

## Examples of Transfer Standards

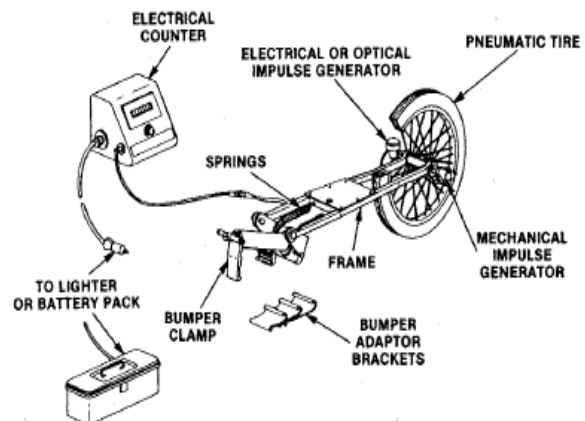
### Examples of Type 1 Transfer Standards

1. **Scales** used to check deliveries from hydrocarbon gas and hydrogen gas dispensers (Hydrocarbon Gas Vapor-Measuring Devices Code 3.33 and Hydrogen-Gas-Measuring Devices Code 3.39)
  - a. A high accuracy class scale is used to determine the quantity of gas dispensed by weighing a tank empty and after the tank is filled by the dispenser.
  - b. The scale is tested on location using mass standards before the scale is used as a transfer standard under the environmental conditions in which it is used.
  - c. The quantity delivered by the dispenser is captured in the tank and the net quantities weighed on the scale are compared to the quantities indicated on the dispenser.
2. **Fifth-wheel** used to test distance measuring devices (Odometer 5.53 & Taximeter 5.54 Codes, 5.60. Transportation Network Measurement Systems – Tentative Code)

Excerpt from NBS Handbook 137, published 1980:

**3.3. FIFTH-WHEEL TEST EQUIPMENT.** - The fifth wheel is a commercially-available distance-measuring device recommended for use by weights and measures officials as a field transfer standard for testing the accuracy of taximeters and odometers on rented vehicles. The instrument is an accurate distance-measuring device (its error is less than 10% of the smallest applicable tolerance (1%)). However, it requires calibration at periodic intervals to maintain its accuracy. A calibrated fifth wheel may also be used to layout a taximeter or odometer measured course.

**3.3.1. DESCRIPTION OF FIFTH WHEEL.** - A schematic drawing of a fifth-wheel assembly is shown in Figure 8. Certain components of the assembly are described referring to the nomenclature shown in the illustration.



- a. A steel tape standard is used to lay out a measured mile course.
  - b. The fifth-wheel is calibrated periodically against the measured mile course.
  - c. The fifth-wheel is attached to the vehicle under test and the distance measured by the fifth-wheel is compared to the distance indicated by the distance measuring device of the vehicle under test.
  - d. The error and uncertainty associated with the fifth-wheel is less than 1/3 of the tolerance applied to the distance measuring device of the vehicle under test.
  - e. Periodic calibration is needed to verify the accuracy of the fifth-wheel.
3. **Alternatives to using a steel tape** (Wire- and Cordage-Measuring Devices, 5.51)
  - N.1. Testing Medium.** – Wherever feasible, a wire- or cordage-measuring device shall be tested with a steel tape not less than 10 mm (<sup>3</sup>/<sub>8</sub> in) in width and at least 15 m (50 ft) in length. When a device cannot be tested in this manner because of the design of the device, it shall be tested with a dimensionally stable

material appropriately marked and compared at frequent periodic intervals with a steel tape in order to assure that any marked interval is not in error by more than 1/3 of the tolerance of the device at that particular interval.)

- a. As an alternative to using a steel tape to test wire- and cordage-measuring devices, “Dimensionally stable material... not in error by more than 1/3 of the tolerance of the device” may be used.
- b. Dimensionally stable material (for example, steel cable) means that the material will not stretch or slip as it is passed through the device and maintains its length under the conditions of use within 1/3 of the tolerance applied to the device.
- c. The length of the material is verified using a steel tape before it is used as a transfer standard.
- d. The length of the material should be verified at frequent periodic intervals.

## **Examples of Type 2 Transfer Standards**

1. **Master meters** (Many years ago, these were PD meters) (Milk Tank Code 4.42)
  - a. The calibration of farm milk tanks (versus acceptance or testing) was originally done using water transfer from a metal neck-type prover into the milk tanks. The NIST H105-3 tolerance for metal neck-type provers is 0.05%. The maintenance and acceptance tolerances for farm milk tanks is 0.2%.
  - b. The Milk Tank Code allows the use of either the prover method or the master meter method for the acceptance test of milk tanks, provided that the master meter system is capable of operating within 25% of the applicable tolerance.
  - c. Master metering systems are to be verified before and after the gauging process (N.5.1.).
  - d. The maintenance and acceptance tolerances for the master meter method is 0.4% (T.4.).
2. **Transfer standards and master meter systems** (Cryogenic Liquid Meter Code 3.34 and Liquid CO<sub>2</sub> Code 3.38)
  - a. Both codes allow the use of transfer standards to test meters used in these applications.
  - b. The test drafts when transfer standards are used are to be at least equal to two minutes at the maximum discharge rate.
  - c. When transfer standards are used, the tolerances applied to the meters under test shall be increased by two times the standard deviation of the applicable transfer standard when compared to a basic reference standard.