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A11104 937746

NBS  
Publi-  
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**NATIONAL BUREAU OF STANDARDS  
HANDBOOK H44  
1949**

**SPECIFICATIONS, TOLERANCES, AND  
REGULATIONS FOR COMMERCIAL WEIGHING  
AND MEASURING DEVICES**

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NBS  
No. 44

**UNITED STATES DEPARTMENT OF COMMERCE  
NATIONAL BUREAU OF STANDARDS**









## 1951 CORRECTION SHEET 1

### National Bureau of Standards Handbook H44

#### Changes Adopted by the 36th National Conference on Weights and Measures—1951

NOTE.—The corrections which follow have been so printed that the material may be cut and pasted either at the points where the corrections should be made or on the appropriate blank pages adjacent to the several codes.

### LINEAR MEASURES

*Handbook page 18.* Substitute for specification paragraph S. 1., the following:

S. 1. UNITS.—The total length of a linear measure may be subdivided into any or all of the following: Inches, feet, yards, and binary submultiples of the inch and the yard and integral multiples thereof. A 1-yard measure may also be graduated to show  $\frac{1}{8}$  and  $\frac{3}{8}$  yard subdivisions. Other subdivisions are allowable only on measures designed for special purposes and when required for such purposes. [1951]

### CORDAGE-MEASURING DEVICES

*Handbook page 27.* Substitute for tolerance paragraph T. 1., the following:

T. 1.—Maintenance tolerances on under-registration and on over-registration shall be as shown in table 1; acceptance tolerances shall be one-half the maintenance tolerances. (The error of a cordage-measuring device—to which the tolerance is applied—is the difference between the indication of the device and the corresponding actual length of steel tape passed through the device.) [1951]

*Handbook page 28.* Add a new notes section, immediately preceding P. PERFORMANCE REQUIREMENTS EXCEPT TOLERANCES as follows:

#### N. NOTES.

N. 1. TESTING MEDIUM.—A cordage-measuring device shall be tested with a steel tape of not less than  $\frac{1}{2}$  inch in width and 50 feet in length. The tape shall have a smooth surface or intaglio figures and graduations (i. e., the figures and graduations shall not be raised). [1951]

### LIQUID MEASURES

*Handbook page 40.* Substitute for specification paragraph S. 1., the following:

S. 1. UNITS.—The capacity of a liquid measure shall be 1 gill,  $\frac{1}{2}$  liquid pint, 1 liquid pint, 1 liquid quart,  $\frac{1}{2}$  gallon, 1 gallon,  $1\frac{1}{4}$  gallons,  $1\frac{1}{2}$  gallons, or a multiple of 1 gallon, and the measure shall not be subdivided. [1951]



## 1951 CORRECTION SHEET 2

NBS Handbook H44—Changes by 36th National Conference

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### PRE-PACKAGED-ICE-CREAM MEASURE-CONTAINERS

*Handbook page 51.* Add the new Tentative Code on Pre-Packaged-Ice-Cream Measure-Containers as follows:

#### TENTATIVE CODE

#### FOR

### PRE-PACKAGED-ICE-CREAM MEASURE-CONTAINERS

#### A. APPLICATION.

A. 1.—This code applies only to pre-packaged-ice-cream measure-containers as defined. It does not apply to those items covered by the codes for Liquid Measures and Measure-Containers. [1951]

#### D. DEFINITIONS.

D. 1. PRE-PACKAGED-ICE-CREAM MEASURE-CONTAINER.—A container intended to be used once only, to determine in advance of sale the quantity of ice cream, sherbet, or other similar frozen dessert, on the basis of liquid measure, comprising a wholesale or retail marketing unit, and to serve as the container for the delivery of the commodity. [1951]

#### S. SPECIFICATIONS.

S. 1. CAPACITIES.—The capacity of a pre-packaged-ice-cream measure-container shall be  $\frac{1}{2}$  liquid pint (8 fluid ounces), 1 liquid pint, 1 liquid quart,  $\frac{1}{2}$  gallon, 1 gallon,  $2\frac{1}{2}$  gallons,  $3\frac{1}{2}$  gallons, or a multiple of 1 gallon: Provided, That other capacities less than  $\frac{1}{2}$  liquid pint shall be permitted. [1951]

#### S. 2. DESIGN.

S.2.1. CAPACITY POINT.—The capacity of a pre-packaged-ice-cream measure-container shall be sharply defined by (a) the top edge, (b) a graduation near the top edge, or (c) the lowest portion of a shoulder, cap seat, lid seat, or indentation near the top edge of the container; a graduation or indentation shall extend at least halfway around the circumference or across two opposite sides of the container. A pre-packaged-ice-cream measure-container shall contain its indicated capacity without apparent distortion from its designed regular shape. [1951]



# 1951 CORRECTION SHEET 3

NBS Handbook H44—Changes by 36th National Conference

## (Pre-Packaged-Ice-Cream Measure-Containers—Continued.)

S. 3. MARKING.—A pre-packaged-ice-cream measure-container shall be marked with a statement of its capacity in terms of one of the specified units prescribed in S.1. or, if the capacity is less than  $\frac{1}{2}$  liquid pint, in terms of fluid ounces; if the capacity is stated in terms of the pint or quart, the word "Liquid" or the abbreviation "Liq" shall be included. The capacity statement shall be (a) on the side, (b) on that portion of the top fold which will be exposed to view when the package is closed, or (c) both on the bottom and on the lid or cover of such containers as have removable lids or covers. If the capacity point is defined by a graduation, the container shall be marked on its side with a conspicuous and suitable statement clearly identifying this graduation as the capacity point. [1951]

## T. TOLERANCES.

T. 1.—Acceptance tolerances in excess and in deficiency shall be as shown in table 1.

TABLE 1.—Acceptance Tolerances for Pre-Packaged-Ice-Cream Measure-Containers

Capacity of pre-packaged-ice-cream measure-container	Tolerance			
	In excess		In deficiency	
	<i>Fluid drams</i>	<i>Cubic inches</i>	<i>Fluid drams</i>	<i>Cubic inches</i>
$\frac{1}{2}$ pint or less-----	3	0. 6	1. 5	0. 3
1 pint-----	4	1. 0	2. 0	. 5
1 quart-----	6	1. 4	3. 0	. 7
$\frac{1}{2}$ gallon-----	9	2. 0	4. 5	1. 0
1 gallon-----	12	2. 8	6. 0	1. 4
Over 1 gallon-----	Add 12 fluid drams per gallon	Add 2. 8 cubic inches per gallon	Add 6. 0 fluid drams per gallon	Add 1. 4 cubic inches per gallon

[1951]



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LIQUID-MEASURING DEVICES

*Handbook page 61.* Substitute for specification paragraph S.2.5., the following:

S.2.5. DISCHARGE-LINE VALVES.—A discharge valve may be provided at the discharge end of the hose or elsewhere in the hose line only (a) if the device is of the wet-hose type, or (b) if any drainage of the hose will automatically become obvious to an observer. If the discharge valve is so positioned, any other shut-off valve in any portion of the discharge line leading to this outlet, shall be of the automatic or semiautomatic set-stop, or predetermining type, or shall be operable only (a) by means such as a wrench or screw driver (but not a pin) entirely separate from the device, or (b) by mutilation of a lead-and-wire seal by which the valve is sealed open. In a wet-hose, pressure-type device, an effective anti-drain valve shall be incorporated in the discharge valve or shall be installed immediately adjacent thereto. (See also S.10.4.) [1951]

## SCALES

*Handbook page 94.* Substitute for definition paragraph D.10., the following:

D.10. RATIO TEST.—A test to determine the accuracy with which the actual multiple of a scale agrees with its designed multiple. This test is utilized in the case of scales employing counterpoise weights and is made with standard weights substituted in all cases for the weights commercially used on the scale. It is appropriate to utilize this test in the case of some scales not employing counterpoise weights. [1951]





## 1951 CORRECTION SHEET 5

### NBS Handbook H44—Changes by 36th National Conference

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#### (Scales Continued)

*Handbook page 106.* Substitute for note paragraph N.1.5., the following:

N.1.5. SR DETERMINATIONS.—These shall be made in connection with the test with increasing loads on all non-automatic-indicating scales, and determinations shall be made at zero load and at the maximum load applied to the scale, and, preferably, also at a load intermediate between zero and maximum load. On a cream-test scale, for the SR determination at maximum load, the pan or pans shall bear a centrally-positioned load equal to 2 avoirdupois ounces multiplied by the number of test bottles which the pan or pans will accommodate. An automatic-indicating element or a balance indicator which is purely auxiliary to a primarily non-automatic-indicating scale, and which may or may not be employed at the option of the operator, shall not exempt the scale from the SR requirements when the automatic-indicating element or balance indicator is disconnected or detached; SR determinations may be made on such a scale with the automatic-indicating element or balance indicator disconnected or detached, and if such scale is one in which the weighbeam travel is in excess of that required by S.2.3.2., the SR determination shall be based upon the weighbeam travel required by S.2.3.2. [1951]

#### WEIGHTS

*Handbook page 124.* Substitute for tolerance paragraph T.1., the following:

T.1.—The maintenance tolerances in excess or in deficiency for commercial avoirdupois weights, for commercial troy weights, for weights used in connection with prescription scales, and for weights used in connection with cream-test and moisture-test scales shall be, respectively, as shown in tables 1, 2, 3, and 4; acceptance tolerances shall be one-half the maintenance tolerances: Provided, That the maintenance tolerances for counterpoise weights for scales having a ratio of 1000:1 or over shall be one-half the values shown in table 1. [1951]







# 1953 CORRECTION SHEET 1

## National Bureau of Standards Handbook 44

### Changes Adopted by the 38th National Conference on Weights and Measures—1953

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NOTE.—The corrections which follow have been so printed that the material may be cut and pasted either at the points where the corrections should be made or on the appropriate blank pages adjacent to the several codes.

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#### SCALES

*Handbook page 90.* Substitute for definition paragraph D.1.11. the following:

D.1.11. WHEEL-LOAD WEIGHERS AND SCALES; AXLE-LOAD SCALES.—Devices intended solely for official use in the enforcement of traffic and highway laws. [1953]

D.1.11.1. WHEEL-LOAD WEIGHER.—A compact, self-contained, portable scale specially adapted to determining the wheel loads of vehicles on highways. [1953]

D.1.11.2. WHEEL-LOAD SCALE.—A scale, permanently installed in a fixed location, having a load-receiving element specially adapted to determining the wheel loads of highway vehicles. [1953]

D.1.11.3. AXLE-LOAD SCALE.—A scale, permanently installed in a fixed location, having a load-receiving element specially adapted to determining the combined load of all wheels (1) on a single axle or (2) on a tandem axle, of a highway vehicle. [1953]

*Handbook page 112.* Substitute for tolerance paragraph T.2.3.1. the following:

T.2.3.1. FOR LARGE-CAPACITY SCALES EXCEPT LIVESTOCK, COAL-MINE, VEHICLE, WHEEL-LOAD, AXLE-LOAD, AND FREIGHT SCALES, WHEEL-LOAD WEIGHERS, AND RAILWAY TRACK SCALES.—Basic maintenance tolerances for large-capacity scales except livestock, coal-mine, vehicle, wheel-load, axle-load, and freight scales, wheel-load weighers, and railway track scales, on under-registration or on over-registration, shall be as shown in table 9; basic acceptance tolerances shall be one-half the basic maintenance tolerances. [1953]



## 1953 CORRECTION SHEET 2

### NBS Handbook 44—Changes by 38th National Conference

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#### (Scales—Continued)

*Handbook page 113.* Substitute for the caption of table 9 the following:

**TABLE 9.—Maintenance Tolerances for Large-Capacity Scales, Except Livestock, Coal-Mine, Vehicle, Wheel-Load, Axle-Load, and Freight Scales, Wheel-Load Weighers, and Railway Track Scales. [1953]**

*Handbook page 113.* Substitute for tolerance paragraph T.2.3.2. the following:

**T.2.3.2. FOR LIVESTOCK, COAL-MINE, VEHICLE, WHEEL-LOAD, AXLE-LOAD, AND FREIGHT SCALES.**—Basic maintenance tolerances for livestock, coal-mine, vehicle, wheel-load, and axle-load scales, and for scales used exclusively in determining charges for freight transportation, on under-registration or on over-registration, shall be  $1\frac{1}{2}$  pounds per 1,000 pounds of test load on ratio tests and 2 pounds per 1,000 pounds of test load on weighbeam, reading-face, and unit-weight indications; basic acceptance tolerances shall be one-half the basic maintenance tolerances. [1953]

*Handbook page 25.* Change code title from TENTATIVE CODE FOR CORDAGE-MEASURING DEVICES to CORDAGE-MEASURING DEVICES. (This code was given final adoption by the 37th National Conference on Weights and Measures in 1952. This change was not included in the 1952 Correction Sheets.)





## 1953 CORRECTION SHEET 3

NBS Handbook 44—Changes by 38th National Conference

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Insert in Handbook between pages 82 and 83 the following:

**TENTATIVE CODE  
FOR  
FARM MILK TANKS  
[1953]**

**A. APPLICATION.**

A.1.—This code applies to farm milk tanks, as defined, only when these are used, or are to be used, under an express contract between the producer and the purchaser and on the premises of the producer, for the commercial measurement of milk or other fluid dairy product. If such measurement is accomplished by means of a fluid meter, this code does not apply; in such case the meter shall be subject to the applicable provisions of the code for liquid-measuring devices.

**D. DEFINITIONS.**

D.1. FARM MILK TANK.—A unit for measuring milk or other fluid dairy product, comprising a combination of (1) a stationary tank, whether or not equipped with means for cooling its contents, (2) means for reading the level of liquid in the tank, such as a removable gage rod or a gage tube, and (3) a chart for converting level-of-liquid readings to gallons, or such a unit in which readings are made on gage rod or gage tube directly in terms of gallons. Each compartment of a subdivided tank shall, for purposes of this code, be construed to be a "farm milk tank." (These units are variously known commercially as "farm bulk milk tanks," "farm cooling tanks," "farm holding tanks," and "producers tanks.")

**S. SPECIFICATIONS.**

S.1. DESIGN. (See also S.2.4.)

S.1.1 **LEVEL.**—A farm milk tank shall be in normal operating position when it is in level. The tank shall be equipped with suitable special means by which this level can be determined and established, such as a permanently attached two-way or circular level, a plumb bob, leveling lugs, or the like; or the top edge or edges of the tank shall be so constructed throughout as to provide an accurate reference for level determinations.

S.1.2. **DISCHARGE VALVE.**—A farm milk tank shall be equipped with a discharge valve through which the tank may be completely emptied when the tank is in level.

S.1.3 **GAGE-ROD BRACKET.**—If a farm milk tank is designed for use with a gage rod, a substantial metal gage-rod bracket shall be rigidly and permanently attached to the tank. The bracket and rod shall be so designed that, whenever the rod is placed in engagement with the bracket and released, the rod will automatically seat itself at a fixed height and will hang in a vertical position with a clearance of not less than 3 inches between the graduated side of the rod and the tank wall which it faces.

## S.2. INDICATING MEANS.

S.2.1. **GAGE ROD.**—A gage rod shall be of metal and shall be of suitable and rigid design. When seated on its bracket, the rod shall not touch the bottom of the milk tank. The rod shall be graduated throughout an interval corresponding to at least the upper one-half of the tank capacity.

S.2.2. **GAGE TUBE.**—If a farm milk tank is designed for use with a transparent gage tube, such tube shall have an inside diameter of not less than  $\frac{1}{2}$  inch and shall be open at its top end. At the inlet end of the tube there shall be a shut-off valve. Immediately adjacent to the tube there shall be permanently mounted a graduated metal scale extending throughout an interval corresponding to at least the upper one-half of the tank capacity. The graduated scale shall be so designed and mounted as to reduce parallax to a minimum.

S.2.3. SPACING AND WIDTH OF GRADUATIONS.—On a gage rod or gage-tube scale, the spacing of the graduations, center to center, shall be not more than 0.0625 ( $\frac{1}{16}$ ) inch and not less than 0.03125 ( $\frac{1}{32}$ ) inch, and the graduations shall be not less than 0.005 inch in width. (See also G-S.4.2.3. and G-S.4.3.)

S.2.4. VALUES OF GRADUATIONS.—On a gage rod or gage-tube scale, the graduations may be designated in inches and fractions thereof. In this case there shall be provided for each such rod or scale and each of the farm milk tanks with which it is associated, a gallonage chart showing values in terms of gallons corresponding to each graduation on the rod or scale. If a rod or scale is associated with but one farm milk tank, in lieu of linear graduations, values in terms of gallons may be shown directly on rod or scale. Graduation designations shall increase from the bottom upward. The value of a graduated interval (exclusive of the interval from the bottom of the tank to the lowest graduation) shall not exceed 1 gallon for a tank of a capacity of 500 gallons or less, and shall not exceed 2 gallons for a tank of a capacity of more than 500 gallons.

S.3. GALLONAGE CHART.—A gallonage chart shall show values at least to the nearest  $\frac{1}{2}$  gallon for a farm milk tank of a capacity of 500 gallons or less, and at least to the nearest 1 gallon for a tank of a capacity of more than 500 gallons. All letters and figures on a chart shall be distinct and easily readable, the chart shall be substantially constructed, and the face of the chart shall be so protected that its lettering and figures will not tend easily to become obliterated or illegible.

S.4. INSTALLATION.—A farm milk tank shall be rigidly installed in level without the use of removable blocks or shims under the legs. If the tank is not mounted permanently in position, the correct position on the floor for each leg shall be clearly and permanently defined.

S.5. IDENTIFICATION.—A farm milk tank and any gage rod and gallonage chart associated therewith shall be mutually identified, as by a common serial number, in a prominent and permanent manner.

## N. NOTES.

N.1. CALIBRATION.—Farm milk tanks shall be originally gaged and officially tested “to deliver.”

N.2. TESTING MEDIUM.—Water shall be used as the testing medium in gaging and testing farm milk tanks.

N.3. GAGE-TUBE READINGS.—All gage-tube readings on a farm milk tank, whether during gaging, testing, or commercial use, shall be made to the top of the meniscus of the liquid in the tube.

N.4. APPROVAL SEALS.—When a farm milk-tank installation is officially tested and approved, the gage rod and the gallonage chart, if these elements are utilized, as well as the tank itself, shall be suitably marked to indicate such approval.

## T. TOLERANCES.

T.1. MINIMUM TOLERANCE VALUES.—On a particular farm milk tank, the maintenance and acceptance tolerances applied shall be not smaller than one-half the value of the minimum graduated interval on the gage rod or gage-tube scale.

T.2. BASIC TOLERANCE VALUES.—Basic maintenance and acceptance tolerances on under-registration and on over-registration shall be as shown in table 1.

TABLE 1.—Maintenance and Acceptance Tolerances for Farm Milk Tanks

Indicated gallonage	Tolerance
	<i>Gallons</i>
500 or less.....	$\frac{1}{2}$
501 to 1,000, incl.....	1
1,001 to 1,500, incl.....	$1\frac{1}{2}$
1,501 to 2,000, incl.....	2
Over 2,000.....	$2\frac{1}{2}$

## R. REGULATIONS.

R.1. LEVEL CONDITION.—A farm milk tank shall be maintained in level.





## 1954 CORRECTION SHEET 1

### National Bureau of Standards Handbook 44

#### Changes Adopted by the 39th National Conference on Weights and Measures—1954

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NOTE.—The corrections which follow have been so printed that the material may be cut and pasted either at the points where the corrections should be made or on the appropriate blank pages adjacent to the several codes.

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### LINEAR MEASURES

*Handbook page 18.* Substitute for specification paragraph S.4. the following:

S.4. GRADUATIONS.—Graduations shall be perpendicular to the edge of the measure. Line graduations shall be not wider than 0.03 inch. Raised graduations shall be not wider than 0.12 inch at their widest point. On any measure, the width of the graduations shall not exceed one-fourth the value of the smallest subdivision of the measure. The requirements of general specifications G-S.4.2.3. and G-S.4.3. shall not apply to linear measures. [1954]





## 1954 CORRECTION SHEET 2

NBS Handbook 44—Changes by 39th National Conference

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### TAXIMETERS

*Handbook page 30.* Substitute for definition paragraphs D.13. and D.14. the following:

#### D.13. ROAD TESTS.

D.13.1. ACTUAL ROAD TEST.—A test similar to a wheel test, except that the mechanism is actuated as a result of vehicle travel. [1954]

D.13.2. SIMULATED ROAD TEST.—A test similar to a wheel test, except that the vehicle wheel or wheels which actuate the taximeter rest in a cradle formed by rollers, one of which is a mileage-measuring element. [1954]

D.14. WHEEL TEST.—A test of the entire taximeter assembly when mounted on a vehicle, the road results being computed from the counted number of revolutions of the wheel or wheels actuating the taximeter and the mean effective circumference of tire. The vehicle remains at rest during this test. [1954]

*Handbook page 32.* Insert after specification paragraph S.10. the following:

S.11. INTERFERENCE.—The construction of a taximeter shall be such that there will be no interference between the time and the mileage portions of the mechanism at any speed of operation corresponding to a vehicle speed faster than the speed at which the basic rate of mileage revenue equals the basic waiting-time rate; specifically, the registration of a taximeter in the "hired" condition shall agree with its performance in the "time not recording" condition within 1 percent. [1954]



## 1954 CORRECTION SHEET 3

### NBS Handbook 44—Changes by 39th National Conference

#### (Taximeters—Continued)

*Handbook page 33.* Add note paragraphs N.2., N.2.1., N.2.2., and N.2.3. following paragraph N.1.

#### N.2. TESTING PROCEDURES.

N.2.1. INTERFERENCE TEST.—As part of the bench test if such a test is made, otherwise as a part of such other test as is made, a special test shall be made to check for possible interference between the taximeter time and mileage mechanisms, a condition that may develop at relatively slow speeds of vehicle operation. This test consists of a comparison of taximeter performance for a nominal 1-mile interval when the taximeter is in “hired” (time-recording) condition, with its performance for a like interval when the taximeter is in “time not recording” condition; performance under these two conditions of operation shall be in agreement within the limit specified in S.11. Throughout this test the mechanism shall be operated at a speed corresponding to a vehicle speed of 2 or 3 miles per hour faster than the speed at which the basic mileage-revenue rate equals the basic waiting-time rate. [1954]

N.2.2. WORN TIRES.—For purposes of tolerance application on an actual or simulated road test, a vehicle tire shall be considered to be “worn” when and after the tread wear is equivalent to approximately one-half the normal useful life of the tire. (Normally the half-life point of tire wear is reached only after the tire has been operated for at least 10,000 miles.) [1954]

N.2.3. EFFECTIVE TIRE CIRCUMFERENCE.—In computing road results on a wheel test and in calculating the required values for change gears, the mean effective circumference of tire shall be used. This shall be determined as follows: 1. Mount upon a vehicle a new tire of the size, kind, and make in use, and inflate this to normal operating pressure. 2. Cause the tire to describe exactly at least three complete revolutions upon a smooth surface. 3. Measure the total distance advanced by the tire. 4. Divide this distance by the number of revolutions made, to establish the average distance advanced per revolution. 5. Subtract 1 percent from this average distance. [1954]



1954 CORRECTION SHEET 4

NBS Handbook 44—Changes by 39th National Conference

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(Taximeters—Continued)

*Handbook page 33.* Substitute for tolerance paragraph T.1.2. the following:

**T.1.2. ON WHEEL AND ROAD TESTS.**—With respect to distance computed, indicated, or actually traveled, no tolerance on overregistration, except that on a road test or simulated road test, if the tires actuating the taximeter are worn (see N.2.2.), the tolerance on overregistration shall be 1 percent of the interval under test; and as the tolerance on underregistration, 4 percent of the interval under test with an added tolerance of 100 feet whenever the initial interval is included in the interval under test. [1954]

*Handbook page 34.* Insert after regulation paragraph R.1. the following:

**R.2. INFLATION OF VEHICLE TIRES.**—The pressure in vehicle tires that actuate a taximeter shall be maintained at not less than the normal operating pressure established in advance for such tires by the operator of the vehicle. Such pressure shall in no case be less than the pressure recommended by the manufacturer for a tire of that particular size, kind, and make. [1954]



## 1954 CORRECTION SHEET 5

NBS Handbook 44—Changes by 39th National Conference

### LIQUID-MEASURING DEVICES

*Handbook page 59.* Substitute for definition paragraphs D.2. and D.3. the following:

D.2. **RETAIL DEVICE.**—A device designed for single deliveries of less than 100 gallons and, in addition, any device designed or used for retail deliveries of motor fuels to individual highway vehicles. [1954]

D.3. **WHOLESALE DEVICE.**—Any device other than a retail device. [1954]

*Handbook page 64.* Add specification paragraph S.10.5. after paragraph S.10.4. as follows:

S.10.5. **ZERO-SET-BACK INTERLOCK.**—Effective July 1, 1957, a retail device of the meter type used for dispensing motor fuel shall be so constructed that, after a particular delivery cycle has been completed by movement of the starting lever to its shut-off position, an effective automatic interlock will prevent a subsequent delivery being started until the indicating elements have been returned to their correct zero position. [1954]





## 1954 CORRECTION SHEET 6

NBS Handbook 44—Changes by 39th National Conference

### GREASE-MEASURING DEVICES

*Handbook page 72.* Substitute for application paragraph A.1. the following:

A.1.—This code does not apply to (a) devices constructed to weigh grease or transmission lubricant and to deliver such material by weight, (b) devices designed solely for the high-pressure lubrication of bearings and similar parts, (c) devices designed to measure motor (crank-case) oil and automatic-transmission fluid (automotive), and (d) devices used solely in operations for which a flat rate is charged, no variation in the charges being made because of the varying amounts of lubricant delivered. [1954]

*Handbook page 72.* Substitute for definition paragraph D.1. the following:

D.1. GREASE-MEASURING DEVICE.—A mechanism or machine designed to measure grease or transmission lubricant and to deliver such material by definite volume. [1954]

*Handbook page 74.* Substitute for specification paragraph S.5.2. the following:

S.5.2. LIMITATION OF USE.—If a device is intended to measure accurately only certain types or varieties of greases or transmission lubricants, its limitations shall be clearly and permanently stated on the device. [1954]



# 1954 CORRECTION SHEET 7

NBS Handbook 44—Changes by 39th National Conference

## VEHICLE TANKS

*Handbook page 81.* Substitute for tolerance table 1 the following:

**TABLE 1.—Tolerances on Vehicle-Tank Compartments  
Used as Measures**

Compartment capacity	Tolerance	
	On first test	On subsequent tests
<i>Gallons</i>	<i>Pints</i>	<i>Quarts</i>
200 or less.....	4	2
201 to 400, incl.	4	3
401 to 600, incl.	5	4
601 to 800, incl.	6	5
801 to 1,000, incl.	7	6
Over 1,000.....	Add 1 pint per 200 gallons or fraction there- of.	Add 1 quart per 200 gal- lons or frac- tion thereof.

[1954]

*Handbook page 81.* In the heading of tolerance table 2, strike out the words "on Single-Compartment Tests."



## 1954 CORRECTION SHEET 8

NBS Handbook 44—Changes by 39th National Conference

*Handbook pages 82–83.* Substitute for the Tentative Code for Farm Milk Tanks the following:

**FARM MILK TANKS****[1954]****A. APPLICATION.**

A.1.—This code applies to farm milk tanks, as defined, only when these are used, or are to be used, under an express contract between the producer and the purchaser and on the premises of the producer, for the commercial measurement of milk or other fluid dairy product. If such measurement is accomplished by means of a fluid meter, this code does not apply; in such case the meter shall be subject to the applicable provisions of the code for liquid-measuring devices.

**D. DEFINITIONS.**

D.1. FARM MILK TANK.—A unit for measuring milk or other fluid dairy product, comprising a combination of (1) a stationary tank, whether or not equipped with means for cooling its contents, (2) means for reading the level of liquid in the tank, such as a removable gage rod or a surface gage, and (3) a chart for converting level-of-liquid readings to gallons; or such a unit in which readings are made on gage rod or surface gage directly in terms of gallons. Each compartment of a subdivided tank shall, for purposes of this code, be construed to be a “farm milk tank.” (These units are variously known commercially as “farm bulk milk tanks,” “farm cooling tanks,” “farm holding tanks,” and “producers tanks.”)

D.2. GAGE ROD.—A graduated, “dip-stick” type of measuring rod designed to be partially immersed in the liquid and to be read at the point where the liquid surface crosses the rod.

D.3. SURFACE GAGE.—A combination of (1) a stationary indicator and (2) a movable, graduated element designed to be brought into contact with the surface of the liquid from above.

**S. SPECIFICATIONS.****S.1. DESIGN.** (See also S.2.4.)

**S.1.1. LEVEL.**—A farm milk tank shall be in normal operating position when it is in level. The tank shall be equipped with suitable special means by which this level can be determined and established, such as a permanently attached two-way or circular level, a plumb bob, leveling lugs, or the like; or the top edge or edges of the tank shall be so constructed throughout as to provide an accurate reference for level determinations. The tank shall be so constructed that it will remain in level under all normal conditions of lading.

**S.1.2. DISCHARGE VALVE.**—A farm milk tank shall be equipped with a discharge valve through which the tank may be completely emptied when the tank is in level.

**S.1.3. GAGE-ROD BRACKET.**—If a farm milk tank is designed for use with a gage rod, a substantial gage-rod bracket shall be rigidly and permanently attached to the tank. The bracket and rod shall be so designed that, whenever the rod is placed in engagement with the bracket and released, the rod will automatically seat itself at a fixed height and will hang in a vertical position with a clearance of not less than 3 inches between the graduated side of the rod and the tank wall which it faces.

**S.1.4. SURFACE-GAGE BRACKET.**—If a farm milk tank is designed for use with a surface gage, a substantial surface-gage bracket shall be rigidly and permanently attached to the tank. The bracket and gage shall be so designed that, when the gage assembly is placed in engagement with the bracket, the indicator, if not permanently mounted on the tank, will automatically seat itself in correct operating position, and the graduated element will be vertically positioned and will be securely held at any height to which it may be manually set.

**S.2. INDICATING MEANS.**

**S.2.1. GAGE ROD.**—When seated on its bracket, the gage rod shall not touch the bottom of the farm milk tank. The rod shall be graduated throughout an interval corresponding to the gallonage range within which the tank is to be used, and in no case shall this range be less than the upper one-half of the tank capacity.

S.2.2. **SURFACE GAGE.**—When properly engaged with its bracket and set to its lowest position, the surface gage shall not touch the bottom of the farm milk tank. The gage shall be graduated throughout an interval corresponding to the gallonage range within which the tank is to be used, and in no case shall the range be less than the upper one-half of the tank capacity.

S.2.3. **SPACING AND WIDTH OF GRADUATIONS.**—On a gage rod or surface gage, the spacing of the graduations, center to center, shall be not more than 0.0625 (1/16) inch and not less than 0.03125 (1/32) inch; the graduations shall be not less than 0.005 inch in width, and the clear interval between adjacent edges of successive graduations shall be not less than 0.015625 (1/64) inch. (See also G-S.4.2.3.)

S.2.4. **VALUES OF GRADUATIONS.**—On a gage rod or surface gage, the graduations may be designated in inches and fractions thereof, or may be identified in a numerical series without reference to inches or fractions thereof. In either of these cases there shall be provided for each such rod or gage and each farm milk tank with which it is associated, a gallonage chart showing values in terms of gallons of liquid in the tank, corresponding to each graduation on the rod or gage. If a rod or gage is associated with but one farm milk tank, in lieu of linear or numerical-series graduations and gallonage chart, values in terms of gallons of liquid in the tank may be shown directly on the rod or gage. The value of a graduated interval (exclusive of the interval from the bottom of the tank to the lowest graduation) shall not exceed 1 gallon for a tank of a nominal capacity of 500 gallons or less, and shall not exceed 2 gallons for a tank of a nominal capacity of more than 500 gallons.

S.3. **GALLONAGE CHART.**—A gallonage chart shall show values at least to the nearest  $\frac{1}{2}$  gallon for a farm milk tank of a capacity of 500 gallons or less, and at least to the nearest 1 gallon for a tank of a capacity of more than 500 gallons. All letters and figures on the chart shall be distinct and easily readable, the chart shall be substantially constructed, and the face of the chart shall be so protected that its lettering and figures will not tend easily to become obliterated or illegible.

S.4. **INSTALLATION.**—A farm milk tank shall be rigidly installed in level without the use of removable blocks or

shims under the legs. If the tank is not mounted permanently in position, the correct position on the floor for each leg shall be clearly and permanently defined.

S.5. IDENTIFICATION.—A farm milk tank and any gage rod or surface gage and gallonage chart associated therewith shall be mutually identified, as by a common serial number, in a prominent and permanent manner.

#### N. NOTES.

N.1. GAGING AND TESTING.—Farm milk tanks shall be originally gaged and officially tested "to deliver."

N.2. TESTING MEDIUM.—Water shall be used as the testing medium in gaging and testing farm milk tanks.

N.3. APPROVAL SEALS.—When a farm milk tank is officially tested and approved, the gage rod or surface gage, and the gallonage chart if a chart is utilized, as well as the tank itself, shall be suitably marked to indicate such approval.

#### T. TOLERANCES.

T.1. MINIMUM TOLERANCE VALUES.—On a particular farm milk tank, the maintenance and acceptance tolerances applied shall be not smaller than one-half the value of the minimum graduated interval on the gage rod or surface gage.

T.2. BASIC TOLERANCE VALUES.—Basic maintenance and acceptance tolerances on underregistration and on overregistration shall be as shown in table 1.

TABLE 1.—Basic Maintenance and Acceptance Tolerances for Farm Milk Tanks

Indicated gallonage	Tolerance
	<i>Gallons</i>
500 or less.....	$\frac{1}{2}$
501 to 1,000, incl.....	1
1,001 to 1,500, incl.....	$1\frac{1}{2}$
1,501 to 2,000, incl.....	2
Over 2,000.....	$2\frac{1}{2}$

#### R. REGULATIONS.

R.1. LEVEL CONDITION.—A farm milk tank shall be maintained in level.



## NBS Handbook 44—Changes by 39th National Conference

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SCALES

*Handbook page 101.* Substitute for that part of specification paragraph S.4. appearing at top of page 101 the following:

*nominal capacity. A small-capacity uncompensated spring scale other than a straight-face spring scale shall be conspicuously marked to show that the scale is illegal for use in the sale of foodstuffs other than fruits and vegetables. [1954]*

*Handbook page 117.* Substitute for regulation paragraphs R.4.2. and R.4.3. the following:

**R.4.2. ON LIVESTOCK SCALES.**—The value of the minimum graduation on the main weighbeam elements, on the tare weighbeam elements, and on the reading-face elements of a livestock scale shall be not greater than 5 pounds: *Provided, That the reading face of any "quick-weighing" or "tell-tale" attachment auxiliary to a weighbeam shall be uniformly graduated into intervals of 5 pounds or less, 100 pounds, or some integral multiple of 100 pounds, and no others. [1954]*

**R.4.3. ON VEHICLE SCALES.**—The value of the minimum graduation on the main weighbeam elements, on the tare weighbeam elements, and on the reading-face elements of a vehicle scale shall be not greater than 20 pounds: *Provided, That the reading face of any "quick-weighing" or "tell-tale" attachment auxiliary to a weighbeam shall be uniformly graduated into intervals of 20 pounds or less, 100 pounds, or some integral multiple of 100 pounds, and no others. [1954]*



**UNITED STATES DEPARTMENT OF COMMERCE**

**CHARLES SAWYER, Secretary**

**NATIONAL BUREAU OF STANDARDS**

**E. U. CONDON, Director**

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**NATIONAL BUREAU OF STANDARDS HANDBOOK H44**

**Superseding Handbook H29**

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**SPECIFICATIONS, TOLERANCES,  
AND REGULATIONS  
FOR  
COMMERCIAL WEIGHTS AND MEASURES  
AND  
WEIGHING AND MEASURING  
DEVICES**

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**(Issued September 1, 1949)**



**UNITED STATES  
GOVERNMENT PRINTING OFFICE  
WASHINGTON : 1949**

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For sale by the Superintendent of Documents, Washington, D. C. — Price \$1.00

# National Bureau of Standards

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## PREFACE

This Handbook supersedes Handbook H29 of the National Bureau of Standards, published in 1942, and presents the specifications, tolerances, and regulations adopted by the National Conference on Weights and Measures through the Thirty-fourth Conference held in 1949. These codes are recommended by the National Bureau of Standards for promulgation by the States.

E. U. CONDON,  
*Director, National Bureau of Standards.*

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SPECIFICATIONS, TOLERANCES, AND  
REGULATIONS  
FOR  
COMMERCIAL WEIGHTS AND MEASURES  
AND WEIGHING AND MEASURING  
DEVICES  
AS ADOPTED BY THE  
NATIONAL CONFERENCE ON WEIGHTS  
AND MEASURES  
AND RECOMMENDED BY THE  
NATIONAL BUREAU OF STANDARDS FOR  
ADOPTION BY THE SEVERAL STATES

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## INTRODUCTION

**Source.**—The specifications, tolerances, and regulations published herein comprise, in their latest form, all of the current codes as adopted by the National Conference on Weights and Measures,<sup>1</sup> the latest action reported having been taken by the Thirty-fourth National Conference on Weights and Measures in 1949. The Conference Committee on Specifications and Tolerances,<sup>2</sup> acting at the request of the Conference or upon its own initiative, prepares from time to time, with the cooperation of the National

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<sup>1</sup>The National Conference on Weights and Measures is a body made up of State and local weights and measures officials from all parts of the United States, which normally meets annually at the National Bureau of Standards, Washington, D.C. For a more detailed description of the Conference and its activities, see chapter 12, National Bureau of Standards Handbook H26, Weights and Measures Administration. Copies of that publication may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 75 cents each.

<sup>2</sup>A standing committee of the National Conference, consisting of five members. The present Chairman of the Committee is John P. McBride, Director of Standards and Necessaries of Life, State of Massachusetts (Boston); the Secretary of the Committee is R. W. Smith, National Bureau of Standards (Washington, D. C.).

Bureau of Standards, proposed amendments or additions to the material previously adopted by the Conference; such amendments or additions are then presented to the Conference as a whole, where they are discussed by weights and measures officials and representatives of interested manufacturers or industries; eventually the proposals of the Committee, which may have been amended on the floor, are voted upon by the weights and measures officials, a majority vote being required for adoption. It is the practice to adopt new codes tentatively, final action being deferred at least until the succeeding Conference; sometimes a code will retain its tentative status for a longer period. Major changes in existing codes are sometimes handled as in the case of new codes; at other times an important change in an existing code is regularly adopted but a future date is specified before which the change shall not be put into effect. Not infrequently the effective date for a major change in requirements—and sometimes for a new code—is specified as a month or so subsequent to the dates for the succeeding meeting of the Conference in order to provide the opportunity for review and modification of the requirements and for changing the effective date.

All of the specifications, tolerances, and regulations given herein are recommended by the National Bureau of Standards for official promulgation in and use by the several States in exercising their control of commercial weighing and measuring apparatus; a similar recommendation is made with respect to the local jurisdictions within a State, in the absence of the promulgation of specifications, tolerances, and regulations by a State agency.

**Purpose.**—The purpose of specifications and tolerances is to eliminate from use, without prejudice to apparatus which conforms as closely as practicable to the official standards, weights and measures and weighing and measuring devices which are false, which are of such construction that they are faulty—that is, which are not reasonably permanent in their adjustment or will not repeat their indications correctly—or which facilitate the perpetration of fraud.



**Classification of Specifications.**—The classification of specifications into “retroactive” and “non-retroactive” requirements is made in order that the requirements may be put into force and effect without unnecessary hardship and without wholesale condemnation of apparatus which, while not of the best construction, is nevertheless fairly satisfactory and may be used for some time without greatly prejudicing the rights of purchasers. Non-retroactive specifications are those which, while clearly desirable, are not so vital that they should at once be enforced with respect to all apparatus. It is not to be expected, however, that non-retroactive specifications shall always remain non-retroactive; in a given jurisdiction it is entirely proper that a weights and measures official, following a careful analysis of existing conditions, fix reasonable periods for the continuance of the non-retroactive application of particular specifications, at the expiration of which periods such specifications will become retroactive in their application. These periods should be of such length as to avoid undue hardship on the owners of apparatus and, in the case of some specifications, should approximate the average useful life of the apparatus in question. The periods will, of course, differ for different apparatus, and may differ for different specifications in the same code.

In order that all parties at interest may have timely and ample notice of impending changes in the status of specifications, the date or dates at which non-retroactive specifications are to become retroactive should be published in combination with the code itself if sufficient data are then at hand to make such action feasible; otherwise, equally effective notice should be given at the earliest practicable date.

In earlier compilations of the specifications, the non-retroactive character of specifications originally so classified was retained, regardless of the time which may have elapsed since original adoption; this was done for the guidance of officials in jurisdictions about to inaugurate weights and measures supervision. In 1949 the character of many specifications was changed by the National Conference from non-retroactive to retroactive, in the belief

that ample time had been allowed for the elimination, by obsolescence, of apparatus which it was originally expedient to exempt from these then non-retroactive requirements, and that ample time had also been allowed for equipment manufacturers to adjust fully to these requirements. The greatly reduced amount of non-retroactive material shown herein conforms, therefore, to a recent evaluation of what requirements should be newly promulgated as non-retroactive. It may well be that in jurisdictions in which the older codes have been in effect for many years, a still more extensive change-over from non-retroactive to retroactive character can properly be made at this time.

In order properly to enforce the specifications it is necessary to be able to distinguish the apparatus to which the non-retroactive specifications do not apply. This may be accomplished as follows: At the time of the first examination of apparatus, all devices encountered, and sealed, as the result of an accuracy test and an inspection involving the application of the retroactive specifications only, may be permanently and clearly stamped in a prominent position, preferably near the seal, with a steel die bearing a star (\*) or some other simple design. Not only apparatus in use but also that in the stocks of manufacturers and dealers should be marked as described. After the first examination, all apparatus not so marked will be subject to all of the specifications, both retroactive and non-retroactive, while the apparatus marked with the special stamp will continue to be exempt from the provisions of the non-retroactive specifications and will be regulated only by the retroactive ones.

**Revised Form of Codes.** — The form and texts of the codes of specifications, tolerances, and regulations were extensively revised in 1949 in an effort to clarify the meaning, simplify the language, eliminate repetition of requirements, present requirements in logical and uniform order, and establish a uniform elastic system for numerical identification of paragraphs. One feature of this revision is the establishment of a General Code, the requirements of which apply generally to all classes of weighing and meas-

uring apparatus. Thus, to learn the requirements applicable to a particular class of apparatus, both the General Code, and the specific code for the class of apparatus in question, must be consulted.

**Correction Sheets.**—The National Bureau of Standards plans to issue from time to time printed sheets showing changes in and additions to the codes published in this Handbook. These correction sheets will be printed to conform with the text of this publication.

In many cases it will be found practicable to attach a portion or all of a correction sheet directly at that point in the original text where the change is to be made; this method of making corrections is recommended. In any event, each correction should be promptly inserted in the Handbook and suitable notation should be made adjacent to the original of the modified text, or at the proper point for insertion of new material, directing attention to the change; blank pages are included at numerous points following codes or major subdivisions thereof, to facilitate the pasting-in of corrections to material immediately preceding.

Correction sheets will be supplied without charge. The distribution will be made automatically to the regular weights and measures mailing list of the Bureau. Purchasers of one or more copies of Handbook H29 may receive the number of correction sheets needed by addressing to the Office of Weights and Measures, National Bureau of Standards, Washington 25, D. C., a request to be placed on the mailing list for correction sheets for Handbook H44, specifying the number of such sheets required.



# **SPECIFICATIONS, TOLERANCES, AND REGULATIONS**

## **GENERAL CODE**

### **G-A. APPLICATION.**

G-A.1. COMMERCIAL EQUIPMENT. — These specifications, tolerances, and regulations apply to commercial weighing and measuring equipment, that is, to weights and measures and weighing and measuring devices commercially used or employed in establishing the size, quantity, extent, area, or measurement of quantities, things, produce, or articles for distribution or consumption, purchased, offered, or submitted for sale, hire, or award, or in computing any charge or payment for services rendered on the basis of weight or measure, or in determining weight or measure when a charge is made for such determination: Provided, That for the purposes of this paragraph, production-incentive payments, wages, or bonuses which are supplementary to the regular wages of employees shall not be construed as “payments for services rendered”.

G-A.2. CLASSES OF EQUIPMENT.—The specifications, tolerances, and regulations for equipment of particular classes, as set up by separate codes herein, apply fully to equipment falling clearly within such classes. Also, insofar as they are clearly appropriate, these requirements likewise apply to equipment of special design or otherwise failing to come clearly within the definition of a particular class, and when equipment designed for special purposes is examined, due consideration shall be given to the design and to the conditions of use of the equipment.

G-A.3. GENERAL AND SPECIFIC REQUIREMENTS.—General requirements apply in all cases unless suspended or modified by specific requirements of limited application. (For example, as to computing scales, a specific require-



ment in the code for computing scales supersedes any "general" requirement with which it conflicts.)

G-A.4. METRIC EQUIPMENT.—It is lawful throughout the United States to employ the weights and measures of the metric system, and these specifications, tolerances, and regulations shall not be understood or construed as in any way prohibiting the manufacture, sale, or use of equipment designed to give results in terms of metric units. The specific provisions of these requirements, and the principles upon which the requirements are based, shall be applied to metric equipment insofar as appropriate and practicable. The tolerances on metric equipment, when not specified herein, shall be equivalent to those specified for similar equipment constructed or graduated in the customary system.

#### G-D. DEFINITIONS.

G-D.1. ACCURATE.—A piece of equipment is "accurate" when its performance or value—that is, its indications, its capacity, its deliveries, its registrations, its actual value, etc., as determined by tests made with suitable standards—conforms to the standard within the applicable tolerances and other performance requirements. Equipment which fails so to conform is "inaccurate".

G-D.2. CORRECT.—A piece of equipment is "correct" when, in addition to being accurate, it meets all applicable specification requirements. Equipment which fails to meet any of the requirements for correct equipment is "incorrect".

G-D.3. TENTATIVE.—Requirements classed as "tentative" have only a trial or experimental standing and are not to be enforced. They represent requirements which have progressed beyond the initial development stage but upon which final action has not been taken, and which are being formally presented for observation and study to test the practicability and suitability of their final adoption.

G-D.4. RETROACTIVE.—"Retroactive" requirements are enforceable with respect to all equipment. Retroactive requirements are printed herein in ordinary roman type.

G-D.5. NON-RETROACTIVE. — “Non-retroactive” requirements are enforceable only with respect to equipment which is manufactured in or brought into the State after the requirements have been promulgated. Non-retroactive requirements are not enforceable with respect to equipment which is in the State at the time of such promulgation, either in use or in the stocks of manufacturers or of dealers in such equipment. *Non-retroactive requirements are printed herein in italic type.*

#### G-D.6. DESIGNATION OF ERRORS.

G-D.6.1. EXCESS AND DEFICIENCY.—When an instrument or device is of such a character that it has a value of its own which can be determined, its error is said to be “in excess” or “in deficiency” depending upon whether its actual value is, respectively, greater or less than its nominal value. This category of instruments includes such instruments as linear measures, liquid measures, milk bottles, vehicle-tank compartments, and weights. Examples of instruments having errors “in excess” are:

A linear measure which is too long.

A liquid measure which is too large.

A weight which is “heavy”.

Examples of instruments having errors “in deficiency” are:

A lubricating-oil bottle which is too small.

A vehicle-tank compartment which is too small.

A weight which is “light”.

G-D.6.2. OVER-REGISTRATION AND UNDER-REGISTRATION.—When an instrument or device is of such a character that it registers or indicates values as a result of its operation, its error is said to be in the direction of over-registration or under-registration (that is, the device is “over - registering” or “under - registering”), depending upon whether its registrations or indications are, respectively, greater or less than they should be. This category of devices includes such devices as fabric-measuring devices, taximeters, liquid-measuring devices, and weighing scales. Examples of devices having errors of “over-registration” are:

- A fabric-measuring device which registers or indicates more than the true length of material passed through it.
- A taximeter which registers or indicates more than the actual distance traveled by the vehicle on which it is installed.
- A gasoline-measuring device which registers or indicates more than the true amount of the gasoline delivered by the device.

Examples of devices having errors of "under-registration" are:

- A grease-measuring device which registers or indicates less than the true amount of lubricant which it delivers.
- A fuel-oil meter which registers or indicates less than the true amount of oil which it delivers.
- A weighing scale which registers or indicates less than the true value of the applied load.

G-D.7. TOLERANCE.—A value fixing the limit of allowable error or departure from true performance or value.

G-D.8. PRIMARY INDICATING ELEMENTS. — On any weighing or measuring device, the primary indicating (or registering or recording) elements are those principal elements relating to quantity or money value which are necessarily utilized by the operator in normal commercial use of the device. This expression does not include such auxiliary elements as, for example, the totalizing counter or register on a fluid meter which is supplementary to the elements indicating the amounts of individual deliveries.

G-D.9. MAIN AND SUBORDINATE GRADUATIONS.—"Main" graduations are those indicating the primary or principal subdivisions of a graduated scale; all other graduations are "subordinate" graduations.

G-D.10. MULTIPLES AND BINARY SUBMULTIPLES.—"Multiple" means an integral multiple, that is, a result obtained by multiplying by a whole number. "Binary submultiples" are fractional parts obtained by successively dividing by the number 2; thus, one-half, one-fourth, one-eighth, one-sixteenth, and so on, are binary submultiples.



**G-S. SPECIFICATIONS.**

**G-S.1. IDENTIFICATION.**—*All commercial equipment except weights shall be conspicuously, clearly, and permanently marked, for purposes of identification, with the name, initials, or trademark of the manufacturer and with the manufacturer's designation which positively identifies the pattern or the design of the device.*

**G-S.2. FACILITATION OF FRAUD.**—All commercial equipment and all mechanisms and devices attached thereto or used in connection therewith shall be so constructed, assembled, and installed for use that they do not facilitate the perpetration of fraud.

**G-S.3. PERMANENCE.**—All commercial equipment shall be so constructed as to make it reasonably probable that, under normal service conditions, accuracy will be maintained and operating parts will continue to function properly.

**G-S.4. INDICATING AND REGISTERING ELEMENTS.**

**G-S.4.1. GENERAL.**—All commercial equipment shall be provided with indicating or registering elements. Primary indicating and registering elements and all apertures through which they are read shall be so constructed and located that for any position which such elements may assume in the course of normal operation the indications and registrations are clear and definite and may be easily and accurately read. Parallax effects shall be reduced to the practicable minimum.

**G-S.4.2. GRADUATIONS.**

**G-S.4.2.1. GENERAL.**—In any series of graduations, corresponding graduations shall be uniform in size and character. The values of graduations shall be adequately defined by a sufficient number of figures, words, and/or symbols, unless the graduations have no specific values. Figures, words, and symbols defining the values of graduations shall be uniformly placed with reference to the graduations and shall be as close thereto as practicable, but shall not interfere with the accuracy of reading. Graduations and their defining figures, words, and sym-

bols shall be of such character that they will not tend easily to become obliterated or illegible.

G-S.4.2.2. LENGTH.—Graduations shall be so varied in length that they may be conveniently read.

G-S.4.2.3. WIDTH.—In any series of graduations the width of a graduation shall in no case be greater than the width of the minimum clear interval between graduations, *and the width of main graduations shall be not more than 50 percent greater than the width of subordinate graduations*. Except as provided in S.4.5., graduations shall in no case be less than 0.008 inch in width.

G-S.4.3. CLEAR INTERVAL BETWEEN GRADUATIONS. — The clear interval between adjacent edges of successive graduations of a series of graduations shall be not less than 0.02 inch for graduations representing money values, not less than 0.03 inch for weighbeam graduations, and not less than 0.04 inch for other graduations, except as provided in G-S.4.5. If the graduations are “staggered”, the interval shall be measured, if necessary, between a graduation and an extension of the adjacent graduation. If the graduations are not parallel, the measurement shall be made at the line of travel of the end of the indicator.

#### G-S.4.4. INDICATORS.

G-S.4.4.1. GENERAL.—The index of an indicator shall be symmetrical about the graduations with which it is used. Except as provided in G-S.4.5., the clearance between the index of an indicator and the graduations shall be not more than 0.06 inch.

G-S.4.4.2. LENGTH.—The index of an indicator shall reach to the finest graduations with which it is used unless the indicator and the graduations are in the same plane, in which case the distance between the end of the indicator and the ends of the graduations, measured along the line of the graduations, shall be not more than 0.04 inch.

G-S.4.4.3. WIDTH.—*The width of the index of an indicator in relation to the series of graduations with which it is used shall be (a) not less than the width of the narrowest graduation, (b) not greater than the width of the*

*widest graduation, (c) not greater than the width of the minimum clear interval between quantity graduations, and (d) not greater than three-fourths of the width of the minimum clear interval between money-value graduations.*

**G-S.4.5. REQUIREMENTS WHEN INDICATIONS ARE MAGNIFIED.**—When in normal usage a series of graduations and an indicator on a weighing or measuring device are necessarily directly viewed as magnified by a lens system, the specified dimensions of 0.008 inch in G-S.4.2.3., 0.02 inch and 0.04 inch in G-S.4.3., and 0.06 inch in G-S.4.4.1., shall be reduced in inverse proportion to the effective angular magnification of the lens system in a vertical plane, determined when the eye of the observer is 12 inches from the graduations. When in normal usage a series of graduations is necessarily viewed as magnified and projected by an optical system onto a screen, the specified dimensions of 0.008 inch in G-S.4.2.3., and of 0.02 inch and 0.04 inch in G-S.4.3., shall be applied to the magnified images as projected on the screen.

**G-S.5. RECORDING ELEMENTS.**—The requirements for indicating and registering elements shall, insofar as practicable, extend to recording elements and to the representations produced by them, and shall be broadly applied to appropriate portions of such representations so as to require the same degree of clearness, definiteness, precision of reading, and the like, as is required in the case of indicating and registering elements.

**G-S.6. LETTERING.** — All required markings and instructions shall be distinct and easily readable and shall be of such character that they will not tend easily to become obliterated or illegible.

#### **G-N NOTES.**

**G-N.1. CONFLICT OF LAWS AND REGULATIONS.** — If any provisions of these specifications are found to conflict with existing State or local laws, ordinances, or regulations relating to safety or fire prevention, the enforcement of such provisions shall be suspended until the conflicting requirements can be harmonized.

**G-T. TOLERANCES.**

**G-T.1. ACCEPTANCE TOLERANCES.**—Acceptance tolerances apply to equipment of the following classes:

- (a) Equipment which is about to be put into use for the first time.
- (b) Equipment which has been put into use within the preceding 3 months and is being officially tested for the first time.
- (c) Equipment which is being officially tested for the first time within 3 months after reconditioning or overhaul.
- (d) Equipment which is being officially tested for the first time within 3 months after repair and adjustment following official rejection.

**G-T.2. MAINTENANCE TOLERANCES.**—Maintenance tolerances apply to equipment in actual use, except as provided in G-T.1.

**G-T.3. APPLICATION.**—Tolerances “in excess” and tolerances “in deficiency” apply to errors in excess and to errors in deficiency, respectively. (See G-D.6.1.) Tolerances “on over-registration” and tolerances “on under-registration” apply to errors in the direction of over-registration and of under-registration, respectively. (See G-D.6.2.)

**G-T.4. INTERMEDIATE VALUES.**—For a capacity, indication, load, etc., intermediate between two capacities, indications, loads, etc., listed in a table of tolerances, the tolerance prescribed for the lower capacity, indication, load, etc., shall be applied.

**G-T.5. RECORDED REPRESENTATIONS.**—When a weighing or measuring device is equipped with means for recording representations on a tape, ticket, card, and the like, the regularly prescribed tolerances shall be applied to the recorded representations, except as follows:

- (a) If the recorded representation is an impression of an indicator and a series of graduations, the maintenance tolerance shall be not less than the value of one of the graduated intervals and the acceptance tolerance shall be not

less than one-half the value of one of the graduated intervals.

- (b) If the recorded representation is an impression comprising figures only, there shall be added to the tolerance which would otherwise be applicable an amount equal to one-half the value of the increment between successive values which can be represented.

#### G-R. REGULATIONS.

G-R.1. POSITION OF EQUIPMENT.—All equipment used in retail trade, except when used exclusively for putting up packages in advance of sale, shall be so positioned that its indications may be accurately read, and the weighing or measuring operation observed, from some reasonable "customer" position. The permissible distance between the equipment and a reasonable customer position shall be determined in each case upon the basis of the individual circumstances, particularly the size and character of the indicating elements.

G-R.2. MAINTENANCE OF EQUIPMENT.—All equipment in commercial service and all mechanisms and devices attached thereto or used in connection therewith shall continuously be maintained in proper operating condition throughout the period of such service.

G-R.3. SUITABILITY OF EQUIPMENT.—Commercial equipment shall be suitable as to design and capacity for the service in which it is used. [1950]

G-R.4. USE OF ADJUSTMENTS.—Weighing elements and measuring elements which are adjustable shall be adjusted only to correct those conditions which such elements are designed to control, and shall not be adjusted to compensate for defective or abnormal installation or accessories or for badly worn or otherwise defective parts of the assembly. Any faulty installation conditions shall be corrected, and any defective parts shall be renewed or suitably repaired, before adjustments are undertaken. Whenever equipment is adjusted, the adjustments shall be so made as to bring performance errors as close as practicable to zero value. [1950]

G-R.5. METHOD OF OPERATION.—Equipment shall be operated only in the manner which is obviously indicated by its construction or which is indicated by instructions on the equipment; if operated in any other manner the equipment shall be subject to condemnation. [1950]







## LINEAR MEASURES

### S. SPECIFICATIONS.

S.1. UNITS.—The total length of a linear measure may be subdivided into any or all of the following: Inches, feet, yards, and binary submultiples of the inch and the yard. Other subdivisions are allowable only on measures designed for special purposes and when required for such purposes.

S.2. PROTECTION OF ENDS.—If an end measure is made of material softer than brass, the ends of the measure shall be protected by brass (or other metal at least equally hard) securely attached.

S.3. DESIGN AND FINISH.—A rigid measure shall be straight. A folding measure shall open to a definite stop and when so opened shall be straight. Measures shall be finished smooth.

S.4. GRADUATIONS.—Graduations shall be perpendicular to the edge of the measure. Line graduations shall not be wider than 0.03 inch. Raised graduations shall not be wider than 0.12 inch at their widest point. On any measure, the width of the graduations shall not exceed one-fourth the value of the smallest subdivision of the measure.

### T. TOLERANCES.

T.1. FOR MEASURES EXCEPT METAL TAPES. — Maintenance tolerances in excess or in deficiency shall be as shown in table 1; acceptance tolerances shall be one-half the maintenance tolerances.



TABLE 1.—Maintenance Tolerances for Linear Measures Except Metal Tapes

Interval	Tolerance
<i>Feet</i>	<i>Inch</i>
1/2 or less.....	1/64
1.....	1/32
2.....	1/16
3.....	3/32
4.....	1/8
5.....	5/32
6.....	3/16

T.2. FOR METAL TAPES.—Maintenance and acceptance tolerances in excess or in deficiency shall be as shown in table 2, tapes of 25 feet and over being at a tension of 10 pounds, tapes of less than 25 feet being at a tension of 5 pounds, and all tapes being supported throughout on a horizontal flat surface.

TABLE 2.—Maintenance and Acceptance Tolerances for Metal Tapes

Interval from zero	Tolerance
<i>Feet</i>	<i>Inch</i>
6 or less.....	1/32
7 to 30, incl.....	1/16
31 to 55, incl.....	1/8
56 to 80, incl.....	3/16
81 to 100, incl.....	1/4

## R. REGULATIONS.

R.1. TACKS.—Measures constructed of tacks driven into a counter, or similar measures, shall not be allowed.



## FABRIC-MEASURING DEVICES

### A. APPLICATION.

A.1. — This code applies only to fabric-measuring devices, as defined, which, by reason of the character of their primary indicating elements, are obviously designed for use in connection with retail sales.

### D. DEFINITIONS.

D.1. FABRIC-MEASURING DEVICE.—A mechanism or machine designed to indicate automatically the length of fabric passed through it, which may or may not include means to indicate automatically the total money value of material measured, for a series of unit prices.

### S. SPECIFICATIONS.

S.1. UNITS.—A device shall indicate lengths in terms of eighth-yards, quarter-yards, half-yards, and yards. In addition, lengths may be indicated in terms of any or all of the following subdivisions:  $\frac{1}{3}$  yard,  $\frac{1}{16}$  yard, 1 foot, and 1 inch.

S.2. CLEAR INTERVAL BETWEEN GRADUATIONS. — This shall be at least  $\frac{11}{16}$  inch for  $\frac{1}{8}$ -yard graduations, and  $\frac{1}{8}$  inch for 1-inch graduations.

S.3. WIDTH OF INDEX OF INDICATOR. — This shall not exceed the width of the narrowest graduations with which it is used, and shall in no case exceed 0.015 inch.

S.4. MONEY-VALUE COMPUTATIONS. — These shall be either full-computing type (see S.4.1.) or limited-computing type (see S.4.2.).

S.4.1. FULL-COMPUTING TYPE.—In this type the money value, at each of a series of unit prices, shall be computed automatically for every length within the range of measurement of the fabric-measuring device. Value graduations shall be supplied and shall be accurately positioned. The value of each graduated interval shall be 1 cent at all prices per yard of 30 cents and less, and shall not exceed

2 cents at higher prices per yard. Five-cent intervals may be represented in the 2-cent range by special graduations, but these shall not be positioned in the clear intervals between graduations of the regular series.

**S.4.2. LIMITED-COMPUTING TYPE.** — In this type the money values, at each of a series of unit prices, shall be computed automatically only for lengths corresponding to a definite series of length graduations. There shall be no value graduations. At no position which the chart can assume shall two value figures at the same price per yard be completely and clearly exposed to view at one time. Money values shown shall be mathematically accurate except that a fraction of less than  $\frac{1}{2}$  cent shall be dropped and that the next higher cent shall be shown in the case of a fraction of  $\frac{1}{2}$  cent or more. One of the following requirements shall be met:

- (a) There shall be a money-value computation for each length graduation within the range of measurement of the device.
- (b) No money-value computation shall be exposed to view except at such times as the device shows a length indication for which a corresponding series of value indications is computed.
- (c) Each column or row of money-value computations shall be marked to show the length to which the computations correspond, the device shall be marked to show the character and limitations of the computations, and there shall be computations corresponding to at least  $\frac{1}{8}$  yard throughout the range of measurement of the device.

**S.5. RETURN TO ZERO.** — Primary indicating elements shall be readily returnable to a definite zero indication; means shall be provided to prevent the return of the indicating elements beyond their correct zero position.

**S.6. LIMITATION OF USE.**—If a device will not accurately measure all fabrics, it shall be marked to indicate clearly its limitations.

**P. PERFORMANCE REQUIREMENTS EXCEPT TOLERANCES.**

**P.1. INCREASING AND DECREASING INDICATIONS.**—Indications of length and money value shall be accurate whether the indications are being increased or decreased.

**T. TOLERANCES.**

**T.1.**—Maintenance tolerances on under-registration and on over-registration shall be as shown in table 1; acceptance tolerances shall be one-half the maintenance tolerances. (The error of a fabric-measuring device—to which the tolerance is applied—is the difference between the indication of the device and the corresponding actual length of testing tape passed through the device.)

**TABLE 1.**—Maintenance Tolerances for Fabric-Measuring Devices

Indication of device	Tolerance	
	On under- registration	On over- registration
<i>Yards</i>	<i>Inches</i>	<i>Inches</i>
2 or less.....	3/8	1/4
3.....	3/8	5/16
4.....	1/2	5/16
5.....	5/8	3/8
6.....	3/4	3/8
7 and 8.....	1	1/2
9.....	1 1/4	5/8
10 and 11.....	1 1/2	3/4
12 and 13.....	1 3/4	7/8
14 and 15.....	2	1
Over 15.....	Add 1/8 inch per indicated yard.	Add 1/16 inch per indicated yard.

**T.1.**—Maintenance tolerances on under-registration and on over-registration shall be as shown in table 1; acceptance tolerances shall be one-half the maintenance tolerances, except that the acceptance tolerance on under-registration shall be not smaller than  $\frac{1}{4}$  inch. (The error of a fabric-measuring device—to which the tolerance is applied—is the difference between the indication of the device and the corresponding actual length of testing tape passed through the device.) [1950]



# **TENTATIVE CODE FOR CORDAGE-MEASURING DEVICES**

## **D. DEFINITIONS.**

**D.1. CORDAGE-MEASURING DEVICE.** — A mechanism or machine designed to indicate automatically the length of cordage, wire, cable, or similar flexible material passed through it.

## **S. SPECIFICATIONS.**

**S.1. UNITS.** — A cordage-measuring device shall indicate lengths in terms of feet.

### **S.2. DESIGN.**

**S.2.1. MEASURING ELEMENTS.** — These shall be constructed to reduce to the practical minimum the slippage of material being measured and lost motion in gear trains.

**S.2.2. INDICATING MEANS.**—This shall be so constructed that the proper method of reading the indications will be readily apparent. The motion of the most sensitive indicating element shall be continuous as material being measured is passed through the device; the motion of other indicating elements may be intermittent. If the most sensitive element of the indicating system utilizes an indicator and graduations, the relative movement of these parts corresponding to a measurement of 1 foot shall be not less than  $\frac{1}{4}$  inch. If separate elements are utilized to tally feet, tens of feet, hundreds of feet, and so on, indications on all such elements shall advance in the same direction, complete revolutions of each such element shall be accurately and definitely tallied, and all such elements shall be accurately synchronized. Indicating elements shall be susceptible of advancement only by the mechanical operation of the device, and shall be readily returnable, in a backward direction only, to a definite zero indication; means shall be provided to prevent the return of indicating ele-



ments beyond their correct zero position. Provided, that a device may be cleared by advancing the indicating elements to zero if (a) all indications are automatically obscured until a correct zero setting is established, or (b) if the clearing operation, once started, cannot be interrupted and will automatically continue until a correct zero setting is established.

**S.2.3. GRADUATIONS.** — These shall be not wider than 0.04 inch.

**S.2.4. INDICATORS.**—If the graduations with which an indicator cooperates are of equal width, the widths of the index of the indicator and of the graduations shall be equal; if main graduations are wider than subordinate graduations, the width of the index of the indicator shall be not greater than the width of the main graduations and shall be not less than the width of the subordinate graduations.

**S.3. PROVISION FOR SEALING.**—If the measuring or indicating elements are adjustable, provision shall be made for applying a lead-and-wire seal or seals in such a manner that no such adjustments can be made without mutilating the seal or seals.

**S.4. MARKING.**

**S.4.1. LIMITATION OF USE.**—If a device is intended to measure accurately only certain types or varieties of flexible materials, its limitations shall be clearly and permanently stated on the device.

**S.4.2. OPERATING INSTRUCTIONS.** — Any necessary operating instructions shall be clearly stated on the device.

**S.4.3. INDICATIONS.**—Indicating elements shall be identified by suitable words or legends so that the values of the indications will be unmistakable.

## **P. PERFORMANCE REQUIREMENTS EXCEPT TOLERANCES.**

**P.1. SPEED AND DIRECTION OF OPERATION.**—The indication of a device shall be accurate when it is operated at any speed and in any manner which may reasonably be employed in commercial use of the device, and whether material is being passed through it in a forward or backward direction.



**T. TOLERANCES.**

T.1.—Maintenance tolerances on under-registration and on over-registration shall be as shown in table 1; acceptance tolerances shall be one-half the maintenance tolerances. (The error of a cordage-measuring device — to which the tolerance is applied—is the difference between the indication of the device and the corresponding actual length of test material passed through the device.)

TABLE 1.—Maintenance Tolerances for Cordage-Measuring Devices

Indication of device	Tolerance	
	On over-registration	On under-registration
<i>Feet</i>	<i>Inches</i>	<i>Inches</i>
0 to 10 incl.-----	$\frac{1}{2}$	1
11 to 20, incl.-----	1	2
21 to 30, incl.-----	$1\frac{1}{2}$	3
31 to 40, incl.-----	2	4
41 to 50, incl.-----	$2\frac{1}{2}$	5
Over 50-----	Add 1 inch per indicated 50 feet.	Add 2 inches per indicated 50 feet.



## TAXIMETERS

### D. DEFINITIONS.

D.1. TAXIMETER. — A device which automatically calculates, at a predetermined rate or rates, and registers, the charge for hire of a vehicle.

D.2. FARE.—That portion of the charge for the hire of a vehicle which is automatically calculated by the taximeter through the operation of the mileage and/or time mechanism.

D.3. EXTRAS.—Charges to be paid by the passenger in addition to the fare, including any charge at a flat rate for the transportation of passengers in excess of the stated number and any charge for the transportation of baggage.

D.4. FACE.—That side of a taximeter upon which passenger charges are indicated.

D.5. SINGLE-TARIFF TAXIMETER.—One which calculates fares at a single rate only.

D.6. MULTIPLE-TARIFF TAXIMETER. — One which may be set to calculate fares at any one of two or more rates.

D.7. CLEARED.—A taximeter is “cleared” when it is inoperative with respect to all fare registration, when no figures indicating fare or extras are exposed to view, and when all parts are in that position in which they are designed to be when the vehicle to which the taximeter is or may be attached is not engaged by a passenger.

D.8. FLAG. — A plate at the end of the lever arm by which the operating condition of the taximeter is manually controlled.

D.9. MONEY DROP.—An increment of fare registration. The “initial money drop” is the initial increment of fare registration following the flag pull.

D.10. GEAR BOX.—An assembly of change gears to compensate for tires of different sizes.

D.11. INITIAL MILEAGE OR TIME INTERVAL.—The interval corresponding to the initial money drop.

D.12. BENCH TEST.—A test of a taximeter head alone, except that the gear box may be attached.

D.13. WHEEL TEST.—A test of the entire taximeter assembly when mounted on a vehicle, the mechanism being actuated by the mechanical revolution of the vehicle wheel or wheels while the vehicle remains at rest.

D.14. ROAD TEST.—A test similar to a wheel test, except that the mechanism is actuated as a result of vehicle travel.

## S. SPECIFICATIONS.

S.1. BASIS OF FARE CALCULATION. — Taximeters shall calculate fares only upon one of the following bases:

(a) Mileage traveled.

(b) Time elapsed.

(c) A combination of mileage traveled and time elapsed. In this case, when the taximeter is operative with respect to fare registration, the fare-registering mechanism shall be actuated by the mileage mechanism whenever the vehicle is in motion at such a speed that the rate of mileage revenue per unit of time equals or exceeds the time rate; and the fare-registering mechanism may be actuated by the time mechanism whenever the vehicle speed is less than this and when the vehicle is stopped. Also in this case, means shall be provided for the vehicle operator to make the clock mechanism either operative or inoperative with respect to the fare-registering mechanism.

## S.2. REQUIRED INDICATIONS.

S.2.1. OPERATING CONDITION.—It shall be shown on the taximeter face whether the mechanism is set to be operative or inoperative and, if operative, the character of fare registration for which it is set. While the taximeter is cleared, the indication "Not Registering", "Vacant", or an equivalent expression shall appear. If a single-tariff taximeter is set to be operative on any basis, the indication "Registering", "Hired", or an equivalent expression shall appear. If a multiple-tariff taximeter is set to be

operative on any basis, the basis for the particular tariff for which it is set shall be shown; for the lowest rate the indication "Registered", "Hired", or an equivalent expression will be sufficient, but at any higher rate the indication shall be some such expression as "3 or more persons". If the taximeter is set so that the clock mechanism is inoperative with respect to fare registration, the indication "Time not recording", or an equivalent expression, shall appear except when the taximeter is cleared; this indication may replace the indication specified for a single-tariff taximeter and for the lowest rate on a multiple-tariff taximeter, but shall be in addition to the indication specified for the higher rates on a multiple-tariff taximeter.

**S.2.2. ACCUMULATED FARE.**—Fare indications shall be identified by the word "Fare" or by an equivalent expression. Values shall be defined by suitable words or monetary signs.

**S.2.3. EXTRAS.**—Registration of charges for extras is not required, but when provided these charges shall be shown as a separate item and shall not be included in the fare registration. These charges shall be identified by the word "Extras" or by an equivalent expression. Values shall be defined by suitable words or monetary signs.

**S.3. PROTECTION OF INDICATIONS.**—Indications shall be displayed through and entirely protected by glass securely attached to the metal housing of the taximeter.

**S.4. VISIBILITY OF INDICATIONS.**—Indications of fare and extras shall never be obscured or covered except when the taximeter is cleared.

**S.5. STATEMENT OF RATES.**—Mileage and time rates for which a taximeter is adjusted, and the schedule of charges for extras when such charges are recognized, shall be marked on the taximeter face. If mileage and time rates are not uniform, such rates shall be stated for the initial interval and for subsequent intervals. The words "Rate", "Rates", or "Rates of Fare", shall precede the actual statement of the rates. Rate statements shall be self-explanatory and readily understandable by the ordinary pas-

senger. Rate statements shall either be of a permanent character or be displayed through and entirely protected by glass securely attached to the metal housing of the taximeter.

**S.6. MARKING OF CHANGE GEARS.**—Individual change gears shall be plainly marked to show the number of their teeth.

**S.7. FLAG.**—A flag shall be provided. The positions of the flag and its associated lever arm shall be mechanically defined, and displacement from any one of these positions shall be sufficiently obstructed so that the accidental or inadvertent changing of the operating condition of the taximeter is improbable. The flag shall be at its highest position when the taximeter is cleared, and in this position the whole of the flag shall be above the level of the taximeter housing. Possible movement of the flag to an operating position immediately following its movement to the cleared position shall automatically be delayed enough to permit the taximeter mechanism to come to complete rest in the cleared condition.

**S.8. CONTROL FOR EXTRAS REGISTRATION.**—The knob, handle, or other means provided to actuate the extras mechanism shall be inoperable whenever the taximeter is cleared.

**S.9. PERMANENCE.**—Wherever wear or deformation of ratchets, pawls, and similar combinations will affect the accuracy or consistency of indication of a taximeter, such parts shall be of such material and hardness that the wear or deformation resulting from use will be reduced to the practicable minimum.

**S.10. SEALING.**—Adequate provision shall be made for affixing lead-and-wire seals to a taximeter and to other parts required for service operation of a complete installation on a vehicle, so that no adjustments, alterations, or replacements affecting in any way the indications, rates, or accuracy of the taximeter or the assembly can be made without mutilating the seal or seals.

## **N. NOTES.**

**N.1. NON-USE OF EXTRAS.**—If and when charges for



extras are prohibited by legal authority or are discontinued by a vehicle operator, the extras mechanism on any taximeter capable of registering charges for extras shall be rendered inoperable or all indications on the taximeter face of charges for extras shall be effectively obscured by permanent means.

## **T. TOLERANCES.**

**T.1. ON MILEAGE TESTS.**—Maintenance and acceptance tolerances shall be as follows:

**T.1.1. ON BENCH TEST.**—With respect to the nominal number of spindle revolutions, no tolerance on over-registration; and as the tolerance on under-registration, 2 percent of the interval under test with an added tolerance of 100 feet whenever the initial interval is included in the interval under test.

**T.1.2. ON WHEEL AND ROAD TESTS.**—With respect to distance computed or actually traveled, no tolerance on over-registration, except that on a road test if the vehicle tires are seriously worn the tolerance on over-registration shall be 1 percent of the interval under test; and as the tolerance on under-registration, 4 percent of the interval under test with an added tolerance of 100 feet whenever the initial interval is included in the interval under test. (In computing road results and calculating the values of change gears for the purpose of applying tolerances, the mean effective circumference of tire shall be used. This shall be determined upon a new tire of the size, kind, and make in use, inflated to the recommended pressure, and mounted upon a vehicle, by causing the tire to describe several complete revolutions upon a smooth surface, finding the average distance advanced per revolution, and deducting from the result 1 percent.)

**T.2. ON TIME TESTS.** — Maintenance and acceptance tolerances shall be as follows:

**T.2.1. ON INDIVIDUAL TIME INTERVALS.** — A tolerance on over-registration, of 3 seconds per minute (5 percent); and a tolerance on under-registration, of 9 seconds per minute (15 percent) on the initial time interval, and of 6 seconds per minute (10 percent) on other time intervals.

**T.2.2. ON AVERAGE TIME INTERVAL COMPUTED AFTER EXCLUDING THE INITIAL INTERVAL.**—No tolerance on over-registration; and a tolerance on under-registration, of 3 seconds per minute (5 percent).

**R. REGULATIONS.**

**R.1. POSITION AND ILLUMINATION.** — When mounted upon a cab a taximeter shall be so placed that its face is in plain view of a passenger seated upon the rear seat of the cab. Adequate lighting facilities shall be provided for so illuminating the face of the taximeter that the indications thereof may be conveniently read by the passenger, and the face of the taximeter shall be so illuminated whenever the taximeter is in operation and artificial illumination is necessary for the convenient reading of its indications.





## ODOMETERS

### A. APPLICATION.

A.1. COMMERCIAL USE.—This code applies to odometers which are used or to be used to determine charges for hire of a vehicle.

A.2. SPECIAL USE. — When official examinations are undertaken on odometers whose readings form the basis for the payments of fees or taxes to or for the preparation of reports for governmental agencies, for the determination of insurance premiums, and in similar cases, the requirements of this code shall be applied insofar as they are applicable and appropriate to the conditions of such special uses.

### D. DEFINITIONS.

D.1. ODOMETER.—A device designed to be attached permanently to a vehicle and adapted to register automatically the distance traversed by the vehicle. For the purpose of this code, this definition includes hub odometers, cable-driven odometers, and the mileage-recording, or odometer, portions of “speedometer” assemblies for automobiles.

### S. SPECIFICATIONS.

S.1. UNITS.—An odometer shall register in terms of miles and tenth-miles.

#### S.2. REGISTERING ELEMENTS.

S.2.1. DESIGN.—The registration of an odometer shall be susceptible of increase only by the rotation of the vehicle wheel or wheels. The tenth-mile indicator may advance continuously or intermittently; other indicators shall advance intermittently. In the case of an indicator which advances intermittently, movement shall be communicated to the indicator drum or dial only during that period in which the advance of the mechanism corresponding to not more than the tenth-mile immediately preceding the next higher indication, is taking place. An odometer

may be provided with means for reducing the registration to zero.

**S.2.2. READABILITY.**— Mileage figures and their background shall be of sharply contrasting colors. The colors of all figures except those indicating tenth-miles shall be uniform, and the color of the tenth-mile figures shall be different from the color of the other figures. Except during the period of advance of an indicator to the next higher indication, only one figure on each drum or dial shall be exposed to view. Any protective covering intended to be transparent shall be in such condition that it can be made transparent by ordinary cleaning of its exposed surface.

**S.2.3. VISIBILITY.**—An odometer shall be so positioned that it is readily accessible for the reading of its registration. When an odometer is utilized upon a vehicle for the purposes for which a taximeter is commonly employed, the odometer shall be so positioned on the vehicle that the registrations are in full view from the interior of the vehicle.

**S.3. SEALING.**—Adequate provision shall be made for affixing lead-and-wire seals to an odometer and to other parts required for service operation of a complete installation on a vehicle, so that no adjustments, alterations, or replacements affecting in any way the indications or accuracy of the odometer or the assembly can be made without mutilating the seal or seals. The sealing means shall be such that it is not necessary to disassemble or remove any part of the vehicle or the odometer to apply or inspect the seals.

## **N. NOTES.**

### **N.1. TESTING.**

**N.1.1. ROAD TEST.**—A “bench test” is inadequate, and the complete odometer assembly, installed on the vehicle with which it is to be used, shall be given a road test over a measured course, except as provided in N.1.2. The test shall be made with the vehicle carrying an average load and with its tires inflated to recommended pressure.

**N.1.2. WHEEL TEST.**—If a road test is impracticable,

the complete odometer assembly, installed on the vehicle with which it is to be used, shall be given a wheel test, the mechanism being actuated by the mechanical revolution of the vehicle wheel or wheels while the vehicle remains at rest.

N.2. SEALING.—After approval of the complete assembly, suitable seals shall be applied so that no part of the odometer mechanism or of the connections leading thereto may be removed, or modified in such a way as to affect the accuracy of registration, without mutilating the seal or seals.

#### T. TOLERANCES.

T.1. ON ROAD AND WHEEL TESTS.—Maintenance and acceptance tolerances shall be as follows: With respect to distance actually traveled or computed, no tolerance on over-registration, except that on a road test if the vehicle tires are seriously worn the tolerance on over-registration shall be 1 percent of the interval under test; and as the tolerance on under-registration, 4 percent of the interval under test. (In computing road results, the mean effective circumference of tire shall be used. This shall be determined upon a new tire of the size, kind, and make in use, inflated to the recommended pressure, and mounted upon a vehicle, by causing the tire to describe several complete revolutions upon a smooth surface, finding the average distance advanced per revolution, and deducting from the result 1 percent.)

#### R. REGULATIONS.

R.1. REINSPECTION.—Whenever an odometer has been damaged, or repairs which might in any way affect the accuracy of its registration have been made, or any of the official seals have been mutilated, such odometer shall not thereafter be used until it has been officially inspected and reapproved.



## LIQUID MEASURES

### A. APPLICATION.

A.1.—This code applies to liquid measures, as defined, except special varieties of liquid measures for which separate codes have been set up.

### D. DEFINITIONS.

D.1. LIQUID MEASURE.—A rigid measure of capacity, designed for general and repeated use in the measurement of liquids.

### S. SPECIFICATIONS.

S.1. UNITS.—The capacity of a liquid measure shall be 1 gill,  $\frac{1}{2}$  liquid pint, 1 liquid pint, 1 liquid quart,  $\frac{1}{2}$  gallon, 1 gallon, or a multiple of 1 gallon, and the measure shall not be subdivided.

S.2. MATERIAL. — Measures shall be made of metal, glass, earthenware, enameled ware, composition, or similar and suitable material. If made of metal, the thickness of the metal shall be not less than the appropriate value given in table 1.

TABLE 1.—Minimum Thicknesses of Metal for Liquid Measures

Capacity of measure	Minimum thickness	
	For iron or steel, plated or unplated <sup>(a)</sup>	For copper or aluminum
	<i>Inch</i>	<i>Inch</i>
1 pint or less.....	0.010	0.020
1 quart, $\frac{1}{2}$ gallon, 1 gallon.....	.014	.028
Over 1 gallon.....	.016	.032

(a)The following commercial tin plates comply with these requirements: For 1 pint or less, ICL; for 1 quart,  $\frac{1}{2}$  gallon, and 1 gallon IX; for over 1 gallon 2XL.

**S.3. DESIGN.**

**S.3.1. CAPACITY POINT.**—The capacity of a measure shall be determined to a definite edge, or to the lowest portion of a plate, bar, or wire, at or near the top of the measure, and shall not include the capacity of any lip or rim which may be provided.

**S.3.2. REINFORCING RINGS.**—Reinforcing rings, if used, shall be attached to the outside of the measure and shall show no divisions or lines on the inside surface of the measure.

**S.3.3. DISCHARGE.** — A measure equipped with a discharge faucet or valve shall be susceptible of complete discharge through the faucet or valve when the measure is standing on a level surface.

**S.4. MARKING.**—A measure shall be marked on its side with a statement of its capacity; if the capacity is stated in terms of the pint or quart, the word “Liquid” or the abbreviation “Liq” shall be included.

**N. NOTES.**

**N.1. ICE CREAM MOLDS AND CANS.**—This code shall not be construed to prohibit 3-pint and 5-pint brick molds and 2½-gallon (10-quart) cans when used exclusively for ice cream.

**T. TOLERANCES.**

**T.1.**—Maintenance tolerances in excess and in deficiency shall be as shown in table 2; acceptance tolerances shall be one-half the maintenance tolerances.

TABLE 2.—Maintenance Tolerances for Liquid Measures

Capacity of measure	Tolerance			
	In excess		In deficiency	
	<i>Fluid drams</i>	<i>Cubic inches</i>	<i>Fluid drams</i>	<i>Cubic inches</i>
1/2 pint or less.....	2	0.4	1.0	0.2
1 pint.....	3	.7	1.5	.3
1 quart.....	4	.9	2.0	.5
1/2 gallon.....	6	1.4	3.0	.7
	<i>Fluid ounces</i>			
1 gallon.....	1	1.8	4.0	.9
			<i>Fluid ounces</i>	
2 gallons.....	2	3.5	1	1.8
3 and 4 gallons.....	4	7.0	2	3.6
5 gallons.....	6	11.0	3	5.4
10 gallons.....	10	18.0	5	9.0





## GRADUATES

### D. DEFINITIONS.

D.1. GRADUATE.—A subdivided, glass measure of capacity, either cylindrical or conical in shape, provided with a pouring lip and a base.

### S. SPECIFICATIONS.

S.1. BASIS OF GRADUATION.—A graduate shall be graduated either “to contain” or “to deliver” when the temperature of the graduate is 20°C (68°F), and shall be marked accordingly in a permanent and conspicuous manner.

S.2. MATERIAL. — A graduate shall be made of good-quality, thoroughly annealed, clear, transparent glass, free from bubbles and streaks, and of uniform but not excessive thickness.

#### S.3. DESIGN.

S.3.1. PROPORTIONS. — On a cylindrical graduate, the total length of the graduated scale shall be not less than five times the internal diameter of the graduate. On a conical graduate, the total length of the graduated scale shall be not less than two times the internal diameter of the graduate at its highest graduation, and at one-fourth capacity the length of the graduated scale to this point shall be not less than the internal diameter of the graduate at the same point.

S.3.2. BASE. — The base shall be perpendicular to the axis of the graduate and of such diameter that the empty graduate will stand on a surface making an angle of 25 percent, or approximately 15°, with the horizontal.

#### S.4. GRADUATIONS.

S.4.1. GENERAL.—Graduations shall be perpendicular to the axis of the graduate and parallel to each other. Graduations shall be etched or engraved and shall be not wider than 0.015 inch (0.38 millimeter). No graduation shall extend less than one-fourth of the distance around the

graduate. On single-scale graduates, the main graduations shall extend at least one-half of the distance around the graduate, and if these do not completely encircle the graduate their middle points shall be directly opposite to the lip of the graduate. On double-scale, or duplex, graduates, there shall be a clear space between the ends of the main graduations on the two scales and this space shall be approximately  $90^\circ$  from the lip of the graduate and shall conform to the requirements of table 1.

TABLE 1.—Clear Space Between Ends of Main Graduations on Double-Scale Graduates

Circumference of the graduate at the graduations	Clear space between ends of main graduations
	<i>Inch</i>
Less than 5 inches.....	1/8 to 1/4
5 to 10 inches, inclusive.....	1/4 to 1/2
Over 10 inches.....	3/8 to 5/8

S.4.2. MARKING. — Each main graduation shall be marked to show its value; intermediate graduations shall not be marked. Value figures shall be uniformly positioned either directly upon or immediately above the graduations to which they refer. Figures placed upon graduations shall be set in from the ends of the graduations a sufficient distance to allow the ends of the graduations to be used in making a setting. (See also S.1.)

#### T. TOLERANCES.

T.1.—Maintenance and acceptance tolerances in excess or in deficiency shall be as shown in tables 2 and 3 for graduates which are graduated “to contain”, and shall be 25 percent greater than the values shown in tables 2 and 3 for graduates which are graduated “to deliver”. (The tolerance to be applied at any graduation is determined by the inside diameter of the graduate at the graduation in question.)



TABLE 3.—Acceptance and Maintenance Tolerances for Graduates, Expressed in Metric Units

Inside diameter of graduate	Toler- ance	Inside diameter of graduate	Toler- ance	Inside diameter of graduate	Toler- ance
<i>Millimeters</i>	<i>Milli- liters<sup>a</sup></i>	<i>Millimeters</i>	<i>Milli- liters<sup>a</sup></i>	<i>Millimeters</i>	<i>Milli- liters<sup>a</sup></i>
10.....	0.04	40.....	0.85	70.....	3.2
11.....	.05	41.....	.90	71.....	3.4
12.....	.06	42.....	.95	72.....	3.5
13.....	.07	43.....	1.00	73.....	3.6
14.....	.08	44.....	1.05	74.....	3.7
15.....	.09	45.....	1.10	75.....	3.9
16.....	.10	46.....	1.15	76.....	4.0
17.....	.12	47.....	1.25	77.....	4.1
18.....	.14	48.....	1.30	78.....	4.2
19.....	.16	49.....	1.35	79.....	4.4
20.....	.18	50.....	1.4	80.....	4.5
21.....	.20	51.....	1.5	81.....	4.6
22.....	.22	52.....	1.6	82.....	4.8
23.....	.24	53.....	1.6	83.....	4.9
24.....	.26	54.....	1.7	84.....	5.0
25.....	.28	55.....	1.8	85.....	5.1
26.....	.30	56.....	1.9	86.....	5.2
27.....	.35	57.....	2.0	87.....	5.4
28.....	.35	58.....	2.0	88.....	5.5
29.....	.40	59.....	2.1	89.....	5.6
30.....	.45	60.....	2.2	90.....	5.7
31.....	.45	61.....	2.3	91.....	5.9
32.....	.50	62.....	2.4	92.....	6.0
33.....	.55	63.....	2.5	93.....	6.1
34.....	.60	64.....	2.6	94.....	6.2
35.....	.60	65.....	2.7	95.....	6.4
36.....	.65	66.....	2.8	96.....	6.5
37.....	.70	67.....	2.9	97.....	6.6
38.....	.75	68.....	3.0	98.....	6.8
39.....	.80	69.....	3.1	99.....	6.9
				100.....	7.1

A "milliliter" is the one-thousandth part of the liter. This unit is also commonly known as the "cubic centimeter", although this is not an accurate usage, the units not being exactly equal; however, the difference between them is not significant for purposes of this table, and for this purpose they may be used interchangeably.



## MEASURE-CONTAINERS

### A. APPLICATION.

A.1.—This code does not apply to measure-containers used for milk, cream, or buttermilk, these being covered by the code for Milk Bottles, or to measure-containers used for the pre-packing of “packages” of commodities.

### D. DEFINITIONS.

D.1. MEASURE-CONTAINER.—A container intended to be used once only, to determine at the time of retail sale the quantity of commodity comprising a retail sale made from bulk supply on the basis of liquid measure and to serve as the container for the delivery of the commodity to the customer.

### S. SPECIFICATIONS.

S.1. UNITS.—The capacity of a measure-container shall be 1 gill ( $\frac{1}{4}$  liquid pint, 4 fluid ounces),  $\frac{1}{2}$  liquid pint, 1 liquid pint, 1 liquid quart,  $\frac{1}{2}$  gallon, or 1 gallon, and the measure-container shall not be subdivided.

#### S.2. DESIGN.

S.2.1. CAPACITY POINT.—The capacity of a measure-container shall be sharply defined by (a) the top edge, (b) a graduation near the top edge, or (c) the lowest portion of a shoulder, cap seat, lid seat, or indentation near the top edge, of the measure-container. A graduation or indentation shall extend at least halfway around the circumference or across two opposite sides of the measure-container.

S.2.2. PROPORTIONS. — The overall inside height of a measure-container shall be not more than two times the average inside diameter of a conical or cylindrical measure-container or not more than the length of the short side of a mid-section of a measure-container of rectangular cross section.

S.3. MARKING.—A measure-container shall be marked

with a statement of its capacity in terms of one of the units prescribed in S.1.; if the capacity is stated in terms of the pint or quart, the word "Liquid" or the abbreviation "Liq" shall be included. The capacity statement shall be (a) on the side, (b) on that portion of the top fold which will be exposed to view when the measure-container is closed, or (c) both on the bottom and on the lid or cover of such measure-containers as have removable lids or covers. If the capacity point is defined by a graduation, the measure-container shall be marked on its side with a conspicuous and suitable statement clearly identifying this graduation as the capacity point.

# T. TOLERANCES.

T.1.—Acceptance tolerances in excess and in deficiency shall be as shown in table 1.

TABLE 1.—Acceptance Tolerances for Measure-Containers

Capacity of measure-container	Tolerance			
	In excess		In deficiency	
	<i>Fluid drams</i>	<i>Cubic inches</i>	<i>Fluid drams</i>	<i>Cubic inches</i>
1/2 pint or less...	3	0.6	1.5	0.3
1 pint.....	4	1.0	2.0	.5
1 quart.....	6	1.4	3.0	.7
1/2 gallon.....	9	2.0	4.5	1.0
1 gallon.....	12	2.8	6.0	1.4





## MILK BOTTLES

### D. DEFINITIONS.

D.1. MILK BOTTLE.—Any glass bottle of the general form which has customarily been used for the measurement and delivery of milk, cream, and buttermilk at retail and any other container employed for this purpose.

D.2. PLANE OF SEALING SURFACE. — The plane established by the under side of the bottle cap (corresponding to the plane of the cap seat), or by the under side of the crown cap or other cover if the bottle is sealed over its top (corresponding to the top edge of the bottle).

### S. SPECIFICATIONS.

S.1. UNITS.—The capacity of a milk bottle shall be 1 gill,  $\frac{1}{2}$  liquid pint, 1 liquid pint, 1 liquid quart,  $\frac{1}{2}$  gallon, 1 gallon, or 2 gallons, when the temperature of the bottle is 20°C (68°F).

#### S.2. DESIGN.

S.2.1. CAPACITY POINT OF REGULAR MILK BOTTLE. — The capacity point of a regular bottle shall be  $\frac{1}{4}$  inch below the plane of the sealing surface if the inside diameter of the bottle immediately below such plane is 2 inches or less; if such diameter is over 2 inches, the capacity point shall be a point  $\frac{1}{8}$  inch below the plane of the sealing surface.

S.2.2. CAPACITY POINT OF SPECIAL MILK BOTTLE.—If a bottle is provided with a permanent, clearly defined graduation extending at least halfway around the bottle to define the capacity point, as in bottles intended for pasteurization of milk in the bottle, this graduation may be positioned at any distance below the plane of the sealing surface up to and including the maximum distances shown in table 1, and directly over, below, or beside the graduation the words "Fill to line", or a similar and suitable statement, shall be permanently marked.

TABLE 1.—Maximum Distances Between Graduation and Plane of Sealing Surface on Special Bottles

Capacity of bottle	Maximum distance between graduation and plane of sealing surface
	<i>Inch</i>
1/2 pint or less.....	5/8
1 pint.....	1
1 quart.....	1 1/2
1/2 gallon .....	2

S.3. MARKING.—A bottle shall be permanently marked with a statement of its capacity and with the word “Sealed”, and this marking shall not be on the bottom of the bottle. (See also S.2.2.)

#### N. NOTES.

N.1. OPTIONAL-CLOSURE BOTTLES.—When a bottle is designed for optional, or “multiple”, types of bottle closure, the plane of the lowest sealing surface shall govern for purposes of the application of specification requirements.

#### T. TOLERANCES.

T.1.—Maintenance and acceptance tolerances in excess or in deficiency on the average capacity of bottles shall be as shown in table 2, and shall be applied to the results of a test of not less than 25 bottles of the same capacity and ownership, selected at random from the whole supply available. (The tolerance on average capacity shall be applied to the average error of the bottles tested; this average error is determined by adding together all individual errors in excess, adding together all individual errors in deficiency, subtracting the smaller sum from the greater, and dividing this result by the total number of bottles tested.) The error on any individual bottle tested shall not exceed four times the specified tolerances on average capacity. Any failure to meet individual or average tolerance requirements shall be construed as failure to conform to

tolerance requirements on the part of the entire lot of bottles tested.

TABLE 2.—Maintenance and Acceptance Tolerances on Average Capacity of Milk Bottles

Capacity of bottle	Tolerance on average capacity	
	<i>Fluid drams</i>	<i>Cubic inches</i>
1/2 pint or less.....	0.5	0.12
1 pint.....	.75	.17
1 quart.....	1.0	.23
1/2 gallon.....	1.5	.35
1 gallon.....	2.5	.6
2 gallons.....	4.5	1.0



## LUBRICATING-OIL BOTTLES

### D. DEFINITIONS.

D.1. LUBRICATING-OIL BOTTLE.—Any bottle used for the measurement of lubricating oil for direct delivery to the crankcase of a motor vehicle, whether or not the bottle is sealed with a cap or some other device.

### S. SPECIFICATIONS.

S.1. UNITS.—The capacity of a bottle shall be 1 liquid pint, 1 liquid quart,  $\frac{1}{2}$  gallon, or 1 gallon, when the temperature of the bottle is 20°C (68°F), and the bottle shall not be subdivided.

S.2. MATERIAL.—*Bottles shall be made of clear, uncolored glass.*

### S.3. DESIGN.

S.3.1. CAPACITY POINT.—The capacity point shall be defined by a permanent, clearly defined graduation not more than 0.1 inch in width, extending at least halfway around the bottle, and the words "Fill to line", or a similar and suitable statement, clearly referring to this graduation, shall be permanently marked on the bottle. An auxiliary, undesignated graduation, less prominent than the capacity graduation, may be placed above the capacity graduation to serve as a guide in filling the bottle with an excess measure of oil.

S.3.2. HEADSPACE.—The capacity of that portion of the bottle above the capacity graduation shall be not less than 3 cubic inches.

S.3.3. CLEARANCE ABOVE CAPACITY GRADUATION.—When any opaque top or spout which is provided is screwed firmly in place or is otherwise securely attached, the lower edge of such top or spout shall be at least  $\frac{1}{4}$  inch above the capacity graduation.

S.3.4. DRAINAGE.—A bottle, and any top or spout which

is provided, shall be so constructed as to permit free and unobstructed drainage of the contents of the bottle.

S.4. MARKING.—A bottle shall be permanently marked on its side with a statement of its capacity. (See also S.3.1.)

#### N. NOTES.

N.1. TESTING MEDIUM.—A lubricating-oil bottle shall be tested with water, the top of the meniscus of the water being brought into coincidence with the bottom of the capacity graduation.

#### T. TOLERANCES.

T.1.—Maintenance and acceptance tolerances in excess shall be as shown in table 1; there shall be no tolerance in deficiency.

TABLE 1.—Maintenance and Acceptance Tolerances, in Excess Only, for Lubricating-Oil Bottles

Capacity of bottle	Tolerance	
	<i>Fluid drams</i>	<i>Cubic inches</i>
1 pint.....	6	1.4
1 quart.....	8	1.8
1/2 gallon.....	12	2.7
1 gallon.....	20	4.5





## LIQUID-MEASURING DEVICES

### A. APPLICATION.

A.1.—This code does not apply to water meters or to devices for the measurement of greases or transmission oils.

### D. DEFINITIONS.

D.1. LIQUID-MEASURING DEVICE.—A mechanism or machine designed to measure and deliver liquid by volume, which may or may not include means to indicate automatically the total money value of liquid measured, for one of a series of unit prices.

D.2. RETAIL DEVICE.—A device obviously designed for retail deliveries to individual consumers.

D.3. WHOLESALE DEVICE.—A device obviously designed for single deliveries of 100 gallons or more.

D.4. WET-HOSE TYPE.—A type of device intended to be operated with the discharge hose full of liquid at all times; a “wet hose” is the discharge hose on this type of device.

D.5. DRY-HOSE TYPE.—A type of device in which it is intended that the discharge hose be completely drained following the mechanical operations involved in each delivery; a “dry hose” is the discharge hose on this type of device.

D.6. PRESSURE TYPE.—A type of device designed for operation with the liquid under pressure artificially produced.

D.7. GRAVITY TYPE.—A type of device designed for discharge by gravity.

D.8. VISIBLE TYPE. — A type of device in which the measurement takes place in a visible glass measuring chamber.

**S. SPECIFICATIONS.****GENERAL SPECIFICATIONS APPLICABLE TO  
BOTH RETAIL AND WHOLESALE DEVICES**

**S.1. UNITS.**—A device shall have a discharge capacity per stroke, or per cycle of the primary indicating elements, of 1 gallon, a multiple of the gallon, or a binary submultiple of the gallon: Provided, That a device may be constructed to make deliveries corresponding to specific money values at a definite unit price.

**S.2. DESIGN.**

**S.2.1. LEVEL.**—A device shall be in normal operating position when it is in level. If the performance of a device is changed by more than the values of the acceptance tolerances when operated in any position which is 3°, or 5 percent, out of level, the device shall be equipped with a two-way or circular level, a plumb bob, leveling lugs, or the like.

**S.2.2. STOP MECHANISM.** — If stops or other stroke-limiting elements are subject to direct pressure or impact, the security of their positions shall be accomplished by positive, non-frictional engagement of parts, and they shall be adjustable to provide for deliveries within prescribed tolerances. If two or more stops or other elements may selectively be brought into operation to permit deliveries of predetermined amounts, the position for the proper setting of each such element shall be accurately defined, inadvertent displacement from position shall be obstructed, and the delivery for which the device is set at any time shall be conspicuously indicated.

**S.2.3. DISCHARGE HOSE.**—This shall be adequately reinforced. A dry hose shall be of such length and stiffness as to facilitate its drainage. The inlet end of a dry hose or an equivalent outlet pipe shall be at such a height as to permit proper drainage of the hose or pipe and in any case shall be at least 5 feet above the normal level upon which the receiving vehicle or vessel stands; there shall be an automatic vacuum breaker or equivalent means to prevent syphoning and to insure the complete and rapid drainage of the hose or pipe.

**S.2.4. COMPLETENESS OF DELIVERY.** — If two or more delivery outlets are provided, delivery through one outlet shall not affect a subsequent delivery through any other outlet. If there is any possibility of diversion of measured liquid from a delivery outlet apparently in sole use and from which liquid is actually flowing, automatic means shall be provided by which any such diversion taking place will become obvious to an observer. Supply-line valves intended to prevent reversal of flow shall operate automatically.

**S.2.5. DISCHARGE-LINE VALVES.** — A discharge valve may be provided at the discharge end of the hose or elsewhere in the hose line only (a) if the device is of the wet-hose type, or (b) if any drainage of the hose will automatically become obvious to an observer. If the discharge valve is so positioned, any other shut-off valve in any portion of the discharge line leading to this outlet, shall be operable only (a) by use of means such as a wrench or screw driver (but not a pin) entirely separate from the device, or (b) by mutilation of a lead-and-wire seal by which the valve is sealed open. In a wet-hose, pressure-type device, an effective anti-drain valve shall be incorporated in the discharge valve or shall be installed immediately adjacent thereto. (See also S.10.4.)

**S.2.6. AIR ELIMINATION.** — A meter device shall be equipped with an effective mechanical air eliminator or other effective means to prevent passage of air or vapor through the meter.

**S.3. INDICATING MEANS.** (See also S.11. and S.21.)

**S.3.1. GENERAL.** — Quantity and money-value indications shall be readable from any reasonable customer position. Fractional parts of the gallon may be indicated in terms of either decimal or binary-submultiple subdivisions. Dials and graduated scales intended to remain stationary under normal operating conditions shall be permanently fixed in position. Two or more scales used in combination with a single indicator shall read in the same direction. If delivered quantities are determined by bringing the surface of the liquid in a glass measuring chamber

into coincidence with indicators or graduations, such indicators or graduations shall be inside the measuring chamber and not more than 1/16 inch from its surface.

S.3.2. UNIT-PRICE INDICATION.—A device which automatically indicates the total money value of the liquid measured for one of a series of unit prices shall display on each face of the device the unit price at which computations are being made at any time. A device which makes deliveries corresponding to specific money values at a definite unit price shall automatically display on each face of the device the unit price at which deliveries are being made at any time.

S.3.3. GRADUATIONS. — These shall be not wider than 0.04 inch. Figures defining the values of graduations shall be uniformly positioned as close as practicable to the graduations and shall be in regular sequence.

S.3.4. INDICATORS.—The width of the index of an indicator shall not exceed the width of the graduations with which it cooperates.

S.4. PROVISION FOR SEALING.—Provision shall be made for applying lead-and-wire seals in such manner that no measuring or quantity-indicating element (except such as alters deliveries corresponding to specific money values) and no element for controlling the delivery rate of a meter when such rate tends to affect the accuracy of deliveries, can be adjusted without mutilating the seal or seals.

## S.5. MARKING.

S.5.1. RATES AND PRESSURES.—A device shall be marked to show its maximum discharge rate under normal installation conditions, and the minimum discharge rate and the maximum working pressure recommended by the manufacturer: Provided, That on a retail device, in lieu of the maximum rate, a phrase such as "Full flow" may be used: *And provided further, That the minimum rate for a retail device shall not exceed 5 gallons per minute, and for a wholesale device shall not exceed 20 percent of the marked maximum rate.*

S.5.2. VALVE INSTRUCTION. — If a device is equipped with a valve intended to be sealed open under normal

operating conditions, a metal plate or tag, carrying a statement to the effect that the device shall not be operated unless the valve is sealed open, shall be attached adjacent to such valve.

**S.5.3. LIMITATION OF USE.**—If a device is intended to measure accurately only liquids having particular properties, its limitations shall be clearly and permanently stated on the device.

**ADDITIONAL SPECIFICATIONS APPLICABLE TO  
RETAIL DEVICES ONLY**

**S.10. DESIGN.**

**S.10.1. SENSITIVENESS.**—A retail device shall be readily operable to deliver accurately each quantity which the device holds itself forth to deliver. The diameter of the measuring chamber of a visible device for dispensing motor fuel shall be between 9.75 and 12.25 inches.

**S.10.2. DRAINAGE CHAMBER.** — In a visible-type dry-hose, retail device, if, during a delivery operation, measured liquid will continue to flow through the discharge valve for 3 seconds or more after the liquid has disappeared from sight in the measuring chamber or after the liquid appears to cease falling in the measuring chamber, there shall be installed adjacent to the discharge valve an auxiliary visible drainage chamber which will show conspicuously when any portion of the measured liquid has not been discharged through the valve after this has been closed.

**S.10.3. DRAINAGE PERIOD.**—A retail device for dispensing motor fuel shall be constructed or calibrated for complete drainage to the delivery side of the discharge valve, after the main flow has ceased, within a period of 10 seconds. The main flow shall be assumed to have ceased (a) in a piston-type device upon completion of the up-stroke of the piston, and (b) in a visible-type device when liquid has disappeared from sight in the measuring chamber, or when there is a sudden drop in the level of the liquid in an auxiliary drainage chamber. (In a calibration or test, the amount delivered by the device, as specified, at the end of the prescribed drainage period, shall be taken as the full



delivery of the device for the nominal quantity in question.)

**S.10.4. INITIAL OPERATING CONDITION.**—A retail device, except a visible-type device, shall be constructed to show whether or not the system is properly filled with liquid before a delivery is begun: Provided, That a manually-operated shut-off valve may be installed in the stand pipe of a piston-type device, and a check valve may be installed in the discharge line of any device equipped with an effective mechanical air eliminator or equivalent means.

**S.11. INDICATING ELEMENTS.** (See also S.3.)

**S.11.1. INDICATION OF DELIVERY.**—A retail device shall be constructed to show automatically its initial zero condition and the amounts delivered up to the nominal capacity of the device. If the nominal capacity is less than 50 gallons, it shall be conspicuously shown on each face of the device. Indication of delivery shall take place only when full delivery has been made, except that this requirement shall not apply to the dribble flow resulting from the down-stroke of a piston if a clear and conspicuous statement is placed on the device adjacent to the indicating means to the effect that the piston (or the indicator) must be returned to its initial position to produce full delivery.

**S.11.2. RETURN TO ZERO INDICATION.**—The primary indicating elements of a retail device shall be susceptible of advancement only by the mechanical operation of the device, and shall be readily returnable to a definite zero indication; means shall be provided to prevent the return of the indicating elements beyond their correct zero position: Provided, That a device may be cleared by advancing the indicating elements to zero if the movement, once started, cannot be interrupted, or if the indications are automatically obscured until the elements reach zero position.

**S.11.3 VISIBILITY.**—The bottom of the lowest indicating element of a retail device shall be at least 36 inches above the normal level upon which the receiving vehicle or vessel stands. The indications of a retail device shall be readable from any position within a field of 120°, de-

finied by two vertical planes each passing through the center of the face of the device at an angle of 30°.

**S.12. MONEY-VALUE COMPUTATIONS.** — These shall be either full-computing type (see S.12.1) or limited-computing type (see S.12.2.).

**S.12.1. FULL-COMPUTING TYPE.**—In this type the money value, at one or at each of a series of unit prices, shall be computed for every delivery within the range of measurement of the device. Value graduations shall be supplied and shall be accurately positioned. The value of each graduated interval shall be 1 cent at all prices per gallon of 30 cents and less, and shall not exceed 2 cents at higher prices per gallon. Five-cent intervals may be represented in the 2-cent range by special graduations, but these shall not be positioned in the clear intervals between graduations of the regular series.

**S.12.2. LIMITED-COMPUTING TYPE.**—In this type the money values, at one or at each of a series of unit prices, shall be computed automatically only for deliveries corresponding to a definite series of quantity graduations. Money values shown shall be mathematically accurate except that a fraction of less than  $\frac{1}{2}$  cent shall be dropped and that the next higher cent shall be shown in the case of a fraction of  $\frac{1}{2}$  cent or more. One of the following requirements shall be met:

- (a) There shall be a money-value computation for each quantity graduation within the range of measurement of the device.
- (b) No money-value computation shall be exposed to view except at such times as the device shows a quantity indication for which a corresponding value indication or series of value indications is computed.
- (c) Each value indication or series of value indications shall be marked to show the quantity to which the computation or computations correspond, and the device shall be marked to show the character and limitations of the computations.

**ADDITIONAL SPECIFICATIONS APPLICABLE TO  
WHOLESALE DEVICES ONLY****S.20. DESIGN.**

**S.20.1. SENSITIVENESS.**—A wholesale device shall be readily operable to deliver accurately any quantity from 50 gallons to the capacity of the device. If the most sensitive element of the indicating system utilizes an indicator and graduations, the relative movement of these parts corresponding to a delivery of 1 gallon shall be not less than 0.20 inch.

**S.21. INDICATING ELEMENTS. (See also S.3.)**

**S.21.1. MINIMUM DELIVERY INDICATION.**—The value of the smallest unit of indicated delivery on a wholesale device shall not exceed 1 gallon.

**NOTES AND PERFORMANCE REQUIREMENTS APPLICABLE TO  
BOTH RETAIL AND WHOLESALE DEVICES****N. NOTES.****N.1.—TESTING PROCEDURES.**

**N.1.1. DISCHARGE RATES.**—The “normal” test of a commercially installed meter or meter-type device shall be made at the maximum discharge rate developed under the conditions of installation. “Special” tests, to develop the operating characteristics of meters and meter-type devices, shall be made as circumstances require; a retail device shall be so tested at a minimum discharge rate of 5 gallons per minute; a wholesale device shall be so tested at a minimum discharge rate of (a) 15 gallons per minute for a device smaller than 2 inches in rated size, (b) 20 percent of the marked maximum rate for a device 2 inches or over in rated size, or (c) at any lower minimum rate marked on the device.

**N.1.2. TESTING DRAFTS.**—The full capacity delivery and each intermediate delivery for which the device is designed shall be tested in the case of retail piston-type and visible-type devices; for other types of retail devices used for dispensing motor fuel, testing drafts of at least 5 gallons shall be utilized. For wholesale devices, testing drafts should be equal to at least the amount delivered by the



device in 1 minute at its maximum discharge rate, and shall in no case be less than 50 gallons.

**N.1.3. ELAPSED-TIME TEST.**—In this test, allowance shall be made for the unavoidable errors resulting solely from changes in the volume of the liquid in the device as caused by temperature variations; this change in volume in the case of motor fuels may be computed at 0.6 percent per 10°F change of temperature and 1.1 percent per 10°C change of temperature.

#### **P. PERFORMANCE REQUIREMENTS EXCEPT TOLERANCES.**

**P.1. OPERATING CONDITIONS.**—The deliveries of a device shall be accurate (a) irrespective of whether operation is continuous or intermittent, (b) irrespective of the speed of operation, subject, however, to the provisions of T.1., and (c) irrespective of the time elapsing between operations, subject, however, to the provisions of T.2.

#### **T. TOLERANCES.**

**T.1. ON “NORMAL” TESTS AND “SPECIAL” TESTS EXCEPT ELAPSED-TIME TESTS.**—Maintenance tolerances on under-registration or on over-registration shall be as shown in Table 1; acceptance tolerances for retail devices and on “normal” tests of wholesale devices shall be one-half the maintenance tolerances; acceptance tolerances on “special” tests of wholesale devices shall be the same as the maintenance tolerances on such tests. (See N.1.1.) (The error of a liquid-measuring device—to which the tolerance is applied—is the difference between the registration of the device and the amount of liquid actually delivered by the device.)

TABLE 1. — Maintenance Tolerances for Liquid-Measuring Devices

For retail devices		For wholesale devices		
Indication of device	Tolerance	Indication of device	Tolerance	
			On "normal" tests	On "special" tests
<i>Gallons</i>	<i>Cubic inches</i>	<i>Gallons</i>	<i>Cubic inches</i>	<i>Cubic inches</i>
1/2 or less.	2.....	50.....	50.....	50.....
1.....	3.....	Over 50.....	Add 1/2 cubic inch per indicated gallon.	Add 1 cubic inch per indicated gallon.
2.....	4.....			
3.....	5.....			
4.....	6.....			
5.....	7.....			
Over 5.....	Add 1 cubic inch per indicated gallon.			

T.2. ON ELAPSED-TIME TEST.—Maintenance tolerances are 2 cubic inches per hour for a retail device and 5 cubic inches per hour for a wholesale device; acceptance tolerances are one-half the maintenance tolerances. (The error to which these tolerances are applied is the leakage error resulting solely from the nonuse of the device.)

## R. REGULATIONS.

### R.1. INSTALLATION.

R.1.1. PLUMB AND LEVEL CONDITION.—A device installed in a fixed location shall be installed plumb and level and the installation shall be sufficiently strong and rigid to maintain this condition.

R.1.2. SUCTION HEAD.—A piston-type device shall be so installed that the total effective suction head will not be great enough to cause vaporization of the liquid being dispensed, under the highest temperature and lowest barometric pressure likely to occur.

**R.1.3. DISCHARGE RATE.**—A wholesale device shall be so installed that the actual maximum discharge rate will not exceed the rated maximum discharge rate; if necessary, means for flow regulation shall be incorporated in the installation, in which case this shall be fully effective and automatic in operation.

**R.2. LENGTH OF DISCHARGE HOSE.**—The length of the discharge hose on a retail device shall not exceed 15 feet, measured from the outside of the housing of the device to the inlet end of the discharge nozzle, unless it can be demonstrated that a longer hose is essential to permit deliveries to be made to receiving vehicles or vessels. Unnecessarily remote location of a device shall not be accepted as justification for an abnormally long hose.

**R.3. RETURN OF INDICATING ELEMENT TO ZERO.**—Any device used in making retail deliveries to individual consumers shall be so constructed that the primary indicating elements are readily returnable to a definite zero indication, and these elements shall be returned to zero following each such delivery.

**R.4. USE OF ADJUSTMENTS.**—Adjustment of measuring or indicating elements shall not be made to correct for leaks, slippage, excessive length of supply line, or other defects not directly associated with the adjustable elements.

**R.5. METHOD OF OPERATION.**—A device shall be operated only in the manner which is obviously indicated by its construction or which is indicated by instructions on the device; if operated in any other manner the device shall be subject to condemnation.

**R.6. IDENTIFICATION OF RESPONSIBLE PARTY.**—A coin-operated retail device shall be legibly and permanently marked to show the name and address of the person, firm, or corporation to whom application may be made for adjustment of any claim arising from failure of the device to deliver accurately.





## GREASE-MEASURING DEVICES

### A. APPLICATION.

A.1.—This code does not apply to (a) devices constructed to weigh grease or transmission oil and to deliver such material by weight, (b) devices obviously designed solely for the high-pressure lubrication of bearings and similar parts, and (c) devices used solely in operations for which a flat rate is charged, no variation in the charges being made because of the varying amounts of lubricant delivered.

### D. DEFINITIONS.

D.1. GREASE-MEASURING DEVICE. — A mechanism or machine designed to measure grease or transmission oil and to deliver such material by definite volume.

### S. SPECIFICATIONS.

S.1. UNITS.—A device shall have a discharge capacity per stroke, or per cycle of the primary indicating elements, of 1 liquid pint, a multiple of the liquid pint, or a binary submultiple of the liquid pint.

#### S.2. DESIGN.

S.2.1. STOP MECHANISM.—If stops or other stroke-limiting elements are subject to direct pressure or impact, the security of their positions shall be accomplished by positive, non-frictional engagement of parts, and they shall be adjustable to provide for deliveries within prescribed tolerances. If two or more stops or other elements may selectively be brought into operation to permit deliveries of predetermined amounts, the position for the proper setting of each such element shall be accurately defined, inadvertent displacement from position shall be obstructed, and the delivery for which the device is set at any time shall be conspicuously indicated.

S.2.2. COMPLETENESS OF DELIVERY.—There shall be no means by which diversion of measured lubricant from

measuring chamber or discharge line during operation of the device can be made. Valves intended to prevent reversal of flow shall be automatic in operation. There shall be an effective anti-drain valve immediately adjacent to the outlet end of the discharge hose.

**S.2.3. EXHAUSTION OF SUPPLY.**—Means shall be provided for making the device inoperable or for giving a conspicuous and distinct warning when the level of the supply of lubricant becomes so low as to endanger the accuracy of measurement.

### **S.3. INDICATING MEANS.**

**S.3.1. GENERAL.**—The amount delivered up to a total of not less than 5 pints, shall be indicated automatically. If the most sensitive element of the indicating system utilizes an indicator and graduations, the relative movement of these parts corresponding to a delivery of 1 pint shall be not less than 1 inch. A graduated scale or dial shall be permanently attached. Indicating elements shall be susceptible of advancement only by the mechanical operation of the device, and shall be readily returnable to a definite zero indication; means shall be provided to prevent the return of the indicating elements beyond their correct zero position.

**S.3.2. GRADUATIONS.**—These shall be not wider than 0.04 inch.

**S.3.3. INDICATORS.**—The width of the index of an indicator shall not exceed the width of the graduations with which it cooperates.

**S.4. PROVISION FOR SEALING.**—If the measuring or indicating elements are adjustable, provision shall be made for applying lead-and-wire seals in such a manner that no such adjustments can be made without mutilating the seal or seals.

### **S.5. MARKING.**

**S.5.1. WORKING PRESSURE.**—If a device is operable by air pressure the air-pressure gage shall show, by special graduations or otherwise, the maximum and minimum working pressures recommended by the manufacturer.

S.5.2. LIMITATION OF USE.—If a device is intended to measure accurately only certain types or varieties of greases or transmission oils, its limitations shall be clearly and permanently stated on the device.

#### P. PERFORMANCE REQUIREMENTS EXCEPT TOLERANCES.

P.1. SPEED OF OPERATION.—The deliveries of a device shall be accurate (a) irrespective of the time elapsing between operations, and (b) irrespective of the speed of operation, except that if the device is operable by air pressure and is tested at an operating pressure below the minimum recommended by the manufacturer, only the tolerance on over-registration shall be applied, and errors of under-registration shall be disregarded.

#### T. TOLERANCES.

T.1.—Maintenance tolerances on under-registration or on over-registration shall be as shown in table 1; acceptance tolerances shall be one-half the maintenance tolerances.

TABLE 1.—Maintenance Tolerances for Grease-Measuring Devices

Indication of device	Tolerance	
	<i>Fluid ounce</i>	<i>Cubic inches</i>
1 pint or less.....	0.7	1.25
Over 1 pint.....	Add 0.7 fluid ounce per in- dicated pint.	Add 1.25 cubic inches per in- dicated pint.

#### R. REGULATIONS.

R.1. ADJUSTMENTS.—The measuring or indicating elements of a grease-measuring device shall not be adjusted to correct for leaks, slippage, or similar defects.





## VEHICLE TANKS

### D. DEFINITIONS.

D.1. VEHICLE TANK.—An assembly used for the delivery of liquids, comprising a tank, which may or may not be subdivided into two or more compartments, mounted upon a vehicle, together with its accessory piping, valves, meters, etc.

D.2. COMPARTMENT.—The entire tank when this is not subdivided; otherwise, any one of those subdivisions of a tank designed to hold liquid.

### S. SPECIFICATIONS.

#### GENERAL SPECIFICATIONS APPLICABLE BOTH TO VEHICLE TANKS USED AS MEASURES AND TO VEHICLE TANKS EQUIPPED WITH METERS

S.1. STRENGTH.—The shell and bulkheads shall be so constructed that they will not become distorted under any condition of liquid lading.

S.2. VENTING.—Effective venting means shall be provided to prevent the formation of air pockets in a compartment by permitting the escape of air from all parts of the compartment designed to be filled with liquid, and to permit the influx of air to a compartment during discharge therefrom.

#### ADDITIONAL SPECIFICATIONS APPLICABLE ONLY TO VEHICLE TANKS USED AS MEASURES

### S.10. DESIGN.

S.10.1. FILL OR INSPECTION OPENING.—The fill or inspection opening of a compartment shall be of such size that it can readily be determined by visual inspection that the compartment has been properly filled or completely emptied, and that the affixing of any required seals can readily be accomplished. In no case shall the fill or inspection opening, if circular, have a diameter of less than  $7\frac{5}{8}$  inches, or, if other than circular, have an effective area of less than 45 square inches.

**S.10.2. COMPARTMENT CAPACITY AND EMERGENCY VALVE.**—If a compartment is equipped with an emergency (or safety) valve, this shall be positioned at the lowest point of outlet from the compartment, and the compartment capacity shall be construed as excluding the capacity of the piping leading therefrom.

**S.10.3. INDICATOR.**—A permanently attached indicator shall be located within the fill or inspection opening, approximately midway between the ends of the compartment. The indicator shall be so designed that it will distinctly and unmistakably define the capacity point of the compartment when liquid is in contact with the lowest portion of the indicator. Adequate provision shall be made for affixing a lead-and-wire seal or seals to an adjustable indicator and to any removable part to which an indicator may be attached, so that no adjustment of the indicator can be made and so that the said part cannot be removed without mutilating the seal or seals.

**S.10.4. SENSITIVENESS AND EXPANSION SPACE.**—An indicator shall be so positioned in a compartment that at the level of the indicator a change of 0.04 inch in the height of the liquid surface will represent a volume change of not more than the value of the tolerance "On first test" for the nominal compartment capacity, and that when the compartment is filled to its capacity point there will remain an expansion space of at least 0.75 percent of the nominal compartment capacity.

**S.10.5. MANIFOLD VALVES.**—When two or more compartments discharge through a manifold, an effective and automatic means shall be provided to prevent passage of liquid from the manifold into the discharge line from any compartment.

**S.10.6. COMPLETENESS OF DELIVERY.**—When a vehicle tank is standing upon a level surface, complete delivery shall be made from any compartment through its delivery faucet or valve whether other compartments are full or empty.

## **S.11. MARKING.**

**S.11.1. COMPARTMENT IDENTIFICATION.** — Each com-

partment of a multiple-compartment vehicle tank shall be conspicuously marked with an identifying letter or figure, and each delivery faucet or valve shall be correspondingly marked to identify the compartment whose discharge it controls.

**S.11.2. COMPARTMENT CAPACITY.**—Adjacent to the delivery faucets or valves there shall be a conspicuous statement of the capacity, to the nearest half-gallon, of each compartment, and this statement shall say that the capacities shown are determined to the lowest portions of the compartment indicators.

**ADDITIONAL SPECIFICATIONS APPLICABLE ONLY TO  
VEHICLE TANKS EQUIPPED WITH METERS**

**S.20. DESIGN.**

**S.20.1. AIR ELIMINATION.**—The unit shall be equipped with an effective air eliminator or other effective means to prevent passage of air or vapor through the meter.

**S.20.2. DIVERSION OF MEASURED LIQUID.**—No means shall be provided by which any measured liquid can be diverted from the measuring chamber of the meter or the discharge line therefrom: Provided, That two or more delivery outlets may be installed if automatic means is provided to insure that (a) liquid can flow from only one such outlet at one time and (b) the direction of flow for which the mechanism may be set at any time is definitely and conspicuously indicated.

**S.20.3. DELIVERY HOSE.**—On a gravity-discharge unit, the delivery hose shall be as short as practicable, and there shall not be a shut-off valve at its outlet end. On a pump-discharge unit, the delivery hose shall be of the wet-hose type with a shut-off valve at its outlet end, and immediately adjacent to this valve there shall be a spring-loaded check valve so adjusted that drainage of the hose will automatically be prevented.

**S.21. METER.**

**S-21.1. POSITION AND TYPE.**—The indicating elements of a meter shall be so positioned that their indications may be easily and accurately read, and, except as provided in S.21.2., a meter shall conform to all applicable specifica-

tion requirements for wholesale-type devices given in the code for Liquid-Measuring Devices.

**S.21.2. INDICATING ELEMENTS.**—Primary indicating elements may be advanced only by the mechanical operation of the meter and shall be readily returnable to a definite zero indication; means shall be provided to prevent the return of the indicating elements beyond their correct zero position: Provided, That a meter may be cleared by advancing the indicating elements if during this operation the indications are obscured and remain obscured until zero position is reached. The value of the smallest unit of indicated delivery on a meter used for retail deliveries of fuel oil shall not exceed 1 pint.

**NOTES AND PERFORMANCE REQUIREMENTS APPLICABLE BOTH TO  
VEHICLE TANKS USED AS MEASURES AND TO VEHICLE TANKS  
EQUIPPED WITH METERS**

**N. NOTES.**

**N.1. TESTING MEDIUM.**

**N.1.1. FOR COMPARTMENT TESTING.**—Water or light fuel oil shall be used as the testing medium in determining the capacity of a vehicle-tank compartment.

**N.1.2. FOR METER TESTING.**—A vehicle-tank meter shall be tested with liquid of the same character, or of approximately the same viscosity, as the liquid to be commercially measured.

**N.2. TESTING PROCEDURES.**

**N.2.1. DISCHARGE RATES FOR METERS.**—The “normal” test of a meter shall be made at the maximum rate permitted by the installation. “Special” tests, to develop the operating characteristics of a meter and the operating elements associated therewith, shall be made as circumstances require; a meter smaller than 2 inches in rated size shall be so tested at a minimum discharge rate of 15 gallons per minute, and a meter 2 inches and over in rated size shall be so tested at a minimum discharge rate of 20 percent of the marked maximum rate, or the test shall be made at any lower minimum rate marked on the meter.

**N.2.2. TESTING DRAFTS FOR METERS.**—Testing drafts should be equal to at least the amount delivered by the

meter in one minute at its maximum discharge rate, and shall in no case be less than 50 gallons.

**N.2.3. EVAPORATION AND VOLUME CHANGE OF TEST LIQUID.**—Care shall be exercised to reduce to a minimum evaporation losses, and volume changes resulting from changes in temperature, of the test liquid.

**N.2.4. ADJUSTMENT AND REMARKING.**—When the error of a compartment exceeds the applicable tolerance, the capacity of the compartment shall be adjusted to agree with its marked capacity, or its marked capacity shall be changed to agree with its capacity as determined by the test.

## **P. PERFORMANCE REQUIREMENTS EXCEPT TOLERANCES.**

**P.1.—OPERATING CONDITIONS FOR METERS.**—The delivery of a meter shall be accurate (a) irrespective of whether its operation is continuous or intermittent, and (b) when operated as specified in N.2.1., subject, however, to the provisions of T.2.

## **T. TOLERANCES.**

**T.1. ON VEHICLE-TANK COMPARTMENTS.** — Tolerances in excess or in deficiency for vehicle-tank compartments used as measures which are being officially tested for the first time, or for the first time following repairs or modifications which might affect compartment capacities, shall be as shown in table 1 in the column headed "On first test"; on other official tests the tolerances shall be as shown in table 1 in the column headed "On subsequent test". (The error of a compartment — to which the tolerance is applied—is the difference between the marked capacity of the compartment and the compartment capacity as determined by test.)

TABLE 1.—Tolerances on Vehicle-Tank Compartments  
Used as Measures

Compartment capacity	Tolerance	
	On first test	On subsequent test
<i>Gallons</i>	<i>Pints</i>	<i>Quarts</i>
200 or less.....	4	2
201 to 400, incl.....	4	3
401 to 600, incl.....	5	4
601 to 800, incl.....	6	5
801 to 1,000, incl.....	7	6
Over 1,000 .....	Add 1 pint per 200 gallons	Add 1 quart per 200 gallons

T.2. ON VEHICLE-TANK METERS.—Maintenance tolerances, on under-registration or on over-registration, shall be as shown in table 2; acceptance tolerances on “normal” tests shall be one-half the maintenance tolerances; acceptance tolerances on “special” tests shall be the same as the maintenance tolerances on such tests. (See N.2.1.)

TABLE 2.—Maintenance Tolerances for Vehicle-Tank Meters on  
Single-Compratment Tests

Indication of meter	Tolerance	
	On “normal” tests	On “special” tests
<i>Gallons</i>	<i>Cubic inches</i>	<i>Cubic inches</i>
50 .....	50	50
Over 50.....	Add ½ cubic inch per indicated gallon	Add 1 cubic inch per indicated gallon



**R. REGULATIONS.**

**R.1. REINSPECTION.**—Whenever a vehicle tank is damaged, repaired, or modified in any way which might affect the accuracy of measurement of its deliveries, it shall not thereafter be used for measurement until it has been officially inspected and reapproved.

**R.2. CONDITIONS OF USE.**—When a vehicle tank is used as a measure, the vehicle shall stand upon a level surface during the filling of the compartments. During a delivery the vehicle shall be so positioned as to insure complete delivery whenever the delivery is such that a compartment should be completely emptied.





## DRY MEASURES<sup>3</sup>

### A. APPLICATION.

A.1.—This code does not apply to “standard containers” used for the measurement of fruits and vegetables and as shipping containers therefor.

### D. DEFINITIONS.

D.1. DRY MEASURE.—A rigid measure of capacity, designed for general and repeated use in the measurement of solids, including baskets used as dry measures in capacities of  $\frac{1}{2}$  bushel or more.

### S. SPECIFICATIONS.

S.1. UNITS. — The capacity of a measure shall be 1 bushel, a multiple of the bushel, or a binary submultiple of the bushel, and the measure shall not be subdivided or double-ended.

S.2. MATERIAL. — A measure shall be made of metal, well-seasoned wood, composition, or similar and suitable material.

#### S.3. DESIGN.

S.3.1. CAPACITY POINT.—The capacity of a measure shall be determined by the top edge of the measure.

S.3.2. SHAPE.—A measure, other than a basket, of a capacity of  $\frac{1}{2}$  bushel or less, shall be cylindrical or conical in shape; if conical, the top diameter shall exceed the bottom diameter, but by not more than 10 percent of the bottom diameter; and the top diameter shall in no case be less than the appropriate minimum diameter shown in table 1. The bottom of a measure, other than a basket, shall be perpendicular to the axis of the measure and shall be flat, except that a metal bottom may be slightly corrugated. The bottom of a measure shall not be adjustable or movable.

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<sup>3</sup>This code should not be promulgated in any jurisdiction in which the use of dry measures is prohibited by law.

TABLE 1.—Minimum Top Diameters for Dry Measures Other Than Baskets

Capacity of measure	Minimum top diameter
	<i>Inches</i>
1 pint.....	4
1 quart.....	5 $\frac{3}{8}$
2 quarts.....	6 $\frac{5}{8}$
1/2 peck.....	8 $\frac{1}{2}$
1 peck.....	10 $\frac{7}{8}$
1/2 bushel.....	13 $\frac{3}{4}$

S.3.3. TOP REINFORCEMENT.—The top edge of a measure shall be reinforced; on a wooden measure other than a basket, of a capacity of 1 quart or more, this reinforcement shall be in the form of a firmly attached metal band.

S.3.4. HANDLES.—A measure of a capacity of 1 bushel or more shall be equipped with handles.

S.4. MARKING. — A measure shall be conspicuously marked on its side with a statement of its capacity; if the capacity is stated in terms of the pint or quart, the word "Dry" shall be included. The capacity statement shall be in letters at least  $\frac{1}{2}$  inch high and  $\frac{1}{4}$  inch wide on a measure of any capacity between  $\frac{1}{4}$  pint and 1 peck, and in letters at least 1 inch high and  $\frac{1}{2}$  inch wide on a measure of a capacity of  $\frac{1}{2}$  bushel or more; the statement on a measure of a capacity of  $\frac{1}{8}$  pint and less, designed particularly for the measurement of seeds, shall be as prominent as practicable, considering the size and design of such measures.

#### T. TOLERANCES.

T.1.—Maintenance tolerances in excess and in deficiency shall be as shown in table 2; acceptance tolerances shall be one-half the maintenance tolerances.

TABLE 2.—Maintenance Tolerances for Dry Measures

Capacity of measure	Tolerance	
	In excess	In deficiency
	<i>Cubic inches</i>	<i>Cubic inches</i>
1/32 pint or less.....	0.1	0.05
1/16 pint.....	.15	.1
1/8 pint.....	.25	.15
1/4 pint.....	.5	.3
1/2 pint.....	1.0	.5
1 pint.....	2.0	1.0
1 quart.....	3.0	1.5
2 quarts.....	5.0	2.5
1/2 peck.....	10.0	5.0
1 peck.....	16.0	8.0
1/2 bushel.....	30.0	15.0
1 bushel.....	50.0	25.0

## BERRY BASKETS AND BOXES

### A. APPLICATION.

A.1.—This code applies to baskets and boxes for berries and small fruits in capacities of 1 dry quart and less.

### S. SPECIFICATIONS.

S.1. UNITS.—The capacity of a basket or box shall be  $\frac{1}{2}$  dry pint, 1 dry pint, or 1 dry quart.

### T. TOLERANCES.

T.1.—Acceptance tolerances in excess and in deficiency shall be as shown in table 1.

TABLE 1.—Acceptance Tolerances for Berry Baskets and Boxes

Capacity of basket or box	Tolerance	
	In excess	In deficiency
	<i>Cubic inches</i>	<i>Cubic inches</i>
1/2 pint.....	1	0.5
1 pint.....	2	1.0
1 quart.....	3	1.5

## SCALES

### A. APPLICATION.

A.1. GENERAL.—The code for scales comprises general requirements which are generally applicable to all classes, and specific requirements for certain individual classes. (Scales are also subject to the requirements of the General Code for weighing and measuring devices insofar as these are applicable.) Specific requirements supersede general requirements in all cases of conflict. This code does not apply to automatic packaging devices or to automatic weight-checking devices. (See also G-A.1. and G-A.2.)

A.2. PRECIOUS-METALS SCALES.—The requirements for Class A prescription scales shall apply, insofar as they are applicable, to scales used for the purchase and sale of precious metals.

A.3. COMMERCIAL PERSON WEAIGHERS.—The requirements for person weighers apply to coin-operated person weighers and to other scales used for weighing persons when a charge is made for the weighing service.

A.4. MOISTURE-TEST SCALES.—The requirements for cream-test scales shall apply, insofar as they are applicable, to moisture-test scales, except that prescribed test loads shall be 10 grams instead of 18 grams.

### D. DEFINITIONS.

#### D.1. CLASSES OF SCALES.

D.1.1. SMALL-CAPACITY SCALE. — One of the bench (counter) or hanging type having a nominal capacity of 400 pounds or less.

D.1.2. LARGE-CAPACITY SCALE.—Any scale other than a small-capacity scale. (A scale of any capacity designed to stand on the floor is a "large-capacity" scale.)

D.1.3. BEAM SCALE. — One on which the weights of loads of various magnitudes are indicated solely by means of one or more weighbeam bars either alone or in combination with counterpoise weights.

**D.1.4. AUTOMATIC-INDICATING SCALE.** — One on which the weights of applied loads of various magnitudes are automatically indicated throughout all or a portion of the weighing range of the scale. A “full-automatic-indicating” scale is one on which the capacity of the automatic-indicating elements equals the nominal capacity of the scale. A “semi-automatic-indicating” scale is one on which the capacity of the automatic-indicating elements is less than the nominal capacity of the scale. (A scale which automatically weighs out commodity in predetermined drafts, such as an automatic grain hopper scale, a packaging scale, and the like, is not an “automatic-indicating” scale.)

**D.1.5. SPRING SCALE.** — An automatic-indicating scale in which the counterforce is supplied by an elastic body or system of such bodies, the shape or dimensions of which are changed by applied loads. A “compensated” spring scale is one equipped with a device intended to compensate for changes in the elasticity of the spring or springs resulting from changes in temperature, or one so constructed as to be substantially independent of such changes; an “uncompensated” spring scale is one not so equipped or constructed. A “straight-face” spring scale is one in which the indicator is affixed to the spring without intervening mechanism and which indicates weight values on a straight graduated reading face. (The use in a scale of metal bands or strips in lieu of pivots and bearings does not constitute the scale a “spring” scale.)

**D.1.6. COMPUTING SCALE.** — One which indicates the money values of amounts of commodity weighed, at predetermined unit prices, throughout all or part of the weighing range of the scale.

**D.1.7. PRESCRIPTION SCALE.**—A scale or balance adapted to weighing the ingredients of medicinal and other formulas prescribed by physicians and others and used or intended to be used in the ordinary trade of pharmacists and chemists. “Class A” and “Class B” scales are those meeting the requirements for Classes A and B, respectively, of the code for Prescription Scales.

**D.1.8. CREAM-TEST SCALE.**—One adapted to determining the butterfat content of milk, cream, or butter.

D.1.9. **MOISTURE-TEST SCALE.**—One adapted to determining the moisture content of butter.

D.1.10. **PERSON WEIGHER.**—A scale specially adapted to weighing persons. A “ticket” person weigher is one which, on each weighing operation, automatically records the weight on a ticket, card, or the like and automatically delivers this to a suitable receptacle on the outside of the scale.

D.1.11. **WHEEL-LOAD WEIGHER.** — A compact portable scale specially adapted to determining the wheel loads of vehicles on highways and intended solely for official use in the enforcement of traffic and highway laws. (A wheel-load “weigher” is to be distinguished from a wheel-load “scale”, the latter being a scale installed in a fixed location. An “axle-load scale” is similar to a wheel-load scale except that it is adapted to determining the combined load of all wheels on a single vehicle axle.)

D.1.12. **VEHICLE SCALE.** — One adapted to weighing highway vehicles, loaded or unloaded.

D.1.13. **LIVESTOCK SCALE.**—For purposes of the application of requirements for SR, tolerances, and minimum graduations, a scale having a nominal capacity of 6,000 pounds or more and used primarily for weighing livestock standing on the scale platform. (An “animal scale” is a scale adapted to weighing single heads of livestock.)

D.1.14. **COAL-MINE SCALE.**—One used at a coal mining operation for determining the wages of miners on a production basis.

## D.2. CAPACITY.

D.2.1. **NOMINAL CAPACITY.**—The largest weight indication which can be obtained by the use of all of the reading elements in combination, including the amount represented by any removable weights furnished or ordinarily furnished with the scale, but excluding the amount represented by any extra removable weights not ordinarily furnished with the scale and excluding also the capacity of any auxiliary weighing attachment not contemplated by the original design of the scale: Provided, That when a scale is constructed to give weight indications in both the



customary and metric systems, this definition shall be applied to the indications in one system only: And provided further, That in applying this definition the capacity of any fractional bar is to be included only when this exceeds  $2\frac{1}{2}$  percent of the sum of the capacities of the remaining reading elements.

**D.2.2. READING-FACE CAPACITY.** — The largest weight which may be indicated on the reading face, exclusive of the use of any unit weights or other elements.

### **D.3. INDICATING ELEMENTS.**

**D.3.1. WEIGHBEAM OR BEAM.**—An element comprising one or more bars equipped with movable poises.

**D.3.2. MAIN BAR.**—A principal weighbeam bar, usually of relatively large capacity as compared with other bars of the same weighbeam. (On an automatic-indicating scale equipped with a weighbeam, the main weighbeam bar is frequently called the “capacity” bar.)

**D.3.3. TARE BAR.**—An auxiliary weighbeam bar, primarily for the purpose of determining, or balancing out, the weights of empty containers.

**D.3.4. FRACTIONAL BAR.** — A weighbeam bar of relatively small capacity, for obtaining indications intermediate between notches or graduations on the main bar.

**D.3.5. POISE.**—A movable weight mounted upon or suspended from a weighbeam bar and used in combination with graduations, and frequently with notches, on the bar to indicate weight values. (A suspended poise is commonly called a “hanging” poise.)

**D.3.6. READING FACE.**—That element of an automatic-indicating scale on which weight values are automatically indicated. (A circular reading face is frequently called a “dial”.)

**D.3.7. BALANCE INDICATOR.** — A combination of elements, one or both of which will oscillate with respect to the other, for indicating the balance condition of a non-automatic-indicating scale. The combination may consist of two indicating edges, lines, or points, or a single edge, line, or point and a graduated scale.

**D.3.8. OVER-AND-UNDER INDICATOR.**—An automatic-in-

dicating element, incorporated in or attached to a scale and comprising an indicator and a graduated scale with a central or intermediate "zero" graduation and a limited range of weight graduations on either side of the zero graduation, for indicating weights greater than and less than the predetermined values for which other elements of the scale may be set. (A scale having an over-and-under indicator is classed as an automatic-indicating scale.)

#### D.4. ZERO-LOAD BALANCE.

D.4.1. GENERAL DEFINITION.—A correct weight indication of zero when there is no load on the load-receiving element.

D.4.2. FOR A NON-AUTOMATIC-INDICATING SCALE. — A condition in which (a) the weighbeam is at rest at or oscillates through approximately equal arcs above and below the center of a trig loop, (b) the weighbeam or lever system is at rest at or oscillates through approximately equal arcs above and below a horizontal position or a position midway between limiting stops, or (c) the indicator of a balance indicator is at rest at or oscillates through approximately equal arcs on either side of the zero graduation.

D.4.3. FOR AN AUTOMATIC-INDICATING SCALE.—A condition in which the indicator is at rest at or oscillates through approximately equal arcs on either side of the zero graduation.

#### D.5. SENSIBILITY RECIPROCAL OR SR.

D.5.1. GENERAL DEFINITION.—The change in load required to change the position of rest of the indicating element or elements of a non-automatic-indicating scale a definite amount at any load.

D.5.2. FOR A SCALE WITH A TRIG LOOP BUT WITHOUT A BALANCE INDICATOR. — The change in load required to change the position of rest of the weighbeam from the center of the trig loop to the top or bottom of the trig loop, except as is provided in N.1.5.

D.5.3. FOR A SCALE WITHOUT A TRIG LOOP OR BALANCE INDICATOR. — The change in load required to change the position of rest of the weighbeam or lever system from the

horizontal, or midway between limiting stops, to either limit of motion.

**D.5.4. FOR A SCALE WITH A BALANCE INDICATOR.**—The change in load required to cause (a) a relative change of 0.04 inch in the positions of rest of two indicators which move in opposite directions, (b) a change in the position of rest of an indicator such that there is a clear interval between adjacent edges of the indicator and a single zero graduation equal to 0.04 inch on a small-capacity scale, 0.12 inch on a large-capacity scale other than a vehicle, livestock, coal-mine, or railway track scale, and 0.25 inch on a vehicle, livestock, coal-mine, or railway track scale, or (c) a change in the position of rest of an indicator equal to one division on a graduated scale if this distance is greater than that specified in (b).

**D.5.5. ACCEPTANCE AND MAINTENANCE SR REQUIREMENTS.**—Acceptance SR requirements are applicable to scales to which acceptance tolerances are applicable. Maintenance SR requirements are applicable to scales to which maintenance tolerances are applicable. (See General Code, G-T.1. and G-T.2.)

#### **D.6. WEIGHTS USED WITH SCALES.**

**D.6.1. EQUAL-ARM WEIGHT.**—One used on an equal-arm scale.

**D.6.2. COUNTERPOISE WEIGHT.**—A slotted or “hanger” weight intended for application near the tip of the weigh-beam of a scale having a multiple greater than 1.

**D.6.3. UNIT WEIGHT.**—One contained within the housing of an automatic-indicating scale and mechanically applied to and removed from the mechanism.

**D.6.4. COUNTERBALANCE WEIGHT.**—A weight intended for application near the butt of a weighbeam for zero-load balancing purposes.

**D.7. NOSE-IRON.**—A slidably-mounted, manually-adjustable pivot assembly for changing the multiple of a lever.

**D.8. MULTIPLE OF A SCALE.**—In general, the multiplying power of the entire system of levers. Specifically, on

a beam scale the number of pounds on the load-receiving element which will be counterpoised by 1 pound applied to the tip pivot of the weighbeam.

D.9. VALUE OF MINIMUM WEIGHT GRADUATION.—The smallest weight value represented by the interval from the center of one weight graduation to the center of the succeeding weight graduation, or the smallest increment of recorded weight.

D.10. RATIO TEST.—A test to determine the accuracy with which the actual multiple of a scale agrees with its designed multiple. This test is utilized in the case of scales employing counterpoise weights and is made with standard weights substituted in all cases for the weights commercially used on the scale.

## S. SPECIFICATIONS.

### GENERAL SCALE SPECIFICATIONS

#### S.1. DESIGN.

S.1.1. GENERAL.—A scale shall be of such materials and construction that (a) it will support a load of its full nominal capacity without developing undue stresses or deflections, (b) it may reasonably be expected to withstand normal usage without undue impairment of accuracy or the correct functioning of parts, and (c) it will be reasonably permanent in adjustment.

S.1.2. STABILITY OF INDICATIONS.—A scale shall be capable of repeating with reasonable precision its indications and recorded representations. This requirement shall be met irrespective of repeated manipulation of any scale element in a manner duplicating normal usage, including (a) displacement of the indicating elements to the full extent allowed by the construction of the scale, (b) repeated operation of a locking or relieving device, and (c) repeated application or removal of unit weights.

S.1.3. INTERCHANGE OR REVERSAL OF PARTS. — Parts which may readily be interchanged or reversed in the course of normal usage shall be so constructed that their interchange or reversal will not materially affect the zero-load balance or the performance of the scale. Parts which

may be interchanged or reversed in normal field assembly shall be (a) so constructed that their interchange or reversal will not affect the performance of the scale or (b) so marked as to show their proper positions.

S.1.4. PIVOTS.—Pivots shall be made of hardened steel, except that agate may be used in prescription scales, and shall be firmly secured in position. Pivot knife-edges shall be sharp and straight.

S.1.5. BEARINGS. — The bearing surface intended for contact with a pivot knife-edge or point shall be smooth and at least as hard as the opposing edge or point. Bearings in scales having nominal capacities of 5,000 pounds or more shall be made of hardened steel.

S.1.6. LINES OF CONTACT.—Under all operating conditions, proper lines of contact between knife-edges and their opposing bearings shall be maintained or restored.

S.1.7. ANTIFRICTION ELEMENTS. — At all points at which a live part of the mechanism may come into contact with another part in the course of normal usage, frictional effects shall be reduced to a minimum by means of suitable antifriction elements, opposing surfaces and points being properly shaped, finished, and hardened. A platform scale having a frame around the platform shall be equipped with means to prevent interference between platform and frame.

#### S.1.8. BALANCE AND LEVEL.

S.1.8.1. ZERO INDICATION. — There shall be a definite and clear zero graduation on an automatic-indicating scale whether or not the entire reading face is graduated, and on a balance indicator, and provision shall be made for giving an indication on either side of the zero graduation sufficient to show clearly an out-of-balance condition.

S.1.8.2. BALANCING MEANS.—A scale shall be provided with means by which the zero-load balance may be adjusted and any loose material used for this purpose shall be securely enclosed. *The balance ball or equivalent device on a large-capacity scale shall not be rotatable and shall be actuated by a self-contained screw unless the balancing*



*device is motor-controlled or otherwise automatic in operation or is enclosed in a cabinet.*

S.1.8.3. ADJUSTMENT.—A mechanical device for adjusting the zero-load balance or the level of a person-weigher or a small-capacity scale other than a cream-test or prescription scale shall be operable or accessible only by mechanical means outside of and entirely separate from the adjustable element, such as a screw driver or wrench but not a pin.

S.1.8.4. LEVEL-INDICATING MEANS. — If the weighing performance of a person-weigher, or of a bench or counter scale which is portable, is changed by an amount greater than the appropriate acceptance tolerance when it is moved from a level position and rebalanced in a position which is out of level in any direction by 5 percent or approximately 3 degrees, the scale shall be equipped with level-indicating means. *The indications of this level-indicating means shall be readily observable without the necessity of disassembly of any scale parts requiring the use of mechanical means separate from the scale.*

S.1.9. DAMPING MEANS. — An automatic-indicating scale and a balance indicator shall be equipped with effective means for damping the oscillations whenever such means are necessary to bring the indicating elements quickly to rest.

S.1.10. UNIT-WEIGHT MECHANISM.—This shall be constructed to add and remove unit weights one at a time, shall be rapid and positive in its operation, and shall function properly irrespective of the speed of operation. Operation shall be controlled from the outside of the housing by means conveniently located and operating in a simple manner.

S.1.11. ADJUSTABLE WEIGHING ELEMENTS. — An adjustable weighing element such as a nose-iron, a pendulum, or a spring (but not an element for adjusting level or zero-load balance) shall be held securely in adjustment and shall not be adjustable from the outside of the scale. *The position of a nose-iron of a large-capacity scale, as determined by the factory adjustment, shall be accurately, clearly, and permanently indicated.*

**S.1.12. TRAVEL OF PANS OF EQUAL-ARM SCALE.**—The travel, between limiting stops, of the pans of a non-automatic-indicating equal-arm scale not equipped with a balance indicator shall be not less than the minimum travel shown in table 1.

TABLE 1.—Minimum Travel of Pans of Equal-Arm Scale

Nominal capacity of scale	Minimum travel of pans
<i>Pounds</i>	<i>Inch</i>
4 or less.....	0.35
5 to 12, incl.....	.5
13 to 26, incl.....	.75
Over 26.....	1.0

### S.1.13. LOAD-RECEIVING ELEMENTS.

**S.1.13.1. HANGING PAN.**—This shall be suspended from a ring.

**S.1.13.2. HOOK.**—A hook may be provided as a load-receiving element only when no other load-receiving element is provided.

**S.1.13.3. DRAINAGE.** — A load-receiving element intended to receive wet commodities shall be so constructed as to drain effectively.

**S.1.13.4. SCOOP COUNTERBALANCE.**—A scoop on a scale used for direct sales to retail customers shall not be counterbalanced by a removable weight; a permanently attached scoop-counterbalance shall indicate clearly on both the dealer's and customers' sides of the scale whether it is set for the scoop to be on or off the scale.

## S.2. INDICATING MEANS.

**S.2.1. SUBDIVISION.**—In any series of weight graduations the values of the subdivisions shall be uniform throughout the graduated interval.

**S.2.2. ATTACHMENT.** — In any indicator and reading-face combination, the stationary element shall be fixed

securely in position and the movable element shall be attached securely to its operating mechanism: Provided, That a movable auxiliary indicator or reading face, adapted to balancing out tare weights and similar uses, may be provided.

### S.2.3. WEIGHBEAMS.

S.2.3.1. NORMAL POSITION.—The normal balance position of the weighbeam of a beam scale shall be horizontal.

S.2.3.2. TRAVEL.—The weighbeam of a beam scale shall have equal travel above and below the horizontal. The total travel of the weighbeam of a beam scale in a trig loop or between other limiting stops near the weighbeam tip shall be not less than the minimum travel shown in table 2; when such limiting stops are not provided, the total travel at the weighbeam tip shall be not less than 8 percent of the distance from the weighbeam fulcrum to the weighbeam tip.

TABLE 2.—Minimum Travel of Weighbeam of Beam Scale Between Limiting Stops

Distance from weighbeam fulcrum to limiting stops	Minimum travel between limiting stops
<i>Inches</i>	<i>Inch</i>
12 or less.....	0.4
13 to 20, incl.....	.5
21 to 40, incl.....	.7
Over 40.....	.9

S.2.3.3. POISE STOP.—Except on a steelyard with no zero graduation, a shoulder or stop shall be provided on each weighbeam bar to prevent a poise from traveling and remaining back of the zero graduation.

S.2.3.4. SUBDIVISION. — A subdivided weighbeam bar shall be subdivided by means of graduations, notches, or a combination of both. Graduations on a particular bar shall be of uniform width and perpendicular to the top edge of the bar. Notches on a particular bar shall be uni-



form in shape and dimensions and perpendicular to the face of the bar. When a combination of graduations and notches is employed, the graduations shall be so positioned in relation to the notches as to indicate notch values clearly and accurately.

**S.2.3.5. CAPACITY.** — *On an automatic-indicating scale having a nominal capacity of 30 pounds or less, the capacity of any weighbeam bar shall be a multiple of the reading-face capacity, each bar shall be subdivided throughout or shall be subdivided into notched intervals each equal to the reading-face capacity, and the value of any turnover poise shall be equal to the reading-face capacity.*

**S.2.3.6. READABILITY.** — A subdivided weighbeam bar shall be so subdivided and marked, and a weighbeam poise shall be so constructed, that the weight corresponding to any normal poise position can easily and accurately be read directly from the beam, whether or not provision is made for the optional recording of representations of weights.

#### **S.2.4. POISES.**

**S.2.4.1. DESIGN.**—No part of a poise shall be readily detachable. A locking screw shall not be removable. Except on a steelyard with no zero graduation, a poise shall not be readily removable from a weighbeam. The bearing edge of a hanging poise shall be hard and sharp and so constructed as to allow the poise to swing freely in the weighbeam notches.

**S.2.4.2. ADJUSTING MATERIAL.** — The adjusting material in a poise shall be securely enclosed and firmly fixed in position and if softer than brass it shall not be in contact with the weighbeam.

**S.2.4.3. PAWL.**—A poise on a notched weighbeam bar shall have a pawl with a rounded tip which will seat the poise in a definite and correct position at any notch, wherever in the notch the pawl is placed, and hold it there firmly and without appreciable movement. That dimension of the tip of the pawl which is transverse to the longitudinal axis of the weighbeam shall be equal to the corresponding dimension of the notches.

S.2.4.4. **READING EDGE OR INDICATOR.** — The reading edge or indicator of a poise shall be sharply defined, and a reading edge shall be parallel to the graduations on the weighbeam.

S.2.5. **INDICATORS ON AUTOMATIC-INDICATING SCALES.** —When an indicator extends along the entire length of a graduation, that portion of the indicator which may be brought into coincidence with the graduation shall be the same width throughout. *The clearance between the index of the indicator and the reading face on an uncompensated spring scale shall be not more than 0.09 inch.*

S.2.6. **UNIT-WEIGHT INDICATIONS AND REPRESENTATIONS.**—The total value of the unit weights in place at any time shall automatically be shown on the reading face. A recorded weight representation of a scale employing unit weights shall include the total value of any unit weights involved in the weighing.

S.2.7. **BALANCE INDICATOR.**—In a balance indicator consisting of two indicating edges, lines, or points, the ends of the indicators shall be sharply defined and shall be separated by not more than 0.04 inch, measured horizontally, when the scale is in balance.

### S.3. INSTALLATION.

S.3.1. **PROTECTION AGAINST WIND AND WEATHER EFFECTS.**—The indicating elements, the lever system, and the under side of the load-receiving element of a scale shall be adequately protected against wind and weather effects.

S.3.2. **FOUNDATION, ALINEMENT, AND CLEARANCES.** — The foundations and supports of any scale installed in a fixed location shall be such as to insure adequate strength, rigidity, and permanence, all working parts shall be in proper condition as to level and vertical alinement, and adequate clearances shall be provided around all live parts.

S.3.3. **ACCESS TO PIT.** — *Adequate provision shall be made for ready access to the pit of a vehicle or livestock scale for purposes of inspection and maintenance.*

S.4. **MARKING.**—*A scale equipped with unit weights or with which counterpoise weights are intended to be used shall be conspicuously marked with a statement of its*

*nominal capacity. Effective January 1, 1950, a small-capacity uncompensated spring scale other than a straight-face spring scale shall be conspicuously marked to show that the scale is illegal for use in the retail sale of food-stuffs other than fruits and vegetables.*

**ADDITIONAL SPECIFICATIONS FOR STRAIGHT-FACE SPRING SCALES**

**S.10. SPRING SUPPORT.**—The support for the spring of a straight-face spring scale shall be permanently affixed to the frame of the scale.

**S.11. READING FACE.**—The reading face of a straight-face spring scale shall be firmly affixed to the frame of the scale at not less than three points, except that a scale may be properly equipped with a well designed balancing means dependent for its operation upon limited, mechanically-controlled movement of the reading face with respect to the frame.

**S.12. VALUES OF MINIMUM GRADUATIONS.**—The value of the minimum graduation of a straight-face spring scale shall be not greater than the maximum values shown in table 3.

**TABLE 3.—Maximum Values for Smallest Graduations on Straight-Face Spring Scales**

Nominal capacity of scale	Maximum value of smallest graduation
<i>Pounds</i>	<i>Pounds</i>
25.....	1/2
50 and 100.....	1
200.....	2
300 and over.....	5

**ADDITIONAL SPECIFICATIONS FOR COMPUTING SCALES**

**S.20. VALUE GRADUATIONS.**—The value of the money-value graduations on a computing scale shall be (a) not more than 1 cent at all unit prices of 30 cents per pound and less, and (b) not more than 2 cents at all higher unit

prices: **Provided**, That special graduations representing 5-cent intervals may be shown, but not in the spaces between regular graduations. Value figures and graduations shall not be duplicated in any column or row on a chart.

S.21. **CUSTOMERS' INDICATIONS.** — Weight indications shall be shown on the customers' side of a computing scale.

S.22. **READABILITY.**—A computing scale shall be so constructed as to disclose a sufficient number of weight graduations on the customers' side and a sufficient number of weight and money-value graduations on the dealer's side so that at any load within the weighing range of the scale the weight and value indications can be accurately read.

S.23. **PRE-PACKAGING SCALE.**—A computing scale designed to be used exclusively for putting up packages in advance of sale, and conspicuously marked on the operator's side and on the opposite side with the words "For Pre-Packaging Use Only" or with a similar and suitable statement, shall be exempt from the requirements of S.21. and, if "customers' weight indications" are not provided, from the requirements of S.22. which relate to customers' weight indications; and such a pre-packaging scale may be equipped with an auxiliary, manually-operable balancing device if this is so designed that it will operate only in a backward direction (that is, in the direction of under-registration) with respect to the balance condition established by the primary, mechanically-operable balancing device of the scale.

#### **ADDITIONAL SPECIFICATIONS FOR PRESCRIPTION SCALES**

S.30. **BALANCE INDICATION.**—A prescription scale shall be equipped with a balance indicator; if this consists of an indicator and a graduated scale which are not in the same plane, the clearance between the indicator and the graduations shall be not more than 0.04 inch.

S.31. **ARRESTING MEANS.**—A prescription scale shall be equipped with mechanical means for arresting the oscillation of the mechanism.

S.32. **MARKING OF CLASS B SCALES.** — A prescription scale which fails to meet the performance requirements for Class A scales but does meet the performance require-

ments for Class B scales shall be conspicuously marked with the words, "Class B. Not to be used in weighing loads of less than 10 grains", or with a similar and suitable statement conveying the same information.

#### ADDITIONAL SPECIFICATIONS FOR CREAM-TEST SCALES

S.40. BALANCE INDICATION.—A cream-test scale shall be equipped with a balance indicator consisting of an indicator and a graduated scale having not less than 10 equal spaces.

S.41. LEVELING MEANS.—If the weighing performance of a cream-test scale is changed by an amount greater than the acceptance tolerance when it is moved from a level position and rebalanced in a position which is out of level in any direction by 5 percent, or approximately  $3^{\circ}$ , the scale shall be equipped with leveling screws.

#### ADDITIONAL SPECIFICATIONS FOR PERSON WEIGHERS

S.50. NOMINAL CAPACITY. — A person weigher shall have a nominal capacity of not less than 250 pounds.

S.51. ZERO-LOAD BALANCE INDICATION. — A person weigher shall have a definite and clear zero graduation, and an automatic-indicating or ticket person weigher shall be capable of giving a zero-load balance indication throughout a zone corresponding to not less than 5 pounds on either side of the zero graduation.

S.52. WEIGHT INDICATIONS AND REPRESENTATIONS. — The value of the minimum weight graduation on a person weigher shall be not greater than 1 pound. On a person weigher other than a ticket person weigher, weight indications shall be shown from zero to capacity, except that there may be an interval between zero and some definite weight value throughout which weight indications are not shown if, whenever a weighing within this interval is attempted, any coin inserted is automatically returned to a suitable receptacle on the outside of the person weigher or the insertion of a coin in the coin slot is automatically prevented. On a ticket person weigher, there may be an interval between zero and a definite weight value throughout which tickets are not given if, whenever a weighing



within this interval is attempted, any coin inserted is returned or the insertion of a coin is prevented as prescribed in this paragraph, or if the weight is shown on a reading face.

S.53. PRINTING ON TICKET. — On a ticket person weigher, the transfer of the weight record to the ticket shall not be made until the weighing mechanism has had ample opportunity, under normal person-weighing conditions, to come to rest.

S.54. EXHAUSTION OF TICKET SUPPLY. — Throughout any period during which the supply of tickets on a ticket person weigher is exhausted, any coin inserted shall automatically be returned to a suitable receptacle on the outside of the person weigher or the insertion of a coin in the coin slot shall automatically be prevented.

S.55. PROVISION FOR SEALING COIN SLOT. — *Provision shall be made on a person weigher for applying a lead-and-wire seal in such a way that insertion of a coin in the coin slot will be prevented.*

S.56. MARKING.—A person weigher which may give inaccurate results except when special precautions are observed shall be marked conspicuously and permanently with suitable and explicit instructions.

#### GENERAL NOTES, PERFORMANCE REQUIREMENTS, AND REGULATIONS N. NOTES.

##### N.1. TESTING PROCEDURES.

N.1.1. TEST WITH INCREASING LOADS.—This is the normal basic test for a scale, and it shall be made with the test loads approximately centered on the load-receiving element of the scale except on a scale having a nominal capacity greater than the total available known test load, in which case the available test load is used to greatest advantage by concentrating it, within prescribed load limits, upon individual elements of the lever system.

N.1.2. TEST WITH DECREASING LOADS.—This is a special test for automatic-indicating scales only, intended to disclose the general condition of the scale with respect to accuracy of fits, lost motion in connections and gear trains, and general refinement of workmanship, and the weigh-

ing performance of the scale when loads are being reduced. This test is supplementary to the test with increasing loads and shall be made with the test loads approximately centered on the load-receiving element of the scale. This test shall regularly be applied when testing for pattern approval, but shall be utilized as a field test only when, in the course of the normal commercial use of a scale, loads are frequently reduced immediately prior to the weighing operation.

### N.1.3. SHIFT TEST.

N.1.3.1. GENERAL.—This is a special test primarily intended to disclose the accuracy of performance of individual elements of the lever system of a scale and the correctness of adjustment of certain stabilizing elements. This test shall be applied to all scales except hanging scales and shall be made with a half-capacity test load whenever practicable, unless a different shift-test load is prescribed.

N.1.3.2. ON SCALE WITH STABILIZED LOAD-RECEIVING ELEMENT.—On a scale in which the load-receiving element is mounted above the lever system on two main load bearings and is maintained in position by means of a stabilizing linkage, the half-capacity shift-test load shall be centered successively at the center of the load-receiving element and at not less than four equidistant points halfway between the center and the edge of the load-receiving element.

N.1.3.3. ON SCALE WITH FOUR MAIN LOAD BEARINGS.—On a scale in which the load-receiving element is mounted on four main load bearings, a quarter-capacity load shall be centered, as nearly as may be, successively over each main load bearing, or a half-capacity load shall be centered, as nearly as may be, successively at the center of each quarter of the platform: Provided, That on a two-section motor-truck scale in which corner adjustments of the main levers cannot be made, a half-capacity load or more may be concentrated successively across the two ends of the platform in lieu of the general procedure prescribed: And provided further, That on a four-section motor-truck scale, tests shall be made at each section corresponding to the corner or end tests on a two-section scale.

N.1.3.4. ON EQUAL-ARM SCALE. — On an equal-arm scale, the position of the half-capacity load shall be shifted, as prescribed in N.1.3.2., on each pan, and observations shall be made at various combinations of positions on the two pans in order to develop the maximum shift-test error.

N.1.3.5. ON CREAM-TEST SCALE.—The shift test shall be made with a load of 18 grams, this load being successively positioned at all points at which an 18-gram weight might reasonably be placed in the course of normal use of the scale.

N.1.4. MINIMUM TEST-WEIGHT LOAD FOR RAILWAY TRACK SCALE.—In the test of a railway track scale, the test-weight load shall be not less than 30,000 pounds.

N.1.5. SR DETERMINATIONS.—These shall be made in connection with the test with increasing loads on all non-automatic-indicating scales, and determinations shall be made at zero load and at the maximum load applied to the scale, and, preferably, also at a load intermediate between zero and maximum load. On a cream-test scale, for the SR determination at maximum load, the pan or pans shall bear a centrally-positioned load equal to 2 avoirdupois ounces multiplied by the number of test bottles which the pan or pans will accommodate. An automatic-indicating element which is purely auxiliary to a primarily non-automatic-indicating scale, and which may or may not be employed at the option of the operator, shall not exempt the scale from the SR requirements when the automatic-indicating element is disconnected or detached; SR determinations shall be made on such a scale with the automatic-indicating element disconnected or detached, and if such scale is one in which the weighbeam travel is in excess of that required by S.2.3.2., the SR determination shall be based upon the weighbeam travel required by S.2.3.2.

## **P. PERFORMANCE REQUIREMENTS EXCEPT TOLERANCES.**

### **P.1. SR REQUIREMENTS.**

#### **P.1.1. FOR SMALL-CAPACITY SCALES.**

P.1.1.1. GENERAL.—The maximum maintenance SR, except as prescribed in P.1.1.2., P.1.1.3., and P.1.1.4., shall



be the appropriate value shown in table 4, or the value of two of the minimum weighbeam graduations, whichever is less; the maximum acceptance SR shall be one-half the maximum maintenance SR.

TABLE 4.—Maximum Maintenance SR on Small-Capacity Scales Except Prescription and Cream-Test Scales

Nominal capacity of scale	Maximum SR
<i>Pounds</i>	<i>Ounces</i>
3 or less.....	1/8
4 to 7, incl.....	1/4
8 to 14, incl.....	1/2
15 to 23, incl.....	3/4
24 to 39, incl.....	1
40 to 49, incl.....	1 1/4
50 to 74, incl.....	1 1/2
75 to 89, incl.....	2
90 to 99, incl.....	2 1/2
100 and over.....	3

P.1.1.2. FOR CLASS A PRESCRIPTION SCALES. — The maximum maintenance SR shall be 0.2 grain (13 milligrams), or the value of two of the minimum weighbeam graduations, whichever is less; the maximum acceptance SR shall be one-half the maximum maintenance SR.

P.1.1.3. FOR CLASS B PRESCRIPTION SCALES. — The maximum maintenance SR shall be 0.5 grain (32 milligrams); the maximum acceptance SR shall be 0.25 grain (16 milligrams).

P.1.1.4. FOR CREAM-TEST SCALES. — The maximum maintenance SR shall be 1 grain (65 milligrams); the maximum acceptance SR shall be 0.5 grain (32 milligrams).

#### P.1.2. FOR LARGE-CAPACITY SCALES.

P.1.2.1. GENERAL. — The maximum maintenance SR, except as prescribed in P.1.2.2. and P.1.2.3., shall be the value of two of the minimum weighbeam graduations, or

40 pounds, whichever is less; the maximum acceptance SR shall be one-half the maximum maintenance SR.

**P.1.2.2. FOR VEHICLE SCALES.**—The maximum maintenance SR shall be 10 pounds, or the value of two of the minimum weighbeam graduations, whichever is greater; the maximum acceptance SR shall be the value of one of the minimum weighbeam graduations.

**P.1.2.3. FOR RAILWAY TRACK SCALES.**—The maximum maintenance SR on a scale in grain-weighing service shall be 50 pounds and on any other scale shall be 100 pounds; the maximum acceptance SR shall be 50 pounds.

## **T. TOLERANCES.**

### **T.1. FOR SMALL-CAPACITY SCALES.**

#### **T.1.1. APPLICATION.**

**T.1.1.1. TO INCREASING-LOAD TESTS.**—Basic tolerances shall be applied.

**T.1.1.2. TO SHIFT TESTS.**—On a scale with four main load bearings, basic tolerances shall be applied. On a scale with a stabilized load-receiving element, the error developed at any off-center position of the test load shall not differ from the error developed at the center position by more than the tolerance “On ratio test” for the load in question as shown in table 6, except that on a prescription scale or cream-test scale, twice the appropriate basic tolerance shall be applied.

**T.1.1.3. TO DECREASING-LOAD TESTS ON AUTOMATIC-INDICATING SCALES.**—On the decreasing-load indications, twice the basic tolerances shall be applied.

#### **T.1.2. MINIMUM TOLERANCE VALUES.**

**T.1.2.1. ON NON-AUTOMATIC-INDICATING SCALES.**—On a particular scale, the maintenance tolerances applied shall be not smaller than one-half the value of the minimum graduation on the weighbeam or, if the scale is not equipped with a weighbeam, not smaller than the “Minimum tolerance value” shown in table 5 for a scale of the capacity in question; the acceptance tolerances applied shall be not smaller than one-fourth the value of the minimum graduation on the weighbeam or, if the scale is not

equipped with a weighbeam, not smaller than one-half the appropriate "Minimum tolerance value" shown in table 5.

TABLE 5.—Minimum Tolerance Values for Small-Capacity Non-Automatic-Indicating Scales Not Equipped With Weighbeams

Nominal capacity of scale	Minimum tolerance value
<i>Pounds</i>	<i>Ounce</i>
3 or less.....	1/16
4 to 7, incl.....	1/8
8 to 14, incl.....	1/4
15 to 23, incl.....	3/8
24 to 39, incl.....	1/2
40 to 50, incl.....	5/8

**T.1.2.2. ON AUTOMATIC-INDICATING SCALES.**—On a particular scale, the maintenance tolerances applied shall be not smaller than one-fourth the value of the minimum reading-face graduation; the acceptance tolerances applied shall be not smaller than one-eighth the value of the minimum reading-face graduation.

### T.1.3. BASIC TOLERANCE VALUES.

**T.1.3.1. FOR SMALL-CAPACITY SCALES EXCEPT UNCOMPENSATED SPRING SCALES, PRESCRIPTION SCALES, AND CREAM-TEST SCALES.**—Basic maintenance tolerances for small-capacity scales except uncompensated spring scales, prescription scales, and cream-test scales, on under-registration or on over-registration, shall be as shown in table 6; basic acceptance tolerances shall be one-half the basic maintenance tolerances.

**T.1.2.2. ON AUTOMATIC-INDICATING SCALES.**—On a particular scale, the maintenance tolerances applied shall be not smaller than one-fourth the value of the minimum reading-face graduation; the acceptance tolerances applied shall be not smaller than one-eighth the value of the minimum reading-face graduation: Provided, That on prepackaging scales, such as are defined in paragraph S. 23., the maintenance tolerances applied shall be not smaller than one-eighth ounce and the acceptance tolerances applied shall be not smaller than one-sixteenth ounce. [1950]

TABLE 6.—Basic Maintenance Tolerances for Small-Capacity Scales, Except Uncompensated Spring Scales, Prescription Scales, and Cream-Test Scales

Known test load	Tolerance on ratio test	Tolerance on weigh-beam, reading-face, and unit-weight indications
<i>Pounds</i>	<i>Ounce</i>	<i>Ounces</i>
1.....	1/16.....	1/16
2 and 3.....	1/16.....	1/8
4 to 7, incl.....	1/8.....	3/16
8 to 14, incl.....	1/4.....	3/8
15 to 23, incl.....	5/16.....	1/2
24 to 29, incl.....	3/8.....	1/2
30 to 39, incl.....	3/8.....	5/8
40 to 49, incl.....	7/16.....	5/8
50 to 59, incl.....	1/2.....	3/4
60 to 74, incl.....	5/8.....	1
75 to 89, incl.....	3/4.....	1
90 to 99, incl.....	7/8.....	1 1/4
100 and over...	1 oz per 100 lb.	1 1/2 oz per 100 lb

T.1.3.2. FOR UNCOMPENSATED SPRING SCALES.—Basic maintenance tolerances for small-capacity uncompensated spring scales, on under-registration or on over-registration, shall be as shown in table 7; basic acceptance tolerances shall be one-half the basic maintenance tolerances.

TABLE 7.—Basic Maintenance Tolerances for Small-Capacity Uncompensated Spring Scales

Known test load	Tolerance, except for straight-face spring scales	Tolerance for straight-face spring scales
<i>Pounds</i>	<i>Ounces</i>	<i>Ounces</i>
1.....	1/8.....	1/2
2 and 3.....	1/4.....	1
4 to 7, incl.....	1/2.....	2
8 to 11, incl.....	3/4.....	3
12 to 19, incl.....	1.....	4
20 to 29, incl.....	1 1/2.....	6
30 to 49, incl.....	2.....	8
50 to 74, incl.....	3.....	12
		<i>Pound</i>
75 to 100.....	4.....	1
Over 100.....	4 oz per 100 lb.....	1 lb per 100 lb

T.1.3.3. FOR PRESCRIPTION SCALES.—Basic acceptance and maintenance tolerances for prescription scales, on under-registration or on over-registration, on ratio test, shall be as shown in table 8. The acceptance and maintenance tolerance on any weighbeam indication shall be the value of the minimum weighbeam graduation. (On a Class A prescription scale, the nominal capacity shall, in the absence of information to the contrary, be assumed to be  $\frac{1}{2}$  apothecaries ounce.)

TABLE 8.—Basic Acceptance and Maintenance Tolerances on Ratio Tests of Prescription Scales

Known test load		Tolerance on ratio test			
		For Class A scales		For Class B scales	
<i>Ounces apoth</i>	<i>Grams</i>	<i>Grains</i>	<i>Milligrams</i>	<i>Grains</i>	<i>Milligrams</i>
1/2	15	0.2	13	0.5	30
1	30	.4	26	1.0	65
2	60	.8	52	2.0	130
4	120	1.6	104	4.0	260
8	240			8.0	520

T.1.3.4. FOR CREAM-TEST SCALES.—The basic maintenance tolerance for cream-test scales (applied on an 18-gram load), on under-registration or on over-registration, shall be 1 grain (65 milligrams); the basic acceptance tolerance shall be one-half the basic maintenance tolerance.

T.2. FOR LARGE-CAPACITY SCALES.

T.2.1. APPLICATION.

T.2.1.1. TO INCREASING-LOAD TESTS.—Basic tolerances shall be applied.

T.2.1.2. TO SHIFT TESTS.—On a scale other than a vehicle scale, basic tolerances shall be applied. On a vehicle scale the tolerances on corner tests shall be twice the basic tolerances, but on a corner test at a particular load, the algebraic mean of the errors on the two corners at each end of the scale shall be not greater than the basic tolerance for the load in question.

T.2.1.3. TO DECREASING-LOAD TESTS ON AUTOMATIC-INDICATING SCALES.—On the decreasing-load indications, twice the basic tolerances shall be applied.

T.2.2. MINIMUM TOLERANCE VALUES.—On a particular scale, the maintenance tolerances applied shall be not smaller than the value of the minimum graduation on the weighbeam (for a non-automatic-indicating scale) or on the reading-face (for an automatic-indicating scale); the acceptance tolerances applied shall be not smaller than one-half the value of the minimum graduation on the weighbeam (for a non-automatic-indicating scale) or on the reading-face (for an automatic-indicating scale).

T.2.3. BASIC TOLERANCE VALUES.

T.2.3.1. FOR LARGE-CAPACITY SCALES EXCEPT LIVESTOCK, COAL-MINE, VEHICLE, AND FREIGHT SCALES, WHEEL-LOAD WEIGHERS, AND RAILWAY TRACK SCALES.—Basic maintenance tolerances for large-capacity scales except livestock, coal-mine, vehicle, and freight scales, wheel-load weighers, and railway track scales, on under-registration or on over-registration, shall be as shown in table 9; basic acceptance tolerances shall be one-half the basic maintenance tolerances.



TABLE 9.—Maintenance Tolerances for Large-Capacity Scales, Except Livestock, Coal-mine, Vehicle, and Freight Scales, Wheel-Load Weighers, and Railway Track Scales

Known test load	Tolerance on ratio test	Tolerance on weigh-beam, reading-face, and unit-weight indications
<i>Pounds</i>	<i>Ounces</i>	<i>Ounces</i>
99 or less.....	1/2.....	1
100 to 199, incl....	2.....	2
200 to 299, incl....	3.....	4
300 to 399, incl....	4.....	6
400 to 499, incl....	5.....	8
500 to 599, incl....	7.....	10
600 to 799, incl....	8.....	12
		<i>Pound</i>
800 to 999, incl....	11.....	1
1,000 and over.....	3/4 lb per 1,000 lb	1 lb per 1,000 lb

T.2.3.2. FOR LIVESTOCK, COAL-MINE, VEHICLE, AND FREIGHT SCALES.—Basic maintenance tolerances for livestock, coal-mine, and vehicle scales, and for scales used exclusively in determining charges for freight transportation, on under-registration or on over-registration, shall be  $1\frac{1}{2}$  pounds per 1,000 pounds of test load on ratio tests and 2 pounds per 1,000 pounds of test load on weighbeam, reading-face, and unit-weight indications; basic acceptance tolerances shall be one-half the basic maintenance tolerances.

T.2.3.3. FOR WHEEL-LOAD WEAHERS.—The basic maintenance tolerance for individual wheel-load weighers, on under-registration or on over-registration, shall be 3 percent of the known test load; the basic acceptance tolerance on under-registration or on over-registration, shall be 2 percent of the known test load. When two wheel-load weighers are tested as a pair, the tolerance shall be applied to the sum of the indications of the two weighers, and the pair shall be approved or rejected upon the basis of the combined indications. [1950]

T.2.3.4. FOR RAILWAY TRACK SCALES<sup>4</sup>.

1. *Test loads*.—The test loads used consist of standard test weights carried on a 4-wheel truck of known weight having a wheel base of 5 feet.

2. *Test-load positions*. — A section of a railway track scale comprises a pair of main levers (straight-lever type), or a single main lever (torsion-lever type). The location of a section is defined by a vertical plane passing through the midpoints of its load knife-edges. Sections are designated as 1, 2, 3, etc., being numbered from the left to the right of an observer at the weighbeam facing the scale deck.

A test run comprises normal positions of the test load assumed when each pair of wheels of the truck is successively positioned over each section of the scale (except at each end section, where only one truck position is possible), except that in the case of a two-section scale an additional position is utilized with the center of the truck midway between the sections, a position designated as "Center". Sectional positions are designated as 1R, 2L, 2R, 3L, etc., the number denoting the section and the letter denoting that the body of the truck lies to the right or to the left of the section. Any position offset from a normal position is designated by its distance to the right (+) or to the left (—) of the nearest normal position; thus the position 1R+10" is 10 inches to the right of position 1R.

3. *Method of test*.—The normal test consists of test runs made with loads of 40,000 pounds and 80,000 pounds, two runs in opposite directions being made with each load. For a scale to which is attached an automatic-indicating or recording device, tests are made with the device attached and with the device detached.

4. *Character of error*.—The amount by which the scale indication differs from the actual value of the applied test load is the error of the scale for the given position and

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<sup>4</sup>The tolerances for railway track scales are here presented, together with associated text, in the form in which they have been published by the National Bureau of Standards, instead of in the standard form used elsewhere herein.



load. A plus (+) sign denotes that the weight indication exceeds the value of the test load; a minus (—) sign denotes the converse.

5. *Maximum indicated percentage error of weighing.*—The “maximum indicated percentage error of weighing” is computed for scales of more than two sections, and is the largest mean value which can be derived from two errors developed during a single test run for positions (1) not closer together than the distance between adjacent sections on all scales except those in grain-weighing service or (2) farther apart than the distance between adjacent sections on all scales in grain-weighing service.

6. *Tolerances.* I. The tolerances adopted by the Bureau for all railway track scales not equipped with automatic indicating or recording devices and for these latter scales while such devices are detached, are as follows:

A. The maintenance tolerance (applicable to scales in use) for all scales except those in grain-weighing service, is  $\pm 0.20$  percent of the test load being utilized, applied as follows:

(1) For a scale of more than two sections, to the maximum indicated percentage error of weighing as defined above, but with the added requirement that no individual sectional error shall exceed 0.30 percent of the test load being utilized.

(2) For a scale of more than two sections, to the maximum individual percentage error developed when two or more test loads are applied to the scale at the same time at normal positions not closer together than the distance between adjacent sections.

(3) For a two-section scale, to the maximum individual percentage error developed for any position of the test load or loads.

B. The maintenance tolerance (applicable to scales in use) for scales in grain-weighing service is  $\pm 0.10$  percent of the test load being utilized, applied as follows:

(1) For a scale of more than two sections, to the maximum indicated percentage error of weighing as defined above.

(2) For a scale of more than two sections, to the maximum individual percentage error developed when two or more test loads are applied to the scale at the same time and at normal positions which are farther apart than the distance between adjacent sections.

(3) For a two-section scale, to the maximum individual percentage error developed for any position of the test load or loads.

NOTE.—The tolerance for scales in grain-weighing service was adopted pursuant to the recommendations of the Interstate Commerce Commission (Docket No. 9009; 56 ICC 347). These recommendations also contain a provision that a scale shall be corrected whenever a test discloses an error in excess of 0.10 percent for any position of a test load; this provision will be adhered to by the Bureau in its recommendations.

C. The acceptance and adjustment tolerance (applicable to new or newly reconditioned scales) for all scales is  $\pm 0.05$  percent of the test load being utilized, applied to the maximum individual percentage error developed for any position of the test load.

II. The tolerances adopted by the Bureau for all railway track scales in which are embodied or to which are attached automatic indicating or recording devices, for the respective types of scales and conditions of test, are the same as those for scales independent of such devices, except as follows:

A. If the weight is indicated on a reading face, or by means of a printed impression showing the position of an indicating line with reference to a series of graduations, the maintenance tolerance shall not be less than the value of the minimum graduation on the reading face or printed impression, or of one five-hundredth of the capacity of the automatic device, whichever is the smaller value, and the acceptance and adjustment tolerance shall not be less than one-half the minimum specified for the maintenance tolerance.

B. If the weight indication is a printed record comprising figures only, there shall be added to the tolerance which would otherwise be appropriate, an amount equal to 50

percent of the value of the increment between indications that can be printed by the device, or 50 pounds, whichever value is the smaller.

## R. REGULATIONS.

R.1. BALANCE CONDITION.—A scale shall be maintained in balance.

R.2. SUPPORTS AND LEVEL CONDITION.—A scale which is portable and which is being used on a counter or table or on the floor shall be so positioned that it is firmly and securely supported, and the scale shall be maintained in level.

R.3. SUSPENSION OF HANGING SCALE.—A hanging scale shall be freely suspended from a fixed support when in use.

## R.4. VALUE OF MINIMUM GRADUATION.

R.4.1. ON FOOD SCALES. — The value of the minimum graduation on a scale used for the retail sale of foodstuffs shall be not greater than 1 ounce.

R.4.2. ON LIVESTOCK SCALES.—The value of the minimum graduation on a livestock scale shall be not greater than 5 pounds.

R.4.3. ON VEHICLE SCALES.—*The value of the minimum graduation on a vehicle scale shall be not greater than 20 pounds.*

R.5. UNCOMPENSATED SPRING SCALES.—An uncompensated spring scale shall not be used for the retail sale of foodstuffs other than fruits and vegetables.

R.6. WEIGHING OF WET COMMODITIES.—Wet fish and other wet commodities shall be weighed only on scales on which the pan or platform will drain properly.

R.7. LADING.—A scale shall not be used for weighing a load totaling more than the nominal capacity of the scale. A vehicle scale shall not be used for weighing a load smaller than 1,000 pounds.

R.8. CLASS B PRESCRIPTION SCALE. — A Class B prescription scale shall not be used for weighing loads smaller than 10 grains, and may be used for prescription work

only when a Class A prescription scale is provided at the same establishment.

**R.9. APPROACHES TO VEHICLE SCALE.**—A vehicle scale should have at each end of the scale a straight approach at least as long as the scale platform and in the same plane as the platform, except that in no case shall this length be required to be greater than 40 feet.

**R.10. STOCK RACKS.**—A livestock scale shall be equipped with a suitable enclosure, fitted with gates as required, within which livestock may be held on the scale platform, this rack shall be securely mounted on the scale platform, and adequate clearances shall be maintained around the outside of the rack.

**R.11. LENGTHENING OF PLATFORMS.**—The length of the platform of a vehicle scale shall not be increased beyond the manufacturer's designed dimension except when the modification has been approved by competent scale-engineering authority, preferably that of the engineering department of the manufacturer of the scale, and by the weights and measures authority having jurisdiction over the scale.

**R.12. READABILITY OF RECORDED REPRESENTATIONS OF PERSON WEIGHERS.**—A ticket person weigher shall be so maintained in use that all representations of weight transferred to the weight ticket during operation of the weigher shall be clear and distinct.

**R.13. OWNERSHIP IDENTIFICATION ON PERSON WEIGHER.**—A person weigher shall be legibly and permanently marked to show the name and address of the person, firm, or corporation responsible for placing it in service, in combination with some such words as "Operated by" or "Maintained by": Provided, That such statement shall not be required when the person weigher is in service on the premises of such person, firm, or corporation.

**R.14. MARKING OF WHEEL-LOAD WEIGHERS.** — When wheel-load weighers are regularly used in pairs, each weigher of each such pair shall be appropriately marked to identify them as weighers intended to be used in combination.

**R.15. ACCESSIBILITY FOR TESTING PURPOSES.**—A large-capacity scale shall be so located, or such facilities for normal access thereto shall be provided, that the test weights of the weights and measures official, in the denominations customarily provided, and in the amount deemed necessary by the weights and measures official for the proper testing of the scale, may readily be brought to the scale by customary means; otherwise it shall be the responsibility of the scale owner or operator to supply such special facilities, including necessary labor, as may be required to transport the test weights to and from the scale, for testing purposes, as required by the weights and measures official.

**R.16. ASSISTANCE IN TESTING OPERATIONS.**—If the design, construction, or location of a large-capacity scale is such as to require a testing procedure involving special accessories and/or an abnormal amount of handling of test weights, such accessories and/or needed assistance in the form of labor shall be supplied by the owner or operator of the scale, as required by the weights and measures official.

**R.17. PRE-PACKAGING SCALE.** — A scale marked with the words “For Pre-Packaging Use Only” or with a statement of similar meaning, shall be used only for putting up packages in advance of sale and shall not be used for direct sales to retail customers.









## WEIGHTS

### A. APPLICATION.

A.1.—This code does not apply to test weights or other “standards” of mass.

### S. SPECIFICATIONS.

S.1. MATERIAL.—A weight shall be made of a metal or alloy not softer than brass, except that a weight of less than 100 grains (of whatever system) shall not be made of iron or steel and may be made of aluminum.

S.2. DESIGN.—The surface of a weight shall be smooth. A weight of a value of more than 30 grains (of whatever system) shall not have sharp points or corners. A ring on a weight shall not be split or removable. Adjusting material shall be securely positioned and shall not project beyond the surface of the weight.

S.3. FINISH.—A weight shall not be coated with thick, soft, or brittle material.

S.4. MARKING. — A weight shall be marked to show clearly its nominal value, and, in addition, a counterpoise weight shall be marked to show clearly the value it represents when used on the multiplying-lever scale for which it is intended. In the case of weights of the troy and apothecaries systems the nominal values of which are expressed in terms of pounds and ounces, and in the case of weights of the apothecaries system the nominal values of which are expressed in terms of drams, the identifying letters “T” and “Ap” shall be used in combination with the designations of nominal values for weights in the troy and apothecaries systems, respectively, whenever the weights are not so small as to make this impracticable. In the case of weights of the metric system, nominal values shall be expressed in terms of kilograms, grams, and milligrams only; the abbreviations “kg”, “g”, and “mg”, respectively, shall be employed: Provided, That the nominal value of a weight of 30 grains or less (of whatever system) may be

designated by dots, lines, figures, distinctive shape, or other appropriate means.

### T. TOLERANCES.

T.1.—The maintenance tolerances in excess or in deficiency for commercial avoirdupois weights, for commercial troy weights, for weights used in connection with prescription scales, and for weights used in connection with cream-test and moisture-test scales shall be, respectively, as shown in tables 1, 2, 3, and 4; acceptance tolerances shall be one-half the maintenance tolerances.

TABLE 1.—Maintenance Tolerances for Commercial Avoirdupois Weights

Nominal value of weight	Tolerance	
	Equal-arm weights	Counterpoise weights
<i>Ounces</i>	<i>Grains</i>	<i>Grains</i>
1/64.....	0.2	.....
1/32 to 1/8, incl.....	.5	.....
1/4.....	1.0	.....
1/2 and 1.....	2.0	1
2.....	3.0	1
4.....	4.0	2
5.....	5.0	2
8.....	7.0	3
10.....	8.0	4
<i>Pounds</i>		
1.....	10.0	5
2.....	15.0	8
3.....	20.0	10
4.....	25.0	12
5.....	25.0	13
8.....	30.0	18
10.....	40.0	20
15.....	40.0	.....
20.....	60.0	.....
25.....	70.0	.....
50.....	100.0	.....

TABLE 2.—Maintenance Tolerances for Commercial Troy Weights

Nominal value of weight	Tolerance
<i>Pennyweights</i>	<i>Grains</i>
1.....	0.15
2.....	.25
3.....	.3
4.....	.4
5.....	.5
10.....	.7
<i>Ounces troy</i>	
1.....	1.0
2 to 4, incl.....	2.0
5 and 8.....	3.0
10 and 12.....	4.0

TABLE 3.—Maintenance Tolerances for Prescription Weights

Nominal value of weight	Tolerance	Nominal value of weight	Tolerance
<i>Grains</i>	<i>Grains</i>	<i>Milligrams</i>	<i>Milligrams</i>
0.1.....	0.01	20 or less.....	1
.2.....	.015	50.....	2
.5.....	.02	100.....	3
1.....	.03	200.....	4
2.....	.04	500.....	7
5.....	.08		
		<i>Grams</i>	
10.....	.12	1.....	10
20.....	.15	2.....	15
		5.....	25
<i>Scruples</i>			
1.....	.15	10.....	40
2.....	.25	20.....	50
3.....	.3	50.....	100
<i>Drams, apoth</i>			
0.5.....	.2	100.....	150
1.....	.3	200.....	200
2.....	.5	500.....	350
3.....	.6		
4.....	.7		
6 and 8.....	1.0		
<i>Ounces, apoth</i>			
1.....	1.0		
2 to 4, incl.....	2.0		
5 and 8.....	3.0		
10 and 12.....	4.0		

TABLE 4.—Maintenance Tolerances for Weights Used With Cream-Test and Moisture-Test Scales

Nominal value of weight	Tolerance
<i>Grams</i>	<i>Milligrams</i>
9 and 10.....	10
18.....	20



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