Instructions for Field Check of TYPE TR AND FR CIRCUIT BREAKERS In CSP Distribution Transformers

General

Calibration checks, made on hundreds of units which were in service from one to five years, indicate that the breakers in CSP distribution transformers very rarely are outside the original calibrating band. Where the breaker appears to be out of calibration, it is advisable to follow these instructions carefully when recalibrating.

Procedure in Checking Calibration

Inspect the transformer to determine whether the oil is at the normal level marked on the case, and add oil, if necessary, to bring it up to that point. Allow the transformer to stand idle for at least 15 minutes to allow temperature conditions within the unit to become stable. The temperature of the oil should be close enough to that of the room air so that it will not change appreciably during a five minute interval, and should be measured accurately immediately before the test is begun.

When the test is made, the pointers on the adjusting knobs must be in the same position as when the breaker was originally calibrated. On all TR breakers, the pointers should be as shown in Fig. 1, during calibration check. For sometime, all 1½ and 3 Kv-a. transformers with TR breakers were shipped with the knobs turned counterclockwise approximately ½ turn after calibration. This change in adjustment after checking should be made on all such units with serial numbers below 2,500,000.

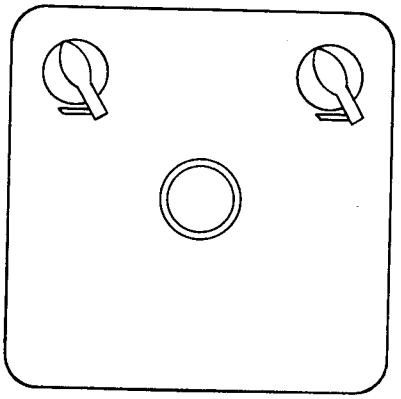
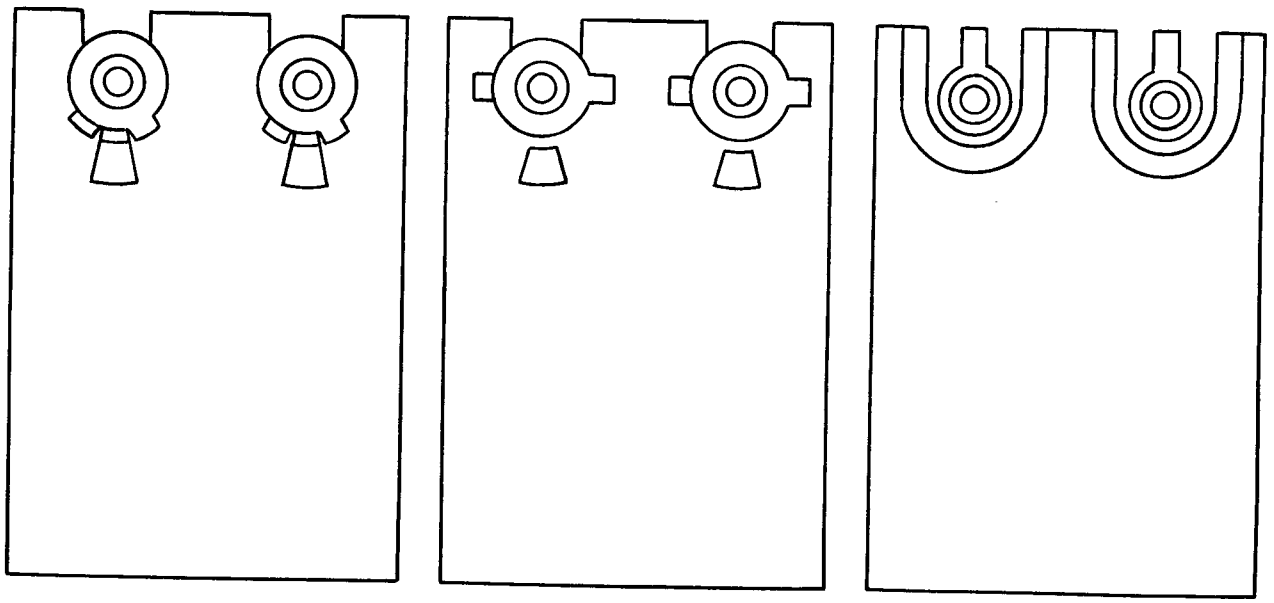


FIG. 1—PROPER POSITION OF INDICATORS ON ADJUSTING KNOBS DURING CALIBRATION CHECK OF TR BREAKERS

Three different pointer arrangements have been used with the FR breaker as shown in Fig. 2. They should be as shown in one of these sketches when the calibration is checked, and should be left in that position when the check is completed.

The numbers on the adjusting knobs have no particular significance, serving only as a convenient means of measuring fractions of a revolution of the knobs when calibrating the breaker.

The proper current for the existing oil temperature, as shown in the following tabulation, should be passed through each bimetal in turn, a cooling period of at least five minutes being allowed between checks on the same or different bimetals. One bimetal is in series with each breaker contact shown on the nameplate or connection diagram. It should be noted that units having 2 breakers are so connected that each bimetal of one breaker is in parallel with a bimetal in the other breaker. In such cases, the currents given in the tabulation should be doubled in making the tests. Since each test will cause a change in the oil temperature, it is



a b c

FIG. 2—PROPER POSITION OF INDICATORS ON ADJUSTING KNOBS DURING CALIBRATION CHECK OF FR BREAKERS

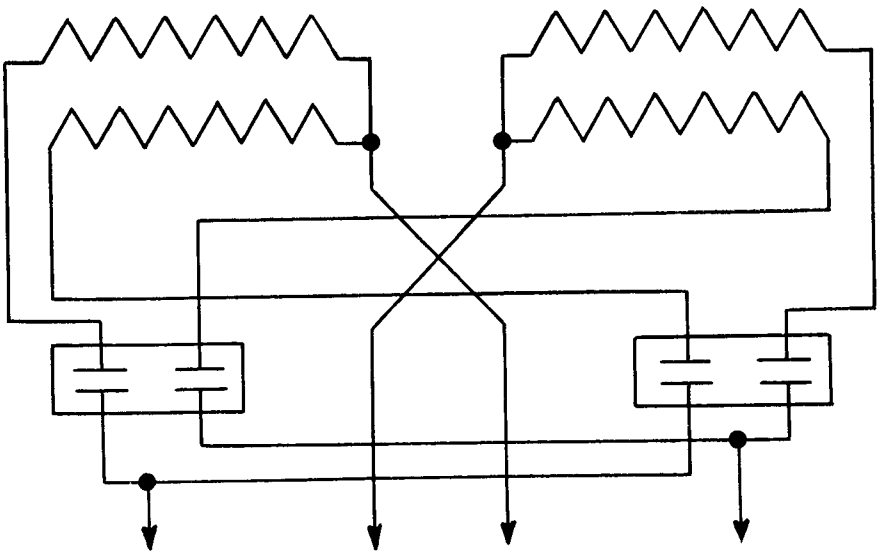


FIG. 3—LOW VOLTAGE CONNECTIONS OF TRANSFORMERS WITH TWO BREAKERS (ADDITIVE POLARITY)

necessary to make a correction in the calibrating current used in subsequent tests, so that the current used will be correct for the oil temperature then existing.

Should the breaker fail to trip, with current specified in the table, below the upper time limit, the test may be repeated, increasing the current 5% when the lower time limit is reached. If tripping then occurs before the upper limit is reached, the breaker may be considered as reasonably close to normal calibration, and no change in adjustment made. If the breaker does not trip below the upper limit, despite the current increase, it should be recalibrated. Before this is done, however, a check should be made to make sure that the proper current is being used.

The time limits given in this Instruction Letter are those used in checking breakers at Sharon Works. Calibration at Sharon is performed under ideal conditions, including closely controlled and accurately measured oil temperature, very accurately regulated current, and fully automatic timing equipment. It is not reasonable to expect that such extreme care and specialized equipment could be used in making field tests as are used at the factory. Due to difference in test conditions and the inevitable variations in measuring devices, it is probable that some breakers which test within the given band at Sharon will fall outside the band when tested in the field.

Since the current-time characteristic for many of these breakers is quite flat, a considerable variation in time corresponds to a small error in trip temperature. Thus, marginal cases which tripped close to the limits in Sharon may be considerably outside the band as checked in the field and not indicate a serious error in trip temperature.

In view of the above considerations, it would be advisable for customers and others making calibration checks in the field to consider breakers which trip within 20% of the given limits as satisfactory. For example: Breaker S#-910802, which is calibrated in Sharon to trip between 36 and 60 seconds, would give satisfactory service if on customer's test it tripped between 29 and 72 seconds. In the case of breakers which have a wide calibrating band, even larger deviations from the band will not indicate significant errors in calibration, due to the flatness of the curve, as mentioned above.

Procedure in Recalibration

In the event that recalibration is necessary, the pointers on the adjusting knobs should be unsoldered and the knobs turned slightly. Clockwise rotation increases the trip time, counter-clockwise rotation decreases it. If more than a quarter turn of the knob is needed to bring the breaker trip within the given band, it is possible that the breaker has been damaged mechanically, and a new breaker may be required. After calibration, the pointers should be resoldered to the adjusting knobs as shown in Fig. 1 or Fig. 2.

When it is necessary to recalibrate one or both breakers in a transformer in which two are supplied, it is desirable to recalibrate each bimetal separately. In such a unit, as mentioned above, each bimetal in one breaker operates in parallel with a bimetal in the other breaker, as shown in Fig. 3. If one breaker is opened by means of the operating handle, the bimetals in the other breaker may be checked and recalibrated, if necessary, using the currents as given in the tables. Note that leads X1 and X2 will be used in checking one bimetal, and leads X3 and X4, in checking the other. The process may then be repeated to calibrate the second breaker, with the first breaker open.

CALIBRATION DATA TYPE TR BREAKERS

Breaker Style No. *	Reference Number	Calibrating Current * with Oil Temp. at 20°C.	25°C.	30°C.	Time Limits Seconds
910 801	193 681-D	58.7	56.6	54.5	26–52
910 802	193 684-B	104.3	100.9	97.4	36–60
910 803	193 687-B	152.2	147.0	141.8	37–73
910 804	193 690-B	183.7	178.0	172.0	34–70
910 805	193 693-B	193.4	187.0	180.8	34–71
910 805-A	193 693-D	193.4	187.0	180.8	34–71
910 806	193 696-B	310.9	301.0	292.0	45–62
910 806-A	193 696-E	327.5	317.0	306.5	40–66
910 807	193 699-B	352.5	343.5	334.1	48–63
910 807-A	193 699-D	378.0	368.0	358.0	42–71
910 808	193 682-D	54.3	52.0	49.7	25–55
910 809	193 684-B	104.3	100.9	97.4	36–60
910 810	193 687-B	152.2	147.0	141.8	37–73
910 811	193 691-B	175.2	169.5	163.3	37–65
910 812	193 694-B	206.3	200.5	194.6	32–61
910 812-A	193 694-D	206.3	200.5	194.6	35–65
910 813	193 696-B	310.9	301.0	292.0	45–62
910 814	193 699-B	352.5	343.5	334.1	48–63
910 815	193 681-B	57.9	55.9	53.9	29–74
910 816	193 686-B	109.2	106.0	102.7	35–61
910 817	193 689-B	158.9	153.2	147.8	33–59
910 818	193 692-B	194.0	189.0	183.7	37–62
910 819	193 695-B	211.0	205.0	199.0	35–75
910 819-A	193 695-D	211.0	205.0	199.0	35–75
910 820	193 698-B	318.4	309.0	299.8	47–63
910 820-A	193 698-D	335.0	325.0	315.0	42–69
910 821	193 701-B	368.0	359.2	350.5	49–63
910 821-A	193 701-D	378.0	368.0	358.0	42–71
910 822	193 752-B	83.0	80.2	77.3	38–71
910 823	193 687-B	152.2	147.0	141.8	37–73
910 824	193 754-B	192.0	186.5	181.0	36–65
910 825	193 698-B	318.4	309.0	299.8	47–63
910 826	193 699-B	352.5	343.5	334.1	48–63
910 827	193 752-B	83.0	80.2	77.3	38–71
910 828	193 753-B	163.4	158.4	153.4	35–65
910 829	193 754-B	192.0	186.5	181.0	36–65
910 830	193 698-B	318.4	309.0	299.8	47–63
910 831	193 699-B	352.5	343.5	334.1	48–63
910 910	193 784-A	309.0	299.0	289.0	46–64
910 910-A	193 784-D	327.5	317.0	306.5	40–66
910 911	193 784-A	309.0	299.0	289.0	46–64
910 911-A	193 784-D	327.5	317.0	306.5	40–66
910 912	193 785-A	338.0	328.0	318.0	46–64
910 912-A	193 701-D	378.0	368.0	358.0	42–71
910 913	193 785-A	338.0	328.0	318.0	46–64
910 913-A	193 701-D	378.0	368.0	358.0	42–71
910 914	208 805-A	303.8	293.0	282.5	45–64
910 914-A	208 805-D	319.5	308.5	297.5	45–70
910 915	208 805-A	303.8	293.0	282.5	45–64
910 915-A	208 805-D	319.5	308.5	297.5	45–70
910 916	208 785-A	338.0	328.0	318.0	46–64
910 916-A	208 701-D	378.0	368.0	358.0	42–71
910 917	208 785-A	338.0	328.0	318.0	46–64
910 917-A	208 701-D	378.0	368.0	358.0	42–71
910 918	193 794-A	330.0	320.8	311.5	45–64
910 918-A	193 794-D	347.0	337.0	327.0	45–73
910 919	193 794-A	330.0	320.8	311.5	45–64
910 919-A	193 794-D	347.0	337.0	327.0	45–73
910 920	193 701-B	368.0	359.2	350.5	49–63
910 920-A	231 097-D	394.3	384.2	374.1	46–73
910 921	193 701-B	368.0	359.2	350.5	49–63
910 921-A	231 097-D	394.3	384.2	374.1	46–73
910 922	193 794-A	330.0	320.8	311.5	45–64
910 922-A	193 794-D	347.0	337.0	327.0	45–73
910 923	193 794-A	330.0	320.8	311.5	45–64

* Notes: In order to obtain calibrating currents for oil temperatures not shown in the table, it may be assumed that the current is a linear function of temperature. In most cases, this assumption is accurate only between 15°C. and 35°C.
In all standard, and most special transformers the breaker style will be found engraved on the cover of the breaker. In some special transformers, the S.O. number will be found, instead of the style number. In such cases, it will be necessary to obtain calibrating data from Sharon Works.

CALIBRATION DATA TYPE FR BREAKERS

Breaker Style No. *	Reference Number	Calibrating Current * with Oil Temp. at 20°C.	25°C.	30°C.	Time Limits Seconds
910 923-A	193 794-D	347.0	337.0	327.0	45–73
910 924	193 701-B	368.0	359.2	350.5	49–63
910 924-A	231 097-D	394.3	384.2	374.1	46–73
910 925	193 701-B	368.0	359.2	350.5	49–63
910 925-A	231 097-D	394.3	384.2	374.1	46–73
910 926	193 794-A	330.0	320.8	311.5	45–64
910 926-A	193 794-D	347.0	337.0	327.0	45–73
910 927	193 794-A	330.0	320.8	311.5	45–64
910 927-A	193 794-D	347.0	337.0	327.0	45–73
910 928	193 701-B	368.0	359.2	350.5	49–63
910 928-A	231 097-D	394.3	384.2	374.1	46–73
910 929	193 701-B	368.0	359.2	350.5	49–63
910 929-A	231 097-D	394.3	384.2	374.1	46–73
912 247	193 757-B	185.5	180.0	174.5	47–67
1 026 137	193 404	48.6	46.2	43.7	25–85
1 118 557	231 097-D	394.3	384.2	374.1	46–73
1 029 106	209 343	55.3	52.7	50.2	15–32
1 029 109	209 344	108.3	103.6	98.8	18–34
1 029 111	209 347	116.8	112.5	108.2	20–36
1 065 943	231 101	96.8	93.2	89.6	18–40
1 104 037	231 396	62.2	59.9	57.6	15–25
1 118 951	209 347	116.8	112.5	108.2	20–36

* Notes: In order to obtain calibrating currents for oil temperatures not shown in the table, it may be assumed that the current is a linear function of temperature. In most cases, this assumption is accurate only between 15°C. and 35°C.
In all standard, and most special, transformers the breaker style will be found engraved on the cover of the breaker. In some special transformers, the S.O. number will be found, instead of the style number. In such cases it will be necessary to obtain calibrating data from Sharon Works.

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