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DEPARTMENT OF COMMERCE
BUREAU OF STANDARDS
S. W. STRATTON, Director

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MANUAL OF INSPECTION AND INFORMATION FOR WEIGHTS AND MEASURES OFFICIALS

By

F. S. HOLBROOK, Inspector of Weights and Measures
Bureau of Standards

ISSUED NOVEMBER 14, 1918

WASHINGTON
GOVERNMENT PRINTING OFFICE
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PART I.—GENERAL POWERS AND DUTIES OF WEIGHTS AND MEASURES OFFICIALS

The instructions contained in this manual necessarily deal to a large extent with the apparatus used in weighing and measuring. This is proper and necessary, since the first essential to correct weighing or measuring is the use of correct apparatus. It can not be expected that correct quantities of commodities will be delivered in trade unless correct apparatus for weighing and measuring is available. Correct apparatus and correct weights, therefore, are of great importance and constitute the groundwork of the whole system for securing the delivery of correct amounts of commodities. They are a necessary protection to both the purchaser and the honest dealer, assuring the one full quantity if by checking the indications by his own observation he takes care that the apparatus is properly used, and assuring the other correct deliveries if he makes proper use of the apparatus.

The use of correct apparatus, duly certified by the official sealer, is not in itself, however, any guaranty that correct quantities will be delivered. There is still opportunity for inaccuracy and fraud to creep into a transaction through carelessness and negligence, through ignorance of proper methods, or through intentionally wrongful

use of correct apparatus. Dishonest and unscrupulous dealers do not confine their efforts to the use of incorrect apparatus, but by clever manipulation may effect a shortage in the quantity of commodities weighed or measured with apparatus which is in itself correct. Hence, while correct apparatus is a necessity and its importance is not to be minimized in any way, it is equally important that other factors concerned in securing reasonable accuracy should not be overlooked.

The purpose of weights and measures inspection is to insure correct determinations of quantity. Correct apparatus alone does not accomplish this. Fraud may be committed with correct weights and measures, and inaccuracies may arise through negligence. The law aims to eliminate these as well as the incorrect apparatus, and it is the duty of officials to suppress all practices resulting in incorrect deliveries. This requires that they shall not only inspect apparatus but shall be alert to detect instances of its improper use.

The weights and measures official whose activities extend only to testing and either sealing or condemning apparatus in use is not entirely fulfilling his duty and fails in a large measure to furnish that protection to the consumer and the honest merchant which it is his official function to furnish. His efficiency is to be measured by the completeness or extent of this protection.

The various steps to be taken by the sealer or inspector in securing correctness of apparatus can be definitely stated, and they are described in detail in this manual. The steps to be taken in preventing the improper or fraudulent use of correct apparatus can not be so definitely

stated, since the details of particular cases and the judgment of the official will determine the best procedure.

In the general enforcement of the model law and of most of the State laws and city ordinances an official may supervise the manner of sale of commodities, check the amounts of commodity put up ready for sale, offered for sale, or sold, investigate all complaints of shortages use every proper effort to assure himself that all the provisions of the law are complied with, and prosecute those who violate these provisions. In the model law these things are made part of the inspector's duties, and in any case they should be done if an honest attempt is to be made to obtain the maximum benefits from the law.

If a short delivery is suspected on account of a complaint or otherwise, when a testing outfit is available the weight or measure of the package or amount of commodity can be checked by means of the portable balance and weights usually furnished, or with other of these pieces of apparatus, or if too heavy or bulky for this, then by other apparatus the accuracy of which can be determined. If it should occur that a shortage is suspected when a testing outfit is not available, the package or amount of commodity can be checked by means of the apparatus of the merchant or dealer selling it, if this apparatus has been sealed and does not bear signs of alteration, and if found short on this test, then the fraudulent use of correct apparatus is indicated. If the apparatus of the merchant delivering the commodity is not sealed or does bear signs of alteration, then the checking can be done on other apparatus in use which has been sealed and can still be certified as correct.

When the weight of commodities in wrappings is checked, the result desired is the actual net weight or the actual net error of the commodity; i. e., the weight of the commodity without wrappings. When an equal-arm balance, such as is often furnished in standard testing outfits, is used, this desired weight ordinarily can be obtained directly by placing similar wrappings to those on the commodity, in the pan of the balance opposite to that in which the wrapped package is placed—i. e., in the pan with the weights—while the weighing is being done. In this case the equal weights of the two sets of wrappings counterbalance one another and are thus eliminated from the result. When a prosecution is to be commenced on the results of the check weighing, the above method should not be depended upon however, but the actual weight of the commodity should be determined by removing all wrappings and weighing the contents alone, or by weighing them in a container or vessel the weight of which has been accurately determined and then subtracting from the result the known weight of this container or vessel.

In reweighing a number of packages of the same supposed size and in similar wrappers, the easiest method of determining the errors on them is as follows: Place weights equal to the supposed or claimed weight of the packages in one pan of the balance with wrappers similar to those on the packages being reweighed, as already described. Now place the packages in the opposite pan, one after another. Do not disturb the original weights, but if the package in the pan does not balance the scale, add small weights to the light pan until the proper balance is obtained. The value of these small weights is the error of the package; if the weights have been added to the pan

in which the original weights have been placed, the package is heavy by this amount; if to the pan in which the package has been placed, it is light by this amount. (In recording the error on a package which is heavy the error should be preceded by a plus (+) sign; on a package which is light the error should be preceded by a minus (−) sign.)

The general powers and duties outlined herein are to be interpreted liberally and an effort should be made to bring to justice every offender against the provisions of the law. The vigilance and efficiency of each weights and measures official in carrying out both the detailed and the general work described—in other words, in securing the determination of proper quantities of commodity in every transaction—will, in a very large measure, determine the ultimate success of the letter and spirit of any weights and measures legislation.

Everything possible should be done to instruct the merchants as to the general provisions of the law, and especially as to what constitutes a violation rendering them liable to a penalty. It should be the desire of every weights and measures official to put the provisions of the law into force and effect and to secure proper compliance with them with as little hardship as possible. Therefore, it should not be their desire to secure convictions for violations in cases where the violations in question are merely technical ones and result from ignorance rather than from criminal carelessness or negligence, dishonesty, or fraud. To guard against this, the education of the merchants is very necessary.

PART II.—SPECIFICATIONS AND TOLERANCES FOR, AND THE EXAMINATION OF, APPARATUS

DESCRIPTION OF SPECIFICATIONS AND TOLERANCES

Source and Purpose.—The specifications and tolerances for commercial apparatus given hereafter are those adopted by the Eleventh Annual Conference on the Weights and Measures of the United States, held in May, 1916, at the Bureau of Standards.

The purpose of these specifications and tolerances is to eliminate from use, without prejudice to apparatus that conforms as closely as is mechanically possible to the official standards, weights and measures and weighing and measuring devices that are false, that are of such construction that they are faulty—i. e., that are not reasonably permanent in their adjustment or will not repeat their weight indications correctly—or that are designed to or may be used to facilitate the perpetration of fraud. The original classes of specifications and tolerances contained in the following pages shall be applicable until the classification hereinafter described is modified, which should occur only at such time as the general condition of the weights and measures and weighing and measuring devices in use make such changes advisable.

Application.—The specifications and tolerances are to be construed to apply to the usual types of weights and measures and weighing and measuring devices used in ordinary commercial transactions and usually coming

within the jurisdiction of the weights and measures official, but only when a proper classification is provided for them. They shall also be construed to apply to apparatus used for special purposes whenever and in so far as they are clearly applicable, but not otherwise.

Classification.—In the set of specifications given hereafter a number of paragraphs, which have been printed in italics, have been limited to apply only to new apparatus in order that these 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 the purchasing public. The specifications taken as a whole are designed to improve the general types of apparatus and to render possible the most efficient enforcement of the law. As old apparatus is replaced, the full set of specifications should be enforced in the case of the new apparatus in order that only that of satisfactory construction will be allowed to be put into use; and at some future date, when the gradual process of elimination has been going on for some time, it will be found possible to remove the limitations on the application of the specifications at first suspended, and all apparatus in use will thus be required to be of entirely satisfactory construction. The specifications which have been applied to both old and new apparatus are those which are most urgently required; the specifications which have been limited to affect new apparatus only are those which, while clearly necessary, can best be postponed for general enforcement until the general provisions of these specifications have been put into effect and have come to be

understood, respected, and observed throughout the jurisdiction of the department enforcing them.

The object of all of these is not only the benefit and the protection of the consumer, but the benefit of the honest merchant and manufacturer as well, in assisting them to carry on their business free from the unjust competition of a dishonest and unscrupulous or ignorant class.

Two sets of tolerances, or allowable errors, have been issued on the theory that apparatus will necessarily deteriorate after being put into use and used for some time, and it would be manifestly unjust to condemn and confiscate apparatus, which was satisfactory when sold, shortly after it is put into use and used.

The more rigid or the more lenient set of tolerances should be applied, respectively, according to whether the apparatus has not yet been put into use or is already in use at the time that any test is made.

Classification of Apparatus.—For the purpose of applying the two sets of specifications, it will be found necessary to divide weights and measures and weighing and measuring devices into classes; and for this purpose the following classes are established:

CLASS 1.—Weights and measures and weighing and measuring devices which, after the promulgation of these specifications, are manufactured in the State or brought into the State.

CLASS 2.—Weights and measures and weighing and measuring devices which are in the State at the time of promulgation of these specifications, either in use, or in the stock of manufacturers of, or dealers in, such apparatus.

All the specifications on the various types of apparatus shall apply to apparatus of class 1.

The specifications printed in italics shall not apply to apparatus of class 2, and therefore shall not be retroactive.

In order to enforce the above specifications, it will be necessary to identify apparatus to which the complete set or the partial set of specifications is to be applied. This may be done as follows: At the time of the first sealing all apparatus belonging to class 2 may be permanently and clearly stamped with a steel die bearing a star (*), or some other simple design or device, in a prominent and conspicuous position near the seal. After the first sealing the complete set of specifications should be applied to apparatus not so stamped; apparatus marked with the device should continue to be regulated by the abbreviated set of specifications until it is retired from use, or until the limitation on the application of the specifications is removed. During the first sealing not only the apparatus in actual use but also all that which is in the stock of manufacturers of apparatus or dealers in apparatus should be marked as described.

CORRECT AND INCORRECT APPARATUS

Definition.—A weight or measure or weighing or measuring device which is defined as correct shall be understood and construed to mean only one which conforms to the standard within the tolerance, under the method of test prescribed, and which in addition, complies with all the specifications applicable to it given in the following pages. All other weights and measures and weighing and measuring devices shall be understood and construed to be incorrect.

The general steps to be taken in the examination of any piece of apparatus under test are the inspecting, the testing, and the sealing or condemning.

Some of the main points to be observed are as follows:

Inspecting, in General.—With the specifications on weights and measures and weighing and measuring devices at hand, examine the piece of apparatus under test carefully, noting whether each requirement for the proper class to which it belongs is complied with, since if this is not the case the piece of apparatus is incorrect.

Testing, in General.—Carry out the test upon the piece of apparatus exactly as described, and use the tolerances given for the proper class to which it belongs. Do not neglect any part of the test, since if any requirement is not satisfied, the piece of apparatus is incorrect.

Sealing and Condemning, in General.—When the inspecting and testing have been completed, seal the piece of apparatus, or condemn and seize it, or tag it as condemned for repairs. (In many jurisdictions the law specifies only one method of condemnation, with specific instructions for procedure. In these cases, of course, the method as laid down in the law must be followed by the official.)

Apparatus should be sealed if it is correct.

When apparatus is sealed, it is desirable that one be able to ascertain from the apparatus itself certain facts; for instance, by what authority it was sealed and when it was last sealed. Some general scheme of sealing commercial apparatus should be adopted which will make it possible to ascertain these facts. It should be especially borne in mind, however, that the devices selected should be as simple as possible in order to facilitate the stamping of the seal, when steel dies are used, and the identification of it thereafter. Upon the first test the complete devices

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should be used. When apparatus is sealed for the second or subsequent time, the whole device will not have to be repeated, but a simple auxiliary device may be adopted which may be impressed upon the apparatus and which will disclose the number of sealings occurring since the year appearing by date upon the apparatus and the year or sealing period during which it was last sealed.

When lead seals are employed, sealing presses containing the proper dies to impress the same devices as above should be furnished with the sealing equipment. These devices should also appear upon any paper seals used. In the last two cases the original devices will usually be repeated in full at each sealing, since in these cases the whole seal is usually replaced.

Apparatus should be condemned and seized if it does not comply with the specifications or if it fails to satisfy the various tests within the tolerances for the class to which it belongs and, further, is in such condition that satisfactory repair is not possible. Thus, the apparatus will absolutely and permanently be removed from either intentional or accidental use. It should be held for use as evidence in the event that a prosecution is to be commenced and should be preserved until after any litigation has been finally decided. If the circumstances surrounding the condemnation of the piece of apparatus are such that no prosecution is to be commenced, it should nevertheless be seized when in the condition described above, and destroyed at such a time and in such a manner as may be deemed advisable and convenient.

If the apparatus is incorrect as defined in the preceding paragraph, but is in such condition that it may be repaired, and, further, the circumstances surrounding its

use are such that no complaint should be filed, it should be tagged as "Condemned for repairs" with a tag which should be part of the equipment, when such a disposition is allowed by the local law. The blanks on this tag and on the stub usually attached thereto should be filled out by the official in every case and the stub preserved by the official. The piece of apparatus, in the event of this disposition, should be again tested as provided in section 10 of the proposed model law (see Appendix II, p. 198) or the similar section of any local law that is based upon it, and upon this test the sealing or the final condemning and seizure should take place as described above. If, on the contrary, it is believed that a complaint should be filed on account of any such apparatus having been used, it should be seized forthwith and held as evidence in the trial of the case. After the final decision it may be disposed of as described above.

In sealing or condemning apparatus in the course of the enforcement of the model law, it is very important that certain precautions be observed; and in the case of any weights and measures law, efficient enforcement demands that proper attention be paid to them. Some of these may be mentioned as follows:

1. Never seal or otherwise approve any piece of apparatus without having made certain that it is correct. This, obviously, is of the very greatest importance, since if this precaution is not observed the whole groundwork of the inspection service will be destroyed and the proper enforcement of the law will entirely fail.

2. Always place a seal upon apparatus which is found to be correct, except in the case of apparatus so small or fragile that sealing is impossible. In any case always

record it in the proper column of the certificate of inspection of apparatus where such a certificate is used, whether it is sealed or not. This is extremely necessary for the protection of merchants, since the model law and many of the State laws provide a penalty for the use of apparatus not sealed or otherwise certified.

The seals should always be applied or fastened as permanently, clearly, and conspicuously as possible, but should never be placed on a moving part of a scale or other piece of apparatus.

3. Always attach a tag labeled "Condemned for repairs" on all apparatus so disposed of, whenever it is possible to do so; and keep a record on the attached stub, where one is provided for that purpose, and on the certificate of inspection of apparatus, in order that the reinspections may be made as required by law. Explain to the merchant what the tag means, how long a time he will be allowed in which to have the apparatus repaired, and that penalties are provided for the removal of the tag or for the use or disposal of the apparatus before the next visit of a weights and measures official.

4. Always seize condemned apparatus whenever possible, since in no other way is it possible absolutely and finally to remove these pieces from commercial use and prevent further violations of the law through their use. Proper steps should also be taken to effect their complete destruction.

LINEAR MEASURES

Specifications.—1. Measures of length shall be made of a material the form and dimensions of which remain reasonably permanent under normal conditions—for example, steel, brass, hardwood, etc.: Provided, however,

That tapes for commercial purposes may be made of cloth, but only when this is wire-woven, and when by this means an actual and sufficient reinforcement and permanency is obtained.

2. *The ends of measures of length made of wood, or of other nonmetallic material liable to wear away through use, shall be protected by some metal not softer than brass, firmly attached to the measure.*

3. Rigid measures of length shall be smooth and straight.

4. Folding measures of length shall be so constructed that each section will come to a definite stop when straightened out.

5. Measures of length shall be graduated in units of the customary system and its usual subdivisions.[1]

6. All graduations shall be clear and distinct, and the main graduations shall be plainly designated. The length of these main graduations shall be greater than that of the intermediate graduations, and the latter shall be varied in length in such a way that they may be conveniently read.

7. *Graduations shall not be greater in width than one-quarter of the width of the smallest subdivision: Provided, however, That if line graduations are employed, their width shall not exceed 0.03 inch; if raised graduations are employed, their width shall not exceed 0.12 inch at their widest point.*

8. All graduations shall be uniformly spaced and be perpendicular to the edge of the measure.

9. Measures of length, so called, defined by tacks driven into a counter, or in any similar way, shall not be allowed.

Tolerances.—The tolerances to be allowed in excess or deficiency on all measures of length, except tapes of steel

[1] This shall not be understood to exclude measures graduated in the metric system. See p. 141.

or other metal, shall not be greater than the following values: Provided, however, That the manufacturers' tolerances or the tolerances to be allowed on all new measures of length, except tapes of steel or other metal, shall not be greater than one-half of the values given.

Length	Tolerance
Feet	Inch
6.....	3/16
5.....	5/32
4.....	1/8
3.....	3/32
2.....	1/16
1.....	1/32
1/2 [a].....	1/64

[a] Or less.

The tolerances to be allowed in excess or deficiency on all tapes of steel or other metal shall not be greater than the following values:

Length	Tolerance	Tension
Feet	Inch	Pounds
100.....	1/4	10
66.....	3/16	10
50.....	1/8	10
33.....	3/32	10
25.....	1/16	10
10.....	1/16	5
6.....	1/32	5
3.....	1/32	5

Inspecting.—Examine the measure under test carefully, noting whether it complies with each of the foregoing specifications which is applicable to it. If the measure does not so comply, it is incorrect.

(Particular attention should be paid to cloth tapes, when these are under test, to make certain that they will be sufficiently permanent in use. The wire reenforcement should be an actual one, and some of the tapes at present on the market, supposedly but not actually reenforced by a strip of tinsel or in a similar way, should not be considered as complying with specification No. 1. It also appears that some tapes, even when wire woven as, for instance, with soft copper wire, are unsatisfactory, since this wire will elongate under a tension to which the tape may be subjected in use, and the tape will thereafter have a permanent error in excess as a result.)

Testing.—If the standard measure used in verifying the measure under test is a metal or wooden bar, lay one beside the other, or place one on top of the other either flat or on edge, in such a way that the zero points of the two measures exactly coincide. If the standard furnished is a steel tape, lay this flat upon the measure under test in the same position. The total length and the various important subdivisions of the measure under test should then be examined to determine whether they coincide with the similar graduations on the standard. If any point on the measure under test fails to agree with the standard, the error at each such point should be noted. Usually this error can be determined directly by means of the subdivisions on the standard itself; or a small steel scale, more finely subdivided, may be employed for this purpose if de-

sired. The use of a reading glass will facilitate a proper comparison between the measures.

Compare the errors thus found with the tolerances given in the preceding table for the appropriate lengths. If any of the errors found are greater than the values there given, the measure is incorrect.

Sealing and Condemning.—If the measure under test complies with each of the specifications and the various lengths are not in error by an amount greater than the tolerances, it should be sealed by stamping it on or near one or both ends with a steel sealing die. If the complete sealing device is composed of two dies, one may be impressed on or near one end and the other on or near the other end.

If the measure does not comply with each of the proper specifications, or if the error on any length is greater than the tolerance on that length, the measure should be condemned and seized or condemned for repairs as the nature of the fault determines. Counter tacks designed to be used as measures of length should be removed.

LIQUID CAPACITY MEASURES

Specifications.—1. Liquid measures shall be made of metal, glass, earthenware, enameled ware, composition, or similar and suitable material, and shall be of sufficient strength and rigidity to withstand ordinary usage without becoming bent, indented, distorted, or otherwise damaged: *Provided, however, That when the measure is made of iron or steel, or iron or steel plated with tin, zinc, or copper, or is made of copper, the minimum thicknesses of the metal shall in no case be less than those given in the following table:*

Capacity of measure	*Minimum thickness if of iron or steel or of plated iron or steel* [a]	*Minimum thickness if of copper*
	Inch	*Inch*
Over 1 gallon	0.016	0.032
1 gallon	.014	.028
½ gallon	.014	.028
1 quart	.014	.028
1 pint or less	.010	.020

[a] The following commercial tin plates will comply with these requirements: Over 1 gallon, 2XL; 1 gallon, ½ gallon, and 1 quart, IX; 1 pint or less, ICL.

2. Liquid measures of the customary system shall be of one of the following capacities only: One gallon, a multiple of the gallon, or a binary submultiple of the gallon; that is, a measure obtained by dividing the gallon by the number 2 or by a power of the number 2: Provided, however, That nothing in this specification shall be construed to prevent the use of forms for ice cream, exclusively, in 5-pint and 3-pint sizes, or bottles for milk or cream in the 3-pint size.

3. Liquid measures shall be so constructed that the capacity is determined by a definite edge, plate, bar, or wire at or near the top of the measure. When one of the last three forms is employed the capacity shall be determined to the lowest point of such plate, bar, or wire.

4. No subdivided liquid measures shall be allowed, and the only reinforcing rings which may be used are those which are firmly attached to the outside of the measure and do not, by indentations or in any other manner, show divisions or lines on the inside surface of the measure.

5. The capacity of the measure shall be conspicuously, legibly, and permanently indicated on the side of the measure. This shall be in combination with the word "Liquid" or the letters "Liq" in the case of measures in which the word "quart" or "pint" occurs. In the case of measures made of earthenware, enameled ware, or composition, this marking shall be of a different color than the measure.

6. If a liquid measure is provided with a tap or spigot, the construction shall be such that the measure may be completely emptied by the tap or spigot while it is standing upon a level surface.

7. When a lip or rim, designed both to facilitate pouring and to receive any overflow, is provided, the measure must be so constructed as to hold its full capacity exclusive of the lip or rim, while it is standing upon a level surface.

Tolerances.—The tolerances to be allowed in excess and in deficiency on all liquid capacity measures shall not be greater than the following values: Provided, however, That the manufacturers' tolerances or the tolerances to be allowed on all new liquid capacity measures shall not be greater than one-half of the values given.

Capacity of measure	Tolerance			
	In excess		In deficiency	
	Liquid ounces	Cubic inches	Liquid ounces	Cubic inches
10 gallons	10	18.0	5.0	9.0
5 gallons	6	11.0	3.0	5.4
4 gallons	4	7.0	2.0	3.6
3 gallons	4	7.0	2.0	3.6
2 gallons	2	3.5	1.0	1.8
1 gallon	1 Drams	1.8	4.0 Drams	.9
½ gallon	6	1.4	3.0	.7
1 quart	4	.9	2.0	.5
1 pint	3	.7	1.5	.3
½ pint	2	.4	1.0	.2
1 gill	2	.4	1.0	.2

Inspecting.—Examine the measure under test carefully, noting whether it complies with each of the foregoing specifications that is applicable to it. Especially should it be noted that no measure be approved that is not of one of the capacities given in specification No. 2. The measure should be clean and have no foreign matter adhering to its interior, since the removal or further collection of this, after sealing, would vary the content. If the interior of the measure has any foreign matter firmly adhering to it, it may first be tested without removing this, since this is the condition in which it has been used and by such a test the official may determine whether it has been employed in delivering incorrect quantities. No measure shall be sealed while it contains such a deposit, however.

It is important that measures which are constructed of too light material be not sealed, since these will be easily bent, indented, and distorted when in use and serious shortages are liable to result before the measure is again examined. Therefore it is important that specification No. 1 be enforced. The thickness of the material may be determined with a micrometer caliper. After the inspector has gained some experience it will be obvious to him that some measures are of proper strength, and the determination of thickness in these cases will be unnecessary, but in all doubtful cases the weight of the material should always be checked on the first inspection of a measure.

If a measure does not comply with all of the specifications that are applicable to it, it is incorrect.

Testing.—If the measure under test is of the nominal size of one of the standard metal measures, fill the latter with water and slide the glass slicker plate across its top so that no bubbles form under the plate. Holding the glass slicker plate firmly on the measure, tilt this over the measure under test and then displace the plate slightly, allowing the water to flow into the latter measure until all has been poured in or until the measure under test is even full. If when the measure is filled there is water remaining in the standard, the measure under test is small by this amount. Determine this deficiency error by pouring this surplus water into a small tolerance graduate and noting the quantity.

If all the water in the standard measure fails to fill the measure under test completely, draw a definite quantity of water into the tolerance graduate, and from this amount complete the filling of the measure. The difference between the quantity of water remaining in the

graduate and the original amount, is the excess error of the measure under test.

Compare the error found with the value given in the tolerance table for the measure of corresponding size. If the error in deficiency or in excess is greater than the value given in the proper column, the measure under test is incorrect.

If there is no standard available of the same capacity as the measure under test but the latter is a multiple of one of these, then this should be filled as above and poured into the measure under test the proper number of times, the error being determined on the last measureful added.

When a glass cylinder subdivided into liquid measures of various sizes is provided and used, the test should be carried out in the same manner as described above. It should be especially noted that readings should be made at the main surface of the liquid in the cylinder, i. e., this should be filled with water until the bottom of the concave surface of the water is level with the graduation line. The small amount of water which creeps up the sides of the glass measure to a higher point than the main surface of the water should be disregarded. A glass cylinder should never be employed when a standard metal measure is at hand or obtainable, since the use of this nearly always causes errors, and inaccurate measures are liable to be sealed and measures within the tolerance are liable to be condemned as a result.

While testing liquid measures take great care that no water is spilled; also that the water does not heap up over the top of the measure under test or overflow it or run into the overflow and pouring lip where there is one.

It is important to note that water should not be poured from the measure under test into the standard measures or glass graduates, since the latter should be kept clean and not be soiled by contact with olive oil, kerosene, and other products sold by the measures which will be tested.

In case a large standard liquid measure is not available and the content of large measures or containers such as barrels, etc., must be found, the above method may sometimes be found to be a difficult and tedious one to carry out in practice. In this case the following method may be substituted for rapid checking where a great degree of accuracy is not essential. Carefully weigh on an accurate commercial scale the barrel or other container while it is empty, clean, and dry, and record its weight. Then run tap water into the container until the proper filling is obtained, reweigh the filled container, and record its weight. The difference between the weight of the container filled and the weight when empty (or tare weight) is the weight of the water which is contained in the receptacle. Divide this by 8.32, the weight per gallon of the water in pounds. The result thus obtained is the capacity of the container, in gallons. (If the water used in the test is warm, the divisor 8.31 will be more accurate, while if the water is cold, as in winter weather, the divisor 8.33 should be used.) If proper precautions are taken, the above result should not be in error by more than one-half of 1 per cent. If a prosecution is to be commenced on the result of the test, the latter method should not be employed, however, since many courts would not give proper attention to evidence so obtained; in such cases a direct comparison with a standard measure should always be obtained.

Sealing and Condemning.—If the measure under test complies with all the specifications given above, and if the error is not greater than the tolerance for this size measure given in the table, it is correct and should be sealed. This should be done, when possible, by stamping it on the handle, lip, or on the side near the top, with the steel sealing dies. If the measure will not take an impression from the steel die, attach a lead seal to the handle by means of a seal press. If the measure does not comply with the specifications or has an error greater than the proper tolerance, condemn and seize it or condemn it for repairs, as the nature of the fault determines.

GLASS GRADUATES

Specifications.—1. *Graduates shall be made to contain or to deliver the indicated volume at 20° C (68° F). They shall be legibly, conspicuously, and permanently marked to indicate whether they are graduated to contain or to deliver.*

2. *Graduates shall be either cylindrical or conical in shape. In the case of all cylindrical graduates the ratio of length of the graduated scale to the internal diameter shall not be less than five to one. In the case of conical graduates the ratio of length of the graduated scale to the internal diameter at the highest graduation shall not be less than two to one, and at one-fourth of the total capacity this ratio shall not be less than one to one.*

3. Graduates shall be made of good quality glass, thoroughly annealed, clear, transparent, of uniform but not excessive thickness, and free from bubbles and streaks.

4. Graduates shall be provided with a base at right angles to the axis *and of such a diameter that the graduate will stand when placed on a surface making an angle of 25 per cent, or approximately 15°, with the horizontal.*

5. All graduates shall be provided with pouring lips.

6. The graduation marks shall be perpendicular to the axis and parallel to the base and to each other.

7. The graduation marks shall be varied in length in such a manner that they may be conveniently read, *but in no case shall any graduation mark extend less than one-fourth of the distance around the graduate. The main graduation marks shall extend at least one-half of the distance around the graduate: Provided, however, That on duplex, or double-scale, graduates a clear space shall be left between the ends of the main graduation marks on the two scales, and this space, measured parallel to the graduation marks, shall conform to the following values:*

Circumference of graduate at the graduation marks	*Distance between ends of graduation marks*
	Inch
Up to 5 inches	*1/8*
From 5 inches to 10 inches, inclusive	*1/4*
More than 10 inches	*3/8*

8. Graduation marks shall be clear and distinct and uniform in character. They shall be etched or engraved, *and shall not exceed 0.015 inch (0.38 mm) in width.* Blown or pressed graduation marks shall not be allowed.

9. *The clear interval between the graduation marks shall not be less than 0.04 inch (1 mm).*

10. The value of the main graduation marks shall be plainly designated, *each number being placed either directly upon or immediately above the graduation mark to which it refers,* but the position of the numbers shall be consistent

throughout the graduated scale. *If placed upon the graduation marks, the numbers shall be placed from the ends a sufficient distance to allow the ends to be used in making a setting. Intermediate graduation marks shall not be numbered.*

11. On all single-scale graduates, where the main graduation marks do not completely encircle the graduate, the middle points of the main graduation marks shall be directly opposite the lip. On duplex, or double-scale, graduates the center of the clear spaces between the ends of the main graduation marks, provided for in specification 7, shall be approximately 90° from the lip.

Tolerances.—The tolerances to be allowed in excess or deficiency on glass graduates shall not be greater than the values given in the following table.

NOTE.—The tolerance to be used at any point on any graduate shall be determined by measuring the inside diameter of the graduate at the point under test and taking from the table the tolerance value corresponding to this diameter.

Tolerance for Graduates of Various Diameters (in Metric Units)

Diameter	Tolerance	Diameter	Tolerance	Diameter	Tolerance
mm	ml [a]	mm	ml [a]	mm	ml [a]
10.....	0.04	15.....	0.09	20.....	0.18
11.....	.05	16.....	.10	21.....	.20
12.....	.06	17.....	.12	22.....	.22
13.....	.07	18.....	.14	23.....	.24
14.....	.08	19.....	.16	24.....	.26

[a] The term milliliter, or "ml," is used herein to designate the one-thousandth part of the liter. This unit is also commonly known as the cubic centimeter, or the "cc." The latter is not an accurate usage, as the units are not exactly equal, but the difference between them is of no consequence for the purposes of this table, and therefore they may be used interchangeably.

Tolerance for Graduates of Various Diameters—Continued

Diameter	Tolerance	Diameter	Tolerance	Diameter	Tolerance
mm	ml	mm	ml	mm	ml
25.....	0.28	51.....	1.5	76.....	4.0
26.....	.30	52.....	1.6	77.....	4.1
27.....	.35	53.....	1.6	78.....	4.2
28.....	.35	54.....	1.7	79.....	4.4
29.....	.40	55.....	1.8	80.....	4.5
30.....	.45	56.....	1.9	81.....	4.6
31.....	.45	57.....	2.0	82.....	4.8
32.....	.50	58.....	2.0	83.....	4.9
33.....	.55	59.....	2.1	84.....	5.0
34.....	.60	60.....	2.2	85.....	5.1
35.....	.60	61.....	2.3	86.....	5.2
36.....	.65	62.....	2.4	87.....	5.4
37.....	.70	63.....	2.5	88.....	5.5
38.....	.75	64.....	2.6	89.....	5.6
39.....	.80	65.....	2.7	90.....	5.7
40.....	.85	66.....	2.8	91.....	5.9
41.....	.90	67.....	2.9	92.....	6.0
42.....	.95	68.....	3.0	93.....	6.1
43.....	1.00	69.....	3.1	94.....	6.2
44.....	1.05	70.....	3.2	95.....	6.4
45.....	1.10	71.....	3.4	96.....	6.5
46.....	1.15	72.....	3.5	97.....	6.6
47.....	1.25	73.....	3.6	98.....	6.8
48.....	1.30	74.....	3.7	99.....	6.9
49.....	1.35	75.....	3.9	100.....	7.1
50.....	1.4				

Tolerance for Graduates of Various Diameters (in U. S. Customary Units)

Diameter		Tolerance		Diameter		Tolerance	
Inches	Sixteenths	Drams	Minims	Inches	Sixteenths	Drams	Minims
..	6	..	0.6	1	15	..	22
..	7	..	0.8	2	0	..	24
..	8	..	1.0	2	1	..	26
..	9	..	1.3	2	2	..	28
..	10	..	1.6	2	3	..	30
..	11	..	2.0	2	4	..	32
..	12	..	2.5	2	5	..	34
..	13	..	3.0	2	6	..	36
..	14	..	3.5	2	7	..	39
..	15	..	4.0	2	8	..	41
1	0	..	5	2	9	..	44
1	1	..	6	2	10	..	47
1	2	..	6	2	11	..	49
1	3	..	7	2	12	..	52
1	4	..	8	2	13	..	55
1	5	..	9	2	14	..	58
1	6	..	10	2	15	1	2
1	7	..	11	3	0	1	5
1	8	..	12	3	1	1	8
1	9	..	14	3	2	1	12
1	10	..	15	3	3	1	15
1	11	..	16	3	4	1	18
1	12	..	17	3	5	1	21
1	13	..	19	3	6	1	24
1	14	..	21	3	7	1	27

Tolerance for Graduates of Various Diameters—Continued

Diameter		Tolerance		Diameter		Tolerance	
Inches	Sixteenths	Drams	Minims	Inches	Sixteenths	Drams	Minims
3	8	1	31	3	13	1	47
3	9	1	34	3	14	1	51
3	10	1	38	3	15	1	55
3	11	1	41	4	0	2	0
3	12	1	44				

Inspecting.—Examine the graduate under test carefully, noting whether it complies with each of the foregoing specifications that is applicable to it. In order to measure the inside diameters mentioned in specification No. 2, a small pair of inside calipers will be found essential. (These will also be necessary to determine the diameter at different points in order to ascertain the tolerance to be allowed as noted hereafter.) This specification is an extremely important one, since the tolerance to be allowed depends on the shape of the graduate, and it should be strictly enforced.

After some experience is gained it will probably be unnecessary to apply a test to ascertain if specification No. 4 is complied with, except in doubtful cases, since the inspector will soon learn what degree of stability this represents. To determine whether or not many of the others are satisfied, observation alone is necessary. The graduate should be clean and have no foreign matter adhering to it, since this would interfere with the test.

If the graduate under test does not comply with all the specifications that are applicable to it, it is incorrect.

Testing.—Since the tolerance table given here is upon a somewhat different basis from those given for other classes of apparatus, some explanation of it may be advisable.

It will be seen that the tolerances are based upon the diameter of the graduate at the point tested instead of upon standard capacities. This is advisable and necessary since the main difficulty of the manufacturer is in the placing of the graduation lines. By following good practice he will be enabled to place the line representing any given capacity within a small distance above or below the proper point. If he were required to place the line more accurately than this, it would raise the price of graduates very greatly; and if permitted more tolerance on the placing of the line it would unnecessarily decrease their accuracy.

Since the diameters of different graduates differ at the same capacity, the volumes represented by a displacement of the graduation line from its correct position also vary. Thus if a graduate is 2 inches in diameter at the 4-ounce graduation line, the error resulting from a displacement of this line of 0.02 inch is 1 per cent, while if the diameter is 1 inch the resulting error from the same displacement is only one-fourth of 1 per cent. Now if a 1 per cent error were allowed at this capacity on both graduates this graduation line on the second graduate would have an allowable displacement of 0.08 inch, an unjustifiable error. If the tolerance were made one-fourth of 1 per cent, then in the case of the first graduate the graduation line would be

required to be placed within an accuracy of 0.005 inch, an unreadable amount.

On this account the tolerance has been made a function of the diameter. The error is prevented from becoming excessive at any capacity by specification No. 2, which limits the shape which graduates may assume.

In general, to determine the tolerance to be allowed at any graduation line on a graduate, measure the inside diameter of the graduate at this line with the calipers mentioned above and select from one of the preceding tables and use as the tolerance the value corresponding to this diameter.

It will be found possible and advisable to test some glass graduates with metal liquid measures, and this may be done in the field, but in the case of others it will be necessary to conduct the tests in the office or other place where a burette may be conveniently set up and used. Of course if it is found possible to carry the necessary burettes from store to store and to set them up as required, this may be done, but it is believed that on account of the danger of breakage such a plan will be found to be impracticable. The graduates which may be tested with metal liquid measures include those having a capacity of 4 ounces or 120 milliliters or more. Graduates having a capacity of less than these amounts should be tested by the use of burettes, as mentioned above.

Whenever it can be avoided, a graduate should never be used to test a graduate, for the reason that errors in the standard and the error in the setting on the line of the standard, especially under unfavorable conditions, may be almost equal to the tolerance on the graduate under test. If the sum of these errors is in the same direction as the

error on the graduate under test, the latter is liable to be passed, although its error greatly exceeds the tolerance, and if in the opposite direction it is liable to be rejected as inaccurate even though it may be well within the tolerance.

Every graduate should be tested at the capacity graduation line, at the first graduation line, and at several intermediate points. The test should be made by filling exactly to the graduation line under test, the error being determined by measuring the amount of water remaining in the standard, or the excess water required to accomplish such filling. In filling to any graduation line great care should be exercised to see that the main surface of the water is in coincidence with the graduation line when the graduate is level; in other words, the readings should be made with the principal surface in the plane of the graduation line. The small amount of water known as the "meniscus," which creeps up the side of the glass measure to a higher point than the main surface of the water, is always to be disregarded in making the setting.

Testing by Use of Metal Liquid Measures.—Fill the liquid measure corresponding in capacity to the graduation line under test, with water, and pour this into the graduate in the manner described under the heading "Liquid capacity measures: Testing," preceding, until all the water has been poured in or until the surface of the water coincides with the graduation line under test, as has been described. If this condition obtains before all the water has been poured in, the capacity indicated by the graduation line is in deficiency by the amount of water remaining in the standard measure. Determine this deficiency error by pouring this surplus water into

the tolerance graduate and noting its quantity. In all readings on the tolerance graduate the same precautions are to be observed as are described for the filling of the graduate under test to the proper graduation line.

If all the water in the standard, when transferred to the graduate under test, fails to fill the graduate up to the proper graduation line, then the capacity indicated by this line is in excess. To determine the size of the error, draw a definite known quantity of water into the tolerance graduate and from this amount complete the filling of the graduate up to the proper graduation line. Subtract the amount of water remaining in the tolerance graduate from the amount of water drawn into this graduate. This difference is the excess error of the graduation line under test. If the error in excess or in deficiency is greater than the capacity of the tolerance graduate, fill this more than once, determining on the final draft the difference noted above. These amounts are then to be added together to determine the total error.

The use of a liquid measure having a capacity of less than 2 liquid ounces is not practicable. Therefore it will not be found possible to test the smallest graduation of the graduate with a metal liquid measure. It will probably be found satisfactory to test this graduation line by means of a small graduate having a capacity of about one-half an ounce, or it may even be done with the tolerance graduate, but in both of these cases the greatest care is to be observed in the filling of this graduate. When the capacity to be tested is greater than the capacity of this small graduate, the latter should be filled the proper number of times, the error being determined on the last amount added. This method is suggested in order to

facilitate the testing of graduates in the field and forms an exception to the rule that one graduate should not be used to test another graduate. The use of a small graduate for this purpose is not as unsatisfactory as the use of a larger graduate, since on a small diameter the setting can be made with a greater degree of accuracy.

When the error in excess or in deficiency has been determined on any graduation line, it should be compared with the tolerance to be allowed at this line, such tolerance to be determined in the manner described. If the error in excess or in deficiency at any point is greater than this tolerance value, the graduate under test is incorrect.

Testing by Use of Burettes.—Fill the burette to the zero graduation line, taking the same precautions in setting as have been described above. Then allow the water to flow into the graduate under test until it has been filled to the proper graduation line or until the surface of the water in the burette has dropped to the capacity graduation line. If the graduate has been properly filled before the capacity of the burette has been reached, then read on the burette the amount which has been delivered into the graduate. The difference between this amount and the nominal capacity of the graduation line under test is the error in the graduate at this graduation line. If the capacity of the burette is insufficient to fill the graduate to the proper graduation line then refill the burette to the zero graduation line and complete the filling of the graduate to the proper graduation line. The error in excess is then read directly on the burette. The refilling will only be necessary in the case of a metric burette which is being used to test metric graduates of the same nominal capacity as the burette and then only

if the graduate has an error in excess. The burettes which are recommended in the customary system have a slightly greater capacity than the graduates that will be tested by them and this excess will make direct reading of errors on the burettes possible regardless of the sign of the error. Similar metric burettes are not recommended, however, since these are not standard articles and they would be difficult to procure and correspondingly higher in price. If a large number of metric graduates are to be tested, it may be found advisable to have special burettes made having a capacity slightly in excess of those listed, since the saving of time will be a considerable factor if the error can be directly read without refilling the burette regardless of whether the error is in excess or in deficiency.

When the error in excess or in deficiency has been determined on any graduation line, it should be compared with the tolerance to be allowed at this line, such tolerance to be determined in the manner described above. If the error in excess or in deficiency at any point is greater than this tolerance value, the graduate under test is incorrect.

Sealing and Condemning.—If the graduate under test complies with all the specifications given above, and if none of the errors are greater than the appropriate tolerances, it is correct and should be sealed. This should be done by marking it in a permanent manner with the proper devices. Such marking may be done by employing a rubber stamp and glass-etching ink, or by such other method of marking on glass as may be considered best. On account of their nature graduates once sealed need never be retested.

If the graduate under test does not comply with all the specifications applicable to it or has an error at any point greater than the proper tolerance, it should be condemned and seized. On account of their nature glass graduates should never be condemned for repairs.

MEASURING PUMPS

Specifications.—*1. When a measuring pump is provided with adjustable stops, the construction shall be such that each stop can be separately sealed in such a manner that its position can not be changed without destroying the seal.*

2. When a measuring device is provided with a graduated or notched scale to indicate the amount to be delivered, this scale shall be riveted or otherwise permanently fixed in position.

3. The amounts delivered shall not vary by more than the tolerance allowed, irrespective of the speed with which the pump is operated and of the time elapsing between operations.

Tolerances.—The tolerances to be allowed in excess and in deficiency shall not be greater than the values given for the liquid measure of corresponding capacity and kind in the preceding tolerance table for liquid measures.

Inspecting.—Examine the measuring pump under test carefully, noting whether it complies with each of the foregoing specifications that is applicable to it. If it does not so comply, the pump is incorrect.

Testing.—Test each quantity which the pump is constructed to deliver by pumping this amount into a measure which has been found to be correct or on which the error has been determined and can be allowed for.

Since the standard measures should not be dirtied by contact with oil, molasses, etc., a cheap set of measures should be accurately tested by means of the standards furnished, their errors, if any, determined, and the commodity pumped into these, any errors previously determined upon the measures being allowed for. Each capacity should be tested several times, the speed of operation and the periods of time elapsing between operations being varied, in order to determine whether specification No. 2 is complied with. If any delivery under these tests is not correct within the tolerances, the measuring pump is incorrect.

Sealing and Condemning.—If the pump is found to comply with the specifications and if each delivery at each capacity is correct as defined above, it should be sealed by attaching a lead seal to each stop in such a way that its position can not be changed without destroying the seal, or if the pump is such a one that the stops are not separately sealable and furthermore is one to which the nonretroactive specifications do not apply, then it may be sealed with one lead seal.

If the above specifications are not complied with, or if any deliveries are incorrect, the pump should be condemned for repairs, or condemned, dismantled, and the parts seized, as the nature of the fault determines.

MILK BOTTLES

Specifications.—1. Bottles used for the sale of milk or cream shall be made only in sizes heretofore specified under the heading "Liquid capacity measures," and they shall be made to contain their indicated capacities at a temperature of 20° C (68° F).

2. Each bottle shall have its capacity clearly blown or otherwise clearly and permanently marked in or on the side of the bottle, and in or on the side or bottom the name, initials, or trade-mark of the manufacturer thereof.

3. Glass bottles with an inside diameter of not over 2 inches immediately below the cap-seat or stopple shall hold the correct capacity when filled to within one-fourth inch of this cap-seat or stopple; bottles with an inside diameter of over this amount immediately below the cap-seat or stopple shall hold the correct capacity when filled to within one-eighth inch of this cap-seat or stopple: Provided, however, That a larger distance shall be allowed below the cap-seat or stopple when the bottles are provided with a clearly defined line blown or otherwise clearly and permanently marked in or on the bottle, and extending at least halfway around it, which indicates the correct capacity, and directly over, below, or beside this line, with the words "Fill to line" or a similar and suitable inscription clearly and permanently marked in or on the bottle. The distance between the line herein mentioned and the cap-seat or stopple shall in no case exceed that given in the table below.

Capacity of bottle	Maximum distance allowable
	Inches
2 quarts	2
3 pints	1¾
1 quart	1½
1 pint	1
½ pint	5/8
1 gill	5/8

Tolerances.—The tolerances to be allowed in excess or deficiency on individual bottles, and on the average capacity of bottles, shall not be greater than the values shown in the following table. The error on the average capacity of bottles shall be determined by finding the error on each of not less than 25 bottles selected at random from at least four times the number tested, and taking the algebraic mean of these errors.

NOTE.—To find the algebraic mean of a number of errors, first add all those errors which are in excess; then add all those errors which are in deficiency; then subtract the smaller sum from the larger, and finally divide this result by the total number of bottles tested.

Capacity of bottle	Tolerance on individual bottles		Tolerance on average capacity	
	Drams	Cubic inches	Drams	Cubic inches
2 quarts	6	1.4	1.5	0.35
3 pints	5	1.2	1.25	.29
1 quart	4	.9	1.0	.23
1 pint	3	.7	.75	.17
½ pint	2	.5	.5	.12
1 gill	2	.5	.5	.12

Inspecting and Testing.—It is not necessary that all milk bottles be inspected and tested, and such a procedure is usually impossible on account of the very large number in use. Some bottles should be taken at random from all shipments of new bottles, however, and occasionally some should be taken from those in use by the various companies also, especially when an inspection service has been in force only a short time, and all these should be

inspected and tested to make sure that they conform to the above specifications and tolerances. In testing bottles it should be determined whether the conditions noted under the tolerance heading are fulfilled, and the accuracy of the average capacity of a number of the bottles should always be checked by taking the algebraic mean of the errors found upon them. This is of great importance, since somewhat large errors are allowed on the individual bottles, on the theory that if the average capacity is nearly correct the consumer in the long run will receive all of the quantity to which he is entitled. If the bottles run uniformly small by an amount equal to the individual tolerances allowed, this condition will not be fulfilled and the official will not be doing his full duty in eliminating short measure from the community.

If bottles in a shipment of new bottles are found not to comply with all the specifications noted above, or if bottles in use are found not to comply with the specifications applicable to them, they are incorrect. If any bottles or lot of bottles already in use have errors exceeding the tolerances under the conditions noted heretofore, all the bottles in use should be tested, and each one having a greater error than the tolerance specified for the liquid measure of appropriate size is to be treated as incorrect. A shipment of new bottles may be treated in the same manner if deemed advisable, but it is believed that a preferable course is to condemn the whole shipment if all the requirements noted above are not complied with.

Sealing and Condemning.—Milk bottles need not be sealed, but a certificate of inspection of apparatus, when such a form is used, should be filled out for the number of bottles tested. All bottles which are found to be incorrect,

applying the definitions given above, should be condemned and seized. Those constituting a shipment of new bottles should not be destroyed immediately, however, but should be held as evidence until the buyer has been afforded opportunity to obtain redress from the manufacturer when he requests that a reasonable time be granted for that purpose.

On account of their nature milk bottles should never be condemned for repairs.

DRY CAPACITY MEASURES

Specifications.—1. Dry capacity measures, and baskets used as dry measures, shall be made of metal, well-dried wood, or composition, or similar and suitable material, and shall be of sufficient strength and rigidity to withstand ordinary usage without becoming materially warped, bent, dented, distorted, or otherwise damaged.

2. Dry measures, and baskets used as dry measures when such are allowed by the other specifications, shall be of one of the following capacities only: One bushel, a multiple of the bushel, or a binary submultiple of the bushel; that is, a measure obtained by dividing the bushel by the number 2 or by a power of the number 2.

3. The capacity of all dry measures, and baskets used as dry measures, shall be conspicuously, legibly, and permanently indicated on the side of the measure. This shall be in combination with the word "Dry" in the case of measures in which the word "quart" or "pint" occurs. The letters shall be at least one-half inch high and one-quarter inch wide on measures having a capacity of 1 peck or less and at least 1 inch high and one-half inch wide on those having a capacity of one-half bushel or more.

4. All dry measures having a capacity of one-half bushel or less shall be cylindrical or conical in shape. If of the latter shape, the top diameter shall be greater than the bottom diameter, but never by an amount exceeding 10 per cent of the latter. In no case shall the bottom diameter exceed the top diameter.

5. The bottoms of all dry measures shall be perpendicular to the axis of the measure and shall be flat, or when made of metal may be slightly corrugated when such corrugations aid in strengthening the measure. Such corrugations, when employed, shall be parallel or radial straight lines only.

6. Wooden dry measures having a capacity of more than 1 pint shall have a metal band firmly attached around the top. All metal dry measures shall be adequately reinforced around the top.

7. Dry measures, and baskets used as dry measures, having a capacity of 1 bushel or more shall be equipped with handles.

8. Baskets shall not be used as dry measures when having a capacity of less than one-half bushel.

9. Dry measures, and baskets used as dry measures, shall be of such construction that the capacity is determined by the top rim of the measure, and no subdivided measures or baskets shall be allowed.

10. Dry measures shall not be double-ended; that is, have the bottom set part way up into the measure so that both ends may be utilized as measures, either of the same or of different capacities.

11. Dry measures, and baskets used as dry measures, shall not have adjustable or movable bottoms.

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12. The minimum diameters of dry measures of various capacities shall conform to the following table:

Capacity of measure	Minimum diameter
	Inches
½ bushel	13¾
1 peck	10⅞
½ peck	8½
2 quarts	6⅝
1 quart	5⅜
1 pint	4

Tolerances.—The tolerances to be allowed in excess and in deficiency on dry capacity measures and baskets used as dry capacity measures shall not be greater than the following values: Provided, however, That the manufacturers' tolerances or the tolerances to be allowed on all new dry capacity measures and baskets used as dry capacity measures shall not be greater than one-half of the values given:

Capacity of measure	Tolerance	
	In excess	In deficiency
	Cu. in.	Cu. in.
1 bushel	50.0	25.0
½ bushel	30.0	15.0
1 peck	16.0	8.0
½ peck	10.0	5.0
2 quarts	5.0	2.5
1 quart	3.0	1.5
1 pint	2.0	1.0
½ pint	1.0	.5
¼ pint	.5	.3

Inspecting.—Examine the measure very carefully, noting whether all the specifications given above are complied with. Especially should it be noted that no measure should be approved which is not of one of the capacities given in specification No. 2, or which is smaller in diameter than the appropriate minimum diameter given in specification No. 12. Also see that the measure actually contains its full apparent capacity and has not been altered since its manufacture or since a previous sealing by cutting off the top, by placing in it an extra thick or a false bottom, or by relapping the sides and reducing the size of the bottom. This inspection should be very carefully made, since experience proves that this type of apparatus is one in which fraudulent afterations are very frequently made.

Testing.—Three methods of testing dry measures are in common use. One, usually employed in office

work and sometimes in field work also, is known as the "bulk-for-bulk" test. The others, which usually are and always should be confined to work in the field, may be denominated the dimensional measurement test and the test by gage. These three methods of test are described in order:

1. Bulk-for-Bulk Test.—This is accomplished by filling a standard measure with water or with some dry commodity and transferring this amount to the measure under test.

When practicable for use, water is the best testing medium. When it is necessary to employ some dry commodity the testing medium most frequently employed in the past has been dried beans or peas, since these were easily obtainable. Investigations carried on by this Bureau, however, indicate that rapeseed is a better medium for this purpose, especially on small-size measures, although dried peas are fairly satisfactory.

When a hopper funnel is available, put in the hopper a slightly greater amount of commodity than is required to fill a measure of the size under test, place the standard measure under the spout, and open the latter by withdrawing the slide. If the proper amount of commodity is used the standard measure will be a little more than level full. The proper filling is then determined by striking off the top of the measure with a straight bevel-edged ruler or similar straight striker resting on both sides of the top of the measure and extending across it. (A round stick is not entirely satisfactory for this purpose on account of its packing effect.) This operation should be completed before the measure is moved from its position, and throughout the test great care should be taken

not to shake down the dry commodity used either in the standard or in the measure under test. With the hopper empty and closed and the base clean, transfer to the hopper the standard measureful of commodity obtained, and then allow it to flow into the measure under test in the same manner. If the commodity used in the test is dried peas, the hopper should be adjusted to such a height that the average length of fall into the measure under test is the same as that into the standard; if rapeseed is used, this adjustment will be unnecessary. Pass the striking stick over the top of the measure as before. If the proper amount of commodity overfills the measure and part of the commodity is consequently struck off, this excess should be collected and measured in a tolerance graduate, and the measure is then small by this amount. If, on the contrary, the measure is not filled, add commodity to it from a previously measured quantity in the tolerance graduate until it is just level full; the amount added is the excess error of the measure under test. If no hopper funnel is available, carry on the test by transferring directly from one measure to the other, using the same precautions as are mentioned above in regard to shaking the measure, etc.

When the error has been determined, compare this with the value given in the tolerance table, for the measure of appropriate size. If the error is greater than the value there given, the measure under test is incorrect.

NOTE.—This method should always be the one employed when legal proceedings are to be instituted upon the results of the test, since the following methods, though fairly satisfactory for rapid checking, will often not be accepted as competent evidence by a court. Also in a case of this kind the original test should be repeated

and the results should agree, so that the proof offered in court will be conclusive.

2. Dimensional Measurement Test.—This test is accomplished by taking the dimensions of the measure and from these computing its capacity.

The formula for computing the volume of a cylinder is

$$V = \pi r^2 h, \text{ or } V = 0.7854\ d^2 h;$$

when d = the diameter of the cylinder and h = the vertical height, both inside measurements.

An approximate formula for computing the volume of a truncated cone is

$$V = 0.7854\ d^2 h;$$

when d = the average between the top and bottom diameters and h = the vertical height, both inside measurements.

In the case of cylindrical and conical measures, the measurements and calculations are made as follows: With a steel tape or other standard linear measure determine the inside top diameter in two places at right angles to each other, and if a variation occurs, find their average; determine the inside bottom diameter in the same way. (The measurement of the bottom of a wooden cylindrical measure is usually made most easily by measuring across the outside bottom from crack to crack where the bottom and side meet. In the case of a conical measure, the measurement of the bottom diameter from crack to crack will not be exact on account of the slope of the sides, but this error is usually negligible; a more exact measurement is, however, obtainable by the use of a pair of inside calipers.) If the average top and bottom diameters are

not the same, average these two results. The result is the average diameter of the cylinder or the frustrum of the cone (the term *d* in the above formulas). Square this diameter—i. e., multiply it by itself—and multiply the result by the constant 0.7854. Measure the inside vertical height of the measure at several points, and if variations occur, determine the average of the results (the term *h* in the above formulas); multiply this by the last product obtained above. The result obtained is the capacity of the measure. (If all the above measurements are taken in inches, the result obtained will be in cubic inches.)

The capacity of the measure having been determined as above, this should be compared with the standard capacity and the error in excess or in deficiency thus determined.

The standard capacities are as follows:

Capacity of measure	Equivalent in cubic inches
1 bushel	2150. 42
½ bushel	1075. 21
1 peck	537. 60
½ peck	268. 80
¼ peck	134. 40
1 quart	67. 20
1 pint	33. 60
½ pint	16. 80

The error of the measure having been arrived at in the manner described above, compare this with the value given in the tolerance table preceding for the measure of

appropriate size. If the actual error is greater than the value there given, the measure under test is incorrect.

Example.—Find the capacity and the error of a conical half-bushel measure 14¾ inches in diameter at the top, 13¾ inches in diameter at the bottom, and 6$\frac{11}{16}$ inches in vertical height, all inside measurements.

Average of top and bottom diameters

$$= \frac{14.75 \text{ inches} + 13.75 \text{ inches}}{2} = \frac{28.50}{2} = 14.25 \text{ inches.}$$

Square of average diameter = 14.25 inches × 14.25 inches = 203.06 square inches.

Average area = 203.06 square inches × 0.7854 = 159.48 square inches.

Volume (or capacity) = 159.48 square inches × 6.69 inches = 1067 cubic inches.

Error = 1075.21 cubic inches — 1067 cubic inches = 8.21 cubic inches (in deficiency).

Since the tolerance in deficiency on the half-bushel measure, as given in the table, is 15 cubic inches, the above measure is within tolerance.

3. Test by Gage.—For the rapid testing of *cylindrical* dry measures, several gages are on the market, these being rules with special graduations. They make use of the dimensions as in the dimensional measurement test, but the computations are eliminated in various ways by the special graduations mentioned, and when the gage is correct in principle and the graduations are accurately placed, it may safely be used to determine whether or not the measure is an accurate one. In a number of forms of these gages the size of the error can not be determined by the use of the gage itself. In these cases, therefore, when

the dimensions of a measure under test do not exactly, or, at any rate, very nearly correspond with the graduations on the gage, the actual error must be determined by one of the methods described heretofore before it can be ascertained whether the measure under test is within the proper tolerance. Since the types and principles of gages vary considerably and full directions for their use are always furnished with them, it appears unnecessary to describe their construction and manner of use.

Sealing and Condemning.—If the measure under test complies with all of the specifications above that are applicable to it, and in addition is not in error by more than the tolerance prescribed, it is correct and should be sealed by marking it with the appropriate devices by means of steel dies, a branding iron, or stencils. If the devices are put upon the side at the top or on the top, and also on the side near the bottom at the point of lapping, and on the inside bottom, it will be possible to detect fraudulent alteration made thereafter, since a change can not easily be made without mutilating one of the seals.

If the measure does not comply with all the specifications, or is found to have an error greater than the proper tolerance, it should be condemned and seized or condemned for repairs, as the nature of the fault determines.

BERRY BASKETS OR BOXES

Specifications.—1. Baskets or boxes for berries or small fruits, of a capacity of 1 dry quart or less, shall be of one of the following sizes: One quart, 1 pint, or one-half pint, dry measure.

Tolerances.—The tolerances to be allowed in excess or deficiency, on baskets or boxes for berries or small fruits,

constructed of wood, shall not be greater than the following values:

Capacity of basket	Tolerance	
	In excess	In deficiency
	Cu. in.	Cu. in.
1 quart	3	1.5
1 pint	2	1.0
½ pint	1	.5

The tolerances to be allowed in excess or deficiency, on baskets or boxes for berries or small fruits, constructed of pasteboard or fiber, shall not be greater than the following values:

Capacity of basket	Tolerance	
	In excess	In deficiency
	Cu. in.	Cu. in.
1 quart	2.0	1.0
1 pint	1.0	.5
½ pint	.5	.25

Inspecting.—Note whether the baskets actually contain their full apparent capacity; that is, see that there is no false bottom or other obstruction designed to prevent the contents from completely filling the box. This inspection is especially necessary when the baskets are filled with the berries or small fruit.

Testing.—One of the following methods should be employed:

1. BULK-FOR-BULK TEST.—This test should be performed in the same way as has been described under the heading "Dry capacity measures: Testing." When small seed is used it is necessary to stop up the cracks in the corners of the basket or box to prevent leakage through them. This may be done by pasting paper on the outside of the box over these openings. Another method is to make a set of brass pieces which will serve as covers for these cracks, and to fasten these on the outside of the box by means of a rubber band. Care should be exercised to use a band light enough so as not to distort the box in any way. As noted in the case of dry measures, heretofore, this method should always be the one employed when legal proceedings are to be instituted upon the results of the test.

2. DIMENSIONAL MEASUREMENT TEST.—For the rapid checking of a number of berry boxes, when these are regular in shape, the dimensions may be measured and the capacity of the box determined by calculation. This is done as follows:

(*a*) In the case of a berry box of the shape of an inverted truncated pyramid with a rectangular base, or in the case of a box with a rectangular base and a top of equal area—i.e., all those having a rectangular base of the same area as the top or of a smaller area—and vertical or sloping straight sides, the formula for computing the volume or capacity is as follows:

$$V = h\frac{lb + l_1 b_1}{2}$$

where l = length of top, b = breadth of top, l_1 = length of bottom, b_1 = breadth of bottom, and h = vertical height, all inside measurements.

With a steel tape or other standard length measure, determine the length and breadth of the top and find its area by multiplying these two values together; determine the area of the bottom in the same way; average these two results by adding them together and dividing by 2; then measure the vertical inside height of the box and multiply the average by this value. The result is the capacity of the box. The difference between the actual capacity and the standard capacity is the error of the box. (Take all measurements in inches and the result obtained will be in cubic inches.)

Example.—Find the capacity of a box 5½ inches long and 3¾ inches wide at the top, $5\frac{1}{16}$ inches long and 3¼ inches wide at the bottom, and 3⅝ inches in vertical height. Then, following directions,

Area of top = 5.5 inches × 3.75 inches = 20.62 square inches.

Area of bottom = 5.06 inches × 3.25 inches = 16.44 square inches.

$$\text{Average area} = \frac{20.62 \text{ square inches} + 16.44 \text{ square inches}}{2}$$

$$= \frac{37.07 \text{ square inches}}{2} = 18.53 \text{ square inches.}$$

Capacity = 18.53 square inches × 3.62 inches = 67.1 cubic inches.

Error = 67.2 cubic inches − 67.1 cubic inches = 0.1 cubic inch.

(*b*) In the case of a box of the shape of a truncated cone or of a cylinder, proceed in the same way as is

described for the dimensional measurement test of dry measures of the proper shape, given heretofore.

The error having been arrived at in either of the ways described, compare with the proper tolerance in the table preceding. If the actual error is not greater than the allowable error, the box is correct; otherwise the box is incorrect.

Sealing and Condemning.—Berry boxes need not be sealed. If any berry box or lot of berry boxes is found which is incorrect—i.e., having an error in excess of the tolerance—it should be condemned and confiscated. On account of their nature berry boxes should never be condemned for repairs.

SCALES

General Specifications.—1. The nominal or rated capacity of a scale is the largest weight indication which can be obtained by the use of all its reading or recording elements in combination.

When one reading or recording element of the scale is designed for auxiliary use only, such as a small bar and poise intended for use in determining weights intermediate between two graduations on the principal bar of the beam, the weight value of this reading or recording element need not be included in the sum, provided that it does not exceed 2 per cent of the sum of the weight values of the remaining reading or recording elements. (Thus, a platform scale with the principal bar of the beam graduated to 100 000 pounds by 1000-pound subdivisions and with an auxiliary bar graduated to 1000 pounds by 20-pound subdivisions may be considered as having a nominal capacity of 100 000 pounds.)

When a scale is designed for use with removable weights and these are furnished with the scale, the amount which these represent when used on the scale shall be included in the sum of the weight values of the reading elements. When the scale is designed for use with removable weights but these are not furnished with the scale, the amount which those represent on the scale that are usually furnished with the scale when weights are included, shall be included in the sum of the weight values of the reading elements.

2. All scales not equipped with a beam or reading face graduated to the full capacity of the scale, or those not equipped with a graduated beam or reading face, which, taken in connection with another graduated beam or beams or with a graduated runner, indicates the capacity of the scale, shall have the nominal or rated capacity conspicuously, clearly, and permanently marked upon them.

2a. No scale shall be used in weighing loads greater than its nominal or rated capacity.

3. All scales shall be of such construction that they will support a load of maximum capacity without undue bending or straining of the parts.

3a. The construction of all scales shall be such that when the beam is displaced to the full extent allowed by the construction of the scale, it will return to its normal position.

4. All knife-edges shall be firmly secured to the levers.

5. All knife-edges shall be of hardened and tempered steel. They shall be sharp and bear throughout the entire length of the parts designed to be in contact.

6. All bearings shall be smooth and at least as hard as the knife-edges. For scales of more than 5000 pounds

capacity, the bearings shall be made of hardened and tempered steel. (The term "bearing" used in this paragraph refers to the entire surface which is designed to be in contact with the edge of a knife-edge or with a point bearing.)

7. When plates or caps are used to limit the longitudinal motion of a knife-edge, the parts of such plates or caps which are liable to come into contact with the knife-edge shall be smooth and at least as hard as the knife-edge. The parts of the knife-edge liable to come into contact with these plates or caps shall be so formed that the friction between them is reduced to a minimum.

8. If a scale has a nose-iron, the position of this at the time of installation of the scale shall be clearly and accurately indicated.

9. If the scale has interchangeable or reversible parts, these shall be so constructed that their interchange or reversal will not affect the balance or the accuracy of the instrument.

10. No scale shall be equipped with a scoop counterbalanced by a removable poise or weight.

11. When the scale is equipped with a permanently attached device intended to counterbalance the weight of a removable scoop, this device shall clearly indicate on the customers' side of the scale whether the scoop should be on or off the scale.

12. The graduations on all beams shall consist of lines, or notches, or of a combination of these. All lines shall be uniform in spacing and parallel to each other. All notches shall be evenly cut, and the lines formed by the intersection of the sloping planes of their sides must be uniform in spacing and parallel to each other. When a combination of lines and notches is employed, the lines

must be properly placed with reference to the notches so as to indicate the value of each notch clearly and correctly.

12a. The graduations on all beams and reading faces shall be clear and distinct *and in no case shall their width be less than 0.008 inch.*

12b. The clear interval between the graduations on all beams shall not be less than 0.04 inch.

13. Each main weight graduation on a beam shall be so marked as to indicate the weight represented by the poise at that point.

14. Shoulders or stops shall be provided on all beams to prevent the poise traveling and remaining back of the zero graduation.

15. The adjusting material in all poises shall be securely inclosed and firmly fixed in position. If of lead or other material softer than brass, it shall not be in contact with the beam.

16. Poises shall be so constructed that no part can be easily detached, and if equipped with a set screw this shall not be removable.

17. Poises on notched beams shall be provided with a pawl or other device, so constructed as to cause the poises to be seated into a definite and correct position in each notch, wherever in the notch the pawl or other device is placed, and to be held there firmly and without appreciable movement.

18. The bearing edge of a hanging poise shall be hard and sharp, and shall be so formed as to allow the poise to swing freely in the notches of the beam.

19. Reading edges or indicators of poises shall be sharply defined, and all reading edges shall be parallel to the graduations on the beam.

20. Poises shall not be readily detachable from the beam: Provided, however, That this specification shall not apply to poises on steelyards unless there is a zero graduation on the beam.

21. When scales are equipped with a beam, the position or oscillation of which is used to indicate the balance of the scale, the normal position of this beam shall be horizontal, and it shall have equal play above and below the normal horizontal position.

22. No scale shall be so constructed that the beam is unstable or accelerating.

23. Scale pans in which fish or other wet commodities are placed when weighed shall be so constructed as to provide for drainage.

23a. All scales shall give correct weight indications whether the load is being increased or decreased.

23b. All devices intended to increase or decrease the capacity of a scale by the addition or subtraction of a weight or weights shall operate properly irrespective of the speed with which they are manipulated.

24. All scales shall be of such construction that they are reasonably permanent in their adjustment and will repeat their weight indications correctly, and are not designed to, or may not be used to facilitate the perpetration of fraud.

25. All scales shall be in balance.

A scale is in balance, as the term is used herein, when it correctly gives a weight indication of zero, when there is no load on the platform, plate, pan, or scoop.

A lever scale of the nonautomatic type not having an indicator and a graduated scale or arc, is in balance when

the beam comes to rest at, or oscillates through approximately equal arcs above and below, the center of the trig-loop when one is provided; or a position midway between other stops when these are provided; or a horizontal position when no trig-loop or other stops are provided.

A scale of the nonautomatic type having an indicator and a graduated scale or arc, is in balance when the indicator comes to rest at, or oscillates through progressively smaller arcs about, a definite and clear zero graduation.

A scale of the automatic type—that is, one having a reading face or dial—is in balance when the indicator comes to rest at a definite and clear zero graduation.

Sensibility Reciprocal.—The term "sensibility reciprocal" hereinafter referred to is defined as the weight required to move the position of equilibrium of the beam, pan, pointer, or other indicating device of a scale a definite amount, at the capacity or at any lesser load, the effect of friction in causing inconstancy of this position of equilibrium being eliminated.

In scales provided with a beam and trig-loop, the sensibility reciprocal is the weight required to be placed upon the platform to turn the beam from a horizontal position of equilibrium in the middle of the trip-loop to a position of equilibrium at the top of the loop, the effect of friction being eliminated as above. The sensibility reciprocal may be determined by subtracting the weight instead of adding it, thereby causing the beam to assume a position of equilibrium at the bottom of the loop; or indirectly, by moving the sliding poise on the beam the required amount in either direction, to obtain the specified change in the position of equilibrium of the beam; or by adding or subtracting small weights to or from the counterpoise until the

specified change is obtained, and determining the equivalent of the small weights used, in terms of weight on the platform.

In the case of equal-arm scales and scales with a single pan or plate above, or hanging from, the beam, which are not provided with a pointer moving over a graduated arc or scale, the sensibility reciprocal is the amount of weight required on the pan or plate to cause it to move from its position of equilibrium, when the scale is in balance, to a position of equilibrium at the limit of its motion.

In the case of scales provided with a single indicator and a graduated scale or arc, one of which oscillates with reference to the other to form a convenient means of determining the position of equilibrium of the beam, and which does not of itself directly indicate in terms of weight, the sensibility reciprocal is the weight required to cause a change in the position of rest of the pointer equal to one division of the graduated scale or arc.

In the case of scales equipped with two indicators which move in opposite directions and oscillate with reference to each other to form a convenient means for determining the position of equilibrium of the beam, the sensibility reciprocal is the weight required to cause a separation of the indicators of 0.04 inch.

NOTE.—The two preceding paragraphs are limited to apply only to cream-test or butter-fat-test scales and apothecaries' prescription scales, but they are included here for the sake of completeness of the definition.

The sensibility reciprocal does not apply to reading faces or dials which indicate directly in terms of weight, but no such reading face or dial which is purely auxiliary to the scale mechanism—such as one, for instance, which

may or may not be employed in the determination of weight—shall be construed to exempt a scale from the sensibility reciprocal requirement, when this face or dial is detached.

NOTE.—The effect of friction on a scale is to make possible a variation of the load on the pan, plate, or platform without any corresponding change in the indication. The value of the sensibility reciprocal which is determined with the effect of friction present will, therefore, be in error by a variable amount. However, in making tests this error must be neglected.

PLATFORM SCALES

Definitions.—A platform scale is a scale having a load-receiving platform carried on multiplying levers which transmit the load to the beam or other reading element, such platform having four or more lines of support comprised in bearings which rest directly upon knife-edges in the multiplying levers.

A counter platform scale is a scale of the above type which is especially adapted on account of its compactness, light weight, moderate capacity, and arrangement of parts, for use upon a counter or table. Within the meaning of this definition, a platform scale is a counter platform scale when it conforms to both of the following:

(1) Its weighing capacity is not more than 400 pounds.

(2) Its beam or other reading element is located at an elevation sufficiently low in relation to the weighing platform to be accessible and easily read when the scale is used upon an elevated table or counter.

Specifications.—1. The foundations of all built-in scales shall be firm and substantial.

2. Platform scales having an outside frame around the platform shall be equipped with means for centering and

checking the platform. These shall cause the platform bearings to return to their normal line of contact on the knife-edges when the platform is displaced to the full extent allowed and also shall prevent the platform bearings from such a displacement that the centering will not take place. The above results may be obtained by any proper means that will not introduce excessive friction and will not cause binding when the parts have been so caused to return to their normal weighing positions.

3. Platform scales shall be so constructed that there is sufficient clearance between the platform and the frame to allow for any expansion due to weather effects. Sufficient clearance shall also be provided to prevent the live parts of the scale from binding on account of an ordinary accumulation of dirt or other ordinary causes.

4. A wagon scale should have at least 12 feet of straight driveway on either end of the scale in the same plane as the platform.

5. Platforms and levers shall be of sufficiently rigid construction that the degree of deflection under the maximum load will not endanger the accuracy of the scale.

6. If a scale is equipped with a relieving device, this shall be so constructed that when the beam is balanced and the device is used to relieve it and engage it again, one or more times, the former balance will again be assumed by the beam.

7. When corner platform loops are removable, each shall be so marked or shaped as to identify it with its proper corner.

7a. The maximum value of the minimum graduations of the graduated beams of counter platform scales used

in the sale of foodstuffs at retail shall be 1 ounce: Provided, however, That this shall not apply to scales used exclusively in the sale of vegetables.

8. All devices for adjusting the balance of a counter platform scale shall be of such construction that they are operative or accessible only by the use of some tool or device which is outside of and entirely separate from the movable mechanism of the scale itself, such as a screw-driver, wrench, etc., but not an adjusting pin.

9. All devices for adjusting the level of a counter platform scale shall be of such construction that they are operative or accessible only by the use of some tool or device which is outside of and entirely separate from the leveling devices, such as a screw-driver, wrench, etc., but not an adjusting pin.

9a. Counter platform scales whose weight indications are changed by an amount greater than one-half the tolerance allowed, when set in any position on a surface making an angle of 5 per cent or approximately 3 degrees with the horizontal, shall be equipped with a device which will indicate when the scale is level, and in no case shall any pendulum operating the scale be considered a leveling device. The scale shall be rebalanced at zero each time its position is altered during this test.

10. All platform scales, except track scales, shall be so constructed that when a load consisting of test weights representing one-half or more than one-half of the capacity of the scale, and not exceeding such capacity, is placed so that its center of gravity lies over the points designated by circles in diagram No. 1, the error at each point shall not exceed the tolerance allowed for the load employed. If a load equal to one-quarter of the capacity is used,

this shall be placed so that its center of gravity lies directly over the platform bearings designated by the circles in diagram No. 2, and the errors shall not exceed those indicated above.

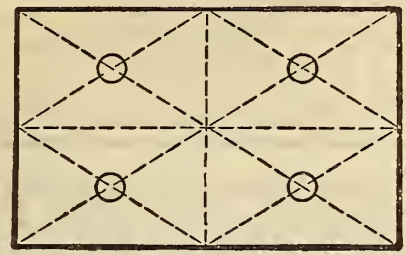

Diagram No. 1.

Diagram No. 2.

11. Any device for altering the sensibility of the scale shall be so limited in its adjustment that the beam can not be made unstable by the manipulation of the device.

12. The minimum travel of the beam in the trig-loop shall conform to the following table:

Length of beam[a]	*Minimum travel of beam in trig-loop*
	Inch
Under 12 inches	*0.4*
Over 12 inches, including 20 inches	*.5*
Over 20 inches, including 40 inches	*.7*
Over 40 inches	*.9*

[a] The "length of beam" refers to the distance from the fulcrum to the trig-loop.

13. All weighing beams shall be so marked and graduated and all poises on these beams shall be so constructed that the weight corresponding to any position of the poise can be read directly on the beam. This condition shall be fulfilled whether a registering or stamping device is used or not.

14. When not modified by the above, the specifications given under the heading "Scales: General specifications" shall apply to platform scales in so far as they are applicable.

Sensibility Reciprocal.—The maximum sensibility reciprocal allowable on all platform scales, except counter platform scales, shall not exceed the value of two of the minimum graduations on the beam at the capacity of the scale or at any lesser load: Provided, however, That the manufacturers' maximum sensibility reciprocal or the maximum sensibility reciprocal on all new platform scales, except counter platform scales, shall not exceed the value of one of the minimum graduations on the beam at the capacity or at any lesser load. The maximum sensibility reciprocals for counter platform scales are

given hereafter under the heading "Counter balances and scales."

(The term "sensibility reciprocal" means the weight required to move the position of equilibrium of the beam, pan, pointer, or other indicating device of a scale a definite amount. In scales provided with a beam and trig-loop the sensibility reciprocal is the weight required to be placed upon the platform to turn the beam from a horizontal position of equilibrium in the middle of the trig-loop to a position of equilibrium at the top of the loop. The sensibility reciprocal may be determined by subtracting the weight instead of adding it, thereby causing the beam to assume a position of equilibrium at the bottom of the loop; or indirectly, by moving the sliding poise on the beam the required amount in either direction, to obtain the specified change in the position of equilibrium of the beam; or by adding or subtracting small weights to or from the counterpoise until the specified change is obtained, and determining the equivalent of the small weights used, in terms of weight on the platform.)

Tolerances.—The tolerances to be allowed in excess or deficiency on all platform scales, except counter platform scales, shall not be greater than the values shown in the following table: Provided, however, That the manufacturers' tolerances or the tolerances on all new platform scales, except counter platform scales, shall not be greater than one-half of the values given: And provided further, That these tolerances on all these platform scales shall in no case be less than the value of one of the minimum graduations on the beam, except that the manufacturers' tolerances or the tolerances on new apparatus shall in no case be less than the value of one-half of one

of the minimum graduations on the beam. The tolerances for counter platform scales are given hereafter under the heading "Counter balances and scales."

Load	Tolerance, Class A		Tolerance, Class B	
	On ratio	On beam	On ratio	On beam
Pounds	Ounces	Ounces	Ounces	Pounds
50	½	1	.....	.....
100	1	2	.....	.....
200	2	4	.....	.....
240	3	6	.....	.....
300	3	6	.....	.....
400	4	8	.....	.....
500	5	10	10	1¼
600	6	12	12	1½
		Pounds	Pounds	
800	8	1	1	2
1000	8	1	1	2
1200	10	1¼	1¼	2½
1500	12	1½	1½	3
1800	14	1¾	1¾	3½
	Pounds			
2000	1	2	2	4
2500	1¼	2½	2½	5
4000	2	4	4	8
6000	3	6	6	12
8000	4	8	8	16
10 000	5	10	10	20
12 000	6	12	12	24
16 000	8	16	16	32
20 000	10	20	20	40

Load	Tolerance, Class A		Tolerance, Class B	
	On ratio	On beam	On ratio	On beam
Pounds	Ounces	Ounces	Ounces	Pounds
24 000	12	24	24	48
30 000	15	30	30	60
40 000	20	40	40	80
80 000	40	80	80	160
100 000	50	100	100	200
160 000	80	160	160	320
200 000	100	200	200	400
300 000	150	300	300	600
400 000	200	400	400	800

Explanation of Preceding Table.—"Class A" scales include the following: Scales of the portable platform type; and also scales of the dormant type which are installed inside of a building having side walls and roof, which protect the scale from weather effects and from sudden changes of temperature.

"Class B" scales include the following: Scales of the railroad track and wagon types; and also scales of the dormant type which are not installed inside of a building having side walls and roof, and which are exposed to weather effects and sudden changes of temperature.

NOTE.—The latter effect, since it causes the condensation of moisture on the scale parts, often has as serious results on the condition of the scale as have weather effects.

The columns with the heading "Tolerance on ratio" refer to the error in the ratio or multiplying power of scales with which counterpoise weights are used.

The columns with the heading "Tolerance on beam" refer to those parts of scales not requiring the use of removable weights; for example, a beam.

The column with the heading "Load" refers to the amount of weight on the platform of the scale.

Application of Tolerances to Railroad Track Scales.—In the case of railroad track scales, designed and used for weighing ordinary freight traffic, when the test load consists of a one-truck test car, the largest algebraic mean of any two errors found for different positions of the test truck shall not exceed the tolerance corresponding to the test load used: Provided, however, That no two errors shall be selected, corresponding to positions of the test truck closer together than the distance between extreme positions which the truck can assume on opposite ends of the shortest span. The tolerance given in the table is not to be applied to the error found for a single position of the test load. (The largest algebraic mean of any two errors may be defined as one-half of the largest plus (+) or minus (−) sum that can be obtained by adding any two errors, such as two plus errors, two minus errors, a numerically large plus error and a numerically small minus error, or a numerically large minus error and a numerically small plus error.)

In order that the largest algebraic mean of any two errors, which represents the maximum error of freight car weighing, may not differ appreciably from the true amount, a test car having a wheel base not exceeding 7 feet should be used.

Inspecting.—Examine the scale carefully, noting whether all the specifications are complied with for the class to which the scale under test belongs.

With no weight on the platform, the poise or poises at zero, and all counterpoise weights removed, see that the beam is in balance, as defined in specification No. 25, under the heading "Scales: General specifications." If this condition is not fulfilled, the official may balance the scale by moving the balance ball or by adding lead or shot to, or subtracting it from, the counterpoise cup. But before this is done the amount of the out of balance condition should be determined and recorded as an indication of the constant error which may have resulted from the use of the scale in that condition.

Knife edges should be sharp and free from accumulations of dirt or rust, while the bearings should be similarly clean and free from grooves. As noted in the specifications, the knife edges and bearings should make contact over the whole length of the surfaces designed to be in contact, since otherwise rapid wear will probably result. Since knife edges are subject to accidental motions in the direction of their length along their bearings, the inspector should make certain that binding does not result from such a motion. If the motion of the scale shows binding when the lever is pressed with moderate force against the cheeks of the bearings, the construction at these points is faulty or the parts are worn. The parts of the scale should not deflect excessively under the application of the maximum load, and the vertical rods and connections by which the various levers are interconnected should be accurately plumb.

Examine the poise on the beam and the counterpoise weights. If these are incrusted with dirt or rust, they should be cleaned before a final test is made, but the indications of the scale should first be taken and recorded in

order that information as to the accuracy or inaccuracy of the scale as found may be available. The counterpoise weights should be examined for evidences of alteration by plugging or removal of material or of misuse by careless handling if they are found to be incorrect.

Examine the notches of the beam, which should be clean so that errors may not result from inaccurate positioning of the poise, bearing in mind that very small differences in the seating of the poise may cause considerable errors in the weight indications.

The scale should be reasonably protected from wind and vibration since accurate weighing is impossible under either condition.

If the scale does not comply with all of the specifications that are applicable to it, it is incorrect.

Testing.—Note 1.—For the most accurate and efficient test of a large platform scale a special set of weights will be found necessary. This set should consist of weights from 10 pounds to 0.0001 (1/10,000) of a pound. The weights from 10 pounds to 0.5 pound, inclusive, should be flat cylindrical slotted weights, and the subdivisions of the pound should be in the decimal system.

While it is realized that by this method somewhat better results may be obtained, especially on wagon scales and railroad track scales, it is recognized that the majority of officials have not been provided with such weights at the present time and that some time must elapse before any considerable number will have procured such equipment. The test given hereafter is therefore described as being conducted with the usual knob weights furnished and one additional weight, namely, a slotted 1-pound weight, which should be used in place of the hanger weight formerly furnished. Any official who does considerable work on platform scales is urged to obtain a copy of the publication, which will soon be issued by the Bureau of Standards, entitled "Inspection, Test, and Adjustment of Wagon Scales," procure the apparatus recommended therein, and adapt himself to the method of test suggested there.

NOTE 2.—The testing of a scale with a full capacity beam or beams and one equipped with a counterpoise and counterpoise weights is performed in the same way except that the inapplicable parts of the tests hereafter described are omitted in the case of the first mentioned class of scales.

(*a*) Displace the beam from its position of equilibrium several times and see that it vibrates up and down smoothly and returns to its original position of rest. The action of the beam should not be jerky nor very rapid; it should not die down too quickly nor should it bind at any point.

(*b*) Place a weight on the platform of the scale and slide the poise out on the beam until the beam balances correctly. Note whether the weight indicated on the beam is the same as the known weight on the platform. Continue the process of adding weights to the platform, balancing the beam by means of the sliding poise, and noting whether the weight on the platform is indicated correctly by the beam, until the capacity weight indication of the beam is reached. However, if a scale is equipped with a full capacity beam or with a beam having a larger capacity than the load which is to be employed in the shift test (see subdivision *c*), this test should be performed at the time that this load is placed upon the platform. The test of the beam should then be continued as before. This method of procedure will economize effort in the handling of the test weights.

To indicate a weight correctly the poise should be exactly on the weight indication corresponding to the known amount of weight on the platform when equilibrium is obtained. If the poise does not correctly register the weights on the platform, the error at each point should

be determined. This is sometimes accomplished by reading the error directly from the beam by noting the difference between the weight indication and the correct weight, or if the beam is notched or is not graduated finely enough to make it possible to read the error with sufficient accuracy, it can be determined as follows: Carefully set the poise in the proper position in the notch or exactly on the graduation determined by the amount of known weights on the platform and then add or subtract weights from the scale platform until a balance is obtained. (See subdivision *b* for description of the easiest method of subtracting the weight.) The error is then determined by the amount of weight in excess or deficiency on the platform as compared with the beam reading. This error should be compared with the value, for the proper load on the platform, given in the preceding table in the column headed "Tolerance on beam" for the class to which the scale under test belongs, unless this value is less than the value of one-half of one of the minimum graduations on the beam for "new" scales, or one of the minimum graduations on the beam for scales other than new scales; in these cases the value of one-half of one of these graduations or of one of these graduations, respectively, shall be used as the tolerance. If the tolerance, however determined, is exceeded by the error actually found, the beam and poise are incorrect. (For scales equipped with counterpoise weights it is usually sufficient to test three or four points on the beam, including the capacity graduation, if the graduations or notches appear to be equally spaced and if the notches are not badly worn at any point or points. On scales equipped

with full-capacity beams, more graduations should be tested.)

(*c*) The "shift test" should now be performed, one of the following methods being employed:

(1) Place a load of test weights equal to one-half of the capacity of the scale or more than one-half of the capacity of the scale, but not exceeding such capacity, upon the platform, and balance the scale, using the poise on the beam if this load can be indicated by the beam, or using standard weights upon the counterpoise, and note if the weight on the platform is correctly indicated; if it is not, determine the error thereon. Now shift the load in such a manner that its center of gravity is directly over the center of one of the parallelograms formed by dividing the platform into four equal parts by lines drawn through the center of the platform and perpendicular to the sides and the ends of the platform. (See diagram No. 1 under specification No. 10, preceding.) The center of gravity of the load can be placed over the center of the parallelogram by distributing the test weights evenly over the whole parallelogram, making several layers of weights if necessary. Determine the error of the scale with the weights in this position. Now shift the weights to the center of the three remaining parallelograms in turn, and determine the error as before. No error found should exceed the value for the appropriate load on the platform given in the column headed "Tolerance on beam," if the beam has been employed, or in the column headed "Tolerance on ratio," if standard weights on the counterpoise have been used, in the preceding table for the class to which the scale under test belongs. If the value given in

the proper column of the table is exceeded when the weights are in any one of the five positions described above, the scale is incorrect.

(2) This method is the same as that described above, except that in this case the amount of test weights should be equal to one-quarter of the capacity of the scale; and the center of gravity of the load of test weights should be placed directly over each of the platform bearings in turn. This last can be accomplished by locating the position of the platform bearings and marking these positions on the platform. Then place a single layer of weights evenly around this point, using the largest number of weights possible; and then stack up the weights evenly over this base until the desired load in test weights is obtained. (Always use a load equal to one-quarter of the capacity of the scale if the test is performed in this manner.)

For a test designed to determine whether the scale is within the tolerance to be allowed, the first test given above is probably the better one, since a greater load is employed. The second test should be chosen when test weights at least equal to one-half of the capacity of the scale are not available; or when the scale is to be adjusted in accordance with the results of the test, in which case the latter test is advisable, since it is desirable, in so far as this is possible, to segregate each error to its proper corner and lever. However, on many scales the platform bearings are so close to the corners of the platform that it is impossible to place the center of gravity of the test load over them without stacking the weights one upon another to a prohibitive height. In such a case the first method of test mentioned above should be followed, whether or not adjustments are to be made.

(*d*) If the scale is equipped with a counterpoise and counterpoise weights, it is now necessary to test the accuracy of the multiplication ratio or the multiplying power of the scale. This multiplication ratio may be defined as the relation between the weight which each counterpoise weight represents on the scale when hung on the counterpoise, and its actual weight. The supposed ratio of most platform scales can be directly obtained from the counterpoise weights themselves, since these two values are usually marked upon them. The multiplication ratio of platform scales other than railroad track scales will usually be found to be one of the following: 1000 : 1, 2000 : 3 (666⅔ : 1), 500 : 1, 1000: 3 (333⅓ : 1), 200 : 1, 100 : 1, 66⅔ : 1, 53⅓ : 1, 50 : 1, 40 : 1, 20 : 1, 16 : 1.

(A ratio in which the smaller term is not the figure 1, can always be reduced to this form by dividing both terms by the number representing the smaller term. Thus in the above, to reduce the ratio of 2000 : 3 to this form, divide both terms by the number 3, and we obtain the result 666⅔ : 1, which is the same ratio as 2000 : 3 but expressed in another form.)

NOTE.—In the test of the multiplication ratio, all the standard weights available to make up a load divisible by 50 or 100 pounds and not exceeding the capacity of the scale should be placed upon the platform with a proper number of weights on the counterpoise, since if it is tested with an inadequate load serious errors may pass unnoticed. An example will clearly demonstrate this. Suppose we have an indoor dormant scale with a ratio of 100 : 1 capable of weighing 1000 pounds by means of loose counterpoise weights and 200 pounds by one-half pound on the beam. The tolerance on the multiplication ratio with the full load of 1000 pounds upon the platform is 8 ounces. The allowable sensibility reciprocal of this scale is 1 pound.

Now suppose a load of 100 pounds is used upon the platform. If the multiplication is constant at all loads, as it should be, the error with this load must not be greater than 1 ounce to make certain that the above tolerance requirement is fulfilled at all loads. Yet the scale should be passed if 1 pound will move the beam from a horizontal position in the center of the trig-loop to a position of equilibrium at the top of the loop, at all loads, including this one. It is extremely doubtful if a variation in balance of more than one-fourth of the sensibility reciprocal could be determined, since this is a change of only one-eighth of the distance between the top and bottom of the trig-loop. Thus if the error were less than 4 ounces it would probably not be detected. Suppose the actual error were 3 ounces. This might well pass unnoticed and the multiplication ratio would be certified as correct upon this test.

Yet with 1000 pounds on the platform the error would be multiplied by 10 and would thus be 30 ounces, or about four times the tolerance of 8 ounces allowable.

Under the above conditions the least load upon the platform that would make the error clearly perceptible would be 400 pounds.

For this reason the practice which has been customary in the past of using only 100 pounds on the platform counterpoised by a 1-pound hanger weight, should be discontinued and the test conducted, as suggested above, with all available weights.

On this account it is suggested that the use of the 1-pound hanger weight be discontinued and a flat slotted 1-pound weight be substituted. This weight can be used as a base upon which enough weights of the usual form furnished can be placed to obtain the necessary load upon the counterpoise. If only one weight is added, to avoid possible errors, this should be placed either to the right or left side of the counterpoise stem rather than to the back or front, since if the counterpoise is thrown out of the vertical it is not advisable that such displacement should be parallel to the edge of the knife-edge since the portion of the total weight sustained by each end of the knife-edge should remain constant.

The method of testing the accuracy of the multiplication ratio of a scale is as follows:

Place all standard weights available to make up a load divisible by 50 or 100 pounds, and not exceeding

the capacity of the scale, on the platform of the scale. Then place the standard slotted 1-pound weight on the counterpoise and set other standard weights on this until the proper nominal load necessary to balance the weight on the platform has been added; for instance, for 500 pounds on the platform a scale having a 100 : 1 ratio will require 5 pounds on the counterpoise; for 200 pounds on the platform a scale having a ratio of 50 : 1 will require 4 pounds on the counterpoise, etc. The beam should then balance correctly. If it does not the error can be determined by adding weights to or subtracting them from the platform. For example, if the scale has a 100 : 1 ratio, and 500 pounds fails to lift the beam and bring it to a proper balance when there are 5 pounds of standard weights on the counterpoise, add weights to the load on the platform until a proper balance is obtained. Suppose the addition of 5 pounds is required; then the actual multiplication ratio is 505 : 5 or 101 : 1, instead of 100 : 1, and the multiplying power is incorrect by 5 pounds on 500 pounds, or 1 pound on 100 pounds. Or suppose that with the original 500-pound load the beam rises too high; then weights must be subtracted from the platform to determine the error on the ratio. The easiest way to accomplish this is to set off one or more even graduations on the beam, by means of the poise, until the beam falls and then to add weights to the platform until the beam balances correctly. The amount of weight virtually subtracted from the load on the platform is the amount added by means of the beam minus the amount added to the platform. This result is the error in the multiplying power, and the original amount on the platform minus this quantity is the larger

term of the ratio. To illustrate: With 5 pounds on the counterpoise and 500 pounds on the platform of the scale the beam rises too high. Four pounds set off by the poise on the beam causes the beam to fall too low. Eight ounces added to the weight on the platform produces equilibrium. The 4 pounds added by means of the beam minus the 8 ounces added to the platform equals 3½ pounds, the error in the multiplying power on 500 pounds. The original amount on the platform, 500 pounds, minus 3½ pounds, is equal to 496½ pounds. Thus the actual ratio is 496½ : 5 or 99 3/10 : 1.

When the error in the multiplying power has been determined, this error should be compared with the value for the proper load on the platform given in the preceding table in the column headed "Tolerance on multiplication" for the class to which the scale belongs, unless this value is less than the value of one-half of the minimum graduation on the beam for "new" scales, or of one of the minimum graduations on the beam for scales other than new scales; in this case, the value of one-half of one of these graduations or of one of these graduations, respectively, shall be used as the tolerance. If the tolerance, however determined, is exceeded by the error actually found, the multiplication ratio is incorrect.

(*e*) The counterpoise weights should now be tested, and this must be done with great accuracy, since any error which may exist in these will be increased in the same proportion as the nominal weight is increased by the multiplying power of the scale. Thus if a weight, used on a scale having a ratio of 1000 : 1, is incorrect by one-fourth ounce, the resulting error of use will be 1000/4 ounces, which equals 250 ounces, or 15 pounds 10 ounces.

The test of these weights should be made according to the method of test described hereafter under the heading "Weights," the tolerance being selected from the column headed by the proper multiplication ratio of the scale to which the weight belongs.

(*f*) With the amount of test weights provided it will often be impossible to test a large-capacity scale to its full capacity or even over a sufficient range to make certain of its accuracy. When a scale has been tested with all the weights available, and it is desirable to obtain a test nearer the capacity, place a large unknown load (such as a loaded wagon) on the scale and balance it accurately by placing standard weights on the counterpoise, completing the balancing, if necessary, by the use of the poise on the beam, and note the amount indicated. Then add the available test weights to the platform (taking care that the total load does not exceed the capacity of the scale) and rebalance the beam by adding standard weights to the counterpoise. The added known load on the platform should be correctly indicated by the scale, or if in error this error should not exceed the tolerance allowed *at a load equal to the value of the test weights added to the scale*, this value being determined as in subdivision *d* preceding. If this condition is not fulfilled, the scale is incorrect. This test may be performed with a minimum handling of the test weights by adding the unknown load, while the weights used in subdivision *d* still remain upon the platform, balancing the beam and reading its indication with this total load and then removing the test weights. The beam should again be brought to a balance and the difference in the two readings noted. This difference should be equal to

the value of the test weights subtracted or, if in error, this error should not exceed the tolerance allowed *at a load equal to the known weight subtracted from the scale.*

(*g*) At several of the loads heretofore used, including zero load and the total load attained in subdivision *f*, upon the platform of the scale, balance the beam accurately in the center of the trig-loop and then add to or subtract from the platform an amount of test weights equal to the value of one of the minimum graduations on the beam for a "new" scale, or two of these graduations for a scale other than a new scale. This addition or subtraction of weight should be sufficient to cause the beam to move to and remain at, the top or bottom of the trig-loop, or its limit of motion. If this condition is not fulfilled the scale is not sufficiently sensitive and is therefore incorrect.

(*h*) To test the constancy of the indications of the scale—i. e., to determine whether the indicated weight of a load is always the same—the large unknown load mentioned in subdivision *f* may be alternately placed upon and taken off the platform several times and its indicated weight noted each time. This indicated weight should always be the same. If variations greater than one-half of the tolerance for this load occur, the scale does not repeat its indications with sufficient consistency and is therefore incorrect. Whatever the variation, however, each reading must be within the tolerance allowed at the load in question since the scale is incorrect if the tolerance is ever exceeded upon this test.

Sealing and Condemning.—If the scale complies with all of the specifications and satisfies all the above conditions of the test within the sensibility reciprocals and

tolerances allowed, it is correct and should be sealed by attaching a lead seal to a stationary part or by stamping it with the proper sealing dies.

If all the specifications are not complied with, or if all the above conditions of test are not fulfilled, then the scale is incorrect and should be condemned and seized or condemned for repairs as the nature of the fault determines.

COUNTER BALANCES AND SCALES

Definition.—A counter scale is a scale of any type which is especially adapted on account of its compactness, light weight, moderate capacity, and arrangement of parts, for use upon a counter or table. It is to be noted, however, that those types embraced in the definitions of platform scales, spring scales, and cream-test and butter-fat-test scales are considered under their specific headings.

Specifications.—1. Bearings shall be so shaped that when the beam or levers are displaced in any manner the knife-edges will return to their proper lines of contact. (The term "bearing" as used in this specification is defined as that part of the scale designed to be in contact with the edge of the knife-edge.)

2. All loose material used for adjusting the balance of a scale shall be securely inclosed.

3. All devices for adjusting the balance of a counter scale shall be of such construction that they are operative or accessible only by the use of some tool or device which is outside of and entirely separate from the movable mechanism of the scale itself, such as a screw-driver, wrench, etc., but not an adjusting pin.

4. All devices for adjusting the level of a counter scale shall be of such construction that they are operative or accessible only by the use of some tool or device which is outside of and entirely separate from the leveling devices, such as a screw-driver, wrench, etc., but not an adjusting pin.

5. *Counter scales whose weight indications are changed by an amount greater than one-half the tolerance allowed, when set in any position on a surface making an angle of 5 per cent or approximately 3° with the horizontal, shall be equipped with a device which will indicate when the scale is level, and in no case shall any pendulum operating the scale be considered a leveling device. The scale shall be rebalanced at zero each time its position is altered during this test.*

6. *In the case of equal-arm scales, either with stabilized pans or plates—that is, those above the beam—or with suspended pans or plates, the minimum fall or drop of the pans or plates from their highest point shall be as follows:*

Capacity	*Minimum fall*
	inch
Four pounds and below	*0.35*
From 4 pounds, including 12 pounds	*.5*
From 12 pounds, including 26 pounds	*.75*
Over 26 pounds	*1.0*

7. In the case of counter scales having unequal arms or having a compound lever system, and equipped with a graduated beam which is not provided at or near its end with a trig-loop or graduated scale or arc or other suitable

reference interval or point for establishing the proper position of balance of the beam, the beam shall have a minimum total angular play of 8 per cent or approximately 5°. In case such scales are provided with a trig-loop or graduated scale or arc or other suitable reference interval or point, the minimum total movement of the beam at such point shall be 0.4 inch if the beam is 12 inches or less in length and 0.5 inch if the beam is over 12 inches in length. (The angular motion of the beam in terms of per cent may be obtained by dividing the total fall or drop of the beam at its end by the distance from the fulcrum to the end of the beam and multiplying this quotient by 100.)

8. *Scales of such construction that any weight or weights which are not visible can be added so as to affect the indications of the scale shall be equipped with a device which will plainly indicate on the customers' side of the scale when the weight or weights have been added and the value which it or they represent on the scale.*

9. On scales of the equal-arm type with stabilized pans—that is, pans above the beam—the under connections and a line connecting the outer knife-edges in the beam shall form a parallelogram. These under connections shall be straight and work freely.

10. All scales shall be so constructed that when a weight whose body has approximately equal diameter and height and which represents one-half of the capacity of the scale is shifted in any direction on the weight plate or on the commodity plate, pan, or scoop to a point one-half the distance between the center and edge of the weight plate or the commodity plate, pan, or scoop, the additional resulting error in the weight indication, due to this cause

alone, shall not exceed the tolerance allowed at the load in question given in the column headed "Tolerance on parts requiring employment of removable weights": Provided, however, That in this test the edge of the weight shall not be made to project over the edge of the weight plate or the commodity plate, pan, or scoop.

10a. The maximum value of the minimum graduations of the graduated beams of counter scales used in the sale of foodstuffs at retail shall be 1 ounce: Provided, however, That this shall not apply to scales used exclusively in the sale of vegetables.

11. In the case of counter scales equipped with an indicator and a reading face or dial, such parts shall conform to all the specifications applicable to them, given under the heading "Spring scales," except that the graduations are not required to be equally spaced.

12. All counter scales shall be in level.

13. When not modified by the above, the specifications given under the heading "Scales: General specifications" shall apply to counter scales in so far as they are applicable.

Sensibility Reciprocal.—The maximum sensibility reciprocal allowable for counter scales shall not exceed the values given in the table below, at the capacity or at any lesser load, with the exception that when the maximum sensibility reciprocal herein given is a larger value than that represented by two of the minimum graduations on any beam with which the scale may be equipped, the latter value shall be applied and used as the maximum sensibility reciprocal, at the capacity or at any lesser load: Provided, however, That the manufacturers' maximum sensibility reciprocals or the maximum sensibility reciprocals on all new counter scales shall be one-half of the values given in the table unless this value is greater than

one of the minimum graduations on the beam, in which case this latter value shall be used.

(The term "sensibility reciprocal" means the weight required to move the position of equilibrium of the beam, pan, pointer, or other indicating device of a scale a definite amount. In the case of equal-arm scales and scales with a single pan or plate above, or hanging from, the beam, which are not provided with a pointer moving over a graduated scale or arc, the sensibility reciprocal is the amount of weight required on the pan or plate to cause it to move from its position of equilibrium, when the scale is in balance, to a position of equilibrium at the limit of its motion.)

Capacity	Maximum sensibility reciprocal allowable	Capacity	Maximum sensibility reciprocal allowable
Pounds	Ounces	Pounds	Ounces
1.....	1/8	24.....	1
2.....	1/8	25.....	1
4.....	1/4	30.....	1
5.....	1/4	40.....	1¼
6.....	1/4	50.....	1½
8.....	1/2	60.....	1½
10.....	1/2	75.....	2
12.....	1/2	90.....	2½
15.....	3/4	100.....	3
20.....	3/4		

Tolerances.—Except on the special tests described above, the tolerances to be allowed in excess or deficiency on counter scales shall not be greater than the values

shown in the following table: Provided, however, That the manufacturers' tolerances or the tolerances to be allowed on new counter scales shall not be greater than one-half of the values given: And provided further, That the tolerance on counter scales at any load shall in no case be less than one-half of the sensibility reciprocal of the scale at the load in question; and when the scale has a reading face or dial, the tolerance shall in no case be less than one-fourth of the minimum graduation on the reading face or dial, except that on new scales they shall in no case be less than one-eighth of such minimum graduation.

Load	Tolerance on parts requiring employment of removable weights	Tolerance on beam or reading face	Load	Tolerance on parts requiring employment of removable weights	Tolerance on beam or reading face
Pounds	Ounces	Ounces	Pounds	Ounces	Ounces
1.....	1/16	1/16	40.....	7/16	5/8
2.....	1/16	1/8	50.....	1/2	3/4
4.....	1/8	3/16	60.....	5/8	1
5.....	1/8	3/16	75.....	3/4	1
6.....	1/8	3/16	90.....	7/8	1¼
8.....	1/4	3/8	100.....	1	1½
10.....	1/4	3/8	150.....	1½	2
12.....	1/4	3/8	200.....	2	3
15.....	5/16	1/2	240.....	2½	4
16.....	5/16	1/2	250.....	2½	4
20.....	5/16	1/2	300.....	3	4½
24.....	3/8	1/2	350.....	3½	5
25.....	3/8	1/2	400.....	4	6
30.....	3/8	5/8			

Inspecting.—Examine the scale under test carefully, noting whether it is set on an approximately level support, or is properly leveled if provided with leveling devices, or hangs freely, and whether it balances correctly as defined in specification No. 25 under the heading "Scales: General specifications," preceding. Every scale found out of balance by more than the smallest tolerance allowed is to be listed as incorrect, and the error should be noted upon the record. If the error is not such a one that a criminal prosecution should be entered thereon, then the scale may be balanced by turning the adjusting screw or balance ball, by adding or subtracting weight from the shot cup under the pan or by altering the amount of balancing material wherever placed and the test continued. If the error of balance appears to be the result of fraud or criminal carelessness a prosecution should be begun. Errors in balance are decidedly not to be neglected, since they are a very common source of false weight and, moreover, they are, perhaps, the least excusable of all errors since they are obvious to the user of the scale. Of course, if it is found that the scale can not be properly balanced, or if it appears that a permanent balance can not be obtained, the scale is incorrect. Assure yourself that all other specifications noted above, and all those headed "General specifications" in so far as they are applicable to the scale under test, are complied with. (In the case of counter platform scales the specifications given heretofore under the heading "Platform scales" and also those headed "General specifications" are to be applied.)

If the scale under test does not comply with each of the specifications given above or noted as applying to it, for the class to which it belongs, it is incorrect.

Testing, Equal-Arm Type.—A scale of the equal-arm type is one which has two pans supported at the opposite ends of a lever, designed to be at equal distances from the fulcrum, so that a weight placed upon one pan will balance an equal weight upon the other.

(Whenever possible all equal-arm counter scales should be tested to their full capacity.)

An equal-arm scale with pans above or below the beam should be tested in the following way:

(*a*) With the scale in balance, displace the beam from its horizontal position of equilibrium several times and see that it plays freely and that it returns each time to its original position.

(*b*) Place equal weights, equivalent, whenever possible, to the capacity of the scale, in the center of each pan. The beam should again assume a correct balance. Displace the beam from this position of equilibrium. The beam should play freely as before and return to its original position. If the scale does not balance correctly in these tests, add small weights to the higher pan until the proper balance of the beam is obtained. Note the total value of the small weights added and compare this amount with that given in the column headed "To'erance on parts requiring employment of removable weights," for the proper load in the preceding tolerance table, for the class to which the scale under test belongs. If the amount necessary to be added does not exceed this tolerance the error in the equality of the arms of the scale is permis-

sible. If this amount does exceed the proper value, the arms are unequal and the scale is incorrect.

If equal weights equivalent to the capacity of the scale can not be obtained for this test, use the maximum amount of equal weights obtainable.

(*c*) With each pan of the scale loaded to full capacity and the scale in proper balance, add just enough small weights to one pan to displace the beam and bring it to a position of rest at the limit of its motion; that is, to the stop provided. Compare this amount of added weight with the value given for the proper capacity, for the class to which the scale under test belongs, in the preceding "Sensibility reciprocal" table. If the amount of weight necessary to be added to produce the above effect exceeds this given value, the scale lacks sensitiveness and is incorrect. If the scale is equipped with a graduated beam and poise and the value of one or of two of the minimum notches or graduations of this for "new" scales and scales other than new scales, respectively, is less than the value of the sensibility reciprocal given in the table, then the latter values shall be used, respectively, as the sensibility reciprocals.

(*d*) If the conditions of all of the above tests are complied with, place a weight whose body has approximately equal diameter and height and which represents about one-half of the capacity of the scale, in the center of each pan or plate and accurately balance the beam, if it is not already in exact balance, by adding small weights, or shot or other material, to the proper pan. Now shift this load on the weight plate in several directions so that the center of gravity of the weight is one-half the distance

from the center to the edge of the pan or plate, taking care, however, that the edge of the weight does not project over the edge of the pan or plate; if this latter condition obtains, so place the weight that its edge is flush with the edge of the pan or plate. (If it is necessary to have this load consist of several weights, shift these in such a way that the conditions mentioned above are fulfilled.) If the balance of the scale is altered, add weights to the higher pan until the beam is again in balance. Note the amount of weight necessary to be added to obtain this condition. Now shift the weight on the commodity pan in the same way, and if necessary, add small weights as before until a proper balance is obtained and note their value. Compare these amounts of added weight with the value of the tolerance given for the load on each pan in the column headed "Tolerance on parts requiring employment of removable weights" in the preceding tolerance table, for the class to which the scale under test belongs.

If any error so determined exceeds this given value, the scale is incorrect.

(*e*) If the scale is equipped with a graduated beam and poise this is tested as follows: Place a standard weight, less than the capacity of the beam, on the pan or scoop, slide the poise out until the beam balances, and see that the weight indicated by the graduated beam corresponds with the amount of weight on the pan or scoop. If it does not so correspond the error can usually be read directly on the beam by noting the difference between the weight indicated and the correct weight. If the beam is notched or is not graduated finely enough so that the error

can be read directly, determine it as follows: Carefully set the poise in the proper position determined by the amount of known weights in the pan or scoop, and then add weights to the higher pan until the beam balances. The amount of weight added to the higher pan, is the error of the beam and poise at this point. If the commodity pan or scoop is the higher one, the scale is slow and delivers too much; if the weight pan is the higher one, the scale is fast and delivers too little. (The manner of determining an error on a scale equipped with a reading face is described in the test of spring scales given hereafter.) Continue to add weights to the pan, determining the error at several of the main divisions of the beam, until the capacity of the beam is reached. The tolerance to be allowed at any point on the beam will be found in the column headed "Tolerance on beam or reading face," for the proper weight in the pan, in the preceding tolerance table, for the class to which the scale under test belongs. If at any point the error found on the beam exceeds this tolerance, the poise is not properly adjusted or the beam is not properly graduated and the scale is incorrect.

Testing, Unequal-Arm Type.—Scales of this type are usually constructed in one of four ways: (1) Scales with one stabilized pan above the beam or one pan suspended below the beam, with one or more beams and poises; (2) counter platform scales (i. e., those of the type defined on p. 68); (3) a combination of these two types, having both a scoop or plate above and a platform below one or more beams (this is the type known as a "union" scale); (4) scales with two stabilized pans situated at unequal distances on opposite sides of a fulcrum. Scales

mentioned under (1) may or may not be equipped with a counterpoise and counterpoise weights; scales described in (2) and (3) are more often so equipped.

(Whenever possible all unequal-arm counter scales should be tested to their full capacity.)

TYPE 1.—These scales should be tested in the following manner:

(*a*) Test the balance of the scale in the manner described in the test of equal-arm scales. (See subdivision *a*, p. 96, under the heading "Testing, equal-arm type.")

(*b*) The graduated beam of the scale should be tested in the manner described heretofore under the heading "Testing, equal-arm type" (see subdivision *e*, p. 98), the tolerances to be allowed being the same as are given in that case. Of course since this type of scale has but one pan or platform, the balance must be established by adding or subtracting weights from this, as the need may be.

(*c*) On all scales equipped with a counterpoise and counterpoise weights the accuracy of the multiplying power of the levers should be tested. The multiplication ratio is usually an even one, such as 4 : 1, 8 : 1, 12 : 1, etc. The value of this ratio should be determined and the test made in the same manner as is described under the heading "Platform scales: Testing." (See subdivision *d*, p. 83.) The tolerance to be allowed will be found in the column headed "Tolerance on parts requiring employment of removable weights," for the proper load on the scale, in the preceding tolerance table, for the class to which the scale under test belongs.

(*d*) The counterpoise weights should now be tested. This test should be made in the manner described here-

after under the heading "Weights: Testing" (see p. 138), the tolerance being selected from the column headed by the proper multiplication ratio of the scale to which the weight belongs.

(*e*) Place a weight whose body has approximately equal diameter and height and which represents one-half the capacity of the scale on the commodity plate, and bring the scale to an exact balance by means of the poise on the beam or the counterpoise weights, if the scale is so equipped, or both. Then shift the weight in several directions on the commodity pan so that the center of gravity of the weight is one-half the distance from the center to the edge of the pan, taking care, however, that the edge of the weight does not project over the edge of the pan. If this latter condition obtains, so place the weight that its edge is flush with the edge of the pan. (If it is necessary to have this load consist of several weights, shift these in such a way that the same conditions are fulfilled.) If the balance of the scale is altered and the commodity pan is too high, add weights to this until the scale is in exact balance. If the commodity pan is too low, slide out the poise until the same condition is obtained. Note the amount of loose weights, or the amount of weight added by means of the poise, necessary to obtain this condition, in the several positions of the load. Compare these amounts of added weight with the tolerance given for this load in the column headed "Tolerance on parts requiring employment of removable weights," in the preceding tolerance table, for the class to which the scale under test belongs. If any error so determined exceeds this given value, the scale is incorrect.

(*f*) At several of the loads heretofore used, including the full-capacity load, determine the sensibility reciprocal, using the same method described and the same values noted under the heading "Testing, equal-arm type," subdivision *c*. (See p. 97.) If the required conditions are not fulfilled, then the scale lacks sensitiveness and is therefore incorrect.

TYPE 2.—Test counter platform scales by the method described heretofore under the heading "Platform scales," using, however, the tolerances and sensibility reciprocals that are required for counter scales in general.

When the proper tolerance in the platform scale test is noted as being in the column headed "Tolerance on ratio," the corresponding tolerance for counter scales will be found in the column headed "Tolerance on parts requiring the employment of removable weights." Likewise the columns headed, respectively, "Tolerance on beam" and "Tolerance on beam or reading face" are equivalent.

TYPE 3.—The union scale is a combination of type 1 of the unequal-arm counter scale and the counter platform scale, type 2, and has two multiplication ratios, which are not usually even ones; one is for the platform below the beam, usually $53\frac{1}{3}$: 1 or $66\frac{2}{3}$: 1, and the other is for the scoop or plate above the beam, which is $6\frac{2}{3}$: 1 in both of the above cases. The counterpoise weights are marked, respectively, 5–40, $\frac{3}{4}$ pound; 10–80, $1\frac{1}{2}$ pounds; etc., in the first case; and 5–50, $\frac{3}{4}$ pound; 10–100, $1\frac{1}{2}$ pounds; etc., in the second case.

Both of these ratios should be tested. In the case of the ratio of $6\frac{2}{3}$: 1, a load of standard weights, equal to an even multiple of 5 pounds and as nearly as possible equal

to the capacity that the part under test is intended to weigh, should be placed in the scoop or pan above the beam, and the same multiple of ¾ pound should be used upon the counterpoise.

For the ratios of 53⅓ : 1 and 66⅔ : 1, a load of standard weights, equal to an even multiple of 20 pounds or 25 pounds, respectively, and as nearly as possible equal to the capacity that the part under test is intended to weigh, should be placed on the platform, and the same multiple of ⅜ pound (6 ounces) should be used upon the counterpoise.

The remainder of the test should be carried out as is described for types 1 and 2 to the extent that each test applies to this type.

Type 4.—For a scale of this type the general method of test closely follows that outlined for counter scales of the equal-arm type, except that instead of using equal loads in the two pans, loads inversely proportional to the lever lengths of the two pans are used in the respective pans. For example, if the lever supporting one pan is one-fourth as long as the lever supporting the other, then four times as much weight in the former pan is required to balance the weight in the other pan.

The weights should be tested in the manner described heretofore, under the heading "Type 1," subdivision *c*. (See p. 100.)

Sealing and Condemning.—If the scale complies with all of the preceding specifications given under the headings "Scales: General specifications," "Counter balances, and scales: Specifications," and "Platform scales: Specifications," which appropriately apply to it, and has fulfilled all of the above tests which apply to the type of

scale under test within the sensibility reciprocals and tolerances prescribed, it is correct and should be sealed by attaching a lead seal by means of the sealing press to some stationary part of the scale in such a manner that it will not interfere with the action of the moving parts. If no suitable place to attach the lead seal can be found, seal it in some conspicuous place by stamping it with the proper steel dies.

If the scale is incorrect, it should be condemned and seized, or condemned for repairs, as the nature of the fault determines.

SUSPENSION SCALES OF THE LEVER TYPE

Definition.—Suspension scales of the lever type are lever scales designed and adapted to be hung from or attached to some support above and outside of the structure of the scale itself, and which are not included within other classes herein defined. This class shall include steelyards, butchers' meat beams, suspension abattoir scales, crane scales, overhead tramway scales, suspension creamery scales, suspension pendulum scales, and the like.

Specifications and Tolerances.—Suspension scales of the lever type having a capacity of more than 400 pounds shall be subject to the same specifications, in so far as these are applicable, and the same sensibility reciprocals and tolerances as platform scales. Suspension scales of the lever type having a capacity of 400 pounds or less shall be subject to the same specifications, in so far as these are applicable, and the same sensibility reciprocals and tolerances as counter scales. In the case of suspension scales of the lever type equipped with an indicator and a reading face or dial, such parts shall conform to all

the specifications applicable to them, given under the heading "Spring scales," except that the graduations are not required to be equally spaced.

Inspecting.—See that the proper specifications are complied with in the same manner as is described under the subdivision to which the steelyard had been assigned.

Testing.—In so far as it is applicable, the manner of test described above under "Platform scales" or "Counter balances and scales" should be applied. Whenever possible the steelyard should be tested to its full capacity, utilizing the poises with which it is equipped, but when the steelyard is equipped with removable hanging poises and the test weights furnished are not sufficient to test the beam of the steelyard to its full capacity using its own poises, the remaining notches may be tested, after all the available weights have been utilized, by substituting a 1-pound hanger weight for the poises belonging to the scale. When this hanger weight is used, the weight required on the hook or hanging platform to balance the beam must bear the same ratio to the weight indication on the beam that the 1-pound hanger weight bears to the poise for which it is substituted. Thus, if the poise weighs 16 pounds, only one-sixteenth of the weight indicated by the graduations should be placed on the hook or hanging platform when the 1-pound hanger weight is placed in the successive notches; if the poise weighs 4 pounds, one-fourth of the load is required, etc. (The poise weights are usually an even number of pounds and their weight is usually indicated on the instrument. Also steelyards are often equipped with two poises of different weights and two sets of graduations, one on each side of the beam, the proper set being determined by the poise used.)

The tolerances on the weight indications when the poises belonging to the scale are employed in the test are given in the table of tolerances for platform scales in the column headed "Tolerance on beam," or in the table of tolerances for counter scales in the column headed "Tolerance on beam or reading face," respectively, according as the scale has a capacity of more than 400 pounds, or of 400 pounds or less. When the hanger weight is used, the tolerances will be found in the columns headed "Tolerance on multiplication ratio" or "Tolerance on parts requiring employment of removable weights," respectively, as above; also, the values opposite the proper load on the platform, and not those corresponding to the indications on the beam, are to be employed. All the poises should be tested in the manner described for the testing of counterpoise weights, the tolerance for the counterpoise weights of the proper multiplication ratio being allowed. The multiplication ratio of the scale under test is found by determining the ratio between the amount which the poise counterbalances when placed on the capacity graduation of the beam and the nominal weight of the poise.

If the scale is equipped with a device designed to pick up the load from the ground and set it back again, this should be operated several times when the scale is empty and when it is loaded, in order to determine whether this changes the balance of the scale, or the weights indicated.

Sealing and Condemning.—Seal or condemn the steelyard under the same conditions and in the same manner as is described in the proper subdivision given heretofore to which the steelyard under test has been assigned under the heading "Specifications and tolerances."

SPRING SCALES

Definition.—A spring scale is a scale in which the weight indications depend upon the change of shape or of dimensions of an elastic body or system of such bodies: Provided, however, That scales in which metallic bands or strips are employed for the primary purpose of fulfilling the functions of knife-edges and bearings shall not be considered spring scales within the meaning of this definition.

Specifications.—1. Graduated faces shall be permanently fixed in position.

2. All graduations shall be clear and distinct and equally spaced *and in no case shall their width be less than 0.008 inch.*

3. The clear interval between the graduations shall not be less than 0.04 inch.

4. The maximum value of the graduations on spring scales used in the sale of foodstuffs at retail shall be 1 ounce: Provided, however, That this shall not apply to scales used exclusively in the sale of vegetables.

5. The scale shall have a definite and clear zero graduation and there shall be no stop to prevent the indicator from going beyond the zero graduation. These conditions shall be fulfilled whether the entire face is graduated or the graduations commence at a fixed load.

6. The indicator shall be firmly attached and reach to the graduated divisions.

7. All indicators shall be so designed and constructed that the indications are definite and may be read with precision.

8. The distance between the indicator and the reading face shall not exceed 0.12 inch.

9. All devices for adjusting the balance of a spring scale shall be of such construction that they are operative or accessible only by the use of some tool or device which is outside of and entirely separate from the movable mechanism of the scale itself; such as a screw-driver, wrench, etc., but not an adjusting pin.

10. All devices for adjusting the level of a spring scale shall be of such construction that they are operative or accessible only by the use of some tool or device which is outside of and entirely separate from the leveling devices; such as a screw-driver, wrench, etc., but not an adjusting pin.

11. No device to alter the working or effective length of the spring shall be placed on the outside of the scale.

12. Spring scales of the hanging type shall be freely suspended from the ring when in use.

13. If scales are provided with a hanging pan, this shall be suspended from a ring and no hook will be allowed. A hook may be used only on those scales for which no pan is provided.

14. Spring scales shall be so constructed that when a weight whose body has approximately equal diameter and height and which represents one-half of the capacity of the scale, is shifted in any direction on the commodity plate, pan, or scoop to a point one-half the distance between the center and the edge of the plate, pan, or scoop, the additional resulting error in the weight indication, due to this cause alone, shall not exceed the tolerance allowed at the load in question given in the column headed "Added tolerance for shift test at half capacity": Provided, however, That in this test the edge of the weight shall not be made to project over the edge of the commodity plate, pan, or scoop.

15. Spring scales whose weight indications are changed by an amount greater than one-half the tolerance allowed, when set in any position on a surface making an angle of 5 per cent or approximately 3 degrees with the horizontal shall be equipped with a device which will indicate when the scale is level. The scale shall be rebalanced at zero each time its position is altered during this test.

16. Spring scales of such construction that a weight or weights which are not visible can be added so as to affect the indications of the scale, shall be equipped with a device which will clearly indicate on the customers' side of the scale when the weight or weights have been added, and the value which it or they represent on the scale.

17. Spring scales shall give correct weight indications whether the load on the plate, pan, or scoop is being increased or decreased.

18. The specifications for each part of combination spring and lever scales shall be the same as those for the type of scale to which such part belongs.

19. All counter spring scales shall be in level.

20. When not modified by the above, the specifications given under the heading "Scales: General specifications" shall apply to spring scales in so far as they are applicable.

Tolerances.—Except on the special tests described above, the tolerances to be allowed in excess or deficiency on all spring scales equipped with a device intended to compensate for changes in the elasticity of the springs due to temperature effects, shall not be greater than the values given in the tolerance table under the heading "Counter balances and scales."

Except on the special tests described above, the tolerances to be allowed in excess or deficiency on all spring scales not equipped with a device intended to compensate

for changes in the elasticity of the springs due to temperature effects, shall not be greater than the values shown in the following table: Provided, however, That the manufacturers' tolerances or the tolerances to be allowed on all new spring scales described herein shall not be greater than one-half of the values given.

However, the tolerances on all spring scales described in the two preceding paragraphs shall in no case be less than one-fourth of the minimum graduation on the reading face or dial, except that on new spring scales they shall in no case be less than one-eighth of such minimum graduation.

Load	Tolerance	Added tolerance for shift test at half capacity	Load	Tolerance	Added tolerance for shift test at half capacity
Pounds	Ounces	Ounces	Pounds	Ounces	Ounces
1	1/8	1/16	30	2	3/8
2	1/4	1/16	40	2	7/16
3	1/4	1/16	50	3	1/2
4	1/2	1/8	60	3	5/8
5	1/2	1/8	75	4	3/4
6	1/2	1/8	90	4	7/8
7	1/2	1/4	120	5	1 1/4
8	3/4	1/4	150	6	1 1/2
10	3/4	1/4	200	8	2
12	1	1/4	300	12	3
15	1	5/16		Pounds	
20	1 1/2	5/16	400	1	.....
24	1 1/2	3/8	500	1 1/4	.....
25	1 1/2	3/8	600	1 1/2	.....

Inspecting.—Examine the scale under test carefully, noting whether all the above specifications for the class to which it belongs, are complied with. Note particularly whether or not the scale is in balance as defined in specification No. 25 under the heading "Scales: General specifications," and whether the indicator returns freely and without excessive vibration to the same position of balance when it is displaced from this position. If the scale is out of balance on the first inspection and yet otherwise complies with the specifications, and if, furthermore, it appears that the error is not due to fraudulent intent, the indicator should be properly adjusted. On some scales this is accomplished by turning an adjusting screw or by adding or subtracting shot or lead from a shot cup attached near the support of the pan. On other scales it will be necessary to remove the glass face, if there is one, loosen a screw the head of which passes through a slot in the indicator hand near the opposite end from the point, and turn the indicator on its pinion to the proper position. Then tighten the screw in the slot and replace the glass face. If the scale is found to be out of balance on a subsequent inspection, it is to be treated either as incorrect or in the same way as a counter scale in a similar condition. Take great care to ascertain that the scale is adjusted in the same condition as when it is used. Thus if a scoop is used on the platform of the scale when weighings are being made, this scoop should be on the platform when the inspections and adjustments are made.

It should also be particularly noted whether the indications of weight appear to vary appreciably when the position of observation is changed in a horizontal or vertical direction. If they do appear to vary appreciably, it is probable that specification No. 8 is not complied with,

and particular attention should therefore be paid to this specification.

If any of the specifications given for the class to which the scale belongs are not complied with, the scale is incorrect.

Testing.—(*a*) Place a small weight on the scale and see that it is indicated correctly. Continue to add weights and note the indications until the capacity of the scale is reached. The first load applied should be equal to the smallest weight graduation on the scale, and several of the loads should be less than the first main weight graduation. At each of the points tested it should be determined whether the indicator will readily assume its proper position by displacing it slightly from its position of rest in each direction and noting its behavior when released. At various points part of the load should be removed and attention paid as to whether the remaining part of the load is correctly indicated. When the test is completed and the entire load removed, the pointer should at once return to the correct zero position. There should not be excessive vibration of the indicator at any point.

If at any load the indicator does not point exactly to the proper graduation, it will be necessary to determine whether or not the error exceeds the tolerance. For this purpose the error can often be read directly on the reading face; but if there is any doubt whether the tolerance is exceeded, the following method may be adopted for determining the error more exactly: Add or subtract weights until the indicator exactly coincides with the proper graduation line. The error of the scale at this point is the value of the weights added or subtracted. Or, instead of subtracting weights when the scale indicates a

fractional part of a subdivision too much, add small weights until the pointer exactly coincides with the next higher graduation. The error at this point is the value of this subdivision of the scale minus the value of the small weights added. (The error on any scale equipped with a reading face may be determined in this way, but the tolerances of the proper type to which such scale belongs will, of course, be applied in all cases.)

In general a spring scale should not be tested with less than 10 different loads. The error in any indication should not be greater than the tolerance value given for the appropriate load in the preceding tolerance table for the class to which the scale under test belongs. If this condition is not fulfilled the scale is incorrect.

(*b*) While the above test is being made, place a weight whose body has approximately equal diameter and height and which represents about one-half of the capacity of the scale, in the center of the pan or plate, and bring the indicator to exact coincidence with one of the graduations on the face by the addition of small weights, or of shot or other material, to the load on the pan. Now shift the load on the pan or plate in several directions so that the center of gravity of the weight is one-half the distance from the center to the edge of the pan or plate, taking care, however, that the edge of the weight does not project over the edge of the pan or plate. If this latter condition obtains, so place the weight that its edge is flush with the edge of the pan or plate. (If it is necessary to have this load consist of several weights, shift these in such a way that the conditions mentioned above are fulfilled.) If the weight indications of the scale are altered by an amount greater than one-fourth of the smallest subdivision on the reading face,

or of one-eighth of this subdivision, according to whether the scale is an old or a new scale, note the errors of the indications. Compare these values with the values for the appropriate loads in the column headed "Added tolerance for shift test at half capacity" in the preceding tolerance table, for the class to which the scale under test belongs. If the error so determined exceeds this given value, the scale is incorrect.

Sealing and Condemning.—If the scale is found to comply with each of the specifications noted above and in addition is found to be within the tolerances at all points under the conditions of test described, it is correct and should be sealed by attaching a lead seal by means of the sealing press, to some nonmovable part of the scale. If no suitable place to attach this can be found, seal it in some conspicuous place by stamping it with the proper steel dies.

If the scale is found to be incorrect on the above tests, it should be condemned and seized or condemned for repairs, as the nature of the fault determines.

STRAIGHT-FACE SPRING SCALES

Definition.—A straight-face spring scale is a spring scale in which an indicator or graduated face is affixed to a spring without intervening mechanism and registers the extension of the spring on a straight graduated face.

Specifications.—1. The support for the spring shall be of sufficient strength and rigidity to sustain the capacity load of the scale without perceptible strain, and such support shall be permanently fixed to the frame of the scale.

2. The graduated face shall be firmly riveted to the frame at not less than three points.

3. The indicator shall be pointed in order to facilitate accurate reading, and it shall not obscure the figures showing the value of the graduations.

4. *The value and spacing of the graduations shall satisfy the requirements of the following table:*

Capacity	*Maximum value of interval*	*Minimum distance between graduations*
Pounds	*Pounds*	*Inch*
25....	1/2	0.03
50....	1	.03
100....	1	.03
200....	2	.03
300....	5	.04
400....	5	.04
500....	5	.04

5. When not modified by the above, the specifications given under the headings "Scales: General specifications" and "Spring scales" shall apply to straight-face spring scales in so far as they are applicable.

Tolerances.—The tolerances to be allowed in excess or deficiency on all straight-face spring scales shall not be greater than four times the values given under the heading "Spring scales: Tolerances."

Inspecting.—Note whether all the above specifications are complied with for the class to which the scale under test belongs. If any of them are not so complied with, the scale is incorrect.

Testing.—When the scale has a pan or platform, the test is made in the manner described under "Spring scales"

above. If the scale has a hook only, the weights should be hung on this hook, and the test above described should be carried out in so far as it is applicable.

Sealing and Condemning.—Seal or condemn under the same conditions and in the same manner as in the case of spring scales.

COMPUTING SCALES

Definition.—A computing scale is a scale which, in addition to indicating the weight, indicates the total price of the amount of commodity weighed, for a series of unit prices.

Specifications.—1. Computing scales shall be correct in both their weight and value indications.

2. Computing scale charts shall not repeat the same values in any given column or row. This applies also to charts on which the value graduations are correctly placed, but which, in addition, have a duplication of value figures in any given column or row.

3. The value graduations on all computing charts shall not exceed 1 cent on all prices per pound up to and including 30 cents. At any higher price per pound the value graduation shall not exceed 2 cents: Provided, however, That nothing in the above shall be construed to prevent the placing of a special value graduation to represent each 5-cent interval. These special graduations may take the form of dots, staggered graduations, or similar forms. They shall be so placed that their meaning and value may be clearly understood, but they shall not be placed in the space between the regular graduations.

4. All computing scales equipped with a drum-shaped chart shall be so constructed that the opening on the dealers'

side discloses at least two value graduations at the lowest price per pound. These scales shall be so constructed that the opening on the customers' side discloses the smallest graduations and a figure representing the proper number of main weight units when any load is placed on the pan or platform.

5. All computing scales shall be equipped with weight indicators on both the dealers' and customers' sides, *and their width shall not exceed 0.015 inch.* The distance between the chart and the weight indicators shall in no case exceed 0.06 inch. Both indicators shall reach to the graduated divisions and shall indicate clearly and correctly.

6. All computing scales shall be equipped with a value indicator on the dealers' side, *and its width shall not exceed 0.015 inch.* The distance between the chart and the value indicator shall in no case exceed 0.06 inch. This indicator shall reach to each value graduation and shall indicate clearly and correctly.

7. *The weight graduations and the value graduations shall be clear and distinct, but in no case shall their width be less than 0.008 inch.*

8. The maximum value of the weight graduations on computing scales used in the sale of foodstuffs at retail shall be 1 ounce: Provided, however, That this shall not apply to scales used exclusively in the sale of vegetables.

9. *The clear interval between the weight graduation marks on all computing scales shall not be less than 0.04 inch. The clear interval between the value graduation marks on all computing scales shall not be less than 0.02 inch: Provided, however, That the latter requirement shall not be construed to apply to the special value graduation denoting the 5-cent interval, mentioned heretofore.*

10. All devices for adjusting the balance of a computing scale shall be of such construction that they are operative or accessible only by the use of some tool or device which is outside of and entirely separate from the movable mechanism of the scale itself, such as a screw-driver, wrench, etc., but not an adjusting pin.

11. All devices for adjusting the level of a computing scale shall be of such construction that they are operative or accessible only by the use of some tool or device which is outside of and entirely separate from the leveling devices, such as a screw-driver, wrench, etc., but not an adjusting pin.

12. Computing scales whose weight indications are changed by an amount greater than one-half the tolerance allowed, when set in any position on a surface making an angle of 5 per cent or approximately 3 degrees with the horizontal, shall be equipped with a device which will indicate when the scale is level, and in no case shall any pendulum operating the scale be considered a leveling device. The scale shall be rebalanced at zero each time its position is altered during this test.

13. Computing scales shall give correct results whether the load is being increased or decreased.

14. All devices intended to increase the capacity of computing scales by the addition of an added weight or weights shall operate properly irrespective of the speed with which they are manipulated.

15. All counter computing scales shall be in level.

16. The specifications on a computing scale and on all parts of a computing scale, when not modified by the above, shall be the same as those of the type to which the scale under test belongs. Also when not modified

by the above, the specifications given under the heading "Scales: General specifications" shall apply to computing scales in so far as they are applicable.

Sensibility Reciprocal.—When the scale is of such a type that the definition of sensibility reciprocal is applicable, the maximum allowable sensibility reciprocal shall be the same value as is permitted for a noncomputing scale of the appropriate type.

Tolerances.—Except on the special tests described above, the tolerances to be allowed in excess or deficiency on all spring computing scales equipped with a device intended to compensate for changes in the elasticity of the springs due to temperature effects, and also all those not operated by springs, shall not be greater than the values given in the tolerance table under the heading "Counter balances and scales." (See pp. 93-94.)

Except on the special tests described above, the tolerances to be allowed in excess or deficiency on all spring computing scales not equipped with a device intended to compensate for changes in the elasticity of the springs due to temperature effects, shall not be greater than the values given in the tolerance table under the heading "Spring scales." (See pp. 109-110.)

However, the tolerances on all computing scales equipped with a reading face or dial shall in no case be less than one-fourth of the minimum graduation on the reading face or dial, except that on new computing scales they shall in no case be less than one-eighth of such minimum graduation.

Inspecting.—Examine the scale under test carefully and note whether all the specifications above, and in addition, all those specifications given previously under the

type to which the scale belongs, are complied with. Thus in a spring-computing scale the specifications for spring scales in general, and in a lever-computing scale the specifications for lever scales in general, should be applied, except when these former specifications are modified by those given under this subdivision; and if the scale under test is a combination of two types, the specifications applicable to each of these should be applied in so far as they are applicable to the scale under test, with the same exception. Pay particular attention to the chart employed on the scale to make certain that the specifications applying to this part are complied with. Thus, charts repeating the same values or having a duplication of value figures in any given column or row, and those on which the value graduations exceed the specified amounts are not allowable. The width of the graduations and the clear space between them, and the width of the weight and value indicators and their distance from the chart, should all be measured and the results compared with the limiting values specified, since these points are of great importance if the scale is to give accurate results. After the official becomes familiar with a certain form of chart and knows it to be correct, it will be unnecessary to repeat all these measurements in each case that this chart is encountered, but there are so many different charts in use, many of which closely resemble each other, that the official must be cautious not to confuse one with another.

If the scale under test does not comply with all the specifications noted above as applying to it, it is incorrect.

Testing.—There are computing scales of the hanging spring type; of the combination spring and lever type, some of which have auxiliary beams with sliding poises;

of the pendulum type, constructed to give automatic indications of weight on the reading face; of the equal-arm type, with partly automatic or nonautomatic readings; of the unequal-arm counter type; and of the counter platform type.

(*a*) The tests to be applied to computing scales of the various types shall be the same as those described heretofore for the type of scale to which the computing scale under test belongs, and the tolerances and sensibility reciprocals shall be applied as noted under those headings preceding. Where the scale is of one type, but is equipped with auxiliary devices the test of which is described under the heading of some other type, these devices shall be tested as described under the proper heading.

(*b*) When the accuracy of the weight indications is being tested, the accuracy of the money values shown should also be determined. This is done by determining the values of a number of different loads at various prices per pound and noting whether these values are correctly indicated with these loads on the pan or platform. Then note whether the value graduations in each of the various columns are equally spaced, etc. The inspector will soon become familiar with the various types of charts and will know from his experience whether or not the chart on the scale under test is correct or incorrect.

If the scale does not satisfy all the above requirements of the weight test within the proper sensibility reciprocals and tolerances, or if the chart is inaccurate, it is incorrect. If a scale is correct in its weight indications, but the computing chart does not comply with the specifications or is otherwise incorrect, the scale may be allowed in use if the computing chart is permanently covered in such a way

that it can not be thereafter used; as by covering the glass over the opening through which the values are observed, with an opaque substance, such as paper glued on, paint, etc.

Sealing and Condemning.—If the scale under test complies with all the specifications and satisfies all the tests noted above it is correct and should be sealed in the same manner as is described heretofore under the heading of "Counter scales." If it does not fulfill all of the above conditions it should be condemned and seized or condemned for repairs, as the nature of the fault determines.

CREAM-TEST AND BUTTER-FAT-TEST SCALES

Definition.—A cream-test or butter-fat-test scale is a scale especially designed and adapted for determining the fat content of cream or butter.

Specifications.—*1. All scales shall be provided with a graduated scale or arc divided into at least 10 equal spaces, over which the indicator shall play.*

2. The clear interval between the graduations on the graduated scale or arc shall not be less than 0.04 inch.

3. The indicator shall be of such length as to reach to the graduated divisions and shall terminate in a fine point to enable the readings to be made with precision.

4. All scales whose weight indications are changed by an amount greater than one-half the tolerance allowed, when set in any position on a surface making an angle of 5 per cent or approximately 3 degrees with the horizontal, shall be equipped with leveling screws and with a device which will indicate when the scale is level. The scale shall be rebalanced at zero each time its position is altered during this test.

5. All scales shall be so constructed and adjusted that when the pans are released or disturbed the pointer will return to its original position of equilibrium.

6. When not modified by the above, the specifications given under the heading "Scales: General specifications" (except specification No. 2) shall apply to cream-test and butter-fat-test scales in so far as they are applicable.

Sensibility Reciprocal.—The maximum sensibility reciprocal allowable for these scales shall not exceed 1 grain, or approximately 65 milligrams, when the maximum load is placed upon the scale: Provided, however, That the manufacturers' maximum sensibility reciprocal or the maximum sensibility reciprocal on all new scales shall not be greater than one-half of this value. (The maximum load is defined as the weight of the sample used in each bottle multiplied by the number of bottles for which the scale is designed, plus the total tare of these bottles.)

(The term "sensibility reciprocal" means the weight required to move the position of equilibrium of the beam, pan, pointer, or other indicating device of the scale a definite amount. In the case of scales provided with a single indicator and a graduated scale or arc, one of which oscillates with reference to the other to form a convenient means for determining the position of equilibrium of the beam, and which does not of itself directly indicate in terms of weight, the sensibility reciprocal is the weight required to cause a change in the position of rest of the pointer equal to one division of the graduated scale or arc.)

Tolerances.—The tolerance to be allowed in excess or deficiency on all cream-test and butter-fat-test scales shall not be greater than one grain or approximately 65

milligrams: Provided, however, That the manufacturers' tolerance or the tolerance to be allowed on all new scales shall not be greater than one-half of this value.

These tolerances shall be applied to single loads of 18 grams each, added successively until the maximum load as defined above is placed upon the scale.

Inspecting.—Examine the scale under test carefully to determine whether all the specifications noted above as applying to it, are complied with. If all these are not complied with, the scale is incorrect.

Testing.—The tests should be the same as those applied to counter scales and to prescription scales and balances, in so far as these are applicable to this type, using the sensibility reciprocal and tolerance given above. If the scale does not comply with the requirements of these tests within this sensibility reciprocal and tolerance, it is incorrect.

Sealing and Condemning.—If the scale under test complies with all the specifications given above and satisfies the conditions of test within the sensibility reciprocal and tolerance allowed, it is correct; if it does not, it is incorrect. Scales of this class shall be sealed or condemned in the same way as is described for counter scales.

PRESCRIPTION SCALES AND BALANCES

Definition.—Prescription scales and balances are scales and balances designed for or adapted to weighing the ingredients of medicinal and other formulas prescribed by physicians and others and entering into the ordinary trade of pharmacists and chemists, and which are used or intended to be used for such purpose.

Specifications.—1. All scales and balances shall be equipped with a device which will accurately indicate the position of equilibrium of the beam. If this device is provided with only one indicating edge, line, or point, then it shall also be provided with a graduated scale or arc. If this device consists of a scale or arc and a single indicating edge, line, or point, or of two indicating edges, lines, or points, which move in opposite directions, these shall be so designed and constructed that when the beam vibrates one will oscillate with reference to the other.

2. Any graduated scale or arc similar to that referred to in specification 1, shall be divided into equal spaces with at least 0.04 inch clear interval between the graduations.

3. If the indicating device referred to in specification 1, is provided with a single indicating edge, line, or point, this shall reach to the graduated scale or arc and shall be designed and constructed to enable the readings to be made with precision. If provided with two indicating edges, lines, or points, these shall be sharply defined *and shall in no case be more than 0.04 inch from each other when the scale is in balance, this space to be measured horizontally.*

4. The distance between the graduated scale and the indicator shall in no case exceed 0.04 inch.

5. All knife-edges and bearings shall be made of hardened and tempered steel or agate.

6. The graduations on all graduated beams shall be clear and distinct, *and in no case shall their width be less than 0.008 inch.*

7. The clear space between graduations on all graduated beams shall not be less than 0.04 inch.

8. All scales and balances shall be provided with a device for arresting the vibration of the beam.

9. All scales and balances shall be so constructed and adjusted that when the beam is released or disturbed it will return to its original position of equilibrium.

10. All scales and balances whose weight indications are changed by an amount greater than one-half the tolerance allowed, when set in any position on a surface making an angle of 5 per cent or approximately 3 degrees with the horizontal, shall be equipped with a device which will indicate when the scale is level, and in no case shall any pendulum operating the scale be considered a leveling device. The scale shall be rebalanced at zero each time its position is altered during this test.

11. For the purpose of applying the sensibility reciprocal and tolerances the capacity of all prescription scales and balances which are in the State, either in use or in the stock of manufacturers of or dealers in such apparatus (class 2) and which shall not have the nominal or rated capacity marked upon them, shall be taken to be 1 apothecaries' ounce (or 30 grams).

12. When not modified by the above, the specifications given under the heading "Scales: General specifications" shall apply to prescription scales and balances in so far as they are applicable.

Sensibility Reciprocal.—The maximum sensibility reciprocal allowable for prescription scales and balances of a capacity of ½ ounce (or 15 grams) or more shall not exceed 0.2 grain (or 13 mg), at the capacity or at any lesser load, with the exception that when this value is larger than that represented by two of the minimum graduations on any beam with which the scale may be

equipped, the latter value shall be applied and used as the maximum sensibility reciprocal, at the capacity or at any lesser load: Provided, however, That the manufacturers' sensibility reciprocal or the maximum sensibility reciprocal on all new prescription scales and balances shall be one-half of the value given unless this value is greater than one of the minimum graduations on the beam, in which case this latter value shall be applied and used as the maximum sensibility reciprocal.

NOTE.—If any prescription scale or balance has a smaller capacity than ½ ounce (or 15 grams), the maximum sensibility reciprocal to be allowed at the capacity or at any lesser load shall be the same proportionate part of 0.2 grain (or 13 mg) that this capacity is of ½ ounce (or 15 grams).

(The term "sensibility reciprocal" means the weight required to move the position of equilibrium of the beam, pan, pointer, or other indicating device of a scale or balance a definite amount. In the case of scales provided with a single indicator and a graduated scale or arc one of which oscillates with reference to the other to form a convenient means for determining the position of equilibrium of the beam, and which does not of itself directly indicate in terms of weight, the sensibility reciprocal is the weight required to cause a change in the position of rest of the pointer equal to one division of the graduated scale or arc.

In the case of scales equipped with two indicators which move in opposite directions and oscillate with reference to each other to form a convenient means for determining the position of equilibrium of the beam, the sensibility reciprocal is the weight required to cause a separation of the indicators of 0.04 inch.)

Tolerances.—The tolerance to be allowed in excess or deficiency on the ratio of arms of prescription scales and balances shall not be greater than the following values:

Load		Tolerance on ratio	
Ounces, ap.	Grams	Grains	Milligrams
8	240	3.2	208
4	120	1.6	104
2	60	.8	52
1	30	.4	26
1/2	15	.2	13

NOTE.—If any prescription scale or balance has a smaller capacity than ½ ounce (or 15 grams), the tolerance to be allowed shall be the same proportionate part of 0.2 grain (or 13 mg) that this capacity is of ½ ounce (or 15 grams).

If the scale is equipped with a graduated beam, the tolerance at any graduation on the beam shall be equal to the actual sensibility reciprocal of the scale at the load in question.

CLASS B

In the case of a drug store doing prescription work, which is provided with a "Class A" prescription scale or balance—that is, one which meets the requirements noted above—then and in that case only an additional prescription scale or balance meeting the following requirements may also be sealed, but only for the weighing of loads of 10 grains or more. Such scale shall be known as a "Class B" prescription scale or balance and shall not be used for weighing any load of less than 10 grains.

All Class B scales and balances shall be conspicuously and clearly marked with the words "Class B. Not to be used in weighing loads of less than 10 grains," or with a similar and suitable wording conveying the same information.[2]

Such scales and balances shall conform to all the specifications for Class A scales and balances, but will be allowed the following sensibility reciprocals and tolerances:

Sensibility Reciprocal.—The maximum sensibility reciprocal allowable for Class B prescription scales and balances shall not exceed 0.5 grain, at the capacity or at any lesser load: Provided, however, That the manufacturers' maximum sensibility reciprocal or the maximum sensibility reciprocal on all new Class B prescription scales and balances shall be one-half of the value given.

Tolerances.—The tolerances to be allowed in excess or deficiency on the ratio of arms of all Class B prescription scales and balances shall not be greater than the following values:

Load		Tolerance on ratio	
Ounces, ap.	Grams	Grains	Milligrams
8	240	8.0	520
4	120	4.0	260
2	60	2.0	130
1	30	1.0	65
1/2	15	0.5	30

[2] In the case of Class B prescription scales and balances, which are hereafter manufactured in the State or brought into the State (Class 1), this requirement shall be fulfilled by the manufacturer. In all other cases the inscription shall be placed upon such scales and balances by the sealer.

NOTE.—If any Class B prescription scale or balance has a smaller capacity than ½ ounce (or 15 grams), the tolerance to be allowed shall be the same proportionate part of 0.5 grain (or 30 mg) that this capacity is of ½ ounce (or 15 grams).

If a Class B prescription scale or balance is equipped with a graduated beam, the tolerance to be allowed at any graduation on the beam shall be 0.3 grain (or 20 mg), unless this value is less than the actual sensibility reciprocal of the scale at the load in question, in which case this actual sensibility reciprocal shall be used as the tolerance at any graduation on the beam.

Inspecting.—A prescription scale or balance is nearly always of a small capacity and of the equal-arm type with two pans hanging from or supported on a lever. It is very necessary that the capacity be known to the inspector and user in order that it may be properly inspected and used. Specification No. 2, under the heading "Scales: General Specifications," requires that prescription scales and balances hereafter furnished be marked with their capacity, and this requirement should be enforced. In accordance with Specification No. 11, above, all others should be assumed to be of a capacity of 1 ounce and it is advisable for the inspector to attach permanently to the scale or balance a metal strip or card bearing this information. Users should be cautioned against employing a prescription scale or balance for loads greater than its capacity, not only because such usage will cause it to deteriorate rapidly in accuracy and sensitiveness but also because under the method of test prescribed its accuracy or inaccuracy in the weighing of such loads will be unknown.

Two classes of prescription scales and balances are considered in the specifications and tolerances. The first

is the ordinary kind, "Class A," and the second is designated as "Class B." Both are required to comply with the same set of specifications, but the sensibility reciprocals and tolerances for the latter class are larger than those applying to the former, for the reason that the latter are intended to be used only for the rougher weighings and therefore the greater accuracy is not essential. It should be especially noted that no drug store doing prescription work should be allowed to depend solely on a Class B scale or balance. Therefore no Class B scale or balance should be sealed for a store which does not also have a sealed Class A scale or balance. If the store has such a scale, however, then an additional scale or balance meeting Class B requirements is advisable since this will enable a druggist to save his better scale for small loads (below 10 grains) and for other loads where a high degree of accuracy is essential. Class B scales or balances should always be labeled, as noted under this class, by the manufacturer or, in some cases, by the inspector. Very often a Class A prescription scale or balance will after long use fall below the requirements of this class, while still remaining within the requirements of Class B. In this case, if a new scale meeting the requirements of Class A is procured by the druggist, the old scale may be sealed and labeled as conforming to Class B.

Examine the scale or balance under test carefully to determine whether all the specifications given which apply to it are, in fact, complied with. Some particular types of scales, however, will be found in very common use and the inspector, after fully satisfying himself that any such type conforms to each of the specifications, will find it unnecessary to repeat in every case the detailed inspec-

tion of each part, such as the clear space between the graduations on the graduated scale and on the graduated beam, etc.

If a prescription scale or balance does not comply with all the specifications that are applicable to it, it is incorrect.

Testing.—The method to be employed in testing a prescription scale or balance is much the same as that given for a counter scale or balance of a similar type. The capacity is, of course, less, the sensitiveness higher, and the tolerance smaller; consequently the work must be done with more care and greater precision, but in other respects the test differs very little from that given heretofore, and it is not necessary to repeat all the various steps to be taken. The test for counter scales should be consulted and applied in so far as it is applicable to the scale or balance under test. The methods given herein are those to which especial attention should be paid or which differ in some respects from those given heretofore.

To determine whether or not the tolerance on the ratio of arms is complied with, apply the test given on page 96. The amount of weight added should not exceed the value corresponding to the appropriate load given in the preceding table. If this condition is not fulfilled, the arms are unequal in length and the scale is incorrect.

To determine the sensibility reciprocal at any load, bring the scale to an exact balance with this load in each pan; then in the case of a scale or balance equipped with an indicator moving over a graduated scale or arc, add weights to one pan until the point of rest of the indicator has changed by one full scale division, or when the scale is equipped with two pointers moving in opposite directions, add weights until these pointers have a point of rest 0.04

inch apart. (After some experience the inspector will be able accurately to estimate this distance.) The value of the weights necessary to be added to produce such a result is the actual sensibility reciprocal of the scale or balance at the load in question. This value should be determined with the capacity load on both pans, and should not be greater than the value given for the maximum sensibility reciprocal allowable.

If it is found that the proper small weights are not available to cause a deflection of the indicator of just one scale division, or a separation of the pointers of just 0.04 inch, then weights may be added until a change of just two or more scale divisions or of 0.08 or 0.12 inch has been caused in the point of rest. The sensibility reciprocal is then determined by dividing this amount of weight by the number of scale divisions that the point of rest has changed, or by the number of units of 0.04 inch each that the pointers have separated.

When the scale is equipped with a graduated beam, the tolerance to be allowed at any point on this beam is the same as the value of the actual sensibility reciprocal of the scale at the load in question. (The value of the actual sensibility reciprocal will not vary appreciably throughout the usual range of the beam; and, therefore, as a rule, the value of the sensibility reciprocal may be determined at a load equal to the capacity of the beam, and this value may be used as the tolerance at all points on the beam.)

To apply this tolerance, the following method may be employed: With the scale in exact balance, move the poise out to several points on the beam successively, including the capacity graduation, and add the indicated

amount of weight to the proper pan. The scale should not be out of balance by more than one scale division on the graduated scale or arc when the scale or balance is so equipped, or in the case of a scale equipped with two pointers these should not be separated by more than 0.04 inch. If this condition is not fulfilled at all points tested, the beam and poise are incorrect.

In scales and balances of Class B, the tolerance on the beam is 0.3 grain (or 20 milligrams) when the actual sensibility reciprocal of the scale is less than this amount, and therefore in this case the error on the beam is to be determined directly with weights. When the actual sensibility reciprocal of the scale or balance is greater than 0.3 grain (and this will usually be the case), the tolerance on the beam is equal to the actual sensibility reciprocal of the scale at this load, as in Class A scales, and therefore in this case the test may be made in the same manner as is described for them.

Sealing and Condemning.—If the scale or balance under test complies with all the specifications given, and has fulfilled all the above tests within the sensibility reciprocals and tolerances prescribed, it is correct and should be sealed in the same manner as has been described for other types of scales.

If the scale is incorrect, it should be condemned and seized or condemned for repairs, as the nature of the fault determines.

WEIGHTS

Specifications.—1. Weights shall be made of steel, iron, brass, or any other metal or alloy of metals not softer than brass: Provided, however, That weights below one-

fourth ounce shall not be made of iron or steel, but may be made of aluminum.

2. Weights shall have smooth surfaces, and no weight of more than 1 gram, 1 pennyweight, or 1 scruple shall have sharp points or corners.

3. Weights shall not be covered with a soft or thick coat of paint or varnish.

4. All holes in which foreign material is to be placed for adjusting purposes must be of such form that this material will be permanently and securely held in place. In no case shall this adjusting material project beyond the surface of the weight.

5. Rings on weights shall not be split or removable.

6. All weights shall be clearly marked with their nominal value, *and in addition weights intended for use on multiplying-lever scales shall be clearly marked with the value they represent when used upon the scale for which they are intended:* Provided, however, That the values of weights of less than 1 gram, 1 pennyweight, or 1 scruple may be designated by dots, lines, figures, definite shape, or other appropriate means.

Tolerances.—The tolerances to be allowed in excess or deficiency on commercial weights shall not be greater than the following values: Provided, however, That the manufacturers' tolerances or the tolerances to be allowed on new commercial weights shall not be greater than one-half of the values given:

Avoirdupois System

Weight	Tolerance, ordinary weights (ratio 1:1)	Tolerance, counterpoise weights for multiplying-lever scales		
		Ratio less than 100:1	Ratio 100:1 and less than 1000:1	Ratio 1000:1 and over
Pounds	Grains	Grains	Grains	Grains
50	100.0	60.0	40.0	20.0
25	60.0	36.0	24.0	12.0
20	60.0	36.0	24.0	12.0
15	40.0	24.0	16.0	8.0
10	40.0	24.0	16.0	8.0
8	30.0	18.0	12.0	6.0
5	30.0	18.0	12.0	6.0
4	20.0	12.0	8.0	4.0
3	20.0	12.0	8.0	4.0
2	15.0	9.0	6.0	3.0
1	10.0	6.0	4.0	2.0
Ounces				
10	10.0	6.0	4.0	2.0
8	5.0	3.0	2.0	1.0
5	5.0	3.0	2.0	1.0
4	5.0	3.0	2.0	1.0
2	3.0	1.8	1.2	.6
1	2.0	1.2	.8	.4
1/2	2.0	1.2	.8	.4
1/4	1.0	.6	.4	.2
1/8	.5	.3	.2	.1
1/16	.5	.3	.2	.1
1/32	.5	.3	.2	.1
1/64	.2	.12	.08	.04

The tolerances to be allowed in excess or deficiency on apothecaries' prescription weights shall not be greater than the following values: Provided, however, That the manufacturers' tolerances or the tolerances to be allowed on new apothecaries' prescription weights shall not be greater than one-half of the values given:

Apothecaries' System

Weight	Tolerance	Weight	Tolerance
Ounces, ap.	Grains	Scruples	Grains
12	4.0	3	0.3
10	4.0	2	.25
8	3.0	1	.15
5	3.0	Grains	
4	2.0	20	.15
3	2.0	10	.12
2	2.0	5	.08
1	1.0	2	.04
Drams		1	.03
8	1.0	.5	.02
6	1.0	.2	.015
4	.7	.1	.01
3	.6		
2	.5		
1	.3		
.5	.2		

Metric System

Weight	Tolerance	Weight	Tolerance
Grams	Milligrams	Milligrams	Milligrams
500.....	350	500.....	7
200.....	200	200.....	4
100.....	150	100.....	3
50.....	100	50.....	2
20.....	50	20.....	1
10.....	40	10.....	1
5.....	25		
2.....	15		
1.....	10		

Inspecting.—Examine the weight under test carefully and note whether it complies with each of the specifications given above which is applicable to it. If it does not so comply, the weight is incorrect.

Testing.—Each weight should be tested. For all ordinary commercial weights of 10 pounds or less, the portable balance recommended should be used. Place the weight to be tested in one pan of the balance and the corresponding amount of standard weights in the opposite pan. If the weight under test is heavy or light and thus fails to balance the beam—i. e., cause it to come to rest in a horizontal position with the indicator in the center of the graduated scale or arc—place enough small weights on the proper pan to accomplish this result. If the weight under test is light, the added weights will be in the same pan with this weight; if heavy, the added weights will be in the opposite pan. If this amount of added

weight is greater than the value given in the appropriate column of the tolerance table for a weight of this size and of the proper class, the weight is incorrect. If the weight under test is larger than 10 pounds it should be tested on a scale which has been tested and found to be correct and which will clearly indicate a change in weight equal to the tolerance on the weight under test.

When the weight is used on an equal-arm balance, the tolerance will be found in the first tolerance column of the table; when the weight is a counterpoise weight, use the value given in the column headed by the proper multiplication ratio.

In testing prescription weights, the small portable balance recommended for this class of work should be used, the same method being employed as that described above whenever this is possible. The smaller weights will, however, sometimes be found to have tolerances so small that it can not be determined directly with standard weights whether or not they are complied with. The reason for this is that no weights of smaller size than 0.05 grain or of 5 milligrams are recommended, since it is not convenient to carry and use such weights in the field. In these cases tolerances must be translated into deflections of the indicator of the portable balance used.

To determine the tolerance in terms of scale divisions in such cases at any load, proceed as follows: With approximately this load in each pan bring the scale to an exact balance, if it is not already accurately balanced, by adding any convenient material to the higher pan, such as a piece of paper or other light object; then place one of the smallest standard weights provided, in one pan, and determine the change caused in the point of rest of the indicator. If this

change amounts to more than one scale division, divide the weight added by the number of scale divisions change in the point of rest. The result is the weight required to change the point of rest of the indicator one scale division. Knowing the weight represented by one scale division, the tolerance in terms of scale divisions is readily found by dividing the tolerance by the weight representing one scale division. A specific example may make this clearer: Suppose the weight under test is a 2-grain weight; this has a tolerance of 0.04 grain which can not be procured with the set of weights recommended. Add a 0.05-grain weight to one pan of the scale or balance which has previously been brought to an exact balance with approximately 2 grains in each pan. The point of rest is found to change 4 scale divisions. The weight required to cause a change of 1 scale division at this load is 0.05 grain divided by 4, or 0.012 grain. The tolerance on the weight under test, 0.04 grain, divided by the weight represented by 1 scale division, 0.012 grain, gives 3.3 scale divisions as the tolerance on the weight.

To apply this tolerance, bring the scale to an exact balance with empty pans, place the standard 2-grain weight and the 2-grain weight under test on the two pans and note where the indicator comes to rest. If this rest point is not more than 3.3 scale divisions from the zero line, the weight under test is within tolerance. If this point is more than 3.3 scale divisions from the zero line, the weight under test is not within the tolerance and is incorrect.

Since the weight represented by 1 scale division (the sensibility reciprocal of the balance) will vary but little within the range of loads for which this method of test

will be used, it will be necessary to determine this value only occasionally after the inspector has become accustomed to his balance; as, for instance, when the actual error on the weight under test is very close to the tolerance allowed on this weight.

Sealing and Condemning.—If the weight complies with all of the specifications and the error determined upon it does not exceed the proper tolerance, it is correct and should be sealed, when it is of such a size that it is practicable to do so, by stamping it with the proper steel dies furnished in the test sets. If there is a lead or other soft metal plug in the weight, this is the proper place to impress the dies. Whether or not it can be sealed, a record of it should be made on the certificate of inspection of apparatus.

If the weight is incorrect, it should be condemned and seized or condemned for repairs, as the nature of the fault determines. In the latter case it will not be marked, but a record of it should be made on the certificate of inspection of apparatus.

APPARATUS IN THE METRIC SYSTEM

No specifications contained in the preceding pages shall be understood or construed to prohibit the sale or use of weights and measures or weighing or measuring devices constructed or graduated in units of the metric system.

The tolerances to be allowed on any weight or measure or weighing or measuring device constructed or graduated in units of the metric system, shall be the same as those specified on similar apparatus of an equivalent size or at an equivalent load in the customary system.

PART III.—WEIGHTS AND MEASURES STANDARDS AND EQUIPMENT

GENERAL CONSIDERATIONS

The procuring of the proper standards and apparatus necessary to enable States and cities of various sizes properly to perform the inspecting, testing, and sealing of apparatus, and the investigational work that is required for the enforcement of the weights and measures law with the maximum of efficiency, is a very important matter, and consequently one which should be given due attention.

In general the requisites may be summed up by stating that the equipment procured should be accurate, permanent, convenient, and complete.

The major consideration is, of course, the accuracy and permanency of the standards and apparatus. For if the standards are not originally correct, or if they do not remain correct, the whole scheme of sealing will fail and the official will be in constant difficulty. For instance, the success or failure of prosecutions for violations of the laws will be found to depend very largely upon the authenticity of the standards, and if any doubt can be inspired regarding them, the whole case, no matter how complete or otherwise conclusive, may fail on this account. It is, therefore, extremely necessary that the standards be of undoubted and provable accuracy when purchased, and that they be of such construction as to undergo the maximum usage with minimum variation.

To the end that such apparatus may be obtained, it should be purchased from a reliable firm and in accordance with a competent set of specifications and tolerances, and before being put into use it should be rigidly inspected and tested to see that these specifications and tolerances are complied with. Periodically thereafter tests should be made to determine whether the apparatus continues to be of sufficient accuracy. These inspections and tests should be official ones, and the various pieces should be suitably sealed, marked, and certified so that they may be identified and their authenticity established whenever such action becomes necessary, as in the case of judicial proceedings, etc.

These official inspections and tests of the standards are usually regulated by law in the various jurisdictions, and when such a law exists, it should be very carefully followed. It is usually required that the primary standards of the State be inspected, tested, sealed, and certified by the National Bureau of Standards before they are accepted as State standards at the time they are acquired, and thereafter at periods of 5 or 10 years; and this procedure should, of course, be followed out in every case. No expense is attached to this, since the law allows the Bureau to do such work for the States free of charge. When these standards have been so verified, they should be carefully kept and maintained and should be used only when absolutely necessary. The best method of maintaining and using them is described in section 2 of the model law (see p. 195), and this procedure is recommended by the Bureau of Standards.

The same section provides that a complete set of copies of the State standards, which set is known and referred to as office standards, be procured, and this set should be

verified by direct comparison with the State standards at regular intervals. These office standards are then used in the testing and adjusting of all other weights and measures used as standards in the State.

Local standards belonging to cities and counties and the working standards of the State should be compared at regular and frequent intervals with the State primary or office standards. This matter is usually carefully regulated by the State law in those States having any efficient law. At the present time there still remain a few States which have no State standards of weights and measures, and still others which, while they have standards, have neither the equipment nor the organization properly to verify the local standards. In these cases the derivation of local standards from recognized primary standards is more difficult. The best procedure in this case is to submit such local standards directly to the Bureau of Standards. By so doing their accuracy and validity is directly established without the interposition of State standards. In the case of cities and counties the organic act creating the Bureau of Standards requires that a reasonable fee be charged for the work of verification. A schedule of the fees fixed may be obtained upon request.

It is advisable for cities and counties to have one complete set of standards and apparatus which is carefully maintained and is never used outside of the office, so that the weights and measures used in the field work can be frequently checked, and adjusted if need be. Especially is this essential in large cities where a number of sets of apparatus are used in the field, which are liable to change either through ordinary wear and tear or unavoidable accident.

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It may be said that, in the latter case, the Bureau of Standards always recommends that such an office set should be procured. However, if it is impossible to secure such standards on account of the lack of appropriations or other cause, the periodic test with the State standards must be deemed sufficient verification. Such weights and measures must be very carefully maintained in these cases, and a recomparison with the State standards should be made at frequent intervals, and immediately if any accident occurs or if for any other reason their accuracy becomes questionable.

STANDARDS AND EQUIPMENT FOR A STATE DEPARTMENT

Following is a suggested list of standards and equipment suitable for the office of a State department. Whenever possible the complete set should be procured, since failure to do this will unquestionably result in some loss of efficiency.

PRIMARY STANDARDS

Weights.— CUSTOMARY.—One set of avoirdupois weights, 50 pounds to $\frac{1}{32}$ ounce, as follows: 50, 20, 20,[3] 10, 5, 2, 2, 1 pounds, 8, 4, 2, 1, ½, ¼, ⅛, $\frac{1}{16}$, $\frac{1}{32}$, $\frac{1}{32}$ ounces.

TROY AND APOTHECARIES'.—One set of troy weights, 10 ounces to 1 pennyweight (0.05 ounce), as follows: 10, 5, 2, 2, 1 ounces, 10, 5, 2, 2, 1 pennyweights.

One set of apothecaries' weights, 1 ounce to 1 scruple, as follows: 1 ounce, 4, 2, 1, ½ drams, 2, 1 scruples.

(This set may be used in combination with the set of troy weights for sizes above 1 ounce since the ounces in the troy system and in the apothecaries' system are identical.)

[3] When economy must be practiced, this weight may be replaced by a 10-pound weight, or it may even be omitted altogether.

GRAIN.—One set of grain weights, 20 grains to 0.01 grain, as follows: 20, 10, 5, 2, 2, 1, 0.5, 0.2, 0.2, 0.1, 0.05, 0.02, 0.02, 0.01 grains.

METRIC.—One set of metric weights, 10 kilograms to 1 milligram, as follows: 10, 5, 2, 2, 1 kilograms, 500, 200, 200, 100, 50, 20, 20, 10, 5, 2, 2, 1 grams, 500, 200, 200, 100, 50, 20, 20, 10, 5, 2, 2, 1 milligrams.

MISCELLANEOUS.—One set of carat weights, 200 carats to 0.01 carat, as follows; 200, 200, 100, 50, 20, 20, 10, 5, 2, 2, 1, 0.5, 0.2, 0.2, 0.1, 0.05, 0,02, 0.02, 0.01 carats.

(Since the carat equals 200 milligrams, this set may be omitted and necessary tests made with the metric weights, the above relation being observed.)

All the above weights should conform to the specifications and tolerances of the Bureau of Standards for Class A weights.[4]

Capacity Measures.—CUSTOMARY.—One set of liquid measures, 1 gallon to 1 gill, (or ½ gill) as follows: 1 gallon, ½ gallon, 1 quart, 1 pint, ½ pint, 1 gill, ½ gill (2 liquid ounces).

(The ½ gill need not be procured unless this size is to be provided for the testing of glass graduates, in which case it should be included here.)

One set of dry measures, ½ bushel to ½ pint, as follows: ½ bushel, 1 peck, ½ peck, ¼ peck, 1 quart, 1 pint, ½ pint.

(In those States having laws prohibiting the use of dry measures, this set should, of course, be omitted.)

METRIC.—One set of metric measures, 1 liter to 1 deciliter, as follows: 1 liter, ½ liter, 2 deciliters, 1 deciliter.

[4] For a description of these requirements, see Circular of the Bureau of Standards No. 3, entitled "The Design and Test of Standards of Mass."

All the above measures should conform to the requirements of the Bureau of Standards for State standard measures.

Length Measures.—CUSTOMARY.—1 bronze yard standard, 1 100-foot steel tape.

METRIC.—1 bronze meter standard, 1 30-meter steel tape.

Detailed specifications for these standards and tapes can be secured from Circular of the Bureau of Standards No. 2, entitled "Measurements of Length and Area, Including Thermal Expansion." A copy of this publication will be forwarded upon request.

OFFICE STANDARDS.

Copies of Primary Standards.—One complete set of copies of the above standards should also be procured, and these should be compared with the State primary standards when acquired and periodically thereafter, and should be used for the purposes described heretofore. These secondary standards need not be of the highest form of construction but should nevertheless be satisfactory ones, and especially should they be permanent in their adjustment. In the case of weights, those complying with the specifications and tolerances of the Bureau of Standards for Class B[5] will be found perfectly satisfactory. In the case of measures, a conical form of somewhat lighter construction than those recommended above, may be procured.

The model law requires a complete set of copies of the State standards, and a number of State laws have the same requirement. It may sometimes be found, however,

[5] For a description of these requirements, see Circular of the Bureau of Standards No. 3, entitled "The Design and Test of Standards of Mass."

especially in the case of newly established departments, that the appropriation is insufficient to furnish the complete set of office standards in addition to the primary standards, during the first year. If certain pieces or sets must be omitted, it will be of importance to determine what the pieces or sets are, the purchase of which can best be deferred until a later date. It is recommended that the standards be struck from the list in the following order, this order being determined by two conditions; i. e., the probable permanence of their adjustment, and the amount of use which they will ordinarily receive.

1. The set of metric capacity measures.[6]
2. The 30-meter steel tape.
3. The bronze meter standard.
4. The set of dry measures.
5. The set of liquid measures.
6. The 100-foot steel tape.
7. The bronze yard standard.

Weights, when used, will vary more than any other class of standard apparatus. Therefore, it is not deemed wise to eliminate any of those listed unless it is unavoidable.

In addition to the copies of the primary standards, other office standards should be secured, as follows:

Measures.—One 5-gallon and one 3-gallon measure.

Graduates.—One set of cylindrical glass graduates in United States liquid ounces and minims, as follows: 60, 120 minims, 1, 2, 4, 8, 16, 32 ounces.

[6] These should not be eliminated, however, if metric gradutates are to be tested, as in this case they will be very necessary.

One set of cylindrical glass graduates in metric units, as follows: 10, 25, 50, 100, 250, 500, 1000 milliliters.[7]

Cylindrical glass graduates in cubic inches, as follows; 3, 10, 35 cubic inches.

Standards for Testing Graduates.—If glass graduates are to be tested, the above standards should be supplemented with the following pieces:

MEASURE.—One brass liquid measure; capacity, ½ gill (2 liquid ounces).

CUSTOMARY SYSTEM BURETTES.—125 minims subdivided to 1 minim; 250 minims subdivided to 2 minims; 1020 minims (17 drams) subdivided to 5 minims.

METRIC SYSTEM BURETTES.—10 milliliters subdivided to $\frac{1}{20}$ milliliter; 50 milliliters subdivided to $\frac{1}{10}$ milliliter; 100 milliliters subdivided to $\frac{2}{10}$ milliliter.

OFFICE EQUIPMENT

In order to make the proper use of the standards described, it is essential that certain pieces of standard equipment be procured, and still other pieces are necessary to the maintenance of an efficient inspection service. Those which are most necessary are given below.

Balances.—Four hanging-pan balances as follows:

Capacities	Sensibility reciprocals[8]
50 pounds or 25 kilograms.	1 grain or 60 milligrams
5 pounds or 2 kilograms.	0.02 grains or 1 milligram
4 ounces or 100 grams....	.01 grain or 0.5 milligram
¼ ounce or 5 grams.....	.001 grain or 0.05 milligram

[7] The term milliliter is used herein to designate the one-thousandth part of the liter. This unit is also commonly known as the cubic centimeter or "cc." The latter is not an accurate usage, as the units are not exactly equal, but the difference is of no consequence in this connection, and therefore the terms may be used interchangeably.

[8] The clear interval between the graduations on the graduated scale or arc shall not be less than 0.04 inch.

It will be found very advisable to procure all four of these balances in order to make certain that the necessary work is accurately done. For instance, one of the uses to which they will be put will be in comparing and adjusting the State office standards with the primary standards. It will be found necessary to do work within the tolerances of Classes A and B of the Bureau's requirements, since if larger tolerances were to be allowed, it would be found impossible to certify that the office standards of the various cities and counties and the field or working standards of the State or of the cities or counties, which are to be compared with the office standards of the State mentioned above, were within the required limits of accuracy. With balances of the above capacities and sensibility reciprocals, it will not be difficult to maintain this essential accuracy in the work.

If the number of balances must be limited to three, however, the three first mentioned should be selected, since this is believed to be the best combination that can be procured. By doing exceptionally painstaking work, it will, perhaps, be found possible to maintain the necessary accuracy with this equipment.

Comparator.—For very accurate comparisons of standards of length, not greater than 1 meter, a comparator will be found necessary. These instruments are usually built to order under the specifications of the purchaser. Upon request, the Bureau will furnish proper specifications for this piece of apparatus.

Tape-Testing Devices.—For those offices in which steel tapes exceeding 3 feet, or 1 meter, in length are to be tested, some apparatus for facilitating the com-

parison of the primary standard tape and the office standard tape, and the comparison of the latter with other standard tapes or with commercial tapes, will be found indispensable. This apparatus may be of simple and inexpensive form; thus, brass plates equipped with clamps to hold the tapes at one end and with simple tension devices at the other, may be set into a level floor at appropriate distances, this device enabling the standard and the tape under test to be compared directly one with the other. No great accuracy can be expected from such a test, however. If greater accuracy is desired, recourse may be had to a bench standard. This latter device will give very much better results and is much more convenient than the former, but is also much more expensive. It consists of a straight steel bar which has the various lengths to be tested marked upon it. Micrometer microscopes and other accessories are provided for when such a standard is installed. As in the case of comparators, this apparatus is built to the order of the purchaser, and the Bureau of Standards will furnish standard specifications upon request.

Hopper Funnel.—When two dry measures, which will both hold water, are to be compared with one another, water will be found to be the best testing medium. When one will not hold water, however, the testing medium must be some dry commodity such as rapeseed or dried peas. When such commodities are employed, a hopper funnel becomes a necessity in order to obtain a proper test. This is a piece of apparatus consisting of a hopper for holding the testing medium used, connected with a delivery spout which can be opened and closed at will, and a base for supporting the measure under test.

Thread-Measuring Reel.—For determining the length of cord, thread, etc., in large quantities, as in balls or skeins or on spools, etc., a thread-measuring reel is very useful. This instrument is made in various forms but consists primarily of a revolving wheel of known circumference, with a device to indicate the number of revolutions of the same.

STANDARDS AND EQUIPMENT FOR A CITY OR COUNTY DEPARTMENT

OFFICE STANDARDS

Whenever a city or county is of sufficient size to justify the expenditure, one set of standards should be furnished, the use of which should be limited to the checking of the field or working standards at frequent intervals and to general work in the office. This set should consist of the same pieces and should comply with the same specifications and tolerances as the sets of State office standards, described heretofore, except that the 100-foot and the 30-meter steel tapes may be omitted in those cases where tapes are tested exclusively by the State department.

OFFICE EQUIPMENT

The office of a city or county weights and measures department having a set of office standards should also be equipped with at least two balances, these preferably to be of the first two sizes specified in State office equipment; i. e., 50 pounds and 5 pounds. In any event the larger size will be found to be advisable. These balances may have the same sensibility reciprocals as those heretofore described, and in the case of the smaller balance, this is recommended on account of the increased work

which will be required of this balance when only two are furnished. The balance of the capacity of 50 pounds will be satisfactory, however, if the sensibility reciprocal is not greater than 200 milligrams.

The comparator mentioned for the State office may always be omitted, since no necessity for extremely accurate comparisons of lengths will arise which it will not be feasible to refer to the State department.

The thread-measuring reel will be of occasional use only.

The hopper funnel for testing dry measures will be found to be of great importance and should be procured.

STANDARDS AND EQUIPMENT FOR FIELD WORK

In selecting this equipment it is not necessary to purchase as high grade apparatus as in the case of primary or office standards, since this need not be adjusted to the same degree of accuracy. The permanency of the adjustment should be carefully considered, however, since otherwise constant readjustments will have to be made. The question of the convenience and rapidity with which such apparatus may be handled rises in the scale of importance and becomes one of the largest factors, since even a small saving in time and work will be of very great value in the aggregate on account of the constant use to which this apparatus will be subjected.

Below is given a list of competent working standards which will be found satisfactory to do the more common work. Each inspector should carry as much of this set as will be necessary to do the proper kind of work to be attempted on any particular tour of inspection.

All of the apparatus should be packed in boxes which will be strong enough to withstand the wear and tear which will necessarily be encountered and should be so arranged therein as to be easily accessible for use. Also all the apparatus possible should be packed in one portable suit case or kit, which should not be too heavy to permit of convenient carrying, since experience has amply demonstrated that apparatus when so assembled is by far the most convenient and efficient in actual use.

ORDINARY INSPECTIONS AND TESTS

Forty (or more) 50-pound cast-iron test weights.

Set of grip-handled weights, 20, 20, 10, 5 pounds.

Set of weights, two 2-pound to two $\frac{1}{32}$-ounce, with one additional 2-pound weight, if desired.

Set of weights, 20 grains to $\frac{1}{10}$ grain.

One 1-pound flat cylindrical slotted weight (diameter to be about 105 millimeters).

(The above weights should conform to the tolerances and specifications of the Bureau of Standards for Class C weights.)

One set of liquid measures, 1 gallon to 1 gill, with a tolerance graduate, capacity 3 cubic inches by $\frac{1}{10}$ cubic inch.

(The measures from the 1-quart size down should preferably be of the nested form, in which case they can be included in the portable kit mentioned.)

One special double-scale cylindrical glass graduate, having the following graduations: 1, ½, and ¼ pint, dry measure, and 1 pint, ½ pint, and 1 gill, liquid measure.

(If the nested measures are selected, this graduate becomes unnecessary, since berry baskets, etc., may be subjected to the dimensional measurement test described elsewhere.)

One dry-measure gage.

One 6-foot steel tape.

One portable balance having a capacity of about 10 pounds and a sensibility reciprocal of about 1 grain.

One inside and outside caliper, sealing dies, lead seals, seal press, record forms, etc., and a few tools of the kind necessary in making simple adjustments on apparatus, such as a screw-driver, hammer, level, pliers, wrenches, adjusting pins, etc.

TESTS OF GLASS GRADUATES[9]

If glass graduates are to be tested in the field, the set of nested liquid measures mentioned heretofore should include a ½-gill (2-liquid-ounce) measure, and two additional cylindrical graduates should be furnished, as follows: One ½-ounce graduate for testing small subdivisions on large graduates, and a tolerance graduate, either of a capacity of 10 milliliters subdivided to 0.2 milliliter, or of 120 minims subdivided to 5 minims, according as the table of tolerances in the metric system or in the customary system is to be used. A small inside caliper for measuring the inside diameter of graduates at various points is also essential.

The standards to be used for testing glass graduates in the office have already been described.

TESTS OF PRESCRIPTION SCALES

For the testing of prescription balances and scales some additional apparatus is necessary. There are prescription weights in both the metric and customary systems in

[9] If glass graduates and prescription balances and scales are to be tested on special trips or by special inspectors, then it may be found advisable to have a special kit made up including only such apparatus as will be used in these lines of work.

common use, and the inspector must be equipped to test in both systems. A small balance will also be indispensable, as the portable balance carried in the kit is wholly unsuited for this kind of work.

This apparatus may also be employed in the testing of jewelers' balances and weights, in case such work is done.

Weights.—Set of prescription weights in the apothecaries' system, as follows: 1, 1 [10] ounce, 4, 2, 2, 1, ½ drams, 2, 1 scruples, 10, 5, 2, 2, 1, 0.5, 0.2, 0.2, 0.1, 0.05 grains.

Set of prescription weights in the metric system, as follows: 20, 20,[10] 10, 10,[10] 5, 2, 2, 1 grams, 500, 200, 200, 100, 50, 20, 20, 10, 5 milligrams.

Both of the above sets of weights must be adjusted to the tolerance of Class B of the Bureau's requirements, in order that the accuracy necessary in these tests may be obtained.

Balance.—Portable equal-arm hanging-pan balance, having a capacity of from 1 to 2 ounces, or 30 to 60 grams, and a sensibility reciprocal of 0.02 grain, or 1 milligram.

ADDITIONAL TESTS

For some special lines of work, additional apparatus must be procured. Thus, if metric weights or measures are to be tested, appropriate working standards must be obtained to enable this work to be done, etc.

[10] The 1-ounce weight and the 20 and 10 gram weights are duplicated to facilitate the test of an equal-arm apothecaries' scale having the usual capacity of 1 ounce, or 30 grams.

PART IV.—SYSTEM OF RECORDS FOR OFFICE AND FIELD USE

GENERAL REQUIREMENTS

One essential to the proper and efficient prosecution of weights and measures inspection work that has often been neglected heretofore is a simple and complete system of recording the work done by the department. Such a system includes a series of forms for field and office use and a method of summarizing and filing these forms, to the various ends that the progress and completeness of the work can be determined, tabulated, and demonstrated at any time and reports quickly and easily prepared, and furthermore, that the record of any merchant can be obtained immediately for scrutiny, as in the case of a pending prosecution, etc. While it is very advisable that the system adopted be complete, it is also necessary that it be as simple as possible without sacrificing any requisite. Caution should be exercised, therefore, in the selection of a system so that the one installed may not be too complex or cumbersome on account of duplication of records, the recording of facts that might well be omitted, or any other cause. For in this case the office work will tend to become topheavy and overshadow or encumber the work in the field which it is supposed to assist and simplify. In this event, if the official, on account of the lack of a sufficient office force, is obliged to do part of this unnecessary work himself, the field work, which is much more important, will suffer; and if the work is intrusted to a sufficient force of clerks, the cost of the work will absorb more than its proper share of the funds available to the department.

SCOPE OF SYSTEM DESCRIBED

A system of forms and records is described in the following pages which is believed to be sufficiently complete to cover the subjects touched upon and which, at the same time, is not open to the objection of complexity. The system, as described, is made applicable to one force of men under a common head, as in a city or county. However, it can be applied without material modification to a State where the work is done wholly by a State department, and it can also be applied without great change to a State in which part or even all of the sealing work is done by local officials, under the supervision of a State department of weights and measures. If, for any reason, the system as described can not be installed as a whole, it may be simplified to suit other needs; and at any rate, some of the forms presented may be found of service.

LIST OF FORMS

The comp'ete system embraces forms as follows:

1. Certificate of inspection of apparatus. (Document size.) (To be made out in duplicate or triplicate in office or field at the time the tests are made.)

2. Package reweighing form. (Document size.) (To be filled out as in 1, above.)

3. Prosccution record form. (Document size.) (For each case commenced in court; data should show name of offender, charge, details of offense, time, place, and result of trial, penalty, remarks, etc.)

4. Daily report form for inspectors. (Document size.) (To be filled in daily by each inspector in actual employ of department.)

5. Ledger page. (Loose leaf.) (For entries from forms 1, 2, and 3 (or from Form 4). To contain all information to be obtained from above forms. The work of inspector in direct employ to be entered each day.)

6. Form card for index of tradesmen. (3 by 5 inches.) (Every person for whom inspections are made should be entered on a separate card. These cards should be filed in alphabetical order.)

MANNER OF USE OF FORMS

1. Certificate of Inspection of Apparatus.—Whenever a weight or measure is inspected by a weights and measures inspector or department, some written evidence of the fact of inspection, the kind and class of instrument, its accuracy or inaccuracy, and its disposition should be made out, and copies should be retained by the owner of the apparatus and by the inspector. This form is prepared for the reception of the above data. The inspector should keep his record for the sake of tabulating and summarizing his work and to obtain a history of each merchant; the merchant should retain his latest certificate to prove the fact that his apparatus has been inspected in accordance with law. At the close of each day's work in the field the inspector will have a record for each store in which apparatus was inspected during the day. These are afterwards filed in the main office under the merchant's file number assigned as hereafter described.

2. Package Reweighing Form.—The reweighing or remeasuring of various packages and amounts of commodity has been emphasized as a most important detail of the inspector's work, and a record of each such reweighing or remeasuring should invariably be kept by the official in order to furnish evidence for prosecutions in some cases, in order to show general prevailing conditions and from time to time the gradual change of conditions, and in order to obtain a general record of each merchant in

his jurisdiction. Each merchant's store, in which packages are reweighed, should be entered on a separate slip whether only a few or many packages have been reweighed. There is no particular reason why the merchant should be given a copy of these results, therefore it would seem that they need not be made out in duplicate. These are afterwards filed in the same way as Form No. 1.

3. Prosecution Record Form.—It is very important for the official to know the details of every prosecution inaugurated by his department, this not only while it is progressing but at all times thereafter, so that the complete past record of a merchant found delivering short weight or mentioned in a complaint can be thoroughly scrutinized; also, in cases where a second or subsequent offense is punishable by a more severe sentence, the former record of an offender must be readily provable. This form fulfills all the above necessities. It is to be filled out at intervals from the discovery of the commission of the offense until the final disposition of the case. These afterwards are filed in the same way as Form No. 1.

4. Daily Report Form for Inspectors.—This form should be turned in or sent to the office at the close of the day's work of each inspector and should include a summary of the results detailed on Forms 1, 2, and 3 described above, and a record of any special work done. The figures from this form are now ready to be entered into the appropriate columns in ledger Form No. 5 described below. They also furnish the chief official with a record of the movements and accomplishments of each man in his employ at the completion of each day's work. These should be filed under the inspector's name.

5. Ledger Page.—The ledger form should be so made out that it will include most or all of the material which it is desired to tabulate in any general report of work done. The mere addition of the various columns should show the number of each class of apparatus that has been inspected, and also the fact of accuracy or inaccuracy and the disposition made in each case, during any given period. It should show the number of packages or amounts of commodity reweighed or remeasured, the number of prosecutions filed with the result in each case, etc. As mentioned above the work of each inspector can be entered daily upon the receipt of his daily report, this information occupying one line. Each inspector should be assigned a separate page and his work totaled each month.

6. Index Card of Tradesmen.—A card index of the various persons, firms, etc., whose weights and measures are inspected, is believed to be very necessary in order that a merchant's entry record may always be easily accessible in the files and in order that the thoroughness of the inspection service in covering the various places of business in any city, town, or county, or portion thereof, may be determined. This index, if it is to be of maximum value, should be as accurate and complete as possible. It may be built up gradually or it may sometimes be obtained almost complete at its inception. Thus, if tradesmen are required to be licensed, it can often be procured from the license lists. However, if no such lists are available, the basis of the index may be procured from a commercial directory and thereafter it will be filled up gradually as new tradesmen's names are determined from the

certificates of inspection of apparatus turned in by the inspectors.

The simplest form of card is one which contains blank spaces for entering the name, business, and address of the dealer, and a number of blank spaces grouped in columns under a series of consecutive years in which can be placed the day and month, or simply the month, of each inspection made in his store, as evidenced by the certificates of inspection. In the upper right-hand corner should be placed a serial number permanently assigned to the merchant. The cards should be arranged in the file in alphabetical order.

GENERAL PROCEDURE FOLLOWED IN KEEPING RECORDS

The manner of keeping records has been indicated by the above, but the procedure may be made plainer by following the process through as follows: Every time an inspection of a piece of commercial apparatus is made, either in the field or in the office, by any inspector or employee, a certificate of inspection of apparatus (Form No. 1) is duly made out and signed and a duplicate retained by the inspector. Also, whenever any packages or amounts of commodities are reweighed or remeasured, the data is entered on a package reweighing form (Form No. 2) which is retained by the inspector. Whenever a prosecution is commenced, a prosecution record form (Form No. 3) is started and filled in from time to time until the record is complete. All the above forms properly filled out are turned in to the office from time to time, for instance, once a week, or whenever a book is filled up, or at stated intervals, as required. At the close of each day's work, each inspector summarizes his work of that day from the forms in his possession upon the daily report

form (Form No. 4), filling in each blank in this form. He then turns in this report to the office. When the daily report forms are received at the office, the data contained therein are transferred to the ledger page (Form No. 5) devoted to the work of this inspector, and the daily reports are then filed. The ledger pages are totaled each month, and the addition of the totals for the various inspectors shows the total work accomplished during the month.

When a number of certificates of inspection of apparatus and package-reweighing certificates are received at the office, each is taken in turn and the merchant's card located in the card-index files. (If no card is found, one is properly made out.) The day and the month or simply the month on the certificate of inspection are then entered in one of the blank spaces on the card under the appropriate year, and the number of the card is placed in the upper right-hand corner of the certificate of inspection or package-reweighing form. The card is then replaced in the index, and the certificate of inspection or package-reweighing form is filed under the number placed upon it. When a complete prosecution form is sent in, this is numbered and filed in the same way.

It results that the entire past record of the merchant appears under one number in the file and can be easily located by an examination of the alphabetical card index. Also that by examination of the dates of last inspection appearing on the cards, neglect of inspections can be quickly located and the reason therefor investigated. To keep the index up to date, the card of any merchant may be stamped "Out of business," in the event that this is found to be the case; and every new merchant can be

entered in the index as soon as his name appears on a certificate of inspection or package-reweighing certificate.

EXTENSION OF SYSTEM

Other forms, such as coal-reweighing certificates, etc., can readily be incorporated into the system as found necessary.

For more complete descriptions of office systems and forms see the article on "Method of keeping city sealers' records" in the Report of the Seventh Annual Conference on Weights and Measures, and the article on "System of keeping records" in the Report of the Tenth Conference, describing the systems used by the Chicago and Philadelphia departments, respectively.

APPENDIXES

APPENDIX I.—FEDERAL LAWS IN RELATION TO WEIGHTS AND MEASURES

STANDARD-BARREL LAW

[38 Stat., ch. 158, p. 1186, 63d Cong.]

An Act To fix the standard barrel for fruits, vegetables, and other dry commodities.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the standard barrel for fruits, vegetables, and other dry commodities other than cranberries shall be of the following dimensions when measured without distention of its parts: Length of stave, twenty-eight and one-half inches, diameter of heads, seventeen and one-eighth inches; distance between heads, twenty-six inches; circumference of bulge, sixty-four inches, outside measurement; and the thickness of staves not greater than four-tenths of an inch: *Provided,* That any barrel of a different form having a capacity of seven thousand and fifty-six cubic inches shall be a standard barrel. The standard barrel for cranberries shall be of the following dimensions when measured without distention of its parts: Length of staves, twenty-eight and one-half inches; diameter of head, sixteen and one-fourth inches; distance between heads, twenty-five and one-fourth inches; circumference of bulge, fifty-eight and one-half inches, outside measurement; and the thickness of staves not greater than four-tenths of an inch.

SEC. 2. That it shall be unlawful to sell, offer, or expose for sale in any State, Territory, or the District of Columbia, or to ship from any State, Territory, or the District of Columbia to any other State, Territory, or the District of Columbia or to a foreign country, a barrel containing fruits or vegetables or any other dry commodity of less capacity than the standard barrels defined in the first section of this Act, or subdivisions thereof known as the third, half, and three-quarters barrel, and any person guilty of a willful violation of any of the provisions of this Act shall be deemed guilty of a misdemeanor and be liable to a fine not to exceed $500, or imprisonment not to exceed six months, in the court of the United States having jurisdiction: *Provided, however,* That no barrel shall be deemed below standard within the meaning of this Act when shipped to any foreign country and constructed according to the specifications or directions

of the foreign purchaser if not constructed in conflict with the laws of the foreign country to which the same is intended to be shipped.

SEC. 3. That reasonable variations shall be permitted and tolerance shall be established by rules and regulations made by the Director of the Bureau of Standards and approved by the Secretary of Commerce. Prosecutions for offenses under this Act may be begun upon complaint of local sealers of weights and measures or other officers of the several States and Territories appointed to enforce the laws of the said States or Territories, respectively, relating to weights and measures: *Provided, however*, That nothing in this Act shall apply to barrels used in packing or shipping commodities sold exclusively by weight or numerical count.

SEC. 4. That this Act shall be in force and effect from and after the first day of July, nineteen hundred and sixteen.

Approved, March 4, 1915.

RULES AND REGULATIONS PROMULGATED UNDER AUTHORITY OF THE FEDERAL STANDARD-BARREL LAW [11]

In accordance with the provisions of section 3 of the act to fix the standard barrel for fruits, vegetables, and other dry commodities (38 Stat., ch. 158, p. 1186, 63d Cong.), approved March 4, 1915, there are hereby promulgated rules and regulations made by the Director of the Bureau of Standards and approved by the Secretary of Commerce.

PARAGRAPH 1. (*a*) The capacities of the standard barrel for fruits, vegetables, and other dry commodities,[12] other than cranberries, and its subdivisions, are as follows:

Size	Cubic inches	Bushels [a]	Quarts [a]
Barrel	7056	3.281	105
¾ barrel	5292	2.461	78¾
½ barrel	3528	1.641	52½
⅓ barrel	2352	1.094	35

[a] Struck measure.

[11] Department of Commerce, Circular of the Bureau of Standards No. 71.

[12] Lime is not included within the purview of the law or of these rules and regulations, since a more recent act (39 Stat., ch. 396, p. 530, 64th Cong.) has established standard barrels especially for lime upon a weight basis.

(*b*) The capacities of the standard cranberry barrel and its subdivisions are as follows:

Size	Cubic inches	Bushels [a]	Quarts [a]
Cranberry barrel	5826	2.709	$86\frac{45}{64}$
¾ cranberry barrel	4369.5	2.032	$65\frac{1}{64}$
½ cranberry barrel	2913	1.355	$43\frac{11}{32}$
⅓ cranberry barrel	1942	0.903	$28\frac{29}{32}$

[a] Struck measure.

PAR. 2. (*a*) Any barrel having the dimensions specified for a standard barrel for fruits, vegetables, and other dry commodities other than cranberries, in section 1 of the standard-barrel law, or any barrel or a subdivision thereof having the contents specified in section 1 of the standard-barrel law and in paragraph 1 (*a*) of these rules and regulations, regardless of its form or dimensions, is a legal standard barrel for fruits, vegetables, or other dry commodities other than cranberries, or a legal subdivision thereof. No other barrel or subdivision in barrel form is a legal container for fruits, vegetables, or other dry commodities other than cranberries.

(*b*) Any barrel having the dimensions specified for a standard barrel for cranberries in section 1 of the standard-barrel law, or any subdivision thereof having the contents specified in paragraph 1 (*b*) of these rules and regulations, regardless of its form or dimensions, is a legal standard barrel for cranberries or a legal subdivision thereof. No other barrel or subdivision in barrel form is a legal container for cranberries.

PAR. 3. The tolerance established hereafter for the dimension specified as "distance between heads" shall be applied as follows on the various types of barrels in use:

(*a*) When a barrel or subdivision thereof has two heads, the tolerance shall be applied to the distance between the inside surfaces of the heads and perpendicular to them.

(*b*) When a barrel or subdivision thereof has but one head and a croze ring or other means for the insertion of a head, such as an inside hoop, etc., at the opposite end, the tolerance shall be applied

to the distance from the inside surface of the bottom head and perpendicular to it to the inside edge of the croze ring, or to a point where the inside surface of a head would come were such head inserted in the barrel.

(*c*) When a barrel or subdivision thereof has but one head and no croze ring or other means for the insertion of a head, such as an inside hoop, etc., at the opposite end, the tolerance shall be applied to the distance from the inside surface of the bottom head and perpendicular to it to a point 1⅛ inches from the opposite end of the staves in the case of a barrel or a ¾ barrel, and to a point 1 inch or ⅞ inch from the opposite end of the staves in the case of the ½ barrel and ⅓ barrel, respectively. When a barrel or subdivision thereof has been manufactured with but one head and no croze ring or other means for the insertion of a head at the opposite end, and it is desired to insert a second head, the croze ring shall be so cut that the inside edge shall not be more than 1⅛ inches from the end of the staves in the case of a barrel or ¾ barrel or not more than 1 inch or ⅞ inch from the end of the staves in the case of the ½ barrel and ⅓ barrel, respectively, or the other means shall be so adjusted that the inside surface of the head when inserted shall not exceed these distances from the end of the staves.

PAR. 4. The tolerance established hereafter for the dimension specified as "diameter of head" shall be applied to the diameter of the head over all, including the part which fits into the croze ring of the completed barrel.

The tolerance established hereafter for the dimension specified as "effective diameter of head" shall be applied as follows on the various types of barrels and subdivisions in use:

(*a*) When a barrel or subdivision thereof has two heads, the tolerance shall be applied to the mean of the average diameters from inside to inside of staves at the inner edges of the heads.

(*b*) When a barrel or subdivision thereof has but one head and a croze ring or other means for the insertion of a head at the opposite end, the tolerance shall be applied to the mean of the average diameters, one taken from inside to inside of staves at the inner edge of the head, the other from inside to inside of staves at the inner edge of the croze ring, or from inside to inside

of staves at a point where the inside surface of a head would come were such head inserted in the barrel.

(*c*) When a barrel or subdivision thereof has but one head and no croze ring or other means for the insertion of a head at the opposite end, the tolerance shall be applied to the mean of the average diameters, one taken from inside to inside of staves at the inner edge of the head, the other taken from inside to inside of staves at a point 1⅛ inches from the end of the staves in the case of a barrel or ¾ barrel, or at a point 1 inch or ⅞ inch from the end of the staves in the case of a ½ barrel or ⅓ barrel, respectively.

The standard allowance for depth of croze ring shall be $\frac{3}{16}$ inch. Therefore, the standard "effective diameter of head" in the case of the standard barrel is 16¾ inches and in the case of the standard cranberry barrel is 15⅞ inches.

PAR. 5. Whenever in these rules and regulations the error on a dimension is mentioned, this error shall be determined by taking the difference between the actual measured dimension and the standard dimension. The error is an error in excess and is to be preceded by a plus sign when the measured dimension is greater than the standard dimension. The error is an error in deficiency and is to be preceded by a minus sign when the measured dimension is less than the standard dimension.

(*a*) The standard dimensions of a barrel for fruits, vegetables, and other dry commodities other than cranberries, and of a barrel for cranberries, with which the actual measured dimensions are to be compared, are as follows:

Dimensions	Barrel for fruits, vegetables, and other dry commodities other than cranberries	Barrel for cranberries
	Inches	Inches
Diameter of head	17⅛	16¼
Effective diameter of head (see par. 4)	16¾	15⅞
Distance between heads	26	25¼
Circumference of bulge, outside measurement	64	58½
Length of stave	28½	28½

(*b*) In the case of all subdivisions of the barrel for fruits, vegetables, and other dry commodities other than cranberries, and all subdivisions of the barrel for cranberries, the following dimensions are hereby standardized for the purpose of the application of tolerances, and the actual measured dimensions are to be compared with these:

Subdivisions of Barrel for Fruits, Vegetables, and other Dry Commodities other than Cranberries

Dimensions	¾ barrel	½ barrel	⅓ barrel
	Inches	Inches	Inches
Effective diameter of head (see par. 4)	15¼	13⅜	11⅝
Distance between heads	23½	20½	18
Circumference of bulge, outside measurement	58½	51½	45¼

Subdivisions of Barrel for Cranberries

Dimensions	¾ barrel	½ barrel	⅓ barrel
	Inches	Inches	Inches
Effective diameter of head (see par. 4).	14⅜	12⅝	11
Distance between heads	23	20	17½
Circumference of bulge, outside measurement	53⅜	47	41⅜

PAR. 6. For the purpose of the application of tolerances, barrels for fruits, vegetables, and other dry commodities other than cranberries, are hereby divided into two classes as follows:

Class 1 shall include (*a*) all barrels no dimension of which is in error by more than the following amounts, and (*b*) all barrels one or more of the dimensions of which are in error by more than the following amounts, and which in addition have no dimension in error in the opposite direction:

	Error, inches
Effective diameter of head	¼
Distance between heads	¼
Circumference of bulge, outside measurement	1½

Class 2 shall include all barrels at least one dimension of which is in error by more than the amounts given above, but which in addition have at least one dimension in error in the opposite direction. (This class includes all barrels mentioned in section 1 of the law in the proviso reading: "*Provided*, That any barrel of a different form having a capacity of seven thousand and fifty-six cubic inches shall be a standard barrel.")

PAR. 7. (*a*) The tolerances to be allowed in excess or in deficiency on the dimensions of all barrels of class 1 shall be as follows:

	Tolerance, inches
Diameter of head	¼
Effective diameter of head	¼
Distance between heads	¼
Circumference of bulge, outside measurement	1½
Length of stave	½

If no dimension of a barrel of class 1 is in error by more than the tolerance given above, then the barrel is within the tolerance allowed.

If one or more of the dimensions of a barrel of class 1 is in error by more than the tolerance given above, then the barrel is not within the tolerance allowed.

(*b*) The tolerance to be allowed in excess or in deficiency on all barrels of class 2 shall be 1½ inches (1.5 inches), and this tolerance is to be applied to the result obtained by the application of the following rule:

Having determined the error of each dimension and given to each its proper sign (see par. 5), add the errors on the effective diameter of head and the distance between heads algebraically and multiply the result by 1.67 (or 5/3). Then add this result to the error on the circumference of bulge algebraically. If the result obtained is not greater than the tolerance given above, then the barrel is within the tolerance allowed; if the result is greater than this tolerance, then the barrel is not within the tolerance allowed.

NOTE.—To find the algebraic sum of a number of quantities having different signs, first add all those having one sign; then add all those having the opposite sign; then subtract the smaller sum from the larger, giving this result the sign of the larger quantity.

(*c*) The tolerance to be allowed in excess or in deficiency on the dimensions of all barrels for cranberries shall be as follows:

	Tolerance, inches
Diameter of head	¼
Effective diameter of head	¼
Distance between heads	¼
Circumference of bulge, outside measurement	1⅜
Length of stave	½

If no dimension of a barrel for cranberries is in error by more than the tolerance given above, then the barrel is within the tolerance allowed.

If one or more of the dimensions of a barrel for cranberries is in error by more than the tolerance given above, then the barrel is not within the tolerance allowed.

(*d*) The tolerances to be allowed in excess or in deficiency on all subdivisions of the standard barrel for fruits, vegetables, and other

dry commodities other than cranberries, and on all subdivisions of the standard barrel for cranberries, shall be the values given in the following table, and these tolerances are to be applied to the result obtained by the application of the following rule:

Having determined the error on each dimension and given to each its proper sign (see par. 5), add the errors on the effective diameter of head and the distance between heads algebraically and multiply the result by 1.67 (or 5/3). Then add this result to the error on the circumference of bulge algebraically. If the result obtained is not greater than the tolerance given in the following table for the proper subdivision, then the barrel is within the tolerance allowed; if the result is greater than this tolerance, then the barrel is not within the tolerance allowed.

Size of subdivision	Tolerance	
	For fruits, vegetables, and other dry commodities	For cranberries
	Inches	Inches
¾ barrel	1⅜ (1.375)	1¼ (1.25)
½ barrel	1¼ (1.25)	1⅛ (1.125)
⅓ barrel	1⅛ (1.125)	1 (1.00)

S. W. STRATTON, *Director.*

Approved:

WILLIAM C. REDFIELD, *Secretary.*

WASHINGTON, *June 30, 1917.*

NOTE.—The above rules and regulations refer entirely to individual barrels, and no separate tolerance has been placed on the average content of a number of barrels taken at random from a shipment. It is not believed that barrels can be so made as to take advantage of the tolerances, and, of course, no attempt should be made to do this. It is, therefore, expected that as many barrels will be above as below the standard capacity. Investigations will be conducted during the present shipping season for the purpose of ascertaining whether this expectation is fulfilled. If it is not, then additional regulations will be issued in the future governing this matter.

STANDARD APPLE-BARREL LAW

[37 Stat., ch. 273, p. 250, 62d Cong.]

An Act To establish a standard barrel and standard grades for apples when packed in barrels, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the standard barrel for apples shall be of the following dimensions when measured without distention of its parts: Length of stave, twenty-eight and one-half inches; diameter of head, seventeen and one-eighth inches; distance between heads, twenty-six inches; circumference of bulge, sixty-four inches outside measurement, representing as nearly as possible seven thousand and fifty-six cubic inches: *Provided,* That steel barrels containing the interior dimensions provided for in this section shall be construed as a compliance therewith.

SEC. 2. That the standard grades for apples when packed in barrels which shall be shipped or delivered for shipment in interstate or foreign commerce, or which shall be sold or offered for sale within the District of Columbia or the Territories of the United States shall be as follows: Apples of one variety, which are well-grown specimens, hand picked, of good color for the variety, normal shape, practically free from insect and fungous injury, bruises, and other defects, except such as are necessarily caused in the operation of packing, or apples of one variety which are not more than ten per centum below the foregoing specifications shall be "Standard grade minimum size two and one-half inches," if the minimum size of the apples is two and one-half inches in transverse diameter; "Standard grade minimum size two and one-fourth inches," if the minimum size of the apples is two and one-fourth inches in transverse diameter; or "Standard grade minimum size two inches," if the minimum size of the apples is two inches in transverse diameter.

SEC. 3. That the barrels in which apples are packed in accordance with the provision of this Act may be branded in accordance with section two of this Act.

SEC. 4. That all barrels packed with apples shall be deemed to be below standard if the barrel bears any statement, design, or device indicating that the barrel is a standard barrel of apples, as herein defined, and the capacity of the barrel is less than the capacity prescribed by section one of this Act, unless the barrel shall be plainly marked on end and side with words or figures showing the fractional relation which the actual capacity of the barrel bears to the capacity prescribed by section one of this Act. The marking required by this paragraph shall be in block letters of size not less than seventy-two point one-inch gothic.

SEC. 5. That barrels packed with apples shall be deemed to be misbranded within the meaning of this Act—

First. If the barrel bears any statement, design, or device indicating that the apples contained therein are "Standard" grade and the apples when packed do not conform to the requirements prescribed by section two of this Act.

Second. If the barrel bears any statement, design, or device indicating that the apples contained therein are "Standard" grade and the barrel fails to bear also a statement of the name of the variety, the name of the locality where grown, and the name of the packer or the person by whose authority the apples were packed and the barrel marked.

SEC. 6. That any person, firm or corporation, or association who shall knowingly pack or cause to be packed apples in barrels or who shall knowingly sell or offer for sale such barrels in violation of the provisions of this Act shall be liable to a penalty of one dollar and costs for each such barrel so sold or offered for sale, to be recovered at the suit of the United States in any court of the United States having jurisdiction.

SEC. 7. That this Act shall be in force and effect from and after the first day of July, nineteen hundred and thirteen.

Approved, August 3, 1912.

STANDARD LIME-BARREL ACT

[39 Stat., ch. 396, p. 530, 64th Cong.]

An Act To standardize lime barrels.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That there is hereby established a large and a small barrel of lime, the large barrel to consist of two hundred and eighty pounds and the small barrel to consist of one hundred and eighty pounds, net weight.

SEC. 2. That it shall be unlawful for any person to sell or offer for sale lime imported in barrels from a foreign country, or to sell or offer for sale lime in barrels for shipment from any State or Territory or the District of Columbia, to any other State or Territory or the District of Columbia, unless there shall be stencilled or otherwise clearly marked on one or both heads of the small barrel the figures "180 lbs. net" and of the large barrel the figures "280 lbs. net" before the importation or shipment, and on either barrel in addition the name of the manufacturer of the lime and where manufactured, and, if imported, the name of the country from which it is imported.

SEC. 3. When lime is sold in interstate or foreign commerce in containers of less capacity than the standard small barrel, it shall be sold in fractional parts of said standard small barrel, and the net weight of lime contained in such container shall by stencil or otherwise be clearly marked thereon, together with the name of the manu-

facturer thereof, and the name of the brand, if any, under which it is sold, and, if imported, the name of the country from which it is imported.

SEC. 4. That rules and regulations for the enforcement of this Act, not inconsistent with the provisions of the Act, shall be made by the Director of the Bureau of Standards and approved by the Secretary of Commerce, and that such rules and regulations shall include reasonable variations or tolerances which may be allowed.

SEC. 5. That it shall be unlawful to pack, sell, or offer for sale for shipment from any State or Territory or the District of Columbia to any other State or Territory or the District of Columbia, any barrels or other containers of lime which are not marked as provided in sections two and three of this Act, or to sell, charge for, or purport to deliver from any State or Territory or the District of Columbia to any other State or Territory or the District of Columbia, as a large or small barrel or a fractional part of said small barrel of lime, any less weight of lime than is established by the provisions of this Act: and any person guilty of a violation of the provisions of this Act shall be deemed guilty of a misdemeanor and be liable to a fine not exceeding $100.

SEC. 6. That it shall be the duty of each district attorney, to whom satisfactory evidence of any violation of this Act is presented, to cause appropriate proceedings to be commenced and prosecuted in the United States court having jurisdiction of such offense: *Provided, however*, That the penal provisions of this Act shall not take effect until January first, nineteen hundred and seventeen.

SEC. 7. That this Act shall be in force and effect from and after its passage.

Approved, August 23, 1916.

RULES AND REGULATIONS FOR THE ENFORCEMENT OF THE LIME-BARREL ACT.[13]

In accordance with the provisions of section 4 of the act to standardize lime barrels (39 Stat., ch. 396, p. 530, 64th Cong.), approved August 23, 1916, there are hereby promulgated rules and regulations for the enforcement of this act, made by the Director of the Bureau of Standards and approved by the Secretary of Commerce.

PARAGRAPH 1. The act, "39 Stat., ch. 396, p. 530, 64th Congress," approved August 23, 1916, entitled "An Act To standardize lime barrels," shall be known and referred to as the "Standard lime-barrel act."

PAR. 2. These rules and regulations are to be understood and construed to apply to lime in barrels, or other containers packed, sold,

[13] Department of Commerce, Circular of the Bureau of Standards No. 64.

or offered for sale for shipment from any State or Territory or the District of Columbia to any other State or Territory or the District of Columbia; and to lime in containers of less capacity than the standard small barrel sold in interstate or foreign commerce; and to lime imported in barrels from a foreign country and sold or offered for sale; also to lime not in barrels or containers of less capacity than the standard small barrel sold, charged for, or purported to be delivered as a large or small barrel or a fractional part of said small barrel of lime from any State or Territory or the District of Columbia to any other State or Territory or the District of Columbia.

PAR. 3. Lime in barrels shall be packed only in barrels containing 280 pounds or 180 pounds, net weight. For the purposes of this paragraph the word "barrel" is defined as a cylindrical or approximately cylindrical vessel, cask, or drum.

PAR. 4. The term "container of less capacity than the standard small barrel," as mentioned in section 3 of the law and as used in these rules and regulations, is defined as any container not in barrel form containing therein a net weight of lime of less than 180 pounds.

The term "label," as used in these rules and regulations, is defined as any printed, pictorial, or other matter upon the surface of a barrel or other container of lime subject to the provisions of this act, or upon cloth or paper or the like which is permanently affixed to it by pasting or in a similar manner.

The term "tag" is defined as a tough and strong strip of cloth or paper or the like, bearing any printed, pictorial, or other matter, which is loose at one end and which is secured to a container of lime subject to the provisions of this act.

PAR. 5 (*a*). The lettering required upon barrels of lime by section 2 of the law shall be as follows: The statement of net weight shall be in boldface capital letters and figures at least 1 inch in height and not expanded or condensed; it shall be clear, legible, and permanent, and so placed with reference to the other lettering that it is conspicuous. The name of the manufacturer of the lime and where manufactured, and, if imported, the name of the country from which it is imported, shall be in boldface letters at least one-half inch in height and not expanded or condensed, and shall be clear, legible, conspicuous, and permanent. None of these letters and figures shall be superimposed upon each other, nor shall any

other characters be superimposed upon the required lettering or otherwise obscure it. All the above statements shall form parts of the principal label.

(*b*) The information required upon containers of lime of less capacity than the standard small barrel by section 3 of the law shall be included in a label: *Provided, however,* That in order to allow the utilization of secondhand or returnable bags made of cloth, burlap, or the like, such information may be upon a tag firmly attached to the container in a prominent and conspicuous position. In case a tag is used to give the required information there must not be any label or another tag upon the container which bears any statement having reference to lime, or any statement of weight whatever, which is not identical with the information upon the tag mentioned above; if a container is to be utilized which bears any such inaccurate information upon a label, such container shall be turned inside out or such information shall be obliterated in so far as it is inaccurate by blotting out the letters or figures, or if such inaccurate information is upon a tag, by removing such tag.

If the required lettering is upon a label, the statement of net weight shall be in boldface capital letters and figures at least three-fourths inch in height and not expanded or condensed; it shall be clear, legible, and permanent, and so placed with reference to the other lettering that it is conspicuous. The word "net" shall form part of the statement of weight. The name of the manufacturer of the lime and the name of the brand, if any, under which it is sold, and, if imported, the name of the country from which it is imported, shall be in boldface letters at least one-half inch in height and not expanded or condensed, and shall be clear, legible, conspicuous, and permanent. None of these letters and figures shall be superimposed upon each other, nor shall any other characters be superimposed upon the required lettering or otherwise obscure it. All the above statements shall form parts of the principal label.

If the required lettering is upon a tag, the statement of net weight shall be in boldface capital letters and figures not less than one-half the height of the largest letters or figures used upon such tag: *Provided, however,* That in every case they shall be not less than one-eighth inch in height (12-point capitals), and not expanded or

condensed. The word "net" shall form part of the statement of weight. The statement shall be clear, legible, and permanent, and so placed with reference to the other lettering that it is conspicuous. The name of the manufacturer of the lime, and the name of the brand, if any, under which it is sold, and, if imported, the name of the country from which it is imported, shall be in boldface letters and figures not less than one-eighth inch in height (12-point capitals), and not expanded or condensed, and shall be clear, legible, conspicuous, and permanent. None of these letters and figures shall be superimposed upon each other nor shall any other characters be superimposed upon the required lettering or otherwise obscure it. All the above statements shall be included upon the same side of the tag.

(*c*) In case the lime is actually packed in barrels or in containers of less capacity than the standard small barrel by some person other than the manufacturer of the lime, the information mentioned above must be given in the manner there described, and in addition there must be a statement to this effect: "Packed by ——— ———" (giving the name and address of the packer). This statement shall be in letters not smaller than is specified for the general statement required in the case of barrels and containers of less capacity than the standard small barrel, respectively (see (*a*) and (*b*) above); it shall not be obscured and shall form part of the principal label or be upon the same side of the tag as in those cases provided.

(*d*) In the case of all lime sold in barrels, the actual place of manufacture of the lime shall be stated on the barrel. In general, this will be the name of the post office nearest or most accessible to the plant. However, when the actual place of manufacture of the lime and the offices of the company are separated but are within the boundaries of the same county of a State, or when, though not within the boundaries of the same county they are so close together that the post-office address of the offices represents substantially and to all intents and purposes the actual place of manufacture of the lime, then the post-office address of the offices of the company will be sufficient: *Provided, however,* That the address given shall always correctly show the State in which the lime is actually manufactured.

More than one place of manufacture of a manufacturer shall not be shown on the same barrel unless the one at which the particular lime in question is manufactured is pointed out.

If the location of the home offices is stated and this is not the place of manufacture within the meaning of the above definition, an additional statement must be included to this effect: "Manufactured at ———" (giving the location of the plant).

PAR. 6. (*a*) When lime is packed in barrels the tolerance to be allowed on the large barrel or the small barrel of lime shall be 5 pounds in excess or in deficiency on any individual barrel: *Provided, however,* That the average error on 10 barrels of the same nominal weight and packed by the same manufacturer shall in no case be greater than 2 pounds in excess or in deficiency. In case all the barrels available are not weighed, those which are weighed shall be selected at random.

(*b*) When lime is packed in containers of less capacity than the standard small barrel, the tolerance to be allowed in excess or in deficiency on individual containers of various weights, shall be the values given in the column headed "Tolerance on individual package," of the following table: *Provided, however,* That the average error on 10 containers of the same nominal weight and packed by the same manufacturer shall in no case be greater than the values given in the column headed "Tolerance on average weight," of the following table. In case all the containers available are not weighed, those which are weighed shall be selected at random.

Weight of package	Tolerance on individual package	Tolerance on average weight
Not greater than 50 lbs	1½ lbs.	⅝ lb.
More than 50 lbs. and not greater than 100 lbs	2 lbs.	¾ lb.
More than 100 lbs. and not greater than 150 lbs	3 lbs.	1¼ lbs.
More than 150 lbs. and less than 180 lbs	4 lbs.	1⅓ lbs.

(*c*) When lime in bulk is sold, charged for, or purported to be delivered as a definite number of large or small barrels, the tolerance to be allowed in excess or in deficiency on such amounts of lime shall be 15 pounds per 1800 pounds (10 small barrels), or 25 pounds per 2800 pounds (10 large barrels).

S. W. STRATTON,
Director.

Approved:
WILLIAM C. REDFIELD,
Secretary.
WASHINGTON, *March 13, 1917.*

NET-WEIGHT AMENDMENT TO THE FOOD AND DRUGS ACT

[37 Stat., ch. 117, p. 732, 62d Cong.]

An Act To amend section eight of an Act entitled "An Act for preventing the manufacture, sale, or transportation of adulterated or misbranded or poisonous or deleterious foods, drugs, medicines, and liquors, and for regulating traffic therein, and for other purposes," approved June thirtieth, nineteen hundred and six.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That section eight of an Act entitled "An Act for preventing the manufacture, sale, or transportation of adulterated or misbranded or poisonous or deleterious foods, drugs, medicines, and liquors, and for regulating traffic therein, and for other purposes," approved June thirtieth, nineteen hundred and six, be, and the same is hereby, amended by striking out the words "Third. If in package form, and the contents are stated in terms of weight or measure, they are not plainly and correctly stated on the outside of the package," and inserting in lieu thereof the following:

"Third. If in package form, the quantity of the contents be not plainly and conspicuously marked on the outside of the package in terms of weight, measure, or numerical count: *Provided, however,* That reasonable variations shall be permitted, and tolerances and also exemptions as to small packages shall be established by rules and regulations made in accordance with the provisions of section three of this Act."

SEC. 2. That this Act shall take effect and be in force from and after its passage: *Provided, however,* That no penalty of fine, imprisonment, or confiscation shall be enforced for any violation of its provisions as to domestic products prepared or foreign products imported prior to eighteen months after its passage.

Approved, March 3, 1913.

REGULATION OF MARKING THE QUANTITY OF FOOD IN PACKAGE FORM [14]

Under section 3 of the Food and Drugs Act of June 30, 1906 (34 Stat. L., p. 768–772), as amended by the act of March 3, 1913, entitled "An act to amend section eight of an act entitled 'An act for preventing the manufacture, sale, or transportation of adulterated or misbranded or poisonous or deleterious foods, drugs, medicines, and liquors, and for regulating traffic therein, and for other purposes,' approved June thirtieth, nineteen hundred and six" (37 Stat. L., p. 732), regulation 29 of the Rules and Regulations or the Enforcement of the Food and Drugs Act has been amended by Food Inspection Decisions 154, 157, 163, and 168, so as to read as follows:

Regulation 29.

STATEMENT OF WEIGHT, MEASURE, OR COUNT

(Sec. 8, par. 3, under "Food," as amended by act of Mar. 3, 1913.)

(*a*) Except as otherwise provided by this regulation, the quantity of the contents, in all cases of food, if in package form, must be plainly and conspicuously marked, in terms of weight, measure, or numerical count, on the outside of the covering or container usually delivered to consumers.

(*b*) The quantity of the contents so marked shall be the amount of food in the package.

(*c*) The statement of the quantity of the contents shall be plain and conspicuous, shall not be a part of or obscured by any legend or design, and shall be so placed and in such characters as to be readily seen and clearly legible when the size of the package and the circumstances under which it is ordinarily examined by purchasers or consumers are taken into consideration.

(*d*) If the quantity of the contents be stated by weight or measure, it shall be marked in terms of the largest unit contained in the package, except that, in the case of an article with respect to which there exists a definite trade custom for marking the quantity of the article in terms of fractional parts of larger units, it may be so marked in

[14] United States Department of Agriculture, Office of the Secretary. Regulation 29, Relating to Marking the Quantity of Food in Package Form, as Amended by Food Inspection Decisions 154, 157, 163, and 168.

accordance with the custom. Common fractions shall be reduced to their lowest terms; decimal fractions shall be preceded by zero and shall be carried out to not more than two places.

(*e*) Statements of weight shall be in terms of avoirdupois pounds and ounces; statements of liquid measure shall be in terms of the United States gallon of 231 cubic inches and its customary subdivisions—i. e., in gallons, quarts, pints, or fluid ounces, and shall express the volume of the liquid at 68° F. (20° C.); and statements of dry measure shall be in terms of the United States standard bushel of 2,150.42 cubic inches and its customary subdivisions—i. e., in bushels, pecks, quarts, or pints, or, in the case of articles in barrels, in terms of the United States standard barrel and its lawful subdivisions—i. e., third, half, or three-quarters barrel, as fixed by the act of March 4, 1915 (38 Stat., 1186): *Provided*, That statements of quantity may be in terms of metric weight or measure. Statements of metric weight should be in terms of kilograms or grams. Statements of metric measure should be in terms of liters or centiliters. Other terms of metric weight or measure may be used if it appears that a definite trade custom exists for marking articles with such other terms and the articles are marked in accordance with the custom.

(*f*) The quantity of solids shall be stated in terms of weight and of liquids in terms of measure, except that in case of an article in respect to which there exists a definite trade custom otherwise, the statement may be in terms of weight or measure in accordance with such custom. The quantity of viscous or semisolid foods, or of mixtures of solids and liquids, may be stated either by weight or measure, but the statement shall be definite and shall indicate whether the quantity is expressed in terms of weight or measure, as, for example, "Weight 12 oz.," or "12 oz. avoirdupois"; "Volume 12 ounces," or "12 fluid ounces."

(*g*) The quantity of the contents shall be stated in terms of weight or measure unless the package be marked by numerical count and such numerical count gives accurate information as to the quantity of the food in the package.

(*h*) The quantity of the contents may be stated in terms of minimum weight, minimum measure, or minimum count, for example, "minimum weight 10 oz.," "minimum volume 1 gallon," or "not

less than 4 oz.": but in such case the statement must approximate the actual quantity and there shall be no tolerance below the stated minimum.

(*i*) The following tolerances and variations from the quantity of the contents marked on the package shall be allowed:

(1) Discrepancies due exclusively to errors in weighing, measuring, or counting which occur in packing conducted in compliance with good commercial practice.

(2) Discrepancies due exclusively to differences in the capacity of bottles and similar containers resulting solely from unavoidable difficulties in manufacturing such bottles or containers so as to be of uniform capacity: *Provided*, That no greater tolerance shall be allowed in case of bottles or similar containers which, because of their design, can not be made of approximate uniform capacity than is allowed in case of bottles or similar containers which can be manufactured so as to be of approximate uniform capacity.

(3) Discrepancies in weight or measure, due exclusively to differences in atmospheric conditions in various places, and which unavoidably result from the ordinary and customary exposure of the packages to evaporation or to the absorption of water.

Discrepancies under classes (1) and (2) of this paragraph shall be as often above as below the marked quantity. The reasonableness of discrepancies under class (3) of this paragraph will be determined on the facts in each case.

(*j*) A package containing 2 avoirdupois ounces of food or less is "small" and shall be exempt from marking in terms of weight.

(*k*) A package containing 1 fluid ounce of food or less is "small" and shall be exempt from marking in terms of measure.

(*l*) When a package is not required by paragraph (*g*) to be marked in terms of either weight or measure, and the units of food therein are six or less, it shall, for the purpose of this regulation, be deemed "small" and shall be exempt from marking in terms of numerical count.

W. G. McAdoo,
Secretary of the Treasury.
D. F. Houston,
Secretary of Agriculture.
William C. Redfield,
Secretary of Commerce.

STANDARD CONTAINER ACT

39 Stat., ch. 426, p. 673, 64th Cong.]

An Act To fix standards for Climax baskets for grapes and other fruits and vegetables, and to fix standards for baskets and other containers for small fruits, berries, and vegetables, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That standards for Climax baskets for grapes and other fruits and vegetables shall be the two-quart basket, four-quart basket, and twelve-quart basket, respectively:

(a) The standard two-quart Climax basket shall be of the following dimensions: Length of bottom piece, nine and one-half inches; width of bottom piece, three and one-half inches; thickness of bottom piece, three-eighths of an inch; height of basket, three and seven-eighths inches, outside measurement; top of basket, length eleven inches and width five inches, outside measurement. Basket to have a cover five by eleven inches, when a cover is used.

(b) The standard four-quart Climax basket shall be of the following dimensions: Length of bottom piece, twelve inches; width of bottom piece, four and one-half inches; thickness of bottom piece, three-eighths of an inch; height of basket, four and eleven-sixteenths inches, outside measurement; top of basket, length fourteen inches, width six and one-fourth inches, outside measurement. Basket to have cover six and one-fourth inches by fourteen inches, when cover is used.

(c) The standard twelve-quart Climax basket shall be of the following dimensions: Length of bottom piece, sixteen inches; width of bottom piece, six and one-half inches; thickness of bottom piece, seven-sixteenths of an inch; height of basket, seven and one-sixteenth inches, outside measurement; top of basket, length nineteen inches, width nine inches, outside measurement. Basket to have cover nine inches by nineteen inches, when cover is used.

SEC. 2. That the standard basket or other container for small fruits, berries, and vegetables shall be of the following capacities, namely, dry one-half pint, dry pint, dry quart, or multiples of the dry quart.

(a) The dry half pint shall contain sixteen and eight-tenths cubic inches.

(b) The dry pint shall contain thirty-three and six-tenths cubic inches.

(c) The dry quart shall contain sixty-seven and two-tenths cubic inches.

SEC. 3. That it shall be unlawful to manufacture for shipment, or to sell for shipment, or to ship from any State or Territory of the United States or the District of Columbia to any other State or Territory of the United States or the District of Columbia, any Climax

baskets or other containers for small fruits, berries, or vegetables, whether filled or unfilled, which do not conform to the provisions of this Act; and any person guilty of a willful violation of any of the provisions of this Act shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined in any sum not exceeding $25: *Provided*, That nothing herein contained shall apply to the manufacture, sale, or shipment of Climax baskets, baskets, or other containers for small fruits, berries, and vegetables when intended for export to foreign countries when such Climax baskets, baskets, or other containers for small fruits, berries, and vegetables accord with the specifications of the foreign purchasers or comply with the law of the country to which shipment is made or to be made.

SEC. 4. That the examination and test of Climax baskets, baskets, or other containers for small fruits, berries, and vegetables, for the purpose of determining whether such baskets or other containers comply with the provisions of this Act, shall be made by the Department of Agriculture, and the Secretary of Agriculture shall establish and promulgate rules and regulations allowing such reasonable tolerances and variations as may be found necessary.

SEC. 5. That it shall be the duty of each district attorney, to whom satisfactory evidence of any violation of the Act is presented, to cause appropriate proceedings to be commenced and prosecuted in the proper court of the United States for the enforcement of the penalties as in such case herein provided.

SEC. 6. That no dealer shall be prosecuted under the provisions of this Act when he can establish a guaranty signed by the manufacturer, wholesaler, jobber, or other party residing within the United States from whom such Climax baskets, baskets, or other containers, as defined in this Act, were purchased, to the effect that said Climax baskets, baskets, or other containers are correct within the meaning of this Act. Said guaranty, to afford protection, shall contain the name and address of the party or parties making the sale of Climax baskets, baskets, or other containers to such dealer, and in such case said party or parties shall be amenable to the prosecutions, fines, and other penalties which would attach in due course to the dealer under the provisions of this Act.

SEC. 7. That this Act shall be in force and effect from and after the first day of November, nineteen hundred and seventeen.

Approved, August 31, 1916.

RULES AND REGULATIONS OF THE SECRETARY OF AGRICULTURE UNDER THE UNITED STATES STANDARD CONTAINER ACT [15]

REGULATION 1.—DEFINITIONS

SECTION 1. Words used in these regulations in the singular form shall be deemed to import the plural, and vice versa, as the case may demand.

SEC. 2. For the purposes of these regulations, unless the context otherwise require, the following terms shall be construed, respectively, to mean—

Paragraph 1. *Standard container act.*—The act entitled "An Act To fix standards for Climax baskets for grapes and other fruits and vegetables, and to fix standards for baskets and other containers for small fruits, berries, and vegetables, and for other purposes," approved August 31, 1916 (39 Stat. L., p. 673).

Par. 2. *Containers.*—Climax baskets for grapes and other fruits and vegetables, and baskets or other containers for small fruits, berries, and vegetables.

REGULATION 2.—TOLERANCES AND VARIATIONS

SECTION 1. For the purpose of ascertaining whether a container is within the tolerances and variations as to capacity allowed by these regulations it shall be tested by the use of a dry measure of the standard capacity applicable to such container, approved by the Bureau of Standards of the United States Department of Commerce. Such test shall be made with rape seed or other medium giving equivalent results. The capacity of the container shall be determined by stricken measure; only the actual capacity when level full shall be considered, and such portion of the contents as may be heaped above the level of the top of the sides shall be disregarded, notwithstanding any raised cover which might permit the extension upward of the contents. In making such test both the container to be tested and the measure of standard capacity by the use of which it is to be tested shall be filled with the testing medium, in the same manner and under the same conditions, by means of a hopper of the type customarily employed for the same purpose in State and Federal laboratories.

SEC. 2. Paragraph 1. As prescribed in this section, the following tolerances and variations in the capacities of containers are found to be reasonable and necessary and are hereby allowed.

[15] Issued Sept. 18, 1917.

Par. 2. The excess or deficiency in capacity of any container, over or under the capacity prescribed for such container in the standard container Act, as specified below in the column designated "Standard Capacity," may be as much as, but not greater than, the amount stated in cubic inches in the same line in the column designated "Excess" or "Deficiency," as the case may be; but, among any lot of containers which are not all of the standard capacity prescribed for such containers by the standard container Act, the number over shall be as nearly equal as may be practical to the number under such standard capacity, within the tolerances and variations allowed therefor in this section.

Standard capacity	Tolerances and variations	
	Excess	Deficiency
	Cubic inches	Cubic inches
1 bushel	50	30
½ bushel	30	18
12 quarts	23	15
1 peck	16	10
½ peck	10	6½
2 quarts	5	3¼
1 quart	3	2
1 pint	2	1½
½ pint	1	¾

Par. 3. In case of a container having a capacity to which a standard is applicable which is not specified in the column headed "Standard Capacity" in the foregoing table, the excess or the deficiency allowed shall be that permitted for the next smaller standard capacity specified in the table, but this shall not apply to containers for which variations and tolerances shall be permitted and established under the Act entitled "An Act To fix the standard barrel for fruits, vegetables, and other dry commodities," approved March 4, 1915 (38 Stat. L., p. 1186), when such variations and tolerances become effective.

SEC. 3. Paragraph 1. As prescribed in this section, the following tolerances and variations in dimensions of Climax baskets for grapes and other fruits and vegetables are found to be reasonable and necessary and are hereby allowed, subject, however, to the tolerances and variations in capacity allowed in section 2 of these regulations.

Par. 2. The excess or deficiency in any dimension specified below in the column designated "Dimensions," over or under the measurement prescribed for such dimension in section 1 of the standard container Act, may be as much as, but not greater than, the amount specified opposite such dimension in the column designated "Excess" or "Deficiency," as the case may be.

Dimensions	Tolerances and variations	
	Excess	Deficiency
	Inches	Inches
Length of bottom piece of 2-quart, 4-quart, or 12-quart Climax basket	1/8	1/8
Width of bottom piece of 2-quart, 4-quart, or 12-quart Climax basket	1/8	1/8
Thickness of bottom piece of 2-quart, 4-quart, or 12-quart Climax basket	1/32	1/32
Height of 2-quart, 4-quart, or 12-quart Climax basket, outside measurement	1/8	1/8
Length of cover of 2-quart, 4-quart, or 12-quart Climax basket	1/8	1/8
Width of cover of 2-quart, 4-quart, or 12-quart Climax basket	1/8	1/8
Combined length and width of top of 2-quart Climax basket, outside measurement	1/2	1/4
Combined length and width of top of 4-quart Climax basket, outside measurement	5/8	3/8
Combined length and width of top of 12-quart Climax basket, outside measurement	3/4	1/2

APPENDIX II.—MODEL STATE LAW ON THE SUBJECT OF WEIGHTS AND MEASURES

DEVELOPMENT OF MODEL LAW

Shortly after the Bureau of Standards was established in 1901 a systematic study and compilation of the laws of the United States and of the several States relating to weights and measures was begun, in order to determine the foundation that existed at that time for the protection of purchasers and consumers against the use of false weights, measures, and apparatus, and against the fraudulent use of correct apparatus in commercial transactions. As a result of this investigation, the material having been found to be of the greatest importance, a special publication was issued by the Bureau of Standards in 1904, entitled "Laws Concerning the Weights and Measures of the United States."

A study of the laws there presented incontestably demonstrated that the laws of the States on the subject of weights and measures were antiquated, weak, and contradictory in their provisions and moreover, independent investigation proved that in very few States was any attempt being made to enforce such requirements as they contained. It was then recognized that new and strict statutes were absolutely necessary in every State if faulty weights, measures, and apparatus were to be eliminated from commercial use and if the delivery of short amounts of commodity was to be prevented.

In 1905 the Annual Conference on the Weights and Measures of the United States was inaugurated, when invitations were sent to the various States requesting the appointment of official delegates to such a meeting. The delegates who assembled immediately saw the necessity of more satisfactory legislation, and with this idea in mind it was very natural that they should consult with one another as to the provisions which should be included. It was apparent to all of them that unless the laws about to be enacted by the several States were uniform the enforcement of all of them would be made

very much more difficult and there would be a very great lack of efficiency in administration. The conclusion was inevitable that the conference should make some official recommendations on the question of State legislation, if it was to be of the maximum assistance in the improvement of conditions then existing throughout the States. As a result, a resolution was adopted, which read as follows:

Resolved, That it is the sense of this convention that meetings of State sealers or custodians of weights and measures be held annually in Washington to discuss and facilitate both National and State legislation tending toward securing uniformity in the laws pertaining to weights and measures and their inspection throughout the United States, and the Bureau of Standards is requested to arrange such a meeting.

At the second annual conference the question of procuring uniformity in the laws of the various States was again discussed, and at that meeting the following resolution was passed:

Resolved, That the executive committee be instructed to draw up a model set of laws to be submitted to this body at its next meeting.

In accordance with this resolution the executive committee of the conference prepared a set of suggestions for National and State laws, embraced in 34 sections, and their recommendations were adopted by the conference. These were, as the name implies, merely suggestions on which laws for the various States were to be based.

The next step in this matter was taken at the Sixth Annual Conference on Weights and Measures, held at the Bureau in 1911, when a model law on the subject of weights and measures, drafted by the Bureau of Standards, due consideration being had for the suggestions for National and State laws and for the various bills which had been framed in accordance with these suggestions and introduced in some of the States, was presented for the action of the conference. After debate on the various provisions and a few minor changes and additions, this model law was adopted by the national conference and recommended for passage to the various States.

The final steps to produce the present model law were taken at the Eighth and Tenth Annual Conferences on Weights and Measures, held at the Bureau of Standards in 1913 and 1915, respectively. Several new sections were inserted, the old sections were rearranged and in some cases split up into shorter sections in order to simplify

them for reference and consultation, and a somewhat simpler wording was adopted where it was believed that the matter would be clarified by so doing. These changes were not of sufficient importance, however, to make those States which has already adopted the law essentially nonuniform with States passing it after these changes were made.

FORMS OF MODEL LAW

The model law is presented in three different forms instead of in the one standard form at first adopted and recommended. The basic provisions of all three forms are exactly the same, the only variations occurring in the methods of enforcement involved. It has been conclusively proven that the original form is not directly applicable to many of the States and that, to gain respectful attention in some of these States, it is necessary to submit it in a practicable form, at once applicable to local conditions. No desirable uniformity is sacrificed by presenting it in these various forms.

The following is a brief description of the three forms and of the local conditions in which each will be found to be peculiarly applicable.

Form No. 1.—This form provides that the entire weights and measures inspection system shall be in the hands of a State department and that the weights and measures laws shall be wholly enforced by men in the service of the State.

This form is intended primarily for States having a comparatively small population per unit of area and few large centers of population; and, secondarily, for those States in which it is believed that such a law can be most competently enforced by a centralization of power.

Form No. 2.—This form provides that the State shall take entire charge of the enforcement of the law in those jurisdictions in which the population per unit of area is so small that local authority can not enforce the provisions with the highest efficiency, and that in those jurisdictions where the population is large enough to justify it a local inspection service under the supervisory authority of the State department shall take up the enforcement of the provisions of the law.

This form is primarily intended for those States having part of their territory thickly settled and other parts only thinly settled.

Form No. 3.—This is the original form of the model law and provides for the enforcement of the provisions by local inspectors in

each city and each county, all under the general supervisory control of a State department of weights and measures.

This form is intended for those States having a large population per unit of area and none or but few sections which are sparsely settled.

Inasmuch as a number of sections in the three forms are identical, the text of Form No. 2 only is included in full here In the case of Forms Nos. 1 and 3, only those sections are given in full which are not identical with one of the sections of Form No. 2, there being an accompanying reference which indicates the numbers of the sections to be taken from Form No. 2, to complete Forms Nos. 1 and 3. The full text of all three forms is included as an appendix to the Report of the Tenth Annual Conference on Weights and Measures, which publication can be secured upon application to the Bureau of Standards.

TEXT, FORM NO. 2

SECTION 1. The weights and measures received from the United States under joint resolutions of Congress approved June 14, 1836, and July 27, 1866, and such new weights and measures as shall be received from the United States as standard weights and measures in addition thereto or in renewal thereof, and such as shall be supplied by the State in conformity therewith and certified by the National Bureau of Standards shall be the State standards of weights and measures.

SEC. 2. In addition to the State standards of weights and measures, provided for above, there shall be supplied by the State at least one complete set of copies of these, to be kept at all times in the office of the State superintendent (commissioner), and to be known as office standards; and such other weights, measures, and apparatus as may be found necessary to carry out the provisions of this act, to be known as working standards. Such weights, measures, and apparatus shall be verified by the State superintendent (commissioner), or his deputy or inspectors, at his direction, upon their initial receipt and at least once in each year thereafter, the office standards by direct comparison with the State standards, the working standards by comparison with the office standards. When found accurate upon these tests the office and working standards shall be sealed by stamping on them the letter "—" and the last two figures of the year with seals which the State superintendent (commissioner) shall have and keep for that purpose. The office standards shall be used in making all comparisons of weights, measures, and weighing or measuring devices submitted for test in the office of the superintendent (commissioner) and the State standards shall be used only in verifying the office standards and for scientific purposes.

SEC. 3. There shall be a State superintendent (commissioner) of weights and measures, who shall be appointed by the governor, by and with the advice and consent of the senate. Such superintendent (commissioner) shall be appointed for a term of five years, and shall receive a salary of $——— a year. There shall be a deputy superintendent (commissioner) of weights and measures and inspectors of weights and measures, the deputy to be appointed by the superintendent (commissioner) of weights and measures and to hold office during the superintendent's (commissioner's) term of office, the inspectors to be appointed from an eligible list prepared by the civil-service board and under the rules of said board. The superintendent (commissioner) of weights and measures shall be allowed for salaries for the deputy superintendent (commissioner) of weights and measures, inspectors of weights and measures, clerical services, traveling and contingent expenses for himself, his deputy, and inspectors such sums as shall be appropriated by the legislature.

SEC. 4. The State superintendent (commissioner) of weights and measures shall forthwith, on his appointment, give a bond in the penal sum of $5000, with sureties, to be approved by the secretary of state (attorney general) for the faithful performance of the duties of his office and for the safe-keeping of the standards intrusted to his care and for the surrender thereof immediately to his successor in office or to the person appointed by the governor to receive them. The deputy superintendent (commissioner) of weights and measures and each inspector of weights and measures shall forthwith upon his appointment give a bond in the penal sum of $1000, with sureties, to be approved by the secretary of state (attorney general), for the faithful performance of the duties of his office and for the safe-keeping of any apparatus intrusted to his care.

SEC. 5. The superintendent (commissioner) of weights and measures shall take charge of the standards adopted by this act as the standards of the State, and cause them to be kept in a fireproof building belonging to the State (or in a safe and suitable place in the office of the superintendent (commissioner)), from which they shall not be removed except for repairs or for certification, and he shall take all other necessary precautions for their safe-keeping. He shall maintain the State standards in good order and shall submit them at least once in ten years to the National Bureau of Standards for certification. He shall keep a complete record of the standards, balances, and other apparatus belonging to the State and take a receipt for same from his successor in office. He shall annually, on the first day of ———, make to the governor a report of all work done by his office.

SEC. 6. The superintendent (commissioner) of weights and measures, or his deputy, or inspectors, at his direction, shall at least once in five years try and prove by the office standards all standard weights, measures, and other apparatus which may belong to any county or city, required to appoint a sealer and purchase and keep

standards of weights and measures by the provisions of this act, and shall seal such when found to be accurate by stamping on them the letter "—" and the last two figures of the year with seals which he shall have and keep for that purpose.

The State superintendent (commissioner), or his deputy, or inspectors, at his direction, shall inspect all standard weights, measures, and other apparatus used by such counties and cities at least once in two years, and shall keep a record of the same. He, or his deputy, or inspectors, at his direction, shall at least once in two years visit these cities and counties for the purpose and in order to inspect the work of the local sealers, and in the performance of such duties they may inspect the weights, measures, balances, or any other weighing or measuring devices of any citizen, firm, or corporation, and shall have the same powers as the local sealer of weights and measures. The superintendent (commissioner) shall issue from time to time regulations for the guidance of county and city sealers, and the said regulations shall govern the procedure to be followed by the aforesaid officers in the discharge of their duties.

SEC. 7. The State superintendent (commissioner) of weights and measures shall have and keep a general supervision of the weights and measures, and weighing or measuring devices offered for sale, sold, or in use in the State. He, or his deputy, or inspectors, at his direction, shall, upon the written request of any citizen, firm, or corporation, or educational institution in the State test or calibrate weights, measures, and weighing or measuring devices used as standards in the State. He, or his deputy, or inspectors, at his direction shall at least once annually test all scales, weights, and measures used in checking the receipts or disbursements of supplies in every institution for the maintenance of which moneys are appropriated by the legislature, and he shall report in writing his findings to the supervisory board and to the executive officer of the institution concerned, and, at the request of such board or executive officer, the superintendent (commissioner) of weights and measures shall appoint in writing one or more employees then in the actual service of the institution who shall act as special deputies for the purpose of checking the receipts or disbursements of supplies.

SEC. 8. When not otherwise provided by law the State superintendent (commissioner) shall have the power, and it shall be his duty in those parts of the State in which a city or county sealer is not required to be appointed by the provisions of this act, to inspect, test, try, and ascertain if they are correct all weights, measures, and weighing or measuring devices kept, offered, or exposed for sale, sold, or used or employed by any proprietor, agent, lessee, or employee in proving the size, quantity, extent, area, or measurement of quantities, things, produce, or articles for distribution or consumption purchased or offered or submitted by such person or persons for sale, hire, or award; and he shall have the power to and shall from time to time weigh or measure and inspect packages or

amounts of commodities of whatsoever kind kept for the purpose of sale, offered or exposed for sale, or sold or in the process of delivery, in order to determine whether the same contain the amounts represented, and whether they be offered for sale or sold in a manner in accordance with law. He shall at least twice each year and as much oftener as he may deem necessary see that all weights, measures, and weighing or measuring devices used are correct. He may for the purpose above mentioned, and in the general performance of his official duties, enter and go into or upon, and without formal warrant, any stand, place, building, or premises, or stop any vendor, peddler, junk dealer, coal wagon, ice wagon, delivery wagon, or any person whatsoever, and require him, if necessary, to proceed to some place which the State superintendent (commissioner) may specify, for the purpose of making the proper tests. Whenever the State superintendent (commissioner) finds a violation of the statutes relating to weights and measures, he shall cause the violator to be prosecuted.

Sec. 9. Whenever the State superintendent (commissioner) compares weights, measures, or weighing or measuring devices and finds that they correspond or causes them to correspond with the standards in his possession, he shall seal or mark such weights, measures, or weighing or measuring devices with appropriate devices.

Sec. 10. The State superintendent (commissioner) shall condemn and seize and may destroy incorrect weights, measures, or weighing or measuring devices which, in his best judgment, are not susceptible of satisfactory repair; but such as are incorrect and yet, in his best judgment, may be repaired, he shall mark or tag as "Condemned for repairs." The owners or users of any weights, measures, or weighing or measuring devices of which such disposition is made shall have the same repaired and corrected within ten days, and they may neither use nor dispose of the same in any way, but shall hold the same at the disposal of the superintendent (commissioner). Any weights, measures, or weighing or measuring devices which have been "condemned for repairs," and have not been repaired as required above, shall be confiscated by the superintendent (commissioner).

Sec. 11. The powers and duties given to and imposed upon the State superintendent (commissioner) of weights and measures by sections eight, nine, and ten are hereby given to and imposed upon his deputy and inspectors also, when acting under his instructions and at his direction.

Sec. 12. There shall be a county sealer of weights and measures in each county having a population of twenty thousand or more inhabitants, exclusive of any city having a population of twenty-five thousand or more inhabitants situated therein, according to the last official State or United States census, who shall be appointed by the board of county commissioners from a list to be furnished by the civil-service board and under the rules of such board where

such board exists; otherwise he shall be appointed by the board of county commissioners for a term of five years. He shall be paid a salary determined by such board, said salary not to be less than $1200 a year, and no fee shall be charged by him or by the county for the inspecting, testing, or sealing or the repairing or adjusting of weights, measures, or weighing or measuring devices. Whenever the board of county commissioners of such a county shall deem it necessary, one or more deputy sealers of weights and measures may be appointed and their salaries fixed as above. All deputies appointed shall have the same powers and may perform the same duties as the county sealer, when acting under his instructions and at his direction.

SEC. 13. There shall be a city sealer of weights and measures in cities of not less than twenty-five thousand population, according to the latest official State or United States census, to be appointed by the mayor from a list to be furnished by the civil-service board and under the rules of such board where such board exists; otherwise he shall be appointed by the mayor, by and with the advice and consent of the common council, for a term of five years. He shall be paid a salary to be determined by the common council, said salary not to be less than $1200 a year, and no fee shall be charged by him or by the city for the inspecting, testing, or sealing, or the repairing or adjusting of weights, measures, or weighing or measuring devices. Whenever the mayor and common council shall deem it necessary, one or more deputy sealers of weights and measures may be appointed and their salary fixed as above. All deputies appointed shall have the same powers and may perform the same duties as the city sealer, when acting under his instructions and at his direction. In those cities in which no sealer is required by the above, the county sealer of the county, if such an officer is required to be appointed by the provisions of this act, shall perform in said cities the duties and have like powers as in the county.

SEC. 14. Nothing in sections twelve and thirteen of this act shall be construed to prevent two or more counties or a county and a city situated therein, each of which are required to appoint sealers under the provisions of this act, from combining the whole or any part of their districts, as may be agreed upon by the boards of county commissioners of the counties, or such board of the county and the mayor and common council of the city, with one set of standards and one sealer, upon the written consent of the State superintendent (commissioner) of weights and measures. A sealer appointed in pursuance of an agreement for such combination shall, subject to the terms of his appointment, have the same authority, jurisdiction, and duties as if he had been appointed by each of the authorities who are parties to the agreement.

SEC. 15. The county or city sealer of weights and measures shall forthwith, on his appointment, give a bond in the penal sum of,

$1000, with sureties, to be approved by the appointing power, for the faithful performance of the duties of his office.

SEC. 16. The board of county commissioners of each county and the common council of each city required to appoint a sealer under the provisions of this act shall procure at the expense of the county or city, and shall keep at all times a set of weights and measures and other apparatus as complete and of such materials and construction as the State superintendent (commissioner) of weights and measures may direct. All such weights, measures, and other apparatus having been tried and accurately proven by the State superintendent (commissioner), shall be sealed and certified to by him as hereinbefore provided, and shall be then deposited with and preserved by the county or city sealer as public standards for each county or city.

Whenever the board of county commissioners of such county or the common council of such city shall neglect for six months so to do, the county auditor of said county, or the city clerk (comptroller) of said city, on notification and request by the superintendent (commissioner) of weights and measures, shall provide such standards and cause the same to be tried, sealed, and deposited at the expense of the county or city.

SEC. 17. Where not otherwise provided by law, the county or city sealer shall have the same powers and shall perform the same duties within his county or city as are granted to and imposed upon the State superintendent (commissioner) of weights and measures by sections eight, nine, and ten of this act.

SEC. 18. The county or city sealer shall keep a complete record of all of his official acts, and shall make an annual report to the board of county commissioners of the county or the mayor and common council of the city and an annual report duly sworn to, on the first day of ———, to the State superintendent (commissioner) of weights and measures, on blanks furnished by the latter; and also, any special reports that the latter may request.

SEC. 19. The superintendent (commissioner) of weights and measures, his deputy, and inspectors, and the county and city sealers and deputy sealers of weights and measures, are hereby made special policemen and are authorized and empowered to arrest, without formal warrant, any violator of the statutes in relation to weights and measures, and to seize for use as evidence, without formal warrant, any false or unsealed weight, measure, or weighing or measuring device or package or amount of commodity found to be used, retained, or offered or exposed for sale or sold in violation of law.

SEC. 20. Any person who shall hinder or obstruct in any way the superintendent (commissioner) of weights and measures, his deputy, or inspectors, or any county or city sealer or deputy sealer of weights and measures in the performance of his official duties shall be guilty of a misdemeanor, and, upon conviction thereof in any court of

competent jurisdiction, shall be punished by a fine of not less than $20 or more than $200, or by imprisonment in the county jail for not more than three months, or by both such fine and imprisonment.

SEC. 21. Any person who shall impersonate in any way the superintendent (commissioner) of weights and measures, his deputy, or inspectors, or any county or city sealer or deputy sealer of weights and measures, by the use of his seal or counterfeit of his seal, or otherwise, shall be guilty of a misdemeanor, and upon conviction thereof in any court of competent jurisdiction, shall be punished by a fine of not less than $100 nor more than $500, or by imprisonment for not more than one year, or by both such fine and imprisonment.

SEC. 21a. It shall be unlawful to sell, except for immediate consumption on the premises, liquid commodities in any other manner than by weight or liquid measure, or commodities not liquid in any other manner than by measure of length, by weight, or by numerical count, unless otherwise agreed in writing by the mutual consent of the buyer and seller: *Provided, however,* That nothing in this section shall be construed to prevent the sale of fruits, vegetables, and other dry commodities in the standard barrel provided for in section 28; or of berries and small fruits in boxes as provided for in section 29; or of vegetables or fruits usually sold by the head or bunch in this manner: *Provided further,* That nothing in this section shall be construed to apply to foodstuffs put up in original packages.

For the purposes of this section the term "original package" shall be construed to include a commodity in a package, carton, case, can, barrel, bottle, box, phial, or other receptacle, or in coverings or wrappings of any kind, put up by the manufacturer, which may be labeled, branded, or stenciled, or otherwise marked, or which may be suitable for labeling, branding, or stenciling, or marking otherwise, making one complete package of the commodity. The words "original package" shall be construed to include both the wholesale and the retail package.

For the purposes of this section the term "commodities not liquid" shall be construed to include goods, wares, and merchandise, which are not in liquid form and which have heretofore been sold by measure of length, by weight, by measures of capacity, or by numerical count, or which are susceptible of sale in any of these ways.

SEC. 22. It shall be unlawful to sell or offer to sell any coal, coke, or charcoal in any other manner than by weight. It shall be unlawful for any person to deliver any coal, coke, or charcoal without each such delivery being accompanied by a delivery ticket and a duplicate thereof, on each of which shall be in ink or other indelible substance, distinctly expressed in pounds, the gross weight of the load, the tare of the delivery vehicle, and the quantity or quantities of coal, coke, or charcoal contained in the vehicle used in such deliveries, with the name of the purchaser thereof, and the name of the dealer from whom purchased. One of these tickets shall be surrendered to the State superintendent (commissioner), his deputy,

or inspectors, or a county or city sealer or deputy sealer of weights and measures, upon his demand for his inspection and this ticket or a weight slip issued by him when he desires to retain the original shall be delivered to the said purchaser of said coal, coke, or charcoal, or his agent or representative at the time of the delivery of the fuel; and the other ticket shall be retained by the seller of the fuel. When the buyer carries away the purchase, a delivery ticket showing the actual number of pounds delivered to him must be given to him at the time the sale is made.

SEC. 23. It shall be unlawful to keep for the purpose of sale, offer or expose for sale, or sell, any commodity in package form unless the net quantity of the contents be plainly and conspicuoulsy marked on the outside of the package, in terms of weight, measure, or numerical count: *Provided, however,* That reasonable variations or tolerances shall be permitted, and that these reasonable variations or tolerances and also exemptions as to small packages shall be established by rules and regulations made by the superintendent (commissioner) of weights and measures: *And provided further,* That this section shall not be construed to apply to those commodities in package form, the manner of sale of which is specifically regulated by the provisions of other sections of this act.

The words "in package form" as used in this section shall be construed to include a commodity in a package, carton, case, can, box, barrel, bottle, phial, or other receptacle, or in coverings or wrappings of any kind, put up by the manufacturer, or, when put up prior to the order of the commodity, by the vendor, which may be labeled, branded, or stenciled, or otherwise marked, or which may be suitable for labeling, branding, or stenciling, or marking otherwise, making one complete package of the commodity. The words "in package form" shall be construed to include both the wholesale and the retail package.

SEC. 24. It shall be unlawful to keep for the purpose of sale, offer or expose for sale, or sell, any commodity composed in whole or in part of cotton, wool, linen, or silk, or any other textile material on a spool or similar holder, or in a container or band, or in a bolt or roll, or in a ball, coil, or skein, or in any similar manner, unless the net amount of the commodity in terms of weight or measure shall be definitely, plainly, and conspicuously marked on the principal label, if there be such a label; otherwise on a wrapping, band, or tag attached thereto.

The words "spool or similar holder, container or band, bolt or roll, or ball, coil, or skein" shall be construed to include the spool or similar holder, container or band, bolt or roll, or ball, coil, or skein put up by the manufacturer; or when put up prior to the order of the commodity, by the vendor. It shall be held to include both the wholesale and the retail package.

SEC. 25. It shall be unlawful for any person to sell, or offer to sell, any butter or renovated or process butter or oleomargarine in any

other manner than by weight. It shall be unlawful for any person to put up, pack, or keep for the purpose of sale, offer or expose for sale, or sell any butter or renovated or process butter, or oleomargarine, in the form of prints, bricks, or rolls in any other than the following sizes, to wit, one-quarter pound, one-half pound, one pound, one and one-half pounds, or multiples of one pound. Each print, brick, or roll shall bear a definite, plain, and conspicuous statement of its true net weight, on the principal label, where there be such a label, otherwise on the outside wrapper thereof; such statement shall be in Gothic type not less than one-quarter inch square.

The prints, bricks, or rolls referred to in this section shall be construed to include those prints, bricks, or rolls put up by the manufacturer or producer; or when put up prior to the order of the commodity, by the vendor.

SEC. 26. All bread kept for the purpose of sale, offered or exposed for sale, or sold, shall be sold by weight. To each loaf of bread shall be attached a label plainly showing its correct weight and the firm name of the manufacturer thereof, the size of the label and type to be used to be specified by the State superintendent (commissioner) of weights and measures. It shall be unlawful for any person to make or keep for the purpose of sale, offer or expose for sale, or sell, any bread other than such as shall be in accordance with the provisions of this section.

SEC. 27. Bottles used for the sale of milk or cream shall be of the capacity of one-half gallon, three pints, one quart, one pint, one-half pint, and one gill. Bottles or jars used for the sale of milk or cream shall have clearly blown or otherwise permanently marked in the side of the bottle the capacity of the bottle and the word "Sealed"; and in the side or bottom of the bottle the name, initials, or trade-mark of the manufacturer and a designating number, which designating number shall be different for each manufacturer and may be used in identifying the bottles. The designating number shall be furnished by the State superintendent (commissioner) of weights and measures upon application by the manufacturer, and upon the filing by the manufacturer of a bond in the sum of $1,000, with sureties, to be approved by the secretary of state (attorney general) conditioned upon their conformance with the requirements of this section. A record of the bonds furnished and the designating numbers and to whom furnished shall be kept in the office of the superintendent (commissioner) of weights and measures.

Any manufacturer who sells or offers to sell milk or cream bottles to be used in this State that do not comply as to size and markings with the provisions of this section shall suffer a penalty of $500, to be recovered by the attorney general in an action against the offender's bondsmen to be brought in the name of the people of the State. Any dealer who uses, for the purpose of selling milk or cream, jars or bottles purchased after this law takes effect that do not comply with

the requirements of this section as to markings and capacity shall be deemed guilty of using a false or insufficient measure.

Sealers of weights and measures are not required to seal bottles or jars for milk or cream marked as in this section provided, but they shall have the power to and shall from time to time make tests on individual bottles used by the various firms in the territory over which they have jurisdiction in order to ascertain if the above provisions are being complied with, and they shall immediately report violations found to the State superintendent (commissioner) of weights and measures.

SEC. 28. The standard barrel for fruits, vegetables, and other dry commodities other than cranberries shall be of the following dimensions when measured without distention of its parts: Length of staves, twenty-eight and one-half inches; diameter of heads, seventeen and one-eighth inches; distance between heads, twenty-six inches; circumference of bulge, sixty-four inches, outside measurement; and the thickness of staves not greater than four-tenths of an inch: *Provided*, That any barrel of a different form having a capacity of seven thousand and fifty-six cubic inches shall be a standard barrel. The standard barrel for cranberries shall be of the following dimensions when measured without distention of its parts: Length of staves, twenty-eight and one-half inches; diameter of heads, sixteen and one-fourth inches; distance between heads, twenty-five and one-fourth inches; circumference of bulge, fifty-eight and one-half inches, outside measurement; and the thickness of staves not greater than four-tenths of an inch.

It shall be unlawful for any person to offer or expose for sale, sell, or ship any other barrels for fruits, vegetables, or other dry commodities, or to offer or expose for sale, sell, or ship any fruits, vegetables, or other dry commodities in other barrels than the standard barrels as defined in this section, or subdivisions thereof known as the third, half, or three-quarters barrel: *Provided, however*, That nothing in this section shall apply to barrels used in packing or shipping commodities sold exclusively by weight or numerical count; *and provided further*, That no barrel shall be deemed below standard within the meaning of this section when shipped to any foreign country and constructed according to the specifications or directions of the foreign purchaser if not constructed in conflict with the laws of the foreign country to which the same is intended to be shipped.

SEC. 29. It shall be unlawful to sell or offer to sell any berries or small fruits in any other manner than by weight, or in the containers described in this section. It shall be unlawful to procure or keep for the purpose of sale, offer or expose for sale, sell, or give away baskets or other open containers for berries or small fruits, holding one quart or less, or to procure or keep for the purpose of sale, offer or expose for sale, or sell berries or small fruits in baskets or other open containers, holding one quart or less, of any other than the following capacities, when level full: One quart, one pint, or one-half pint, standard dry measure.

SEC. 30. Whenever any commodity is sold on a basis of weight, it shall be unlawful to employ any other weight in such sale than the net weight of the commodity; and all contracts concerning goods sold on a basis of weight shall be understood and construed accordingly. Whenever the weight of a commodity is mentioned in this act, it shall be understood and construed to mean the net weight of the commodity.

SEC. 31. Any person who, by himself or by his servant or agent, or as the servant or agent of another person, shall offer or expose for sale, sell, use in the buying or selling of any commodity or thing or for hire or award, or retain in his possession a false weight or measure or weighing or measuring device or any weight or measure or weighing or measuring device which has not been sealed by the State superintendent (commissioner), or his deputy, or inspectors, or by a sealer or deputy sealer of weights and measures within one year, or shall dispose of any condemned weight, measure, or weighing or measuring device contrary to law, or remove any tag placed thereon by the State superintendent (commissioner), or his deputy, or inspectors, or by a sealer or deputy sealer of weights and measures; or who shall sell or offer or expose for sale less than the quantity he represents, or shall take or attempt to take more than the quantity he represents, when, as the buyer, he furnishes the weight, measure, or weighing or measuring device by means of which the amount of commodity is determined; or who shall keep for the purpose of sale, offer or expose for sale, or sell any commodity in a manner contrary to law; or who shall violate any provision of this act for which a specific penalty has not been provided; or who shall sell or offer for sale, or use or have in his possession for the purpose of selling or using any device or instrument to be used to or calculated to falsify any weight or measure, shall be guilty of a misdemeanor, and shall be punished by a fine of not less than $20 or more than $200, or by imprisonment for not more than three months, or by both such fine and imprisonment, upon a first conviction in any court of competent jurisdiction; and upon a second or subsequent conviction in any court of competent jurisdiction he shall be punished by a fine of not less than $50 or more than $500, or by imprisonment in the county jail for not more than one year, or by both such fine and imprisonment.

SEC. 32. The word "person" as used in this act shall be construed to import both the plural and singular, as the case demands, and shall include corporations, companies, societies, and associations.

The words "weights, measures, or (and) weighing or (and) measuring devices," as used in this act, shall be construed to include all weights, scales, beams, measures of every kind, instruments and mechanical devices for weighing or measuring, and any appliances and accessories connected with any or all such instruments.

The words "sell" or "sale" as used in this act, shall be construed to include barter and exchange.

TEXT, FORM NO. 1

Sections 1 to 5, inclusive, are identical with sections 1 to 5, inclusive, respectively, of Form No. 2.

Section 6 is identical with section 7, Form No. 2.

SEC. 7. When not otherwise provided by law the State superintendent (commissioner) shall have the power, and it shall be his duty to inspect, test, try, and ascertain if they are correct, all weights, measures, and weighing or measuring devices kept, offered, or exposed for sale, sold, or used or employed by any proprietor, agent, lessee, or employee in proving the size, quantity, extent, area, or measurement of quantities, things, produce, or articles for distribution or consumption purchased or offered or submitted by such person or persons for sale, hire, or award, and he shall have the power to and shall from time to time weigh or measure and inspect packages or amounts of commodities of whatsoever kind kept for the purpose of sale, offered or exposed for sale, or sold or in the process of delivery in order to determine whether the same contain the amounts represented, and whether they be offered for sale or sold in a manner in accordance with law. He shall at least twice each year and as much oftener as he may deem necessary see that all weights, measures, and weighing or measuring devices used are correct. He may for the purpose above mentioned, and in the general performance of his official duties, enter and go into or upon, and without formal warrant, any stand, place, building, or premises, or stop any vendor, peddler, junk dealer, coal wagon, ice wagon, delivery wagon, or any person whatsoever, and require him, if necessary, to proceed to some place which the State superintendent (commissioner) may specify, for the purpose of making the proper tests. Whenever the State superintendent (commissioner) finds a violation of the statutes relating to weights and measures, he shall cause the violator to be prosecuted.

Sections 8 and 9 are identical with sections 9 and 10, respectively, of Form No. 2.

Section 10 is identical with section 11, Form No. 2, *except* that "sections 8, 9, and 10" should be read "sections 7, 8, and 9."

SEC. 11. The superintendent (commissioner) of weights and measures, his deputy and inspectors, are hereby made special policemen, and are authorized and empowered to arrest, without formal warrant, any violator of the statutes in relation to weights and measures, and to seize for use as evidence, without formal warrant, any false or unsealed weight, measure, or weighing or measuring device or package or amount of commodity found to be used, retained, or offered or exposed for sale, or sold in violation of law.

SEC. 12. Any person who shall hinder or obstruct in any way the superintendent (commissioner) of weights and measures, his deputy, or inspectors, in the performance of his official duties shall be guilty of a misdemeanor, and upon conviction thereof in any court of competent jurisdiction shall be punished by a fine of not less than $20 nor more than $200, or by imprisonment in the county jail for not more than three months, or by both such fine and imprisonment.

SEC. 13. Any person who shall impersonate in any way the superintendent (commissioner) of weights and measures, his deputy, or inspectors, by the use of his seal or counterfeit of his seal, or otherwise, shall be guilty of a misdemeanor, and upon conviction thereof in any court of competent jurisdiction, shall be punished by a fine of not less than $100 nor more than $500, or by imprisonment for not more than one year, or by both such fine and imprisonment.

Section 13a is identical with section 21a, Form No. 2, *except* that "section 28" and "section 29" should be read "section 20" and "section 21," respectively.

Sections 14 to 22, inclusive, are identical with sections 22 to 30, inclusive, respectively, of Form No. 2.

SEC. 23. Any person who, by himself or by his servant or agent, or as the servant or agent of another person, shall offer or expose for sale, sell, use in the buying or selling of any commodity or thing or for hire or award, or retain in his possession a false weight or measure or weighing or measuring device, or any weight or measure or weighing or measuring device which has not been sealed by the State superintendent (commissioner), or his deputy or inspectors, at his direction, within one year; or shall dispose of any condemned weight, measure, or weighing or measuring device contrary to law, or remove any tag placed thereon by the State superintendent (commissioner), or his deputy or inspectors, at his direction; or who shall sell or offer or expose for sale less than the quantity he represents, or shall take or attempt to take more than the quantity he represents, when, as the buyer, he furnishes the weight, measure, or weighing or measuring device by means of which the amount of commodity is determined; or who shall keep for the purpose of sale, offer or expose for sale, or sell any commodity in a manner contrary to law; or who shall violate any provision of this act for which a specific penalty has not been provided, or who shall sell or offer for sale, or use or have in his possession for the purpose of selling or using any device or instrument to be used to or calculated to falsify any weight or measure; shall be guilty of a misdeamenor, and shall be punished by a fine of not less than $20 nor more than $200, or by imprisonment for not more than three months, or by both such fine

and imprisonment, upon a first conviction in any court of competent jurisdiction; and upon a second or subsequent conviction in any court of competent jurisdiction he shall be punished by a fine of not less than $50 nor more than $500, or by imprisonment in the county jail for not more than one year, or by both such fine and imprisonment.

Section 24 is identical with section 32, Form No. 2.

TEXT, FORM NO. 3

Sections 1 to 5, inclusive, are identical with sections 1 to 5, inclusive, respectively, of Form No. 2.

SEC. 6. The State superintendent (commissioner) of weights and measures, or his deputy, or inspectors, at his direction, shall at least once in five years try and prove by the office standards all standard weights, measures, and other apparatus which may belong to any county or city, and shall seal such when found to be accurate by stamping on them the letter "—" and the last two figures of the year with seals which he shall have and keep for that purpose.

The State superintendent (commissioner), or his deputy, or inspectors, at his direction, shall inspect all standard weights, measures, and other apparatus used by the counties and cities at least once in two years, and shall keep a record of the same. He, or his deputy, or inspectors, at his direction, shall at least once in two years visit the various cities and counties of the State for this purpose and in order to inspect the work of the local sealers, and in the performance of such duties they shall have the same powers as the local sealer of weights and measures. The superintendent (commissioner) shall issue from time to time regulations for the guidance of county and city sealers, and the said regulations shall govern the procedure to be followed by the aforesaid officers in the discharge of their duties.

Section 7 is identical with section 7, Form No. 2.

SEC. 8. There shall be a county sealer of weights and measures in each county, who shall be appointed by the board of county commissioners from a list to be furnished by the civil-service board and under the rules of such board where such board exists; otherwise he shall be appointed by the board of county commissioners for a term of five years. He shall be paid a salary determined by such board, said salary not to be less than $1200 a year, and no fee shall be charged by him or by the county for the inspecting, testing, or sealing, or the repairing or adjusting of weights, measures, or weighing or measuring devices. Whenever the board of county commissioners shall deem it necessary, one or more deputy sealers of weights and measures may be appointed and their salaries fixed as above. All deputies appointed shall have the same powers and may per-

form the same duties as the county sealer when acting under his instructions and at his direction.

SEC. 9. There shall be a city sealer of weights and measures in cities of not less than twenty-five thousand population, according to the latest official State or United States census, to be appointed by the mayor from a list to be furnished by the civil-service board and under the rules of such board where such board exists; otherwise he shall be appointed by the mayor, by and with the advice and consent of the common council, for a term of five years. He shall be paid a salary to be determined by the common council, said salary not to be less than $1200 a year, and no fee shall be charged by him or by the city for the inspecting, testing or sealing, or repairing or adjusting of weights, measures, or weighing or measuring devices. Whenever the mayor and common council shall deem it necessary, one or more deputy sealers of weights and measures may be appointed and their salary fixed as above. All deputies appointed shall have the same powers and may perform the same duties as the city sealer when acting under his instructions and at his direction.

In those cities in which no sealer is required by the above the county sealer of the county shall perform in the said cities the duties and have like powers as in the county.

SEC. 10. Nothing in sections eight and nine of this act shall be construed to prevent two or more counties, or a county and a city situated therein, from combining the whole or any part of their districts, as may be agreed upon by the boards of county commissioners of the counties, or such board of the county and the mayor and common council of the city, with one set of standards and one sealer, upon the written consent of the State superintendent (commissioner) of weights and measures. A sealer appointed in pursuance of an agreement for such combination shall, subject to the terms of his appointment, have the same authority, jurisdiction, and duties as if he had been appointed by each of the authorities who are parties to the agreement.

Sections 11 and 12 are identical with sections 11 and 16, respectively, Form No. 2.

SEC. 13. When not otherwise provided by law the county or city sealer shall have the power and it shall be his duty within his county or city to inspect, test, try, and ascertain if they are correct all weights, measures, and weighing or measuring devices kept, offered, or exposed for sale, sold, or used or employed within the county or city by any proprietor, agent, lessee, or employee in proving the size, quantity, extent, area, or measurement of quantities, things, produce, or articles for distribution or consumption purchased or offered or submitted by such person or persons for sale, hire, or award; and he shall have the power to and shall from time

to time weigh or measure and inspect packages or amounts of commodities of whatsoever kind kept for the purpose of sale, offered or exposed for sale, or sold or in the process of delivery, in order to determine whether the same contain the amounts represented, and whether they be kept, offered, or exposed for sale or sold in a manner in accordance with law; he shall at least twice each year and as much oftener as he may deem necessary see that all weights, measures, and weighing or measuring devices used in the county or city are correct. He may for the purpose above mentioned, and in the general performance of his official duties, enter and go into or upon, and without formal warrant, any stand, place, building, or premises, or stop any vendor, peddler, junk dealer, coal wagon, ice wagon, delivery wagon, or any person whomsoever, and require him, if necessary, to proceed to some place which the sealer may specify, for the purpose of making the proper tests. Whenever the county or city sealer finds a violation of the statutes relating to weights and measures, he shall cause the violator to be prosecuted.

Sec. 14. Whenever the county or city sealer compares weights, measures, or weighing or measuring devices and finds that they correspond or causes them to correspond with the standards in his possession, he shall seal or mark such weights, measures, or weighing or measuring devices with appropriate devices to be approved by the State superintendent (commissioner) of weights and measures.

Sec. 15. The county or city sealer shall condemn and seize and may destroy incorrect weights, measures, or weighing or measuring devices which, in his best judgment, are not susceptible of satisfactory repair; but such as are incorrect and yet, in his best judgment may be repaired, he shall mark or tag as "Condemned for repairs" in a manner prescribed by the State superintendent (commissioner) of weights and measures. The owners or users of any weights, measures, or weighing or measuring devices of which such disposition is made shall have the same repaired and corrected within 10 days, and they may neither use nor dispose of the same in any way, but shall hold the same at the disposal of the sealer. Any weights, measures, or weighing or measuring devices which have been "condemned for repairs," and have not been repaired as required above, shall be confiscated by the sealer.

Sections 16 to 19, inclusive, are identical with sections 18 to 21, inclusive, respectively, of Form No. 2.

Section 19a is identical with section 21a, Form No. 2, *except* that "section 28" and "section 29" should be read "section 26" and "section 27," respectively.

Sections 20 to 30, inclusive, are identical with sections 22 to 32, inclusive, respectively, of Form No. 2.

APPENDIX III.—THE METRIC SYSTEM

LEGALITY AND USE OF SYSTEM

The weights and measures official should be familiar with the principles of the metric system of weights and measures. This system has been specifically legalized by Congress, by section 3569 of the Revised Statutes of the United States, which reads as follows:

> It shall be lawful throughout the United States of America to employ the weights and measures of the metric system; and no contract or dealing, or pleading in any court, shall be deemed invalid or liable to objection because the weights or measures expressed or referred to therein are weights or measures of the metric system.

The metric system is extensively used in prescription work in drug stores, and the latest edition of the Pharmacopœia gives preference to the use of this system. It is also coming into more common use by manufacturers. The weights and measures official will thus find it necessary to use it in his ordinary field work.

Therefore the following brief explanation of the system is included in this publication. This has been taken from a publication of the Bureau of Standards entitled "The International Metric System of Weights and Measures," a copy of which can be obtained from the Bureau upon request.

ADVANTAGES OF SYSTEM

Among the advantages claimed for the metric system are (1) the decimal relation between the units, (2) the extremely simple relations of the units of length, area, volume, and weight to one another, and (3) the uniform and self-defining names of units.

SYNOPSIS OF SYSTEM

The fundamental unit of the metric system is the METER—the unit of length. From this the units of capacity (LITER) and of weight (GRAM) were derived. All other units are the decimal subdivisions or multiples of these. These three units are simply

related; e. g., for all practical purposes one CUBIC DECIMETER equals one LITER and one LITER of water weighs one KILOGRAM. The metric tables are formed by combining the words "METER," "GRAM," and "LITER" with the six numerical prefixes, as in the following tables:

PREFIXES	MEANING		UNITS
milli- =*one thousandth*	$\frac{1}{1000}$	.001	
centi- =*one hundredth*	$\frac{1}{100}$	.01	"meter" *for length,*
deci- =*one tenth*	$\frac{1}{10}$	.1	
Unit=one		1	"gram" *for weight or mass,*
deka- =*ten*	$\frac{10}{1}$	10	
hecto- =*one hundred*	$\frac{100}{1}$	100	"liter" *for capacity.*
kilo- =*one thousand*	$\frac{1000}{1}$	1000	

UNITS OF LENGTH

milli-meter =	.001	meter
centi-meter =	.01	"
deci-meter =	.1	"
METER [16] =	1	"
deka-meter =	10	"
hecto-meter =	100	"
kilo-meter =	1000	"

Where *miles* are used in England and the United States for measuring distances, the *kilometer* (1000 meters) is used in metric coun-

[16] One meter equals 39.37 inches exactly.

tries. The kilometer is about 5 furlongs. There are about 1600 meters in a statute mile, 20 meters in a chain, and 5 meters in a rod.

The *meter* is used for dry goods, merchandise, engineering construction, building, and other purposes where the *yard* and *foot* are used. The meter is about a tenth longer than the yard.

The *centimeter* and *millimeter* are used instead of the *inch* and its fractions in machine construction and similar work. The centimeter, as its name shows, is the hundredth of a meter. It is used in cabinet work, in expressing sizes of paper, books, and many cases where the inch is used. The centimeter is about two-fifths of an inch and the millimeter about one twenty-fifth of an inch. The millimeter is divided for finer work into tenths, hundredths, and thousandths.

If a number of distances in millimeters, meters, and kilometers are to be added, reduction is unnecessary. They are added as dollars, dimes, and cents are now added. For example, "1050.25 meters" is not read "1 kilometer, 5 dekameters, 2 decimeters, and 5 centimeters," but "one thousand and fifty meters, twenty-five centimeters," just as "$1050.25" is read "one thousand and fifty dollars, twenty-five cents."

AREA

The table of areas is formed by squaring the length measures, as in our common system. For land measure 10 meters square is called an "ARE" (meaning "area"). The side of one *are* is about 33 *feet*. The HECTARE is 100 meters square, and, as its name indicates, is 100 ares, or about 2½ acres. An *acre* is about 0.4 hectare. A standard United States *quarter section* contains almost exactly 64 hectares. A *square kilometer* contains 100 hectares.

For smaller measures of surface the *square meter* is used. The square meter is about 20 per cent larger than the *square yard*. For still smaller surfaces the *square centimeter* is used. A *square inch* contains about 6½ square centimeters.

VOLUME

The cubic measures are the cubes of the linear units. The *cubic meter* (sometimes called the *stere*, meaning "solid") is the unit of volume. A *cubic meter* of water weighs a *metric ton* and is equal to 1 *kiloliter*. The cubic meter is used in place of the cubic yard

and is about 30 per cent larger. This is used for "cuts and fills" in grading land, measuring timber, expressing contents of tanks and reservoirs, flow of rivers, dimensions of stone, tonnage of ships, and other places where the cubic yard and foot are used. The thousandth part of the cubic meter (1 cubic decimeter) is called the LITER. (See table of capacity units.)

For very small volumes the *cubic centimeter* (cc or cm^3) is used. This volume of water weighs a *gram*, which is the unit of weight or mass. There are about 16 cubic centimeters in a cubic inch. The cubic centimeter is the unit of volume used by chemists as well as in pharmacy, medicine, surgery, and other technical work. One thousand cubic centimeters make 1 liter.

UNITS OF CAPACITY

milli-liter =	.001	liter
centi-liter =	.01	"
deci-liter =	.1	"
LITER [17] =	1	"
deka-liter =	10	"
hecto-liter =	100	"
kilo-liter =	1000	"

The *hectoliter* (100 liters) serves the same purposes as the United States *bushel* (2150.42 cubic inches), and is equal to about 3 bushels. A *peck* is about 9 liters. The liter is used for measurements commonly given in the *gallon*, the liquid and dry *quarts*, a liter being 5 per cent larger than our liquid quart and 10 per cent smaller than the dry quart. A *liter* of water weighs exactly a *kilogram*, i. e., 1000 grams. A thousand liters of water weigh 1 metric ton.

[17] One liter equals 1.05668 liquid quarts or 0.9081 dry quart.

UNITS OF WEIGHT (OR MASS)

milli-gram =	.001	gram
centi-gram =	.01	"
deci-gram =	.1	"
GRAM =	1	"
deka-gram =	10	"
hecto-gram =	100	"
kilo-gram [18] =	1000	"

Measurements commonly expressed in *gross tons* or *short tons* are stated in *metric tons* (1000 kilograms). The metric ton comes between our long and short tons and serves the purpose of both. The *kilogram* and "half kilo" serve for everyday trade, the latter being 10 per cent larger than the pound. The kilogram is approximately 2.2 pounds. The *gram* and its multiples and divisions are used for the same purposes as ounces, pennyweights, drams, scruples, and grains. For foreign postage, 30 grams is the legal equivalent of the avoirdupois ounce.

[18] One kilogram equals 2.204622 avoirdupois pounds.

APPENDIX IV.—GENERAL TABLES OF WEIGHTS AND MEASURES AND TABLES OF EQUIVALENTS

TABLES OF WEIGHTS AND MEASURES

LINEAR MEASURE

12 inches (in.)=1 foot (ft.)
3 feet =1 yard (yd.)= 36 inches
5½ yards =1 rod (rd.) or pole=16½ feet
40 rods =1 furlong (fur.)=220 yards=660 feet
8 furlongs =1 statute mile (mi.)=1760 yards=5280 feet
3 miles =1 league=5280 yards=15 840 feet

SQUARE MEASURE

144 square inches (sq. in.)=1 square foot (sq. ft)
9 square feet =1 square yard (sq. yd.)=1296 square inches
30¼ square yards =1 square rod (sq. rd.)=272¼ square feet
160 square rods =1 acre (A.)=4840 square yards
640 acres =1 square mile (sq. mi.)=3 097 600 square yards
36 square miles =1 township

CUBIC MEASURE

1728 cubic inches (cu. in.)=1 cubic foot (cu. ft.)
27 cubic feet =1 cubic yard (cu. yd.)
144 cubic inches =1 board foot
128 cubic feet =1 cord

CHAIN MEASURE

[Gunter's or surveyor's chain.]

7.92 inches (in.)=1 link (li.)
100 links =1 chain (ch.)=66 feet
80 chains =1 mile (mi.)=5280 feet

[Engineer's chain.]

12 inches (in.)=1 link (li.)
100 links =1 chain (ch.)=100 feet
52.8 chains =1 mile (mi.)=5280 feet

SURVEYOR'S AREA MEASURE

625 square links (sq. li.)=1 square pole or square rod
16 square poles =1 square chain (sq. ch.), surveyor's
10 square chains =1 acre (A.)
640 acres =1 square mile (sq. mi.)
36 square miles =1 township

LIQUID MEASURE

4 gills (gi.)=1 pint (pt.)
2 pints =1 quart (qt.)=8 gills
4 quarts =1 gallon (gal.)=8 pints=32 gills
31½ gallons=1 barrel (bbl.)=126 quarts
2 barrels =1 hogshead (hhd.)=63 gallons=252 quarts

APOTHECARIES' FLUID MEASURE

60 minims (min. or ℿ)=1 fluid (or liquid) dram (fl. dr. or f℥)
8 fluid drams =1 fluid (or liquid) ounce (fl. oz. or f℥)=480 minims
16 fluid ounces =1 pint (O.)=128 fluid drams=7680 minims
8 pints =1 gallon (C.)=128 fluid ounces=1024 fluid drams

DRY MEASURE

2 pints (pt.)=1 quart (qt.)
8 quarts =1 peck (pk.)=16 pints
4 pecks =1 bushel (bu.)=32 quarts=128 pints
105 quarts =1 barrel (for fruits, vegetables, and other dry commodities)=7056 cubic inches

AVOIRDUPOIS WEIGHT

27 11/32 grains (gr.)	=1 dram (dr.)
16 drams	=1 ounce (oz.)=437½ grains
16 ounces	=1 pound (lb.)=256 drams=7000 grains
100 pounds	=1 hundredweight (cwt.)=1600 ounces
20 hundredweight	=1 ton (tn.)=2000 pounds
	(In long measure)
112 pounds	=1 long hundredweight (l.cwt.)
20 long hundredweight	=1 long ton (l.tn.)=2240 pounds

TROY WEIGHT

24 grains (gr.)	=1 pennyweight (dwt.)
20 pennyweights	=1 ounce (oz. t.)=480 grains
12 ounces	=1 pound (lb. t.)=240 pennyweights=5760 grains

APOTHECARIES' WEIGHT

20 grains (gr.)	=1 scruple (s. ap. or ℈)
3 scruples	=1 dram (dr. ap. or ℥)=60 grains
8 drams	=1 ounce (oz. ap. or ℥)=24 scruples=480 grains
12 ounces	=1 pound (lb. ap. or ℔)=96 drams=288 scruples=5760 grains

CIRCULAR MEASURE

60 seconds (″)	=1 minute (′)
60 minutes	=1 degree (°)
90 degrees	=1 quadrant
4 quadrants	=1 circle or circumference

PAPER MEASURE

[Old measure, still in use for small papers.]

24 sheets	=1 quire (qr.)
20 quires	=1 ream (rm.)=480 sheets

[New measure, used for papers put up in cases, bundles, or frames.]

25 sheets	=1 quire (qr.)
20 quires	=1 standard ream (rm.)=500 sheets

TABLES OF EQUIVALENTS

LENGTHS

1 barleycorn	$\frac{1}{3}$ inch.
1 bolt (cloth)	40 yards.
1 cable's length (U. S. Navy)	120 fathoms. 720 feet. 219.457 meters.
1 centimeter (cm)	0.01 meter. 0.3937 inch.
1 chain (ch.) (Gunter's or surveyor's)	66 feet. 20.117 meters.
1 cubit	1.5 feet.
1 decimeter (dm)	0.1 meter. 3.937 inches.
1 dekameter (dkm)	10 meters. 393.7 inches.
1 fathom (U. S.)	6 feet.
1 foot (ft.)	0.3048 meter.
1 furlong (fur.)	10 chains, surveyor's. 660 feet. 201.17 meters.
1 hairsbreadth	$\frac{1}{4}$ line. $\frac{1}{48}$ inch.
1 hand	4 inches.
1 hectometer (hm)	100 meters. 328 feet and 1 inch. 328.083 feet.
1 inch (in.)	2.5400 centimeters.
1 kilometer (km)	1000 meters. 0.62137 mile. 3280 feet and 10 inches. 3280.83 feet.
1 knot (U. S.)	(See Mile, nautical).
1 league (U. S.)	3 miles (statute). 4.82805 kilometers.
1 line (U. S.)	$\frac{1}{12}$ inch.

1 link (li.) (surveyor's)	7.92 inches. 0.2012 meter.
1 link (li.) (engineer's)	1 foot. 0.3048 meter.
1 meter (m)	39.37 inches. 1.0936 yards.
1 micron (μ)	0.001 millimeter. 0.03937 mil.
1 mil	0.001 inch. 0.02540 millimeter.
1 millimicron (mμ)	0.001 micron. 0.00003937 mil.
1 mile (mi.) (statute or land)	5280 feet. 1.6093 kilometers.
1 mile (mi.) (nautical, geographical, or sea, U. S.)	1.1515 miles (statute). 6080.2 feet. 1853.2 meters.
1 millimeter (mm)	0.001 meter. 0.03937 inch.
1 myriameter (myr)	10 kilometers. 6.2137 miles.
1 nail (na.) (cloth)	$\frac{1}{4}$ span. $2\frac{1}{4}$ inches.
1 pace, military	3 feet.
1 pace, common	$2\frac{1}{2}$ feet.
1 palm	3 inches.
1 point (typography)	$\frac{1}{6}$ line. $\frac{1}{72}$ inch.
1 quarter (qr.) (cloth)	9 inches.
1 rod (rd.), pole, or perch	$5\frac{1}{2}$ yards. 5.0292 meters.
1 span	$\frac{1}{8}$ fathom. 9 inches.
1 yard (yd.)	0.9144 meter.

AREAS OR SURFACES

1 acre (A.)	4840 square yards. 0.40469 hectare.
1 are (a)	100 square meters. 119.60 square yards. 0.02471 acre.
1 centare (ca)	(See Square meter.)
1 hectare (ha)	10 000 square meters. 2.4710 acres.
1 section (of land)	1 mile square.
1 square (building)	100 square feet.
1 square centimeter (cm^2)	0.0001 square meter. 0.15500 square inch.
1 square chain (sq. ch.) (surveyor's)	484 square yards. 404.687 square meters.
1 square decimeter (dm^2)	0.01 square meter. 15.500 square inches.
1 square dekameter (dkm^2)	(See Are.)
1 square foot (sq. ft.)	0.11111 square yard. 929.03 square centimeters. 0.09290 square meter.
1 square hectometer (hm^2)	(See Hectare.)
1 square inch (sq. in.)	0.00694 square foot. 6.4516 square centimeters.
1 square kilometer (km^2)	10 000 ares. 247.104 acres.
1 square link (sq. li.)	0.0484 square yard. 0.04047 square meter.
1 square meter (m^2)	1.1960 square yards. 10.764 square feet.
1 square mil (sq. mil)	0.000001 square inch. 0.000645 square millimeter.
1 square mile (sq. mi.)	640 acres. 3 097 600 square yards. 259.00 hectares.
1 square millimeter (mm^2)	0.01 square centimeter. 0.00155 square inch.

1 square myriameter (myr²)	100 square kilometers. 38.610 square miles.
1 square rod (sq. rd.), sq. pole or sq. perch	625 square links. 30.25 square yards. 25.293 square meters.
1 square yard (sq. yd.)	9 square feet. 0.83613 square meter.
1 township	36 square miles.

CAPACITIES OR VOLUMES

1 barrel (bbl.), dry, for fruits, vegetables, and other dry commodities	7056 cubic inches. 105 quarts, dry. 3.281 bushels.
1 barrel (bbl.), liquid	31.5 gallons. 119.237 liters.
1 board foot	$\frac{1}{12}$ cubic foot. 144 cubic inches.
1 bushel (bu.) (U. S)	2150.42 cubic inches. 35.2383 liters.
1 bushel (bu.) (British)	1.00320 bushels (U. S.)
1 centiliter (cl)	0.01 liter. 0.3381 fluid ounce. 0.6102 cubic inch.
1 cord (c.) (firewood)	128 cubic feet.
1 cord foot (firewood)	$\frac{1}{8}$ cord. 16 cubic feet.
1 cubic centimeter (cm³)	0.000001 cubic meter. 0.0610 cubic inch.
1 cubic decimeter (dm³)	0.001 cubic meter. 61.023 cubic inches.
1 cubic foot (cu. ft.)	1728 cubic inches. 28.3170 cubic decimeters.
1 cubic inch (cu. in.)	0.000579 cubic foot. 16.387 cubic centimeters.
1 cubic meter (m³)	1000 cubic decimeters. 1.3079 cubic yards.
1 cubic millimeter (mm³)	0.001 cubic centimeter. 0.00006 cubic inch.

1 cubic yard (cu. yd.) = 9 cubic feet.
= 0.76456 cubic meter.

1 dram, fluid (or liquid) (fl. dr. or f ʒ) (U. S.) = ⅛ fluid ounce.
= 0.2256 cubic inch.
= 3.6966 milliliters.

1 dram, fluid (or liquid) (fl. dr. or f ʒ) (British) = 0.9607 dram, fluid (U. S.).

1 deciliter (dl) = 0.1 liter.
= 0.8454 gill.
= 0.1816 pint, dry.
= 6.1025 cubic inches.

1 dekaliter (dkl) = 10 liters.
= 2.6418 gallons.
= 1.1351 pecks.

1 firkin = 9 gallons.

1 gallon (gal.) (U. S.) = 231 cubic inches.
= 3.7853 liters.

1 gallon (gal.) (British) = 1.2009 gallons (U. S.).

1 gill (gi.) (U. S.) = ¼ quart, liquid.
= 7.2817 cubic inches.
= 0.1183 liter.

1 gill (gi.) (British) = 1.2009 gills (U. S.).

1 heaped bushel = 2747.715 cubic inches.
= 1.278 bushels, struck measure.
= (Also given as 1¼ bushels.)

1 hectoliter (hl) = 100 liters.
= 26.418 gallons.
= 2 bushels and 3.35 pecks.
= 2.838 bushels.
= 6102.5 cubic inches.

1 hogshead (hhd.), liquid = 2 barrels, liquid.
= 63 gallons.
= 238.474 liters.

1 Imperial gallon = (See Gallon, British.)

1 kiloliter (kl) = 1000 liters.
= 264.18 gallons.
= 28.378 bushels.
= 1.308 cubic yards.

1 liter (l)	1.0567 quarts, liquid. 0.9081 quart, dry. 61.0250 cubic inches.
1 milliliter (ml)	0.001 liter. 0.27052 fluid dram. 16.231 minims. 0.06102 cubic inch.
1 minim (min. or ℥) (U. S.)	$\frac{1}{60}$ fluid dram. 0.00376 cubic inch. 0.06161 milliliter.
1 minim (min. or ℥) (British)	0.96073 minim (U. S.).
1 ounce, fluid (or liquid) (fl. oz. or f ℥) (U. S.)	$\frac{1}{32}$ quart, liquid. 1.8047 cubic inches. 29.573 milliliters.
1 ounce, fluid (or liquid) (fl. oz. or f ℥) (British)	0.96073 fluid ounce (U. S.)
1 peck (pk.) (U. S.)	573.605 cubic inches. 8.8096 liters.
1 peck (pk.) (British)	1.0320 pecks (U. S.).
1 pint (pt.), dry (U. S.)	33.60 cubic inches. 0.5506 liter.
1 pint (pt.), liquid (U. S.)	28.875 cubic inches. 0.47317 liter.
1 pint (pt.) (British)	1.0320 pints, dry (U. S.). 1.2009 pints, liquid (U. S.).
1 quart (qt.), dry (U. S.)	67.20 cubic inches. 1.1012 liters.
1 quart (qt.), liquid (U. S.)	57.75 cubic inches. 0.94633 liter.
1 quart (qt.) (British)	1.0320 quarts, dry (U.S.). 1.2009 quarts, liquid (U. S.).
1 quarter (qr.), dry (U. S.)	8 bushels.
1 stere (s)	(See Cubic meter.)
1 tierce, liquid (U. S.)	42 gallons.
1 Winchester bushel	(See Bushel, U. S.).

WEIGHTS OR MASSES

1 barrel (bbl.), (of flour)	196 pounds.
1 barrel (bbl.), (of lime, large)	280 pounds.
1 barrel (bbl.), (of lime, small)	180 pounds.
1 carat (c), metric	200 milligrams. 3. 0865 grains.
1 centigram (cg)	0. 01 gram. 0. 15432 grain.
1 decigram (dg)	0. 1 gram. 1. 5432 grains.
1 dekagram (dkg)	10 grams. 0. 35274 ounce.
1 dram, avoirdupois (dr. av.)	1/16 ounce. 27. 344 grains. 1. 7718 grams.
1 dram, apothecaries' (dr. ap. or ℥)	60 grains. 3. 8879 grams.
1 grain (gr.)	1/7000 pound. 64. 799 milligrams.
1 gram (g)	15. 432 grains. 0. 03527 ounce.
1 hectogram (hg)	100 grams. 3. 5273 ounces.
1 hundredweight, long (l. cwt.)	112 pounds. 50. 802 kilograms.
1 hundredweight, short (cwt. or sh. cwt.)	100 pounds. 45. 359 kilograms.
1 kilogram (kg)	1000 grams. 2. 2046 pounds.
1 millier	(See Ton, metric.)
1 milligram (mg)	0. 001 gram. 0. 01543 grain.
1 myriagram (myg)	10 kilograms. 22. 046 pounds.
1 ounce (oz.), avoirdupois	437·5 grains. 28. 350 grams

1 ounce, troy or apothecaries' (oz. t. or oz. ap. or ℥)	480 grains. 1. 0971 ounces, avoirdupois. 31. 103 grams.
1 pennyweight (dwt.)	24 grains. 1. 5552 grams.
1 pound (lb.), avoirdupois	7000 grains. 453. 5924 grams.
1 pound, troy or apothecaries' (lb. t. or lb. ap.)	5760 grains. 0. 82286 pound, avoirdupois. 373. 24 grams.
1 quarter, long (l. qr.)	28 pounds. 12. 701 kilograms.
1 quarter, short (qr. or sh. qr.)	25 pounds. 11. 340 kilograms.
1 quintal, avoirdupois	(See Hundredweight, short.
1 quintal, metric	100 kilograms. 220. 46 pounds.
1 scruple, apothecaries' (s. ap. or ℈)	20 grains. 1. 2960 grams.
1 stone (British)	14 pounds.
1 ton, long or gross (l. tn.)	2240 pounds. 1. 1200 tons, short. 1. 0160 tons, metric.
1 ton, metric (t), tonneau, or millier	1000 kilograms. 0. 98421 ton, long. 1. 1023 tons, short.
1 ton, short or net (tn. or sh. tn.)	2000 pounds. 0. 89286 ton, long. 0. 90718 ton, metric.
1 tonneau	(See Ton, metric.)

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