The "Relative Value Plan" at Creameries.

Preserving Milk Samples for Testing.
Table of Relative Values.

G. E. PATRICK.

The pooling system of purchasing milk, now universally practiced at separator creameries, is defensible only on grounds of expediency, as a makeshift to be endured only until a better system shall be developed. It makes no pretense to justice in its treatment of the individual patron, it places a premium on quantity rather than and even at expense of quality, it drives patrons possessing rich-milk dairy herds and those who feed liberally and intelligently into private dairying, it tempts the short-sighted and cunning into dishonest practices, and tends in every way to demoralize the creamery industry.

The creamery proprietor is not, however, the chief sufferer. He can always save himself, and continue to profit, by lowering the price of milk to correspond with the average quality of all received, as shown by the butter produced. But the farmer who, producing milk of superior quality from a herd which has cost much time and money to bring together, is obliged to pool with those producing inferior milk, from scrub herds and poor feed,—not to mention the possibility of home-skimming or watering,—he, by long odds, is the greatest sufferer.

The relative value plan, i. e., that of paying each patron according to the *quality* as well as the quantity of his milk, is sure sooner or later to supplant the present irrational system; all that prevents its immediate and universal adoption is the large amount of work supposed to be of necessity incident to it.

The case at present stands thus:

To with certainty accord justice to patrons *all* milk received at the creamery must be sampled, tested and valued; it will not suffice to value one, two or three of a patron's six deliveries per week, and assume the remaining ones to be of like quality. But to test all the deliveries of one hundred or

more patrons daily, week in and week out, would demand so much time and labor as to be well nigh impracticable.

Is such an amount of labor necessary?

Cannot a large part of it be avoided, without material loss in resulting benefits?

An affirmative answer to the last question seems warranted by the results of experimental studies which I have made, described farther on.

The fact that justice to patrons requires every delivery of milk to be sampled and tested does not necessitate that each be tested *separately*; and the solution of the problem lies, I believe, in adopting a plan which may be outlined as follows:

Put the daily samples for each patron, successively, as taken at the weigh-tank, into a receptacle containing a small amount of some efficient preservative which will not interfere with the subsequent testing of the composite sample, and after a certain number of days—say seven or ten—ascertain *by a single test* the average quality of the patron's delivery for that period.

The daily samples taken must of course be, for any one patron, proportional in amount to his daily deliveries; otherwise the composite sample might not show the true average quality of his milk for the period.

One objection to the plan naturally suggests itself, namely, that the quantity of each day's milk submitted to actual test would be small—during summer, with daily deliveries, only one-sixth or one-ninth what it would be by daily testing; and in winter, with deliveries three times a week, one-fourth or one-fifth what it would be were each delivery tested separately.

This objection is more serious as applied to winter than to summer practice, because of the difficulty often experienced in getting a fair sample of milk that has stood thirty-six hours or more, and then been hauled over rough roads to the creamery, freezing the while. For summer practice the objection has much less weight; and for both summer and winter it can be in large measure if not entirely overcome, by making the final test on two or three times the quantity of the composite sample that is commonly used of milk in making a test—the apparatus being on a scale proportionately larger than usual. It is hoped that in this way the limits of error may be so narrowed that the plan above outlined will prove sufficiently exact and reliable, in winter as well as in summer practice.

What Preserving Agent shall be used?

Whatever it be, three qualifications are essential:

1st. It must be an efficient preservative, holding unchanged the fat content of the milk for the desired length of time.

2d. It must keep the sample in good mechanical condition, i. e., it must neither curdle the milk nor allow curdling to take place, nor allow the cream which rises in the sample to form a tough pellicle difficult of uniform distribution throughout the liquid by gentle agitation.

3d. It must not interfere with the working of the method by which the milk is to be tested.

During the past four months I have made a large number of trials with more than a dozen different substances and mixtures, seeking one which should fill the above named requirements. The winter and spring months are of course not the best time of year for securing useful results in such an inquiry, nor are final results in such an inquiry likely to be reached in so short a period as four months at any season; therefore the present report is merely one of work done to date, makes no claim to finality, and will, it is hoped, be followed in a subsequent bulletin by records of further study of the subject during the summer months.

The method employed for testing the milk, fresh and preserved, is that described in Bulletin No. 8, under name of "The Iowa Station Milk Test." [It is quite likely that any preservative whose presence does not interfere in the working of this Test may be used without hindrance in the method of Short—but in absence of trials no positive statement can be made.]

General Results.

Agents and Mixtures found decidedly lacking in fitness for the purpose proposed are the following:

Fluorhydric acid*, carbolic acid, carbolic and acetic acids mixed, ammonia, ammonia and carbolic acid, potassium sulphide, sodium chloride, boric acid in aqueous solution, alcohol†.

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*Announced as a milk-preservative by Richmond,—Analyst, Jan., 1889. It succeeds as a preservative if applied while the milk is *fresh*; but is unfitted for the purpose here in view by its bad behavior in the test, as well as by the curdled condition of the preserved sample.

†Alcohol in sufficient quantly preserves milk fairly well for a time, but is barred out by the fact that an amount of it much exceeding 5 per cent. in the sample—which is too little to preserve the latter long—is likely to yield too high results in the test for fat, by the method here employed.

Agents and Mixtures which have yielded more or less encouraging results are:

Carbolic acid and Alcohol,
Salicylic Acid and Alcohol,
Salicylate of soda, alone and with alcohol,
Salicylate of Soda and Carbolic Acid,
Benzoate of Soda, alone and with Alcohol,
Boric Acid, in dry state,
Mercuric Chloride (corrosive sublimate),
Mercuric Chloride in aqueous ammonium chloride and sodium chloride solutions,
Mercuric Chloride, plus, severally, arsenic acid, arsenious acid, carbolic acid, salicylate and benzoate of soda.

Of this list the only ones that have proved in all respects satisfactory are those containing mercuric chloride, and these have invariably been almost perfect in their performance.

Boric (or boracic) acid when used in large quantities, i. e., 50 to 60 grains per 400 c. c. of milk, has in some cases done fairly well, but never nearly as well as the agent just mentioned; possibly a mixture of this acid with some of the organic preservatives may prove more efficient than either alone, and in this direction further trial will be made during the coming summer.

All the above named mixtures containing mercuric chloride undoubtedly owe their efficiency, mainly if not wholly, to that powerful antiseptic; therefore I will not occupy space with the numerical results obtained with these mixtures, but will merely report figures from the trials of mercuric chloride in simple aqueous solution, and in a solution of sodium chloride (table salt).

Numerical Results.

I. Aqueous Solution. A saturated aqueous solution of mercuric chloride at about 70° Fahr., colored deeply with Aniline Rose Pink, 3B*. The color must be so deep that diffused daylight is barely visible through a one inch layer of the liquid; ten cubic centimeters will then impart a striking color to 400 or 500 c. c. of milk.

The samples during periods of preservation were kept in the laboratory, where the temperature ranged from 55° to 75° Fahr.

*Ordinary Aniline Red (*Fuchsine*) will not do, as it is practically insoluble in concentrated aqueous solutions of either mercuric chloride or sodium chloride. Probably any aniline color which dissolves readily in such solutions will answer the purpose. The one named above chanced to be the one used in these experiments.

Original Test on Milk. Fat, per cent.	Volume Mercury solution added, per cent.	Days kept before final test.	Final Test, (corrected). Fat, per cent.
3.87	10	8	3.87
4.22	5	16	4.17
3.70	5	16	3.70
4.22	4	15	4.18
3.72	2½	11	3.72
3.72	2½	16	3.70
4.22	2	7	4.22
4.22	2	15	4.13
4.92	2	7	4.98
5.40	2	7	5.40
4.22	1	7	4.21
4.22	1	15	4.13
3.91	1	13	3.81
3.91	1	26	3.81

It is a curious fact that milk thus preserved does not curdle even when the fat determinable by the method here employed has begun to diminish.

The question whether this apparent diminution of fat is real, or whether it results only from the inability of the method to discover all the fat present *after the sample has reached a certain age or condition*, was not investigated, as it is of no immediate importance; appearances, however, indicate that the diminution is real.

The older the samples become, the less easily do they work (clarify) in the test; under ten days old, however, the change in this respect is but very slight.

The above figures show that under the conditions of the experiments (as to season and temperature) 4 per cent of the mercury solution was sufficient to prevent sensible loss of fat (discoverable by method employed).

II. Saline Solution (of Mercuric Chloride) made thus: One volume of (a saturated solution, at ordinary temperature, of mercuric chloride in a saturated aqueous solution of common salt) plus (nine volumes of water colored deeply with Aniline Rose Pink, 3 B*). Coloring as deep as described for aqueous solution, above.

This solution contains not far from 2½ times as much mercuric chloride as does the simple aqueous solution.

Original Test on Milk. Fat, per cent.	Volume Mercury solution added, per cent.	Days kept before final test.	Final Test, (corrected). Fat, per cent.
4.41	8	6	4.40
4.41	8	13	4.42
4.22	6	6	4.15
4.22	6	21	4.17
4.41	4	6	4.39
4.41	4	22	†4.22
4.41	2	6	4.43
4.41	2	23	†4.32
4.22	1	7	4.25
4.22	1		4.05
4.22	10	33	†3.80

These figures indicate but little superiority of this solution over the preceding one, and also seem to show that the time is limited during which even a large addition of corrosive sublimate will preserve all the fat unchanged, or in condition to be determined by the method here employed.

Remarks on Corrosive Sublimate.

The facts above recorded may be summarized in two statements:

1st. Mercuric Chloride (or corrosive sublimate) is the only substance yet shown to possess all the necessary requirements for the use here proposed.

*See foot note on page 359.
†Very hard to clarify.

2d. Ten to fifteen grains of this substance are sufficient for the preservation of 200 to 400 cubic centimeters of milk for 10 days, in a warmed room in winter.

Unfortunately this substance is a violent POISON when taken internally, and should never be used except by mature, careful persons, and with rigid observance of those precautions which reason dictates in the handling of such a substance.

Chief among these are the following :

Precautions.

1. Never take from the drug store in the unmixed state whether to be used dry or in solution have the druggist make the preparation, including coloring of same, and label plainly Poison.

2. Keep the preparation always out of reach of children.

3. After use, throw the liquid containing the poison into a pit or vault which is never emptied and is inaccessible to domestic animals.

Considering the possibility of danger which would attend the general use at creameries of so poisonous a substance, and not caring to take risk of blame for other peoples' carelessness, I do not *recommend* its use ; but as an investigator I am bound to report results as I find them, leaving it to the judgment of readers to decide whether or not they can safely utilize the facts reported.

It is hoped that in the future some substance or mixture will be found possessing the requisite qualities as a preservative, yet practically innocuous, and in use free from all possibility of danger.

No efforts will be spared in the attempt to find such an agent, for it is the belief of the writer that in the line here pointed out lies opportunity for great benefit to the dairy and creamery interest of the State.

At present, however, proof lacking of the efficacy of any other agent than the corrosive sublimate, my further remarks will have this agent especially in view, while also applying in a general way to any preservative which may in future be used.

Best Form for Preserving Agent.

The agent is most conveniently applied in the form of a dry powder. The greater convenience over that offered by a liquid, or a solid agent in solution, lies not only in the ease of application, but also, and principally, in the fact that when

the composite milk sample is tested the result *obtained* is the *true* result (expansion by dissolving the powder being assumed negligible); whereas if a liquid agent or a solution be used, correction for dilution must be made on the obtained result.

In the powder form the agent can be easily dealt out with sufficient exactness by means of a small ladle or spoon, made to hold any desired amount.

The Plan.

Whatever preserving agent shall eventually be settled upon as the best, all things considered, for use at creameries, the mode of carrying out the plan here proposed—which plan, by the way, is now being put to the test of practice in a Buchanan county (Iowa) creamery—is as follows:

Have a one quart fruit jar (the common Mason jar serves well) for each patron, plainly marked with name or number.

Into each jar put the same amount of the preservative, an amount sufficient to preserve even the largest of the composite samples to be taken.

Supposing a creamery has 100 patrons, all delivering daily, and that seven days is the period fixed upon for the accumulation of composite samples—i. e. for the period between consecutive testings for each patron—then the entire list of patrons would be divided into six groups of sixteen or seventeen each, each group corresponding to a day of the week. [Should the ten day period be adopted instead of the seven day, then the entire list of patrons would be divided into nine groups of eleven or twelve each,—but we will illustrate the plan as for the seven day period.]

To start the system, on the first day take samples from the first group only; next day, from these and one more group; next day, from these two groups and one more, and so on adding a new group each day. If the start is made on Tuesday, for instance, the group started that day will be the Monday group; for on the following Monday, after samples for that day are taken, their six-day composite samples are to be tested. The second group brought into the system (on Wednesday) will be the Tuesday group, for on that day their samples will be due for testing—and so on with the rest. In this way sixteen or seventeen tests per day will keep up the valuation on all the milk delivered by 100 patrons, and if the ten day period be adopted eleven or twelve tests daily will do the same; but it is doubtful if the last named period will,

all things considered, be found in practice preferable to the former.

The testing of the composite samples should be done during the forenoon, while patrons are delivering, in order that they may without inconvenience be present and see it done.

As previously remarked, the daily samples taken must, for each patron, be proportional in amount to his daily deliveries; if these average between 200 and 600 lbs., a sufficiently large sample is obtained by taking one-tenth as many cubic centimeters as there are pounds in the delivery. This proportion may be called the "normal proportion," and the sample thus obtained the "normal sample." If a patron's deliveries average below 200 lbs., his sample should be *double* the normal—that is, it should be 2 c. c. for each 10 lbs. delivered,—and to avoid mistakes his jar should be labeled "Double Sample." On the other hand, should the daily delivery of any patron run as high as 600 pounds, one-half the normal proportion would give a sufficiently large sample; therefore in such a case a "Half Sample" might be taken daily,—*i. e.* one half a c.c. per ten lbs. delivered,—but this reduction would be in no wise *necessary* unless the "normal samples" proved to be too much for the preservative, in quantity used, to keep entirely unchanged,—a contingency which would be recognized by the appearance and odor of the sample, as well as by the great difficulty met with in executing the test.

After each addition of milk to a jar—and, if the preservative be in liquid form, after *it* is placed in the jar—the latter is tightly closed to prevent evaporation; and moreover, after each addition of milk the contents are thoroughly mixed *by a rotary motion*, which washes the cream down completely from the sides of the jar, and does not churn the contents. The jar is then placed on a solid support (shelf) and *not moved in the slightest* until the next sample of milk is added. This is important, for if moved ever so little after the cream has risen, a little of the latter will adhere so firmly to the sides of the jar that rotary motion of the contents will not remove it.

If all moving of the jar is avoided between successive additions of milk there is, with the corrosive sublimate preservatives, no adhesion whatever of cream, and the latter is easily distributed throughout the entire sample in the manner described.

The samples are measured in a glass cylinder graduated in cubic centimeters; the milk is run in from a mixing dipper

having a small orifice in bottom, with nozzle to direct the stream. This dipper holds about a half pint, and serves to mix thoroughly a much larger quantity of milk, contained in a three- or four-quart dipper, this last being used to mix the contents of the weigh-tank.

As remarked above, if a liquid preservative (or a solid applied in solution) be used, a correction must be applied to the result of the test, to find the true fat content of the milk. To do this requires that the final composite sample be measured, as well as the liquid agent placed in the jar.

Should the aqueous solution of corrosive sublimate be used (which is not advised, as the powder described below is more convenient) about 10 c.c. would be the proper amount to place in each jar. Now, if the composite sample at end of week should measure, say 210 c.c., only 200 c.c. of this would be *milk*, upon which volume the 10 c.c. of diluent would constitute 5 per cent; therefore the result of the test, say it were 3.80 per cent. fat, would have to be increased by 5 per cent of itself, making in this case 3.99 per cent. fat.

But, simple as such correction is, it means considerable work when many tests are made, besides presenting one more opportunity for error; therefore the use of a preservative in powder form strongly commends itself.

A corrosive sublimate powder which has proved satisfactory in laboratory experiments is this:

Mercuric Chloride, ½ lb. Av.

Table salt, ¼ lb. Av.

*Aniline Rose Pink 3 B, ½ oz. Av.

Rub to fine powder in mortar, mix thoroughly, and label POISON.

Of this powder, 16 grains contains nearly the same amount of corrosive sublimate as 10 c.c. of the aqueous solution described on page 359; and approximately that amount of the powder can be readily dealt into each jar by means of a ladle of proper capacity, easily made from a No. 44 cartridge shell.

This powder, while more convenient than the liquid, both in application and in obviating the need of correcting results of test, is also *more dangerous as a poison*, because more concentrated, and *too much care cannot be exercised in its use.*

As elsewhere remarked, no efforts will be spared in the endeavor to find a non-poisonous substitute for this preservative; and further experiments on the preservation of milk-samples will be prosecuted during the summer months.

*See foot note on page 359.

POSTSCRIPT. Just as this BULLETIN goes to press the following report from the proprietor of the Buchanan county creamery above referred to comes to hand, in response to a request for whatever report might be justified by the experience there had, up to date, with the plan or method here described. It goes without saying that a report based upon longer experience would be much more valuable.

BRANDON, BUCHANAN COUNTY, IOWA, May 5, 1890.

PROF. PATRICK—After becoming fully acquainted with your Relative Value Plan by trial in April, I decided to adopt it, and began May 1st paying for milk on that basis. Am proceeding carefully. Of course it takes longer to weigh the milk in, and it takes one hour each day to test the group or set of jars for that day. As to the extra work to the book-keeper, I am not prepared to say that it will make much difference; but on the main point, that is of determining the value of each patron's milk, I do think it a success, and that it is just what has long been needed.

D. A. MCLEISH,
Proprietor of Brandon Creamery.

TABLE OF RELATIVE VALUES.

To facilitate the adoption of the Relative Value Plan I have prepared the subjoined table, which was suggested by a somewhat similar one publised by Director W. W. Cooke, in Bulletin No. 16 of the Vermont Experiment Station. The subjoined, while less extensive than Prof. Cooke's table, is by its range of values better adapted for use in the West.

USE OF THE TABLE.

First. To find the value of milk per hundred lbs., on the basis of a given price per lb. for the butterfat present,—or, which comes to the same thing, on the basis of a given price per hundred for milk containing 4 per cent fat. [20 cents per lb. for butter fat, for instance, is the same as 80 cents per hundred for milk containing 4 per cent fat.]

Decide how much per hundred will be paid for "4 per cent milk," (*i.e.*, containing 4 per cent fat). Look along the horizontal line from 4.00 in the "Fat per cent" column until this price is found; the vertical column in which it stands is the one to be used,—the figures in this column being prices per hundred for milk of the various *percentages of fat* indicated at the left, on the corresponding horizontal lines.

Thus, suppose it is decided to pay 85 cts. per hundred for "4 per cent milk" (or 21¼ cts. per lb. for the butterfat pres-

ent). On the horizontal line from 4.00 (in "Fat per cent" column) .85 is found in the vertical column headed .64. This, then, is the column to be used, and from it we learn that when "4 per cent milk" is worth 85 cts., that containing 3.30 per cent fat is worth 70 cts., that with 4.50 per cent fat 96 cts., and so on.

Second. To find what is due the individual patrons of a co-operative creamery, on the basis of amount of butterfat deliverd:

Find the number of lbs. of butterfat delivered by each patron during any desired period—one day, a week, or ten days—by multiplying his total milk delivery for the period, stated in hundreds of lbs. by its average percentage of fat as found by test, in the simple (if for one day) or composite sample. Let the sum of the lbs. butterfat delivered by all patrons during the period be used as a divisor, and the net returns for butter made during same period or from said deliveries—after deducting the agreed upon amount for cost of making—be used as dividend: the quotient will of course be the amount due patrons per lb. of butterfat delivered. This multiplied by 4 will give the amount due per hundred lbs. of "4 per cent milk." Then by the table, as directed above, find the value per hundred of the milk delivered by each patron. [The same result would of course be reached by multiplying the amount due per lb. of butterfat by the pounds of same delivered by each patron. Which way is the easier can best be learned by experience.]

Price of Milk per 100 Pounds.

Fat, per cent.	DOLLARS AND CENTS.								
3.00	.34	.37	.41	.45	.49	.52	.56	.60	.64
3.10	.35	.39	.43	.46	.50	.54	.58	.62	.66
3.20	.36	.40	.44	.48	.52	.56	.60	.64	.68
3.30	.37	.41	.45	.49	.54	.58	.62	.66	.70
3.40	.38	.42	.47	.51	.55	.59	.64	.68	.72
3.50	.39	.44	.48	.52	.57	.61	.66	.70	.74
3.60	.40	.45	.49	.54	.58	.63	.67	.72	.76
3.70	.42	.46	.51	.55	.60	.65	.69	.74	.79
3.80	.43	.47	.52	.57	.62	.66	.71	.76	.81
3.90	.44	.49	.54	.58	.63	.68	.73	.78	.83
4.00	.45	.50	.55	.60	.65	.70	.75	.80	.85
4.10	.46	.51	.56	.61	.67	.72	.77	.82	.87
4.20	.47	.52	.58	.63	.68	.73	.79	.84	.89
4.30	.48	.54	.59	.64	.70	.75	.81	.86	.91
4.40	.49	.55	.60	.66	.71	.77	.82	.88	.93
4.50	.51	.56	.62	.67	.73	.79	.84	.90	.96
4.60	.52	.57	.63	.69	.75	.80	.86	.92	.98
4.70	.53	.59	.65	.70	.76	.82	.88	.94	1.00
4.80	.54	.60	.66	.72	.78	.84	.90	.96	1.02
4.90	.55	.61	.67	.73	.80	.86	.92	.98	1.04
5.00	.56	.62	.69	.75	.81	.87	.94	1.00	1.06
5.10	.57	.64	.70	.76	.83	.89	.96	1.02	1.08
5.20	.58	.65	.71	.78	.84	.91	.97	1.04	1.10
5.30	.60	.66	.73	.79	.86	.93	.99	1.06	1.13
5.40	.61	.67	.74	.81	.88	.94	1.01	1.08	1.15
5.50	.62	.69	.76	.82	.89	.96	1.03	1.10	1.17
5.60	.63	.70	.77	.84	.91	.98	1.05	1.12	1.19
5.70	.64	.71	.78	.85	.93	1.00	1.07	1.14	1.21
5.80	.65	.72	.80	.87	.94	1.01	1.09	1.16	1.23
5.90	.66	.74	.81	.88	.96	1.03	1.11	1.18	1.25
6.00	.67	.75	.82	.90	.97	1.05	1.12	1.20	1.27

Price of Milk per 100 Pounds.

Fat, per cent.	DOLLARS AND CENTS.								
3.00	.67	.71	.75	.79	.82	.86	.90	.94	.97
3.10	.70	.74	.78	.81	.85	.89	.93	.97	1.00
3.20	.72	.76	.80	.84	.88	.92	.96	1.00	1.04
3.30	.74	.78	.83	.87	.91	.95	.99	1.03	1.07
3.40	.76	.81	.85	.89	.93	.98	1.02	1.06	1.10
3.50	.79	.83	.88	.92	.96	1.01	1.05	1.09	1.14
3.60	.81	.85	.90	.95	.99	1.03	1.08	1.12	1.17
3.70	.83	.88	.93	.97	1.02	1.06	1.11	1.16	1.20
3.80	.85	.90	.95	1.00	1.04	1.09	1.14	1.19	1.23
3.90	.88	.93	.98	1.02	1.07	1.12	1.17	1.22	1.27
4.00	.90	.95	1.00	1.05	1.10	1.15	1.20	1.25	1.30
4.10	.92	.97	1.02	1.08	1.13	1.18	1.23	1.28	1.33
4.20	.94	1.00	1.05	1.10	1.15	1.21	1.26	1.31	1.36
4.30	.97	1.02	1.08	1.13	1.18	1.24	1.29	1.34	1.40
4.40	.99	1.04	1.10	1.15	1.21	1.26	1.32	1.37	1.43
4.50	1.01	1.07	1.13	1.18	1.24	1.29	1.35	1.41	1.46
4.60	1.03	1.09	1.15	1.21	1.26	1.32	1.38	1.44	1.49
4.70	1.06	1.12	1.18	1.23	1.29	1.35	1.41	1.47	1.53
4.80	1.08	1.14	1.20	1.26	1.32	1.38	1.44	1.50	1.56
4.90	1.10	1.16	1.23	1.29	1.35	1.41	1.47	1.53	1.59
5.00	1.12	1.19	1.25	1.31	1.37	1.44	1.50	1.56	1.62
5.10	1.15	1.21	1.27	1.34	1.40	1.47	1.53	1.59	1.66
5.20	1.17	1.23	1.30	1.36	1.43	1.49	1.56	1.62	1.69
5.30	1.19	1.26	1.32	1.39	1.46	1.52	1.59	1.66	1.72
5.40	1.21	1.28	1.35	1.42	1.48	1.55	1.62	1.69	1.75
5.50	1.24	1.31	1.38	1.44	1.51	1.58	1.65	1.72	1.79
5.60	1.26	1.33	1.40	1.47	1.54	1.61	1.68	1.75	1.82
5.70	1.28	1.35	1.43	1.50	1.57	1.64	1.71	1.78	1.85
5.80	1.30	1.38	1.45	1.52	1.59	1.67	1.74	1.81	1.88
5.90	1.33	1.40	1.48	1.55	1.62	1.70	1.77	1.84	1.92
6.00	1.35	1.42	1.50	1.57	1.65	1.72	1.80	1.87	1.95