December 4, 2022

Comments on S&T Item LMD-23.4:
More Data is Needed Before Action is Taken

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Position: This item should be designated as developing, because more data is needed to demonstrate the level of agreement that can achieved among small volume provers and neck-type provers. When field standards of different types and designs are used, it is imperative that acceptable agreement is demonstrated (1) for all of the tests specified to be performed in Handbook 44, and (2) over a reasonable range of environmental and operational conditions. At this time, not enough data has been presented to adequately demonstrate the performance of SVPs compared to neck-type provers under field conditions.

1. The data presented in 1996 is for a single SVP over a limited range of test conditions. Additionally, the test results raise serious questions that were not explored by further testing at the time.
2. Data from fast-flow tests conducted in the spring of 2022 was provided for 71 wholesale meters that were tested with a neck-type prover and an SVP. The average results of the fast-flow tests agreed quite well; however, the range of product temperatures for the SVP was relatively small temperature range and no tests were conducted at slow flow rates. Field comparison data with different SVPs to neck-type provers and over a wider temperature range and a wider range of flow rates is needed to adequately demonstrate the performance of SVPs.

Issue 1: The test data reported in 1996 is insufficient.

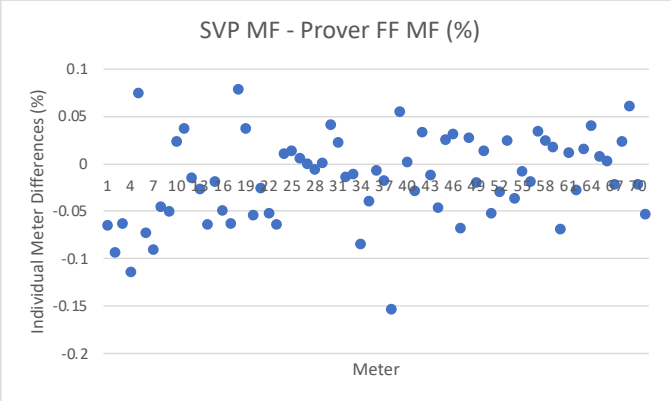
- Only one SVP was used for the tests.
- Of the 48 field tests conducted on fuel products, 12 or 25% were discarded, because the results either had large biases or were not repeatable or both. The one field test conducted at a low flow rate had repeatability of 0.183% for the SVP, 0.12% for the neck-type prover, and a bias of 0.1153%.
- The other 49 comparison tests were conducted in the laboratory using water as the test medium. Of the nine averages for the different sets of tests, eight of the averages had a positive bias. The one set that had a negative bias was discarded, because the seals of the SVP were leaking.

Issue 2: Seventy-one wholesale (loading-rack) meters were tested in the spring of 2022. The table at the right shows the average differences in the meter factors as determined using an SVP and a neck-type prover. The average differences for the meter factors are near zero. The product temperatures in the SVP ranged from 49 to 79 °F. The product temperatures in the neck-type prover ranged from 30 to 74 °F. The comparisons are for fast-flow tests only,

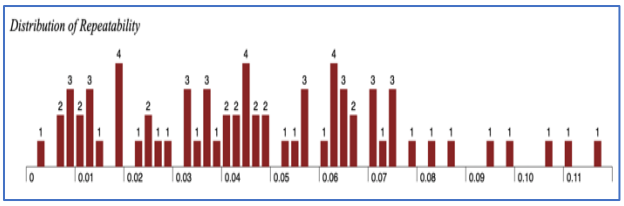
	Average % Difference	95% Confidence Interval	Number of Tests
All Meters	-0.015	±0.011	71
PD	-0.016	±0.014	34
Turbine	-0.015	±0.018	37
ULSD	-0.013	±0.013	18
ULSK	-0.033	±0.024	23
G90	-0.008	±0.031	15
G84	0.002	±0.020	15

since only fast-flow tests were conducted when using the SVP.

The individual meter factors showed some variation, as indicated in the chart to the right. The repeatability of the loading-rack meters themselves may be a major source of the variation in the meter factors for the individual meters. What limits establish acceptable agreement for the average differences in meter test results and for the variations in individual meter test results?



The distribution of the repeatability values for runs in the SVP tests are shown in the chart at the right. Since almost all the tests consisted of five runs, the industry standard for the repeatability limit is 0.05%. Over 40% of the repeatability values exceed 0.05%. I was told that the Handbook 44 tolerance for repeatability (40% of the absolute value of the maintenance tolerance or 0.12%) is used when testing commercial loading-rack meters with an SVP unless the use of the industry standard value of 0.05% is required for a particular fuel terminal.



Conclusions

The field data for meters at one fuel terminal show the level of agreement that can be achieved for meter factors for an SVP and a neck-type prover over a relatively narrow temperature range. More comparative test data is needed to analyze performance:

- For different SVPs and different operators;
- Over a wider range of flow rates; and
- Over a wider range of temperature conditions.