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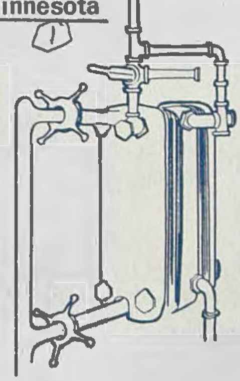
MINNESOTA DAIRY PRODUCTS PROCESSOR



Editor - V. S. Packard

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Several plants are using the Milko-tester as a plant control device. Others may be thinking of purchasing one for the same purpose. Also, the Milko-tester may soon be approved as an optional procedure for butterfat testing of producers' milk. For these reasons we thought it might be desirable to run through the initial calibration procedure. Once the machine is properly calibrated the day to day check on calibration is relatively simple.

A. O. A. C. CALIBRATION OF MILKO-TESTERS

The procedure for calibrating the Milko-tester according to Shipe (1) in A. O. A. C. is:

1. Test in triplicate 20 representative milk samples ranging from 3 to 6 percent fat by 15. 029 or 15. 031 and the Milko-tester (15. 029 and 15. 031 are A. O. A. C. designations for the Roese-Gottlieb and Babcock methods respectively. In other words you could use either method in calibrating the Milko-tester).

2. Calculate the average for each sample by each method to the nearest 0. 01 percent.

3. Calculate the standard deviation of the difference, S_D, as follows:

$$S_D = \sqrt{(\Sigma(D^2) - [(\Sigma D)^2 / N]) / (N - 1)}$$

where D = average of results by 15. 029 or 15. 031 on sample minus the average of Milko-tester results on the same sample, e. g. $(B_1 + B_2 + B_3) / 3 - (M_1 + M_2 + M_3) / 3$ (where B = reading by the Babcock method (or Roese-Gottlieb), and M = reading by the Milko-tester).

where N = number of samples tested (if the specification of 20 samples tested is exceeded, include all samples tested in the calculations except those for which an error in 1 or more determinations can be proven.

(1) Shipe, W. F. 1969. A collaborative study of the Babcock and Foss Milko-tester methods for measuring fat in milk. J. Assn. Off. Anal. Chem., 52:131-138.

The Milko-tester is properly calibrated when the standard deviation of the difference (S_D) is not greater than 0.10 for individual cow sample or not greater than 0.06 for herd or composite samples. If the deviation of the difference exceeds these values, adjust the volume of EDTA solution and/or electrical input to galvanometer of the Milko-tester according to the manufacturer's instructions for calibration and operation.

During any day of use, check the performance by comparing test results obtained on one bulk milk sample with both Milko-tester and 15.029 or 15.031. If the difference is greater than 0.04 percent fat, test three more samples. If the average difference of three additional samples is greater than 0.04 percent fat, recalibrate the Milko-tester.

EXAMPLE

The problem may sound more complicated than it actually is. Let's look at an example and run through the calculation. We will use some available D.H.I.A. data.

Sample	Babcock Test			Milko-tester		
Number	1	2	3	1	2	3
1	3.20	3.28	3.29	3.29	3.31	3.31
2	2.81	2.83	2.80	2.85	2.82	2.80
3	3.20	3.20	3.30	3.24	3.23	3.24
4	4.09	4.10	4.09	4.12	4.11	4.11
5	3.58	3.62	3.60	3.61	3.59	3.61
6	4.58	4.51	4.50	4.61	4.59	4.59
7	3.70	3.71	3.70	3.71	3.70	3.69
8	3.52	3.55	3.54	3.58	3.58	3.57
9	3.65	3.69	3.70	3.72	3.71	3.71
10	9.10	9.10	9.11	9.20	9.20	9.20
11	3.20	3.10	3.09	3.12	3.09	3.09
12	7.10	7.09	7.10	7.22	7.22	7.21
13	4.80	4.80	4.79	4.95	4.92	4.92
14	3.50	3.51	3.49	3.54	3.51	3.52
15	7.20	7.30	7.30	7.41	7.39	7.40
16	5.95	6.00	6.01	6.10	6.17	6.07
17	5.30	5.34	5.31	5.31	5.35	5.38
18	4.37	4.38	4.41	4.44	4.45	4.44
19	2.91	2.95	2.94	2.96	2.93	2.97
20	3.20	3.20	3.18	3.19	3.19	3.15

Now average the results. Add up the test results in each group and divide by three (the number of samples tested).

Then line up the averages as follows:

Babcock	Milko-tester	Difference (D)* Babcock minus Milko-tester	D^2**
3.257	3.303	-.046	.002116
2.813	2.823	-.010	.000100
3.233	3.237	-.004	.000016
4.093	4.113	-.020	.000400
3.600	3.603	-.003	.000009
4.530	4.597	-.067	.004489
3.703	3.700	+.003	.000009
3.537	3.577	-.040	.001600
3.680	3.713	-.033	.001089
9.103	9.200	-.097	.009409
3.130	3.100	+.030	.000900
7.097	7.217	-.120	.014400
4.797	4.930	-.133	.017689
3.500	3.523	-.023	.000529
7.267	7.400	-.133	.017689
5.987	6.113	-.126	.015876
5.317	5.347	-.030	.000900
4.387	4.443	-.056	.003136
2.933	2.953	-.020	.000400
3.193	3.177	+.016	.000256
		Σ D = .912	(D^2) = .091012

*D = Difference. Always subtract the larger from the smaller number, but when the Milko-tester value is higher, place a minus sign before the results.

**D^2 = the difference (D) squared (times itself). For example, in the first result above D = -.046. Then, -.046 X -.046 = .002116.

Now:

(1) add all the "minus" numbers in the D column. Add all the "plus" numbers. Subtract the totals from each other. In the example the minus values total .961. Plus values total 0.49. Then .961 - .049 = .912.

(2) Add all the squared values in the D^2 column. The sign Σ means sum or total. So ΣD = .912 and $\Sigma(D^2)$ = .091012. The formula also calls for $(D)^2$, so

.912 X .912 = .831744

N = the number of triplicate tests, in this case 20. You are now ready to substitute in the formula:

$$S_D = \sqrt{\frac{\Sigma(D^2) - \left[\frac{(\Sigma D)^2}{N}\right]}{N - 1}}$$

Therefore $S_D = \sqrt{\frac{.091012 - \frac{.831744}{20}}{(20-1)}}$

$$= \sqrt{\frac{.091012 - .0415872}{19}} \qquad = \sqrt{\frac{.049425}{19}} = \sqrt{.002601}$$

The designation $\sqrt{\quad}$ means square root. The square root of .002601 is .05099, which is the answer. S_D = .05099, or .051. Since .051 is less than .06 (assuming this to be herd milk), then the machine may be considered in calibration.

Trade names are used in this publication for clarity with the understanding that no discrimination is intended and no endorsement by the Minnesota Agricultural Extension Service is implied.

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