

331 CMR 7.00: DETERMINATION OF MILK FAT CONTENT IN MILK OR CREAM

Section

- 7.01: Sampling Milk
- 7.02: Approved Methods of Testing Milk
- 7.03: Babcock Centrifugal Method
- 7.04: Turbidimetric Method (Foss Milk-o-Tester)
- 7.05: Tables, Figures and Forms
- 7.06: Approved Method of Testing Cream
- 7.07: Care of Glassware and Testing Apparatus
- 7.08: Standard Glassware
- 7.09: Methods of Computing Milk Fat Test Results in Making Payment for Milk
- 7.10: Action with Respect to Improper or Unrepresentative Samples
- 7.11: Measuring, Sampling and Accepting of Raw Milk at Dairy Farms

7.01: Sampling Milk

(1) Frequency of Sampling. A representative sample shall be taken from the entire delivery of each dairy farmer's milk on the day and at the time that such milk, if in cans, is delivered to or received at a milk plant or receiving station, or, if stored in a farm bulk milk tank, is received at the dairy farmer's farm into a tank truck. A determination of milk fat content in such samples as a basis for payment to dairy farmers shall be made in accordance with the provisions of this part either from a composite of such samples, from fresh milk samples of each delivery or from fresh milk samples selected at random.

(a) Unless such samples are to be tested while fresh they shall be combined into a composite sample covering a delivery (pay) period not to exceed 16 days, and reasonable care shall be taken so that each sample added to the composite will, to the extent practicable, reflect proportionately any significant increase in the volume of milk per delivery. Composite samples shall be taken for the entire delivery (pay) period to which payment is applicable and shall not include samples of milk taken during another such period.

(b) Written approval of the director of milk control shall be obtained prior to any use of randomly selected fresh milk samples in determining milk fat content as a basis for payment to dairy farmers. Not less than three such samples (or six in the case of every day delivery) representing a total of six full days milk production as available for delivery on a regular basis shall be so selected in each month for testing by an approved method specified in 331 CMR 7.02 through 7.05. $\frac{1}{3}$ of such samples shall be selected at random from those collected during each approximate ten-day period of the month. Except in the case of herds milked three times daily, no randomly selected fresh milk sample representing an odd number of milkings shall be used in such determinations.

(c) The director of milk control, or his duly authorized agent, may require licensed milk dealers, operators of milk receiving stations or licensed operators of tank trucks receiving milk at dairy farms to collect such additional samples, either composite or fresh, as he may deem reasonable for the purpose of confirming accuracy of sampling and testing and otherwise providing means of verifying compliance with applicable laws, rules and regulations.

(2) Sampling Equipment. Each person taking milk samples the tests of which are to be used in determining a basis for payment in buying or selling shall be equipped as approved jointly by the director and the director of milk control. Such equipment shall include, but not necessarily be limited to, the following:

- (a) Agitator of stainless steel or other approved means of agitation.
- (b) Dipper of ten ml. capacity. Stainless steel or other approved material. Dippers of larger capacity may be used if approved.
- (c) Suitable cylinder or other receptacle for storing sampling equipment and supplies.
- (d) Chemicals for preservation of samples as required.
- (e) Sanitizing Agent.

7.01: continued

(f) Sample containers of glass or other composition each provided with a tight closure to prevent spillage, evaporation and contamination. Each sample container shall be approximately $\frac{1}{4}$ larger in terms of interior capacity than the largest milk sample it is intended to hold so as to permit thorough mixing of the sample prior to testing and to avoid adherence of fat to the inner surface of the closure. The $\frac{1}{2}$ or one pint size wide-necked bottle with rubber stoppers is recommended for composite samples; single service containers of approved composition, design and size may be used for fresh milk samples. For composite sampling three sets of sample containers shall be provided to facilitate the taking of samples, on days that milk fat tests are made and to permit holding of tested samples as provided in 331 CMR 7.01(5).

(3) Sampling Normal Milk.

(a) Each milk sample taken for use in determining a basis for payment in buying or selling shall be truly representative of all the milk to be sampled. Before sampling, therefore, a uniform mixture of milk and milk fat shall be obtained by complete manual or mechanical agitation. In all cases, agitation shall be continued until all cream has been detached from the walls of the can or tank holding the milk and all particles thereof have been broken up and evenly distributed throughout the milk. Prior to transferring a sample to the sample container, the sample dipper shall be rinsed three times in the milk. Whenever milk fat content is to be determined from composite samples, the size of sample taken from each dairy farmer delivery shall not be less than ten ml. for each day's complete milkings so that, for example, the minimum total content of a composite sample representing 14 days' milk production shall not be less than 140 ml. Whenever determination of milk fat content is to be made from randomly selected fresh milk samples by the turbidimetric method (see 331 CMR 7.04), the representative sample drawn from each dairy farmer delivery shall be of sufficient quantity so that not less than 22 ml. remains after initial testing to allow for retesting by the Babcock centrifugal method (see 331 CMR 7.03). If any such determination is to be made from fresh samples initially by the Babcock centrifugal method, each sample drawn shall be not less than 40 ml.

1. Milk in cans. The name or assigned number of each dairy farmer shall be clearly marked on the body of each can in which his milk is delivered or shall be clearly shown on a tag securely fastened to a handle of each can. Receipt of can milk identifiable only by marking on can covers is prohibited. After thorough agitation, a representative sample shall be taken from the center of each can and placed in a clean, dry vessel. If each can delivered does not contain the same quantity of milk, the sample taken from each shall be proportionate. By use of another clean, dry vessel, the combined samples drawn from each can shall be poured back and forth at least three times and a representative sample of the entire delivery shall then be transferred to the sample container.

2. Milk in weigh-tanks. Unless milk delivered in cans has been thoroughly agitated before dumping into a weigh-tank, no sample thereof shall be taken until complete manual or mechanical agitation of the contents of the weigh-tank has been accomplished. If the volume of milk delivered by a dairy farmer makes more than one weighing necessary, or if the weigh-tank used has more than one compartment, the delivery shall be divided into approximately equal parts and a representative sample shall be taken of each such part for combination, mixing and sampling as provided in 331 CMR 7.01(3)(a)1. Weigh-tanks, including gates and valves, shall be maintained in leakproof condition, and no weigh-tank or compartment thereof from which a sample is to be taken shall be divided by any straining device.

3. Milk in farm bulk tanks (see also 331 CMR 7.11). In all instances of sampling milk contained in farm bulk tanks, the milk therein shall be thoroughly mixed by mechanical agitation; provided, that, in the event of power or mechanical failure, a clean and properly sanitized stainless steel hand agitator may be used.

7.01: continued

(b) An approved chemical preservative shall be added in the prescribed quantity to a composite sample container before adding the representative sample of milk. Potassium dichromate at the rate of one grain per 100 ml. of milk is recommended for general use. Preservation of fresh milk samples is unnecessary except in emergency situations and, if the turbidimetric testing method is to be used, only potassium dichromate shall be utilized in such emergency. Upon starting a composite sample, and with each succeeding sample added thereto, a gentle rotary motion shall be used to mix the preservative throughout the sample, thus preventing fat from drying on the inside of the sample container and from forming a hard leathery layer. All samples of milk to which a chemical preservative has been added and all unused supplies of such a chemical shall be kept tightly closed in a locked cabinet or room, except at such times as the milk dealer or receiving station operator, or the authorized agent of either, is in immediate attendance.

(4) Sampling Milk in Abnormal Conditions.

(a) If any portion of a dairy farmer's delivery of milk is known to be frozen, no sample thereof shall be taken until the frozen portion has been gradually thawed out and thorough mixing of the milk has been accomplished.

(b) Milk which clearly shows evidence of churning shall not be sampled.

(c) Milk which is rejected for normal use because of off-flavor, off-odor, high temperature, presence of foreign material or otherwise shall not be sampled unless and until it has been accepted for delivery in some other use. In the case of can milk which is not so accepted, the dairy farmer who produced it shall be given an opportunity to arrange for its return.

(d) If any abnormal conditions, including but not limited to those specified in 331 CMR 7.01, prevent or affect the proper sampling of dairy farmer milk deliveries or result in the non-acceptance thereof, the person responsible for determining the acceptability of such deliveries shall immediately notify the dairy farmer and the director of milk control of such conditions and it shall be the responsibility of the dairy farmer to take corrective action as soon as possible.

(5) Identification, Care and Holding of Samples. The provisions of this section shall apply in particular to milk samples which are intended for testing in the determination of milk fat content as a basis for payment in buying or selling, but shall also apply, whenever appropriate, to the identification, care and holding of samples drawn from dairy farmer milk deliveries for other purposes such as flavor or quality control.

(a) Only clean, dry containers of a type authorized for use under the provisions of 331 CMR 7.01(2)(f) shall be used for milk sample storage. To insure accurate identification of the sample with the dairy farmer from whose delivery it was drawn, each such container shall be plainly marked either with a metal tag on which a number assigned to the dairy farmer is stamped and which is securely fastened to the neck of the container or by indelibly marking such an assigned number on the body of the container. Numbering on the container cap or stopper only is prohibited, unless such cap or stopper is permanently secured to the container. Sample containers shall be consecutively numbered and conflicting numbers shall not appear thereon. In the case of composite samples, care shall be taken to add the sample of each dairy farmer delivery to the correctly numbered container. Other equally satisfactory methods of sample container identification may be used; provided, that approval of any such alternative method is obtained from the director of milk control prior to use.

(b) During the sampling and holding periods specified in 331 CMR 7.01, each set of sample containers shall be identified with a suitable tag showing the date or dates of the dairy farmer deliveries which they represent, the dates of testing and the name and license number of the tester. All samples shall be kept in a vertical position at all times and shall be arranged in numerical order according to the assigned identification numbers and, except when under the immediate supervision of the milk dealer or receiving station operator, or the authorized agent of either, shall be held under tamperproof conditions in a locked cabinet, rack or box. Exposure of milk samples to strong light shall be avoided.

7.01: continued

(c) During the sampling and holding periods specified in 331 CMR 7.01, the temperature of milk in sample containers shall be maintained at all times at from 33° to 40°F. Under no circumstances shall milk samples be allowed to freeze, sour, "oil off" or mold. All premises used in the taking or testing of milk samples for the purpose of determining milk fat content as a basis for payment in buying or selling shall have proper and adequate facilities for the storage of such samples as provided herein and in 331 CMR 7.01(5)(c)b..

(d) Sample containers which are in use shall be kept tightly closed at all times, except when removal of the cap or stopper is necessary for the purpose of adding a newly sampled portion of milk to a composite sample or for tempering and testing such a sample. The collection or condensation of moisture on or near the exterior surface of the cap or stopper shall be avoided. Stoppers which show evidence of mold growth shall, prior to further use, be immersed for not less than ten minutes in a diluted formalin solution (four parts of 40% formaldehyde solution to 96 parts of water) or treated by another equally effective method.

(e) Composite milk samples shall be tested in the plant or receiving station at which the milk deliveries which such samples represent are normally received, unless written permission has been granted by the director of milk control or his duly authorized agent to transfer them for testing to another plant or station or to an approved laboratory within the state. Fresh milk samples selected at random for testing by an approved electronic method may be transferred to an approved laboratory irrespective of location. Only entire samples and not "split" samples shall be transferred and due care shall be taken to maintain samples within the prescribed temperature range and to prevent churning in transit. Whenever composite samples are tested outside the plant at which the milk deliveries represented to them were originally received, they shall be returned to the place of original receipt on or before the fifth day after the close of the delivery (pay) period to which they are applicable; provided, that the operator of an approved dairy laboratory may be exempted by the director of milk control from such provision for the return of samples if the following conditions are met:

1. He has received written authority from the director of milk control granting such exemption.
2. He notifies the director of milk control in writing of the names and addresses of all milk dealer or milk receiving station operators whose samples have been transferred to him.
3. He makes all such samples available at all reasonable times for check-testing by a duly authorized agent of the director of milk control or by an official representative of any dairy farmer whose milk sample he has tested.

(f) When samples are transferred as provided in 331 CMR 7.01(5)(e), the shipping carton or rack holding each lot of samples shall be clearly and indelibly identified by an attached label or tag which shall show the plant or station from which the samples originate, the date or dates of sampling and the name of the sampler. The date on which such samples were received for testing and the date or dates of testing shall also be entered thereon.

(g) No person licensed under the provisions of M.G.L. c. 94A, § 28, of the general law, shall test any sample to determine a basis for payment in buying or selling unless the container thereof is properly marked as provided in 331 CMR 7.01(5)(g), and the shipping carton or rack is properly labeled or tagged as provided in 331 CMR 7.01(5)(f) and unless he has access to a register permitting full identification of the dairy farmer whose milk the sample represents from the number marked on the sample container. Immediately after each sample has been tested, an indelible record thereof shall be made of the dairy farmer's number, name and address and of the test result. Such record shall also show the date of testing, the milk delivery date or period which the sample represents, the tester's name, license number and signature, and the name and address of the milk dealer or receiving station operator at whose plant or in whose behalf the sample was taken. Each such record shall be kept on file for at least 12 months at the plant of receiving station where the milk deliveries represented by the samples were received and a duplicate record shall be kept on file for a like period in the laboratory in which the samples were tested. Where dairy farmer payrolls are processed by computerized methods, the use of other forms and procedure for maintaining accurate testing records may be approved by the director of milk control provided, that, in his opinion, such use complies with the pro-

7.01: continued

visions of 331 CMR 7.01. Such records shall be available for examination at all reasonable times by the director, the director of milk control or the duly authorized agent of either. Pertinent information from any such record shall also similarly be made available upon request to any dairy farmer whose test results are entered therein or to his official representative.

(h) Composite samples in proper condition for testing shall be tested within five days, excluding Sundays and legal holidays, after the close of the delivery (pay) period to which they apply, and written notification of the test result shall be sent to the dairy farmer affected within three days of the date of such test. Fresh milk samples shall be tested within 72 hours of sampling and written notification of the simple average of the test results on all fresh milk samples tested during a given month in determining milk fat content as a basis for payment to him shall be sent to the dairy farmer affected not later than the tenth day of the following month.

(i) After original testing, the remaining portion of each composite sample shall be held under proper conditions as specified in this part for a period of at least five days following the report of test results required by 331 CMR 7.01(5)(h). The remaining portion of the fresh milk samples tested for payment purposes shall be preserved intact for at least one day under refrigeration following original testing. The director of milk control may exempt licensees from this requirement on the basis of established adequate internal control. Such exemption continues in effect unless revoked at the discretion of the director of milk control.

(j) Any test for milk fat content made for purposes of comparison with or verification of an original test shall be made only by a licensed tester in accordance with the provisions of this part and of applicable laws.

(k) Following test and after the holding period required in 331 CMR 7.01(5)(i), sample containers, unless of the single service type, shall be thoroughly washed and dried prior to re-use.

(l) Any sample which has been taken, marked for identification, handled or stored otherwise than in accordance with the provisions of this part shall be deemed unsatisfactory for testing.

(m) No test result obtained from a sample which has been so treated or handled as to cause it to reflect inaccurately the milk fat percentage of the milk from which it was drawn shall be used as a basis for payment.

(n) No dairy farmer delivering milk which is purchased on the basis of the percentage of milk fat contained therein shall be credited with a greater or lesser percentage or average percentage, of milk fat than is actually contained in the milk which he delivered.

(o) No sample test result shall be reported or recorded which represents a greater or lesser percentage, or average percentage, of milk-fat than is actually contained in the milk from which the sample was drawn.

(p) No test result shall be reported or recorded unless such a test has actually been performed.

(q) The director, the director of milk control or the duly authorized agent of either shall enter upon the premises where samples of milk are taken, stored or tested as a basis for payment in buying or selling and may take possession of any or all samples of milk which are on such premises or in the possession of an employee for the purpose of check-testing them for milk-fat content, or may take composite or fresh milk samples from dairy farmer deliveries at plants or milk receiving stations or on dairy farms and may test such samples on the premises or at a laboratory approved by the director of milk control. No sample of milk which has been tested or is to be tested for the purpose of determining milk-fat content as a basis for payment in buying or selling and which is found to be in improper condition for testing or to be not clearly representative on the basis of separately tested reference samples shall be considered valid in any such determination and a report of such circumstances shall be made to the director of milk control who shall take such action as he may deem appropriate under the provisions of applicable law or 331 CMR 7.00.

331 CMR: BUREAU OF MILK MARKETING

7.02: Approved Methods of Testing Milk

The following methods (331 CMR 7.03 and 7.04) are approved and prescribed for use in determining milk-fat content as a basis for payment in buying or selling and shall be subject to routine procedural change from time to time with joint approval of the director and the director of milk control in order to assure continuing conformity with the latest related changes approved and published by the association of Analytical Chemists (AOAC).

7.03: Babcock Centrifugal Method

(1) Apparatus Required.

- (a) Milk test bottles 8% (See 331 CMR 7.08)
- (b) Centrifuge or tester with thermostatic heat control set at 131- 140°F must run rated speed as required in 4d.
- (c) Pipette 17.6 ml (See 331 CMR 7.08)
- (d) Acid measure 17.5 ml (See 331 CMR 7.08)
- (e) Thermometer.
- (f) Speed indicator.
- (g) Manual or mechanical reading dividers or calipers.
- (h) Tempering bath.
- (i) Reading light. As background when measuring fat columns. Light should be diffused (soft green color preferred) and provide illumination from angles above and below level of fat column. Attached magnification devices are suggested.
- (j) Sulfuric acid (Specific gravity of 1.82 to 1.83).

(2) Preparing Individual or Daily Samples for Testing.

- (a) Samples that are in good condition and are tested the same day as taken should be warmed to about 100°F. and mixed thoroughly by pouring from one vessel to another at least three times. All the fat must be well mixed in and the sample uniform throughout before transferring the test charge to the test bottle.
- (b) Samples that are held overnight may have dried fat on the stopper or inside of the sample bottle and should be prepared as though they were composites.

(3) Preparing Composite Samples for Testing.

- (a) Place bottles in warm water up to necks and warm the sample to about 100 to 105°F. to soften all dried fat. Do not exceed 105°F. because of the danger of "oiling off" the milk-fat. Use a policeman to remove any dried fat adhering to the stopper or the inside of the sample bottle.
- (b) Agitate the contents of the bottles gently by a rotary motion several times during the course of preparation to prevent them from "oiling off" when left standing in warm water, also to mix in the softened fat. Never shake the sample vigorously as it may churn the milk-fat. Continue the preparation as above until all the fat is well mixed in and the sample uniform throughout. Pipette samples at between 100° and 105°F. and before adding acid let cool to about 70°F. Mix thoroughly by pouring from one vessel to another at least three times and immediately pipette samples at 100°F. The sample is usually well mixed when it delivers from the pipette into the test bottle without leaving any milk-fat or curd particles adhering to the pipette.

(4) Making the Test.

- (a) Draw into the pipette 17.6 ml of milk prepared as above, and transfer to the milk test bottle carefully; and after about 30 seconds blow the last drop remaining in the end of the pipette into the test bottle. Adjust milk to 22°C \pm (71.6°F).
- (b) Add portion wise 17.5 ml of acid. In adding acid, care should be taken to rinse down the milk adhering to the inside of the neck of test bottle. The temperature of the acid should be 22°C \pm 1°C (71.6°F \pm 1.8°F).
- (c) Mix the milk and acid together by a rotary motion until all the solids not fat have been digested by the acid. Reaction temperature should be 100-105°C (212-221°F). Allow the bottles to stand from one to three minutes before centrifuging to get as complete action of the acid as possible. Mix again before placing in the centrifuge.

7.03: continued

(d) Place the bottles in heated ca 60°C (140°F) centrifuge, balancing the machine by distributing the bottles evenly in the tester. Whirl at the proper speed for five minutes. The proper speed at which to operate the tester will vary according to the diameter of the whirling disc. The following table shows the number of revolutions per minute at which machines of different diameters must be operated. Allow a tolerance of 25 R.P.M. plus or minus, for each speed indicated below:

TABLE 1.

Diameter of Whirling Disc Inches	Number of Revolutions Per Minute
14	909
16	848
18	800
20	759
22	724
24	693

The five minute period of centrifuging must not include the time required to start and stop the machine.

(e) Add hot water above 60°C (140°F) preferably soft or distilled water, until the contents of the test bottle are about ¼ to ½ inch below the base of the neck. Hard water may cause foam on top of fat column and interfere with the reading of the test; if necessary to use it, a small amount of sulfuric acid should be added first.

(f) Whirl in centrifuge for two minutes.

(g) Add hot water above 60°C (140°F) until the fat column is within the graduated scale on the neck of the test bottle.

(h) Whirl in the centrifuge for one minute at 60°C (140°F).

(i) Remove the tests from the centrifuge and place them in a bath of hot water for five minutes. The water in the bath must be 55-60°C (131-140°F), preferably 57°C (134.6°F), and extend to the full height of the fat in the test bottle. It is advisable to have the water at 60°C (140°F) when starting to read the tests and to have some arrangement whereby the temperature can be maintained about 57°C (134.6°F) until all the tests are read. Tempering the tests in the centrifuge will not be permitted because of uneven temperature and inaccurate results.

(j) Remove bottle from the tempering bath, wipe it, and with the aid of the reading light use dividers or calipers to measure fat column in terms of % by wt. to nearest 0.05% from the bottom of the fat column at its lowest point to the top of the fat column at the upper point of the meniscus or cup-shaped surface of the fat column. The use of divider or calipers is required as it facilitates the work and reduces the chance of error. In reading the tests, do not remove a second bottle from the tempering bath until the first has been read and recorded.

(k) Retests must be made if in the finished test the fat column contains charred or foreign substances or curdy particles, or if it is not a perfect test.

A perfect test for milk fat appears as follows:

1. Bright yellow straw color fat column.
2. Extremities of fat column sharply defined.
3. Fat column free from foreign substances as curd or char.
4. Liquid beneath fat column clear.
5. Fat within graduated scale on neck of bottle.

When composite samples of milk vary in milk-fat test, three-tenths of 1% or more from the composite test of the previous period a re-test shall be made to check the accuracy of such test and the result of such test recorded. Variation in milk-fat tests of 3/10 of 1% or more from the previous period test shall be reported in writing. The report shall be mailed within 24 hours by the certificated tester to the milk producer or his authorized representative. When the producer is a member of a cooperative association and its authorized agent is present at the laboratory when such test is made, oral notification to him shall be sufficient.

7.03: continued

- (l) Individual or daily samples must not be poured out until tests have been read, recorded and checked.

7.04: Turbidimetric Method (Foss Milk-O-Tester*).

This method is approved only for determination of milk-fat content in unhomogenized milk. (N. B. within the following text, except for obvious code references, Figures 1 and 2 in 331 CMR 7.05 should be seen.)

(1) Certification and Licensing Requirements.

- (a) No person shall operate a Milk-o-Tester to determine the fat content of milk for payment purposes or for official inspection unless the facilities and testing equipment to be used have been found adequate and have been approved by the director.
- (b) No person shall operate a Milk-o-Tester to determine the fat content of milk for payment purposes or for official inspection unless certificated as to competency by the director and licensed by the director of milk control.
- (c) Any person testing milk samples to be used for the purpose of controlling the accuracy of a Milk-o-Tester shall be certificated as to competency by the director to test milk for fat content by the Babcock centrifugal or other method approved for such purpose by the AOAC and recognized jointly by the director and the director of milk control.

(2) Reference Methods.

- (a) The Babcock centrifugal method, Gerber, Roese-Gottlieb or other method approved jointly by the director and the director of milk control, for determining fat content in milk shall be used as the reference method to maintain the calibration of the Milk-o-Tester instrument as described below.
- (b) Written notification of the reference method to be used shall be sent to the director prior to the installation and first use of a Milk-o-Tester, and any subsequent change in such reference method shall be made only with his specific approval.

(3) Laboratory Facilities and Reagents. The following supplies and facilities shall be available and instruments shall be in good working order:

- (a) Complete set of approved equipment and reagents for testing control milks by an approved reference method.
- (b) A turbidimetric instrument with automatic diluent dispenser intended for testing milk for fat content, accessories, and instruction manual appropriate for the machine in use.
 - 1. Any automatic diluent dispensing device added to a manual instrument shall be done in a manner so as to be activated by either manual means or by changing the position of the collection funnel (7 in Figure 1 of 331 CMR 7.05) and so that the tubing connecting the dispenser to the separation check valve (17 in Figure 1 of 331 CMR 7.05) does not change dimensions during operation of the dispenser.
 - 2. The addition of an automatic dispensing device or any other modification of the instrument shall not change any of the provisions of 331 CMR 7.00, especially those dealing with control and calibration of the instrument.
- (c) Thermostatically controlled water bath with recording thermometer, with proper temperature distribution, set to maintain sample temperature at 95° to 100°F.
- (d) Power supply. Single phase, 115V or 220V, 50 or 60 cycles, within 10% fluctuation with indicating voltmeter convenient to operator.
- (e) Means of measuring pH.
- (f) A strainer of 80 - 100 mesh screen to clarify and mix samples when manual model is in use.

* Foss America, Inc., Fiskill, New York.

7.04: continued

- (g) Supply of distilled or deionized water for flushing and preparation of diluent.
 - (h) Refrigeration at 33° - 40°F for milk sample storage.
 - (i) A laboratory with adequate lighting facilities, adequate counter surface to accommodate all essential equipment and free from disturbing drafts, dust, noise and vibrations.
 - (j) Hot and cold water, wash sinks, and cleansing agents to clean equipment.
 - (k) Adequate waste and sewage system to dispose of all milk, acid and wash water.
 - (l) Preservative. If used, one grain potassium dichromate for each 100 ml. of milk or other formulations approved jointly by the director and the director of milk control.
- (4) Diluent for the Manual Milk-o-Tester. The diluent for the manual Milk-o-Tester shall consist of the following reagents:
- (a) Manual Model with Automatic Diluent Dispenser.
 1. 10.0 liters of distilled or deionized water; 45.0 grams of disodium ethylenediaminetetraacetate, Dow Chemical Co. (EDTA); 7.6 grams of reagent grade sodium hydroxide (NaOH); 10.0 milliliters Tween 20, Atlas Chemical Industries, Inc., (polyoxyethylene (20) sorbitan monolaurate).
 2. If the diluent is to be assembled from the reagents by the user, the following procedure shall be followed: Wash the EDTA into the container with one liter of the distilled water. Dissolve the NaOH in one liter of distilled water and add. Next add seven liters of distilled water. Finally add the 10.0 milliliters of "Tween 20" and rinse the funnel with the final liter of distilled water. Mix well and let stand several hours for air bubbles to disappear. The pH of the final mixture shall be between 9.5 and 10.01.
 3. If the diluent mixture or a concentrated or dried form is purchased from a supplier, the supplier's instructions for making an equivalent solution shall be followed.
 - (b) For Semi-Automatic and Automatic Milk-o-Testers: 45 grams of disodium ethylenediaminetetraacetate, Dow Chemical Co. or J.T. Baker Chemical Co. (EDTA).
7.6 grams of reagent grade sodium hydroxide (NaOH); 1 ml Triton X-100, Rohm & Haas; 1 ml Antifoam A emulsion, Dow-Corning Corporation; sufficient distilled or deionized water to dilute above reagent to 10 liters. The general procedure of 331 CMR 7.04(4)(a)2. shall be followed.
 - (c) Or other approved equivalent for 331 CMR 7.04(4)(a) or 7.04(4)(b) as may be recognized by the director.
- (5) Routine Inspection and Control Prior to Daily Use.
- (a) Preparation of Control Samples. At least four control samples of unstandardized natural milk of sufficient quantity, shall be available to allow for the performance and accuracy checks required by 331 CMR 7.04(5)(a)3. and 7.04(5)(a)4. for a 24 hour period.
 1. At least one control milk shall be a pooled sample of unhomogenized milk from a minimum of three herds and/or 100 cows testing between 3 and 4% fat and at least one control milk shall test between 5 and 6% milk fat.
 2. Each control sample shall be tempered to 95-100°F, on approved preservative added at the required rate if control sample is to be used more than 24 hours after preparation, and mixed thoroughly. Churning shall be avoided. Subdivide each sample into subsamples of adequate size. Keep the control sample thoroughly mixed, but avoid churning during subsampling.
 3. A subsample of each control milk shall be tested in triplicate by the reference method for fat content. All readings shall be made to at least the nearest 0.05% fat if the Babcock or Gerber test is used and to the nearest 0.01% if the Roesse-Gottlieb test is used. The individual results and the average for each control milk shall be recorded as provided in Table 6 in 331 CMR 7.05(6).
 4. The remaining control subsamples shall continue to be stored at 33-40°F. until used. No subsample more than ten days old shall be used.

7.04: continued

5. Prior to the expiration date or use of the last subsample of control milk, whichever comes first, preparation of a new set of control samples shall be completed.

Alternatively, standard mixtures approved by the director may be used in lieu of the control milks. Such mixtures shall be stored, tempered, and tested in the manner prescribed by the director.

(b) Instrument Inspection Prior to Daily Use of Milk-O-Tester Where Applicable:

1. With all electrical power disconnected from the instrument, the meter (14 in Fig 1 in 331 CMR 7.05) shall read exactly 9.2.
2. With the power on, the meter shall read zero with diluent only in the cuvette (9 in Figure 1 in 331 CMR 7.05).
3. The diluent check valve (15 in Figure 1 in 331 CMR 7.05) in the diluent system between the syringe and the diluent supply bottle shall be inspected, thus: Remove the tube from the supply bottle, invert and cycle the automatic syringe. If the film of diluent on the screen increases in quantity, the valve shall be replaced and the inspection repeated until the valve is found satisfactory.
4. There shall be no air bubbles in the diluent syringe (2 in Figure 1 in 331 CMR 7.05) or the tubing connecting this syringe to the separation check valve (17 in Figure 1 in 331 CMR 7.05).
5. Place cooled, freshly boiled distilled or deionized water on the sample intake (three in Figure 1 in 331 CMR 7.05) and press the start button. Collect the discharged water until the collection funnel (seven in Figure 1 in 331 CMR 7.05) is approximately ½ full. If the water has a milky appearance, air is being drawn into the system. This leak must be eliminated before proceeding.
6. The separation valve (in Figure 1 in 331 CMR 7.05) shall be inspected by cycling milk at least three times without collection. If milk leaks back into the diluent line, the valve shall be replaced and the inspection repeated until the valve is found satisfactory.
7. The water bath (18 in Figure 1 in 331 CMR 7.05) shall be maintained at 140°F ± 1°F and at the proper level. The hot water shall circulate freely through the homogenizer heating coil (16 in Figure 1 in 331 CMR 7.05).
8. All moving parts and hose connections shall be inspected for leaks and proper operation. The supply of diluent shall be checked for adequacy.

(c) Daily Performance Check.

1. Accuracy Check. Each day before routine testing begins, at least one subsample of control milk shall be tested in triplicate. Read the test to 0.01%. Disregard the first reading. If the difference between the average of the second and third reading and the average of the three reference method result is 0.1% fat or less, proceed to 331 CMR 7.04(5)(c)2. If the difference is more than 0.1%, test 3 more samples of new control milk. If the average difference of the additional samples exceed 0.1% discontinue operation of the machine, determine the reason and correct before resuming operation.
2. Repeatability Check. Each day before routine testing begins ten consecutive readings on a single well mixed bulk sample of milk shall be made and recorded as a permanent record. The standard deviation of the results shall be made and recorded as a permanent record. The standard deviation of the results shall be less than ± 0.03% fat. This standard deviation, defined below may be assumed to be below the maximum if the range of the ten readings is .07 or less. If the standard deviation is exceeded, discontinue operation of the machine until the cause is determined and corrected. The standard deviation of results shall be calculated by the mathematical equivalent of the following formula:

$$S = \sqrt{\frac{\sum (x_1^2) - \frac{(\sum x_1)^2}{N}}{(N-1)}}$$

Where X_i = results for the i^{th} reading.

N = number of readings.

S = standard deviation of results.

Σ = sum of readings.

7.04: continued

(6) Routine Testing by Milk-o-Tester Method.

(a) Preparation for Testing.

1. A sample shall be tempered to 95-100°F. in the thermostatically controlled water bath prior to testing.
2. Samples held over 24 hours shall be prepared in accordance with 331 CMR 7.03(2)(b).
3. The well mixed sample shall be poured through an 80-100 mesh screen immediately prior to testing when using a manual machine.

(b) Testing of Manual Milk-o-Tester With Automatic Diluent Dispenser.

1. The well-mixed sample shall be placed on the milk intake tube (3 in Figure 1 in 331 CMR 7.05) and the start button pressed immediately after mixing. Air entrance into the milk intake tube shall be avoided.
2. The operator shall wait at least three seconds after the homogenizer (5 in Figure 1 in 331 CMR 7.05) stops before depressing the collection funnel plunger (8 in Figure 1 in 331 CMR 7.05) and activating the diluent syringe (2 in Figure 1 in 331 CMR 7.05).
3. The operator shall wait for the diluent syringe (2 in Figure 1 in 331 CMR 7.05) to return to its rest position under its own power before releasing the collection funnel (7 in Figure 1 in 331 CMR 7.05). The operator shall not assist the return of the syringe in any way.
4. The meter (14 in Figure 1 in 331 CMR 7.05) shall be read to the nearest 0.1% fat immediately after the indicating needle stabilizes, or within 20 seconds, and the results recorded.
5. With any sample that is more than 2.0% fat difference from the preceding sample, disregard the first test result and the sample shall be rerun and the rerun result recorded.
6. If no sample is to run within five minutes, distilled water or diluent shall be cycled through the homogenizer and cuvette twice to clean. The first reading on the next sample shall be invalid and that sample shall be rerun.
7. The instrument cover or suitable replacement shall be in place during operation of the machine.
8. Testing of semi-automatic and automatic models of "Milk-o-Tester". Applicable operational procedures approved by the director shall be followed, otherwise provisions of 331 CMR 7.04(6)(b)1. through 7.04(6)(b)7. shall apply.
9. All samples shall be held unless exempted by the Director of Milk Control until the next hourly or more frequent accuracy check described in 331 CMR 7.04(6)(d) is completed. If this check fails, all samples shall be retested by a duly licensed tester using either an alternative procedure approved by the Director of Milk Control, or held for retesting on the "Milk-o-Tester" after proper repairs and/or adjustments are completed and the machine shown to be in calibration. If sample holding exemption has been granted and the accuracy check fails, immediate rescheduling shall be made of all samples tested subsequent to last correct accuracy check.
10. The identity of each sample shall be preserved explicitly during the holding period described in 331 CMR 7.04(6)(b)9.
11. Samples which are frozen or partially frozen, lumpy, curdled or churned, containing excess amounts of preservatives, or samples that contain flavoring materials such as chocolate, or any milk that has been homogenized previously shall not be tested by the Milk-o-Tester method.
12. The Director or the Director of Milk Control may request and licensed testers shall conduct turbidimetric milk fat determinations on samples supplied by him for the purpose of determining the accuracy of testing and/or send to a location specified by either of them the remaining portion of certain samples for retesting.

7.04: continued

(c) Zero Adjustment.

1. The meter (14 in Figure 1 in 331 CMR 7.05) shall be adjusted to zero on the manual model and to .02 on semi-automatic and automatic models with pure diluent in the flow through cuvette (9 in Figure 1 in 331 CMR 7.05).

This adjustment shall be made before each day's run, before the performance check described in 331 CMR 7.04(5)(c), and before testing samples for calibration purposes as described in 331 CMR 7.04 (7)(c). If out of zero adjustment, make the accuracy check as provided in 331 CMR 7.04(6)(d) then adjust to zero and rerun the accuracy test.

This zero check shall also be made before the accuracy check described in 331 CMR 7.04(6)(d) and after testing of approximately each 50 samples.

The first reading after this zero check shall be invalid and shall be ignored. Such a sample shall be retested.

2. Alternative zeroing procedures approved by the director may be used after testing of each 50 samples.

(d) Accuracy Check. A control sample prepared in 331 CMR 7.04(5)(a) shall be checked each hour or more frequently of machine operation. If the reading is 0.1% fat or less different from the value obtained by the reference method, the machine may continue to be used. If the reading is greater than 0.1% different, follow the procedure given in 331 CMR 7.04(5)(c). At all times, the last 20 control sample tests must meet the criteria of 331 CMR 7.04(7)(a)2., with respect to the average difference and standard deviation of difference from the reference method.

(e) Cleaning.

1. The machine shall be flushed twice with distilled water or diluent if it is to be idle for five minutes or more.

2. The machine shall be thoroughly cleaned at the end of the day's testing by alternately circulating distilled water and an appropriate cleaning solution through the entire system. The final rinse shall be with distilled water or with the diluent.

3. Formation of milkstone in any part of the machine shall not be allowed to occur.

4. Milk and oil splatters shall be wiped from all accessible surfaces on both the exterior and interior of the machine at least daily, and the machine otherwise shall be kept clean.

5. The collection funnel (7 in Figure 1 in 331 CMR 7.05), pipette (6 in Figure 1 in 331 CMR 7.05), and wiper blade shall be kept clean at all times during operation.

6. The machine shall be lubricated and adjusted as required to keep it in good working order.

(7) Instrument Calibration.(a) Definitions.

1. Calibration shall mean to adjust the settings on the instrument so that the readings will match result obtained by the Babcock, Gerber or other reference method approved jointly by the director and the Director of Milk Control.

2. A machine shall be considered to be properly calibrated when the average difference between the machine results and the reference method results, called D, and the standard deviation of difference between methods, called ^sD, are less than the values shown in Table 1 of 331 CMR 7.04(7).

7.04: continued

TABLE 1.

Maximum allowable average difference (D) and the standard deviation of difference (^sD) between the Milk-o-Tester and the reference method.

Reference Method	<u>Machine Calibrated for Use on</u>			
	Individual Cow Samples		Herd or Pooled Samples	
	\bar{D}	^s D	\bar{D}	^s D
Gerber	± 0.04	± 0.08	± 0.04	± 0.06
Babcock	± 0.04	± 0.10	± 0.04	± 0.06
Roese-Gottlieb			± 0.02	± 0.04

(b) Conditions Requiring Calibration.

1. The instrument shall be calibrated when initially installed.
2. The instrument shall be calibrated when the performance check, (331 CMR 7.04(5)(c)), or the accuracy check, (331 CMR 7.04(6)(d)), fail.
3. The instrument shall be calibrated when any of the following parts are replaced, rebuilt, or adjusted; syringe, check valve, separation valve assembly, pipette, cuvette, photocell, lamp, or homogenizer (2, 15, 17, 6, 9, 10, 11, and 5 in Figure 1 in 331 CMR 7.05).
4. The homogenizer (5 in Figure 1 in 331 CMR 7.05) shall be rebuilt, including the replacement of the homogenizing valves, and the instrument subsequently shall be recalibrated after a maximum of 20,000 samples for manual Milk-o-Tester, including control and calibration samples have been tested.

(c) Types of and Preparation of Calibration Samples. One of the following types of samples shall be used for calibration.

1. At least ten samples of individual cow milks testing between 3 and 4% milk fat and at least ten samples of individual cow milks testing between 5 and 6% milk fat, or
2. At least ten pooled or herd milk samples testing between 3 and 4% milk fat and at least ten pooled or herd milk samples testing between 5 and 6% milk fat, except that not more than five of the ten 5 to 6% milk fat samples may be prepared by co-mingling varying amounts of "low" and "high" test milks. A herd milk sample is defined as one representing a minimum of 35 cows milking and a pooled sample as one representing a minimum of three herds' milkings. A variety of fat levels within the required ranges shall be used.
3. The calibration samples shall be tempered and mixed as required in 331 CMR 7.04(6)(a).

(d) Testing Calibration Samples.

1. The Milk-o-Tester shall be operated in accordance with 331 CMR 7.04(6)(b) with the following additions: At least three readings shall be made on each sample. All readings shall be made, recorded and averaged to the nearest 0.01% fat.
2. The well mixed sample for the reference method shall be followed with the following additions: At least three tests shall be made on each sample. All readings shall be made to at least the nearest 0.05% fat, if the Babcock or Gerber test is used and to the nearest 0.01% if the Roese-Gottlieb test is used. The three results shall be averaged and this average shall be regarded as the true fat content of the sample.

(e) Calculation of Calibration Results.

1. The average of the results obtained on the low testing samples (3-4%) by the Milk-o-Tester method shall be compared to average of the results obtained on the same samples by the reference method. If the difference is 0.01% fat or less, the calibration may be continued. If the difference is greater than 0.01% fat, the machine shall be adjusted and the samples retested on the adjusted Milk-o-Tester until the difference is less than 0.01% fat.

331 CMR: BUREAU OF MILK MARKETING

7.04: continued

2. The average of the results obtained on the high testing samples (5-6%) by the Milk-o-Tester method shall be compared to the average of the results obtained on the same samples by the reference method. If the difference is 0.05% fat or less, the calibration procedure may be continued. If the difference is greater than 0.05% fat, the machine shall be adjusted and the samples retested on the Milk-o-Tester until the difference is less than 0.05% fat.
3. The criteria listed in 331 CMR 7.04(7)(e)1. and 7.04(7)(e)2., shall be met simultaneously.
4. The average difference between methods, D, shall be calculated as the difference between the average of the Milk-o-Tester method on all calibration samples and the average of the reference method on all calibration samples. D shall be considered as the mathematical equivalent of the following formula:

$$\bar{D} = \frac{1}{N} \sum (M_i - R_i)$$

Where N = number of samples tested

M_i = average of "Milk-o-Tester" results on the ith sample.

R_i = average of reference method results on the ith sample,
referred to herein as the "true value".

5. The standard deviation of difference, SD of all calibration samples shall be calculated by a mathematical equivalent of the following formula:

$$s_D = \frac{\sqrt{\sum D_i^2 - \frac{(\sum D_i)^2}{N}}}{(N-1)}$$

D_i = difference between the average of "Milk-o-Tester" results for the ith sample and the average of the reference method results for the ith sample. This is equivalent to the M_i - R_i quantity used in 331 CMR 7.04(7)(e)4.

For those unfamiliar with the calculations required in 331 CMR 7.04(7), the work sheet DMC Milko Form #1 may be used to get equivalent results. A sample calculation is shown in Tables 1, 2, and 3 of 331 CMR 7.05.

6. All calibration samples tested on the Milk-o-Tester shall be used in the calculations described in 331 CMR 7.04(7)(e)4. and 7.04(7)(e)5., even though the minimum of 20 samples may be exceeded.
7. The average difference, D, and the standard deviation of difference ^sD, shall not exceed the values shown in Table 1 of 331 CMR 7.04(7).
8. The criteria listed in 331 CMR 7.04(7)(e)3. and 7.04(7)(e)7. shall be met simultaneously. If not, the machine shall be considered to be uncalibrated. After appropriate adjustments, such as changing the amount of diluent delivered or resetting of electrical systems have been made, all calibration samples shall be tested on the machine and new calculations made according to these provisions.

(8) Required Records.

- (a) A record of all butterfat tests shall be maintained in accordance with 331 CMR 7.04(6).
- (b) Additionally, the following records for each machine shall be made and kept on file for a period of three months at the place where Milk-o-Tester testing is used. These records shall be made available at all times to the director or the director of milk control or the duly authorized agent of either:
 1. Work sheet for determining standard deviation (Table 4 in 331 CMR 7.05).
 2. Milk-o-Tester check list (Table 5 in 331 CMR 7.05).
 3. Milk-o-Tester daily performance checks (Table 6 in 331 CMR 7.05).
 4. Calibration and shift value check (Table 7 in 331 CMR 7.05).
 5. Sample record (Table 8 in 331 CMR 7.06).
 6. Temperature chart of water bath.
 7. Any other records requested by the director or the director of milk control.

331 CMR: BUREAU OF MILK MARKETING

7.05: Tables, Figures, and Forms

All records listed under 331 CMR 7.04(8)(b) shall be kept on forms approved by the director of milk control as herein follow and listed as Forms 1 through 5 in 331 CMR 7.05.

(1) Table 1: Sample Work Sheet for Standard Deviation.

TABLE 1.

1	C O L U M N		N O .	
	Step 1	Step 2	Step 3	
Sample No.	2 Average Duplicate Milko	3 Average Triplicate Reference	4 Difference (D) Milko-Reference 4a 4b	5 Difference Squared (D ²)
1	3.53	3.55	.02	.0004
2	3.61	3.60	.01	.0001
3	3.69	3.65	.04	.0016
4	3.40	3.30	.10	.0100
5	3.47	3.45	.02	.0004
6	3.85	3.80	.05	.0025
7	3.62	3.60	.02	.0004
8	3.71	3.75	.04	.0016
9	3.91	3.85	.06	.0036
10	3.62	3.60	.02	.0004
11	6.12	6.15	.03	.0009
12	6.39	6.40	.01	.0001
13	6.75	6.80	.05	.0025
14	6.39	6.35	.04	.0016
15	6.77	6.70	.07	.0049
16	6.42	6.45	.03	.0009
17	6.71	6.75	.04	.0016
18	6.68	6.70	.02	.0004
19	6.71	6.70	.01	.0001
20	6.43	6.45	.02	.0004

Sub Total 4a .44 4b .26
0.18

Step 4¹ - $\sum D(4a \ 4b) =$
 Step 5 - $\sum D$.0344

Step 6 - $D = \frac{\sum D}{N} = \frac{.18}{20} =$.009

Step 7 - $D \times \sum D = .009 \times .18 =$.00162

Step 8 - $\sum D (D \times D) = .0344 \ .00162 =$.03278

Step 9 - $\sum D \frac{(D \times D)}{(N-1)} = \frac{.03278}{19} = s_D^2 = .0017$

Step 10 - Find S_D from S_D in table 3.

- 1 If step 4 is negative, it does not affect results.

331 CMR: BUREAU OF MILK MARKETING

7.05: continued

(2) Table 2: Standard Deviation

TABLE 2.

The data in Table 2 of 331 CMR 7.05 will enable you to arrive at a sufficiently accurate estimate of S_D .

If S_D is:	Then S_D is:
.0001	.01
.0004	.02
.0009	.03
.0016	.04
.0025	.05
.0036	.06
.0049	.07
.0064	.08
.0081	.09
.0100	.10

Since the example cited above S_{D2} was 0.0017 the S_{D2} would fall between 0.04 and 0.05. It would suffice to estimate it as 0.04. If the value for S_{D2} exceeds .0036 on blended milk or .01 on individual cows milk, the instrument obviously needs to be recalibrated.

The Milk-o-Tester will be considered to be properly calibrated when the average difference (D) and the standard deviation of difference (S_D) so calculated are equal to or smaller than the values shown in Table 3 of 331 CMR 7.05.

(3) Table 3: Allowable Average Difference

TABLE 3.

Maximum allowable average difference (D) and standard deviation of difference (S_D) between the Milk-o-Tester and the reference method.

Reference method used	Machine calibrated for use on Individual cow samples		Herd or other blended samples	
	D	S_D	D	S_D
	%	%	%	%
Gerber	± 0.04	± 0.08	± 0.04	± 0.06
Babcock	± 0.04	± 0.10	± 0.04	± 0.06
Roesse-Gottlieb			± 0.02	± 0.04

Since the average difference (D) in the example is 0.009 and the standard deviation (S_D) is 0.04, the machine is in proper calibration because these values are less than the values shown in Table 3 for Reference method for individual cow samples.

331 CMR: BUREAU OF MILK MARKETING

Should either the mean difference or the standard deviation of difference determined as outlined exceed the values shown in the table, the Milk-o-Tester must be adjusted in accordance with the manufacturer's instructions and the calibration procedure repeated by retesting the same samples with the Milk-o-Tester.

7.05: continued

(4) Form 1: Wor Sheet for Determining Standard Deviation

		C O L U M N			N O .
1	3	<u>Step 1</u>	<u>Step 2</u>	<u>Step 3</u>	
		2 4	5		
Sample No.		Average Duplicate Milko	Average Triplicate Reference	Difference (D) Milko - Reference 4a 4b	Difference Squared (D ²)
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

Sub Total 4a____ 4b____

Step 4¹ - $\sum D (4a \ 4b) =$ _____

Step 5 - $\sum D^2$ _____

Step 6 - $D = \frac{D}{N}$ _____ = D *Required*

Step 7 - $D \times \sum D =$ _____ \times _____ = _____

Step 8 - $\sum D^2 (D \times \sum D) =$ _____ _____ =

Step 9 - $\sum D^2 \frac{(D \times \sum D)}{(N - 1)} =$ _____ ^sD² = _____

Step 10 - Find ^sD from ^sD² in table 2.

1. If step 4 is negative, it does not affect results.

331 CMR: BUREAU OF MILK MARKETING

Date

Signature

331 CMR: BUREAU OF MILK MARKETING

NOTE: If at any time difference between average References and average Milko exceeds 0.10%, three additional samples MUST be run IMMEDIATELY. Average difference of 3 should not exceed .10%.

(FMMA 6/71)

7.05: continued

(7) Form 4: Calibration and Shift Value Check

FORM 4.

CALIBRATION AND SHIFT VALUE CHECK

Location _____ Machine No. _____ Date _____
 Shift Value _____ Temperature of the water bath _____
 Temperature of the milk _____

(Step 6 of Calibration Procedure)

MILKO TESTS						REFERENCE TEST	A
1st run	Av.	2nd run	Av.				
1.	_____	_____	_____	_____	_____	_____	_____
2.	_____	_____	_____	_____	_____	_____	_____
3.	_____	_____	_____	_____	_____	_____	_____
4.	_____	_____	_____	_____	_____	_____	_____
5.	_____	_____	_____	_____	_____	_____	_____
6.	_____	_____	_____	_____	_____	_____	_____
7.	_____	_____	_____	_____	_____	_____	_____
8.	_____	_____	_____	_____	_____	_____	_____
9.	_____	_____	_____	_____	_____	_____	_____
10.	_____	_____	_____	_____	_____	_____	_____
Av. _____		Av. _____		Av. _____			

The Cumulative av. between Milko Reference must be within .01%

11.	_____	_____	_____	_____	_____	_____	_____
12.	_____	_____	_____	_____	_____	_____	_____
13.	_____	_____	_____	_____	_____	_____	_____
14.	_____	_____	_____	_____	_____	_____	_____
15.	_____	_____	_____	_____	_____	_____	_____
16.	_____	_____	_____	_____	_____	_____	_____
17.	_____	_____	_____	_____	_____	_____	_____
18.	_____	_____	_____	_____	_____	_____	_____
19.	_____	_____	_____	_____	_____	_____	_____
20.	_____	_____	_____	_____	_____	_____	_____

To calculate standard deviation transfer average of each sample to work sheet (DMC Milko Form #1)

Adjustments made _____

331 CMR: BUREAU OF MILK MARKETING

Licensee Signature

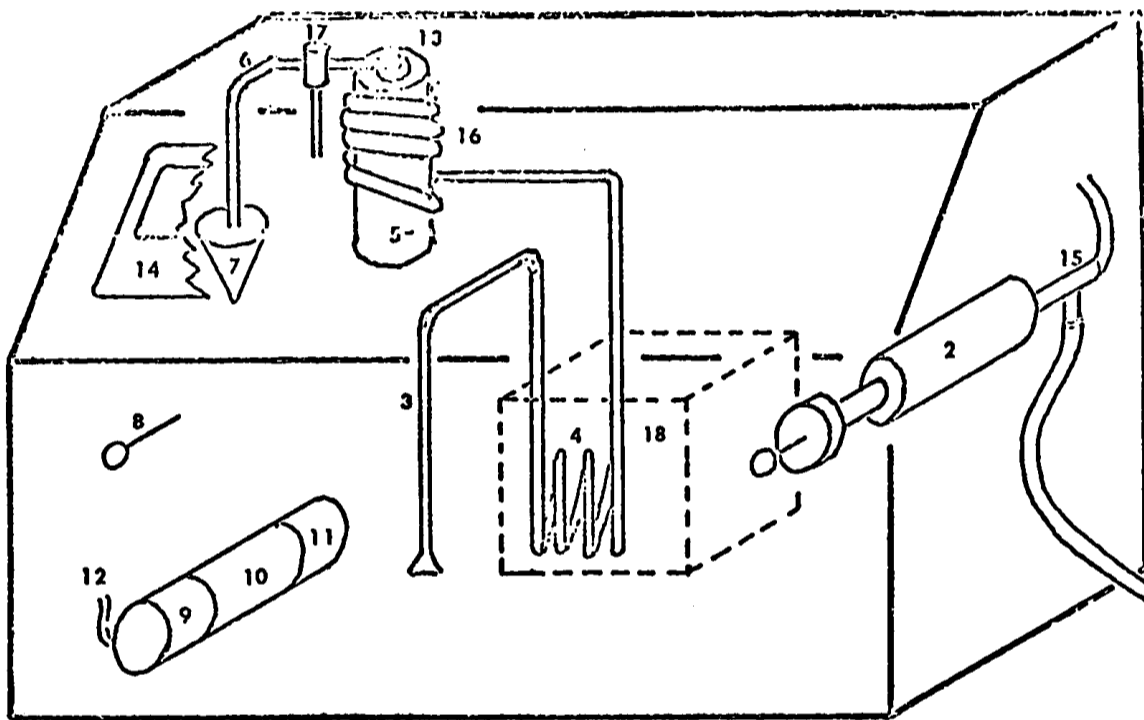
7.05: continued

(9) Figure 1: Diagram of Manual Milk-o-Tester.

FIGURE 1.

Diagram of Milk-o-Tester

(a) Manual Model



1
-
D
i
l
u
e
n
t
i
n
t
a
k
e
1
0
-
P
h
o
t
o
c
e
l
l
2
-
A
u
t
o
m
a
t
i
c
M

etering syringe

11 - Lamp

3 - Milk sample and intake tube

4 - Heating coil

5 - Homogenizer

6 - Pipette

7 - Collection funnel

8 - Funnel positioner

9 - Flow thru cuvette

12 - Cuvette discharge

13 - Homogenizer discharge

14 - Meter

15 - Diluent check valve

16 - Homogenizer heating coil

17 - Separation check valve

18 - Water bath

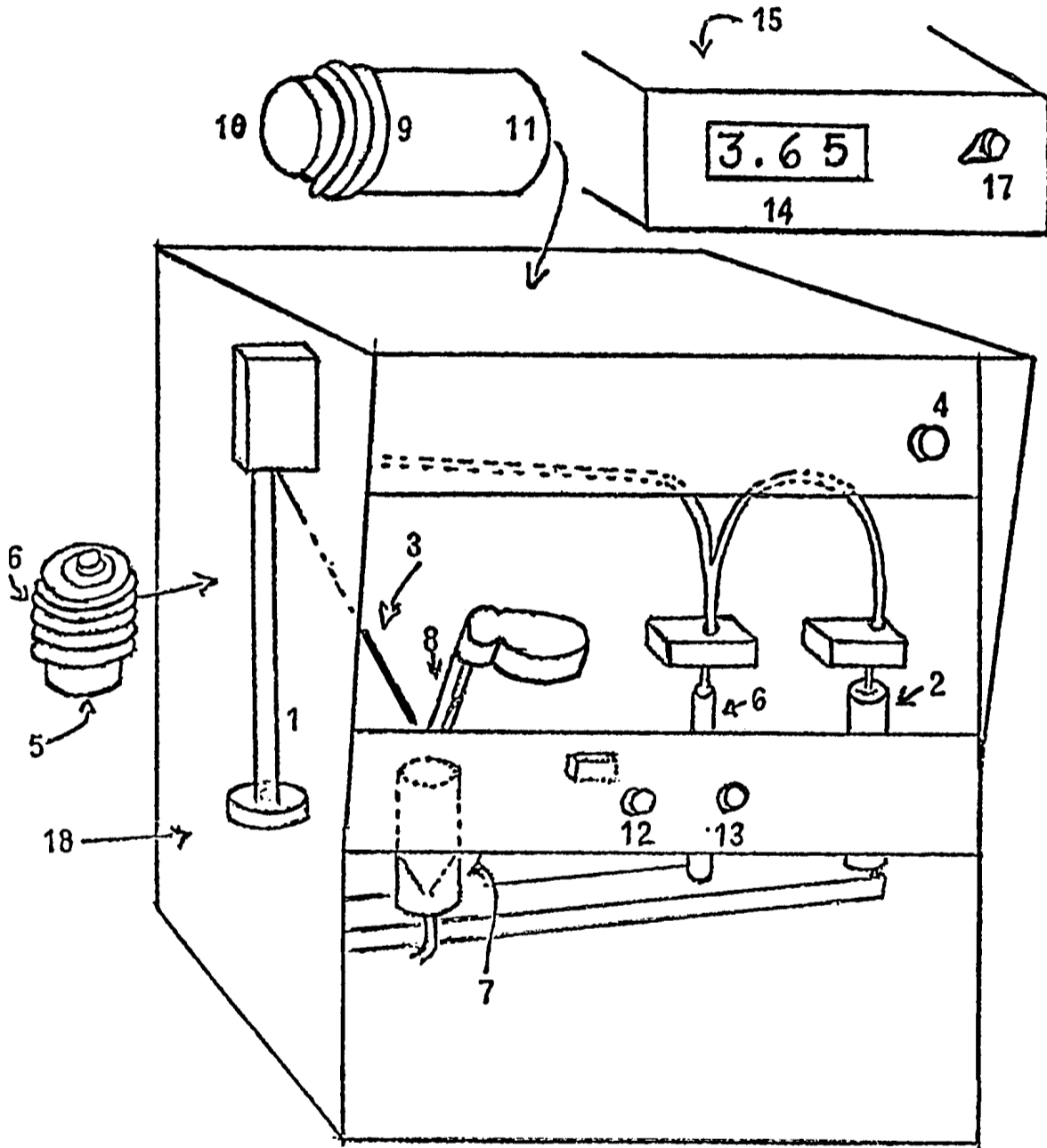
7.05: continued

(10) Figure 2: Diagram of Semi-Automatic and Automatic Milk-o-Tester.

FIGURE 2.

(b) Semi automatic and automatic models

(The automatic differs primarily in sample transport and in details of the sample elevator.)



7.05: continued

KEY TO FIGURE 2 IN 331 CMR 7.05(10)

1. Sample Elevator
2. Diluent metering syringe
3. Milk intake tube and pipette
4. Zero adjust control
5. Homogenizer
6. Milk measuring syringe
7. Mixing funnel
8. Level sensing probe
9. Flow through cuvette
10. Photometer
11. Lamp
12. Sample processing indicator lamp
13. Power indicator lamp
14. Read-out meter
15. Calibration test and setting controls (not shown)
16. Homogenizer heating coil
17. Display mode switch
18. Water bath (not shown)

7.06: Approved Method of Testing Cream

The following method is approved and prescribed for testing cream samples as a basis for payment in buying or selling. The provisions of 331 CMR 7.01 shall, in every appropriate respect, also be applicable to the identification care and handling of cream samples.

(1) Apparatus Required.

- (a) Test bottles (see 331 CMR 7.08)
- (b) Pipettes (see 331 CMR 7.08)
- (c) Cream test scales sensitive to 0.1 of a gram
- (d) Acid measure 17.5 ml. (see 331 CMR 7.08)
- (e) Centrifuge or tester with thermostatic heat control set at 131-140°F. must run rated speed as required in 6A 4d under "Making the Test"
- (f) Speed indicator
- (g) Thermometer
- (h) Tempering bath
- (i) Manual or mechanical reading dividers or calipers
- (j) Sulfuric acid (specific gravity 1.82 to 1.83)
- (k) Red reader (glymol or mediscus remover)

7.06: continued

(2) Preparing Individual or Daily Samples for Testing.

(a) Samples that are in good condition and are tested the same day as taken should be warmed to about 100°F, and mixed thoroughly by pouring from one vessel to another at least three times. All the fat must be well mixed in and the sample uniform through-out before weighing the test charge.

(b) Samples that are held over night may have dried fat on the stopper or inside of the sample bottle and such samples must be prepared as though they were composites.

(3) Preparing Composite Samples for Testing.

(a) Place bottles in warm water up to the necks and warm samples to about 95°F to soften all dried fat. Do not exceed 100°F on account of the danger of "oiling off" the milk fat. Use a policeman to remove any dried fat adhering to the stopper or the inside of the sample bottle.

(b) Agitate the contents of the bottles gently by a rotary motion several times during the course of preparation to prevent them from "oiling off" when left standing in warm water and to mix in the softened fat. Never shake the sample vigorously as it may churn the milk fat.

Continue the preparation as above until all the fat is well mixed in and the sample is uniform throughout. It is advisable especially if difficulty is experienced with char in the finished test, to cool the cream to about 70°F before proceeding with the test. Mix thoroughly by pouring from one vessel to another at least three times.

(4) Making the Test.

(a) Cream scales should be level and on solid foundations.

(b) Mark test bottles plainly, place on the scale and balance properly.

(c) Weigh accurately 9 grams of well mixed cream into the test bottle.

(d) Add 9 ml. of water (about 70°F) to the 9 gram sample before adding the acid.

(e) Add nearly 17.5 ml. of sulfuric acid and mix thoroughly by a rotary motion of the bottle until the contents assume a chocolate brown color. The temperature of the acid should be about 70°F. Bottles should be shaken immediately after adding the acid. Allow bottles to stand from one to three minutes before centrifuging. Shake again when placing bottles in centrifuge.

(f) Place test bottles in the centrifuge so as to balance properly, and whirl at proper speed for five minutes.

(g) Add hot water above 140°F until the fat nearly reaches the base of the neck of the test bottle.

(h) Mix thoroughly and then whirl for two minutes.

(i) Add hot water above 140°F until the fat column is well within the graduated scale on the neck of the bottle.

(j) Whirl for one minute.

(k) Remove the bottles from the centrifuge and place in a bath of hot water for five minutes. The water in the bath must be 131° to 140°F, and extend to the full height of fat in the test bottle. It is advisable to have the water at 140°F when starting to read the test and to have some arrangement whereby the temperature can be maintained above 133°F until all the tests are read.

Tempering the tests in the centrifuge will not be permitted because of uneven temperature and inaccurate results.

(l) Add from four to six drops of glymol or meniscus remover (mineral oil colored with alkanet root) by allowing it to cover the surface of the milk fat column before reading the tests.

(m) Read the percentage of milk fat from the bottom of the fat column at its lowest point to the junction of the glymol and fat column.

The use of dividers is required in reading the tests as it facilitates the work and reduces the chance of error.

In reading the tests, do not remove a second bottle from the tempering bath until the first has been read and recorded.

331 CMR: BUREAU OF MILK MARKETING

7.06: continued

(n) Retests must be made if the finished test and fat column contains charred or foreign substances or curdy particles, or if it is otherwise not a perfect test. When tests vary 2% or more from the previous period a retest should be made to verify the accuracy of the work.

(o) Samples must not be discarded until the tests have been read, recorded and checked.

7.07: Care of Glassware and Testing Apparatus

All testing equipment shall be cleaned and all glassware, such as test bottles, pipettes and the like, shall be thoroughly washed with a suitable detergent and dried upon completion of testing procedures.

Adequate and proper storage space shall be provided for all testing apparatus, equipment and supplies.

7.08: Standard Glassware

All glassware used in testing milk or cream, including test bottles, and pipettes shall conform to the specifications of the United States Bureau of Standards and shall be tested and verified for accuracy as provided in M.G.L. c. 94A, § 25. In order for such glassware to be legal for use in Massachusetts, "Mass" shall be etched thereon and such marking shall be considered proof that such glassware is standard.

7.09: Methods of Computing Milk Fat Test Results in Making Payment for Milk

Final payment in settlement for milk delivered or received during a given delivery (pay) period shall be based on the test, or simple average of tests, for milk fat content performed on a representative sample or samples taken from such milk during exactly the same delivery (pay) period that such payment covers.

(1) Whenever composite samples are used in determining milk fat content as a basis for payment in buying or selling, the simple average of the tests made, rounded to the nearest five hundredths of a percent (for example: 3.75%, 3.80%, 3.85%, etc.) shall establish the average fat content of milk delivered or received during the month, or other delivery (pay) period, in which such samples were drawn.

(2) Whenever fresh milk samples are used in determining milk fat content as a basis for payment in buying or selling, the simple average of the tests performed shall establish the average fat content of the milk delivered or received during the month, or other delivery (pay) period, in which such samples were drawn and, if tests for milk fat content are performed on more than the minimum number of randomly selected fresh milk samples prescribed in 331 CMR 7.01(1)(b), the results of all such tests shall be used in computing the average test. If tests on fresh milk samples are initially performed by the Babcock centrifugal method, the simple average of such tests shall be computed to the nearest five hundredths of a percent (for example: 3.65%, 3.70%, 3.75%, etc.). If tests of fresh milk samples are initially made by the turbidimetric method, the simple average of such tests shall be computed to the nearest hundredth of a percent (for example: 3.63%, 3.64%, 3.65% etc.).

7.10: Action with Respect to Improper or Unrepresentative Samples

If any sample of milk, the milk fat test of which is intended to form a basis for payment in buying or selling, is found to be in improper condition for testing or check-testing, to have been drawn or tested in violation of applicable laws, rules or regulations, or to be clearly not representative of the milk delivered or received, or if samples of dairy farmer milk deliveries have not been taken or are otherwise unavailable for testing, such circumstances shall be reported to the director of milk control who shall, if tests have been made on samples obtained by him, or by his duly authorized agent, under the provisions of 331 CMR 7.01(1)(c) during the delivery (pay) period in questions, require that the test, or average of such tests, be used in determining the basis for payment. Otherwise, the director of milk control shall require that payment for milk be made on the basis of the simple average of the test results obtained on properly representative samples covering the immediately preceding and succeeding delivery (pay) periods.

7.11: Measuring, Sampling and Accepting of Raw Milk at Dairy Farms

(1) Certification and Licensing. As provided in M.G.L. c. 94A, §§ 27A, 28A (see 331 CMR 7.01 through 7.10), no person shall measure, sample or accept raw bulk milk at a Massachusetts dairy farm for inclusion in a bulk tank truck unless he has been certified as to competency in such operations by the director and has thereafter been licensed by the director of milk control. Application for such certification shall be addressed to Deputy in Charge, Milk Control Law, West Experiment Station, University of Massachusetts, Amherst, Massachusetts 01002. Application for such a license shall be addressed to the Director of Milk Control, Leverett Saltonstall Building, 100 Cambridge Street, Boston, Massachusetts 02202. Licenses issued shall be valid for an indefinite period unless suspended or revoked by the director of milk control.

(2) Licensee Requirements.

(a) Whenever engaged in the measuring, sampling or accepting of raw bulk milk at dairy farms, each licensee shall have his license, or a corresponding official identification card, available at all times for inspection by the director, the director of milk control or any duly authorized agent of either said director.

(b) Each licensee shall comply with all applicable provisions of law or of rules and regulations set forth in 331 CMR 7.11 and in 331 CMR 7.01 through 7.10.

(3) Bulk Tank Capacity and Calibration. Tanks installed on dairy farms for bulk storage and cooling of milk shall be of sufficient size so that, in line with the milk pickup schedule established by the milk dealer or the bulk milk hauler, no milk shall be stored outside such a tank or tanks at any time. No milk stored outside a bulk tank shall be sampled or picked up. No milk shall be picked up from a tank which has not been calibrated by the Division of Standards in accordance with the provisions of M.G.L. c. 94A, § 46A. Only a measuring device approved by said division and an interpolation (conversion) chart issued by said division shall be used to determine the quantity of milk contained in a farm bulk tank, and each such tank, device and chart shall be mutually identified by a common serial number in a prominent and permanent manner. The interpolation chart shall be protected by a transparent covering kept clean at all times and shall be conveniently posted in the milk room under adequate light.

(4) Sampling Bulk Tank Milk. In addition to the provisions of this section, the provisions of 331 CMR 7.01 shall, whenever applicable, govern the sampling and accepting of milk stored in farm bulk tanks and the identification, care and holding of samples drawn from such tanks.

(a) Determining condition of milk. All bulk tank milk shall first be checked for possible abnormal conditions specified in 331 CMR 7.01(4) and any necessary action shall be taken in accordance therewith.

7.11: continued

(b) Agitation. Mechanical agitation shall be continuous until milk and milk fat are completely mixed, but in no event for less than five minutes. Manual agitation with a clean and properly sanitized stainless steel hand agitator shall be permitted only in the event of power or mechanical failure.

(c) Measurement. Milk in a farm bulk tank shall be measured only when the surface is completely still and only with the measuring device identified by serial number with that tank. In measuring such milk, the measuring device shall be removed from the tank for cleaning and drying with an absorbent, single-service tissue, carefully inserted into the tank and properly seated and gently withdrawn. The measurement of the milk shall then be accurately read under adequate light and immediately recorded on an appropriate receipt form, a copy of which shall be then provided to the dairy farmer. The measuring device shall be read in accordance with the guidelines established by the National Bureau of Standards as follows: When the milk level is not exactly on a graduation, read as if it were on the nearest graduation; when the milk level is exactly halfway between two graduations, read to the nearest even graduation. If it becomes evident that any farm bulk tank has shifted in any way from the fixed position in which it was originally calibrated, the Division of Standards and all other interested parties shall be notified without delay, and no succeeding measurement of milk contained in such a tank shall be deemed valid unless and until said division has caused satisfactory corrective action to be taken.

(d) Sampling. After thorough agitation, a truly representative sample shall be taken in accordance with the applicable provisions of 331 CMR 7.01 through 7.10 and shall be transferred to an approved sample container properly identified as to the dairy farmer whose milk is represented therein, but such transfer shall not take place above the farm bulk tank. When taking samples for purposes other than milk-fat determination, licensees shall comply with applicable procedure set forth in "Standard Methods," a publication of the A. P. H. A.

(e) Care and holding of samples. Each bulk milk pickup truck shall be equipped with sample cases of durable construction which can be firmly held in place during transit. Such cases shall be tamper-proof and leak-proof except for weep holes to control water level and shall be of sufficient size to facilitate proper refrigeration of milk samples and for insertion of a removable, pocket-type metal rack in which sample containers can be held in a vertical position. There shall be a space of at least one-half inch between the bottom of such a rack and the floor of the sample case containing it so that sample containers holding milk may be partially immersed in ice water and thereby maintained within the prescribed temperature range as required in 331 CMR 7.01(5). To permit monitoring of the temperatures at which milk samples are maintained, a control sample of water in a container identical to that used for the milk samples shall be carried in each such rack and only the control sample shall be used in determining milk sample temperature. Each bulk milk pickup route shall have its own separate rack or racks each properly identified as to route name and number and, on any given run, such a truck shall carry only sample containers identified with dairy farmers whose milk is to be picked up on that run. Other methods of sample temperature control and/or sample storage on bulk milk pickup trucks may be approved by the director of milk control subject to his consideration of proposals submitted to him, but no such method shall be implemented without his prior approval.

(f) Procedure following acceptance, measurement and sampling.

1. The outlet valve of a farm bulk milk tank shall not be opened until the milk contained in the tank has been accepted, measured and sampled.

2. After all milk has been pumped out of a farm bulk milk tank and the hose and pump cord have been disconnected, the tank shall be thoroughly rinsed with lukewarm or cold water by the bulk truck operator.

(g) Auxiliary pumping power. Each bulk milk pickup truck shall be equipped with, or shall have ready access to, an auxiliary power source with which to pump milk from farm bulk milk tanks in the event of electrical power failure.

REGULATORY AUTHORITY