NEW ACCURACY STANDARDS FOR CURRENT TRANSFORMERS

(Reference—Parallelogram Fig. 1) (Par. 4.031 of A.S.A. Standards C-57.1)

These new standards were based on the desire of metermen to include a correlation between ratio error and phase angle which would show the overall effect on watthour meter registration.

As an illustration, note that in the former ¼ accuracy class the error limits were:

Ratio ± ¼ percent:
Phase Angle ± 10 minutes:
At 100% rated current.

Ratio ± ½ percent:
Phase Angle ± 20 minutes:
At 10% rated current.

Compared to this is the new 0.3 accuracy class which designates the following overall Transformer Correction Factor (This is the correction for error due to both ratio error and phase angle):

TCF within 0.997 to 1.003 at 100% rated current.
TCF within 0.994 to 1.006 at 10% rated current.

Thus, the transformer ratio error and phase angle to satisfy these conditions must fall within the 0.3 and the 0.6 class parallelograms (Fig. 1) for 100% and 10% current respectively.

With the old ¼ class, a ratio error of +0.25% would be allowed even if the phase angle was −10 minutes, with an overall total correction (at 60% load PF) of $0.25 + \frac{10}{2600}100 = 0.63\%$ or TCF = 1.0063.

The new limit allows + 0.3% ratio error only if the phase angle is positive, so that it compensates for the ratio error. The phase angle may be as much as $\frac{0.6 \times 2600}{100}$ or +15.6 minutes. Likewise, it allows −0.3% ratio error only if the phase angle is negative (maximum value −15.6 minutes). For intermediate values of ratio error, intermediate phase angles are permitted, according to the 0.3 class parallelogram Fig. 1. The overall correction will never exceed 0.3%.

ACCURACY CLASSES FOR RELAYING SERVICE

Two classes of error are permissible, 2.5% or 10%, as the operator chooses. The accuracy may then be designated, for instance, as 2.5H100. The 2.5 means 2.5% maximum error; the 100 means that the transformer can supply at least 100 volts to the burden without exceeding the error. The 100 volts can be the product of a high burden and a low current, or a low burden and a high current. Examples are:

A high burden, 4 ohms at 25 amperes (5 times normal) gives 100 volts, a low burden, 1 ohm at 100 amperes (20 times normal) gives 100 volts, or any intermediate burden and current, 2 ohms at 50 amperes which also gives 100 volts.

The application engineer uses the standard in this way:

If the actual burden is 3 ohms, and he must have accuracy up to 60 amperes (12 times normal) the necessary voltage is 3 x 60 = 180. A 200 class transformer is required.

He can choose either 2.5% or 10% as required for the application; he would specify either 2.5H200 or 10H200 class accuracy.

This standard does not apply below 5 times nor above 20 times normal secondary current.

NAMEPLATE MARKING

According to the A.S.A. Standard C-57, Par. 4.075(a)(3) the manufacturer may specify on the nameplate a reference to a standard rating sheet which will give the rating of the transformer according to Par. 4.015 as follows:

(1) **"Accuracy at specified standard burdens, currents and frequency."** This is covered by:

(a) the standard accuracy class for

Table I—Metering

The numbers in the table are the A.S.A. Standard Accuracy Classes for Metering (60 Cycles)

Line No.	Burden		
	B 0.1	B 0.5	B 2.
1	0.3	0.3	0.3
2	0.3	0.3	0.6
3	0.3	0.3	1.2
3A	0.3	0.3	2.4
4	0.3	0.6	.6
5	0.3	0.6	1.2
6	0.3	0.6	2.4
6A	0.3	0.6	...
7	0.3	1.2	2.4
8	0.3	1.2	...
9	0.3	2.4	...
10	0.6	0.3	0.6
11	0.6	0.3	1.2
12	0.6	0.6	0.6
13	0.6	0.6	1.2
14	0.6	0.6	2.4
15	0.6	0.6	...
16	0.6	1.2	1.2
17	0.6	1.2	2.4
18	0.6	1.2	...
19	0.6	2.4	2.4
20	0.6	2.4	...
21	0.6	...	...
22	1.2	1.2	1.2
23	1.2	1.2	2.4
24	1.2	1.2	...
25	1.2	2.4	...
26	1.2	...	...
27	0.5 Class at Burden B 0.2		

Table II—Over current

The numbers in the table are the A.S.A. Standard (60 cycle) H Volts Classification

Line No.	% Error Class	
	10	2.5
A	50	...
B	50	50
C	100	...
D	100	50
E	100	100
F	200	50
G	200	100
H	200	200
I	400	100
J	400	200
K	400	400
L	800	200
M	800	400
N	800	800

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NEW ACCURACY STANDARDS FOR CURRENT TRANSFORMERS—Continued

metering service according to Par. 4.031 at the standard burdens (Par. 4.030) B 0.1, B 0.5 and B 2., at 60 cycles;

(b) the standard accuracy class for relaying service according to Par. 4.032(d), at 60 cycles.

(2) **"Thermal and mechanical limits."** According to Par. 4.045 and Par. 4.046 respectively, these are stated in terms of R.M.S. symmetrical current. The time interval taken for the thermal limit is 1 second, but the transformer cannot be used up to this value if it is higher than the mechanical rating. The rating for any interval up to 10 seconds is the rating for 1 second divided by the square root of the number of seconds. According to the new standard, the mechanical rating is one-half the old figure, which was based on peak current ratios, and the thermal limit is 5% higher than the old figure.

Therefore, on the transformer nameplate, a line number from Table I specifies metering accuracy; a line letter from Table II specifies relaying accuracy; and two numbers followed by M and T designate respectively the mechanical and thermal limits in number of times rated current.

Example—Designation on Nameplate
"Rating Leaflet No. IL-3644
1-D-100 M—80T"

EQUIVALENT PARALLELOGRAMS FOR CURRENT TRANSFORMERS

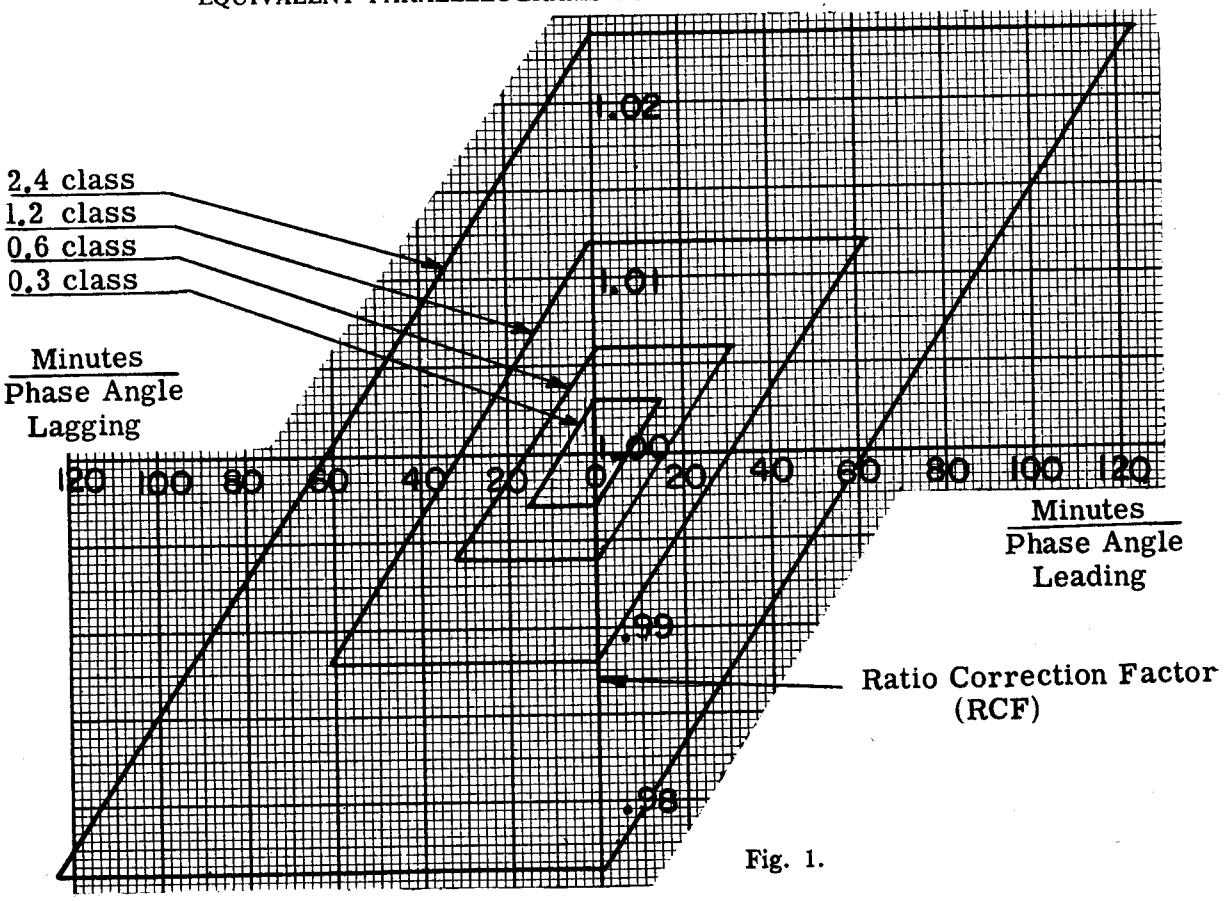

Fig. 1.

LIMITS OF TRANS. CORRECTION FACTOR (TCF)

Accuracy Class	100% Rated Current Min.	100% Rated Current Max.	10% Rated Current Min.	10% Rated Current Max.	Limits of P. F. of Metered Load (Lagging)
2.4	.976	1.024	.952	1.048	0.6 – 1.0
1.2	.988	1.012	.976	1.024	0.6 – 1.0
0.6	.994	1.006	.988	1.012	0.6 – 1.0
0.3	.997	1.003	.994	1.006	0.6 – 1.0

STANDARD BURDENS FOR RATING PURPOSES

Designation of Burden New	Designation of Burden Old	Sec. Burden at 60 Cy. –5 Amps. Imp. Ohms	Volt Amps.	Secondary Current Power Factor
B-0.1	X	0.1	2.5	0.9
B-0.5	Y	0.5	12.5	0.9
B-2	Z	2.0	50.0	0.5

According to the A.S.A. Standard C-57.1, Paragraph 4.031-(e), the limits of phase angle are 2600 (RCF-TCF), where TCF is the limit of overall correction factor given above. The parallelogram is equivalent to the formula.

CURRENT TRANSFORMER RATING

According to the A.S.A. Standard C-57, Par. 4.075(a)(3) the manufacturer may specify on the nameplate a reference to a standard rating sheet which will give the rating of the transformer according to Par. 4.015 as follows:

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(a) the standard accuracy class for metering service according to Par. 4.031 at the standard burdens (Par. 4.030) B 0.1, B 0.5 and B 2., at 60 cycles;

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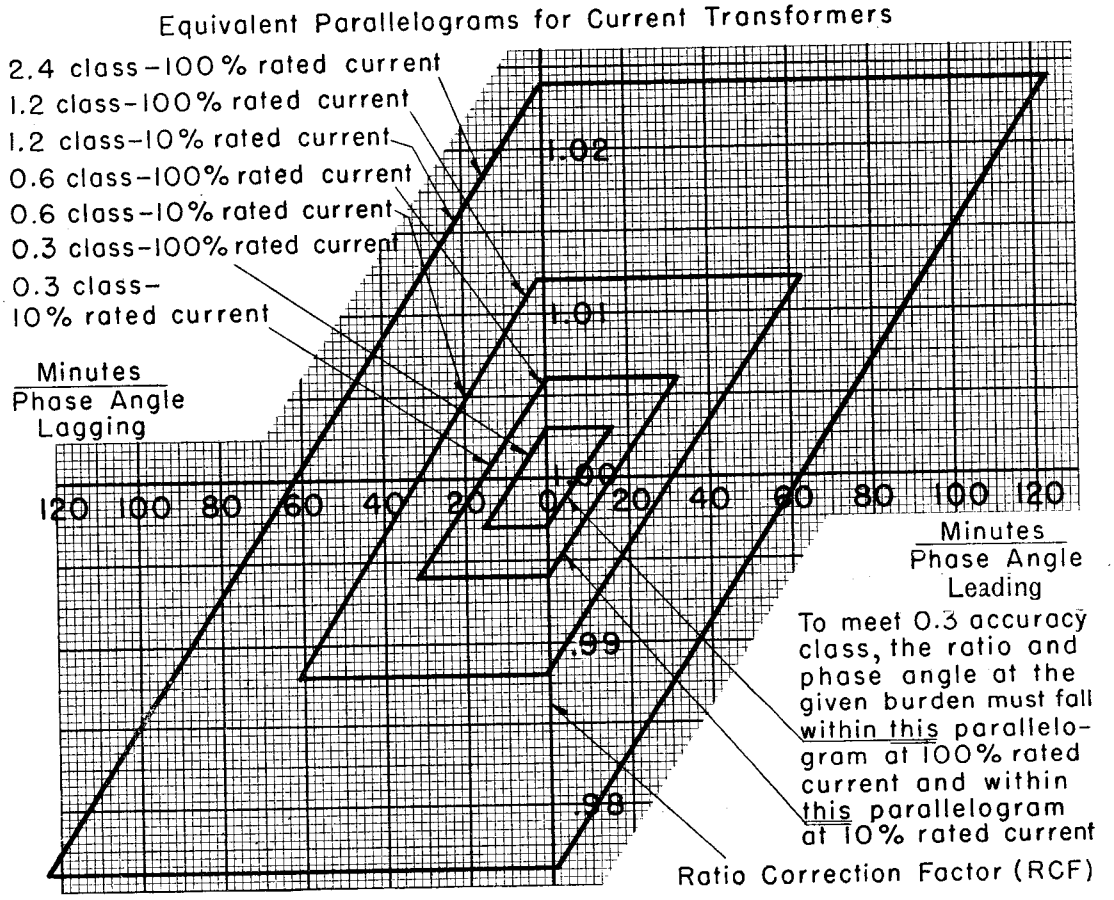

Fig. 1

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B-2	Z	2.0	50.0	0.5

According to the A.S.A. Standard C 57.1, Paragraph 4.031-(e), the limits of phase angle are 2600 (RCF-TCF), where TCF is the limit of overall correction factor given above. The parallelogram is equivalent to the formula.