TESCO – THE EASTERN SPECIALTY COMPANY
Canal Street and Jefferson Avenue
Bristol, PA 19007

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OPERATING INSTRUCTIONS - CATALOG NO. 1043 CT Burden Tester (10 Amp)

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CURRENT TRANSFORMER FIELD TEST SET
CATALOG 1043

1.1 The Eastern Specialty Co. Current Transformer Field Test Set provides a simple means for checking the condition of a current transformer installation without interrupting the Customer's Service.

1.2 The Catalog 1043 is essentially a multi-range ammeter, namely 1.25/2.5/5/10 amperes, with a built-in multi-range resistor burden, namely 0.1/0.2/0.5/1/2/4 OHMS, which is normally shunted out, but can be put in series with the meter by pressing a push button.

1.3 The Catalog 1043 has a Current Range Selector and a Burden Range Selector. Both selector switches in the instrument are of the shorting or bridging type with duplicate contacts in parallel and may be operated at any time without danger of opening the secondary circuit.

Leads for connecting the instrument should be as short as possible and not smaller than #12 AWG. Lead terminations should be such as to assure firm and well secured connections. Overall resistance of leads and terminations should be held within .05 ohm if possible. It is suggested that several pairs of leads with different types of terminations be carried with the instrument in order to meet the various situations that must be dealt with in connecting the instrument to the several points in the circuit. One pair of these leads, terminated at one end with a test plug, provides a very convenient and satisfactory means for connecting to test switches to which test plugs are adapted.

CURRENT TRANSFORMERS AND THEIR SECONDARY CIRCUITS

2.1 It is very important that current transformers undergo some form of test from time to time to determine whether or not they are functioning for this purpose, however, it is both costly to the utility company and an inconvenience to the customer. Since the ratio and the phase-angle characteristics of a current transformer do not change as long as it is free of internal defects, it is only necessary to determine whether or not it has incurred and internal defects.

The Catalog 1043 C.T.F.T.S. is the means to this end; and it accomplishes its purpose while the current transformer is in service and operating under the customer's normal load. Thus all necessary removals are held down to the relatively few current transformers which become defective in service.

2.2 Internal defects which cause malfunctioning of a current transformer are short circuited primary or secondary turns or a ground in the secondary winding, the last being essentially the same as short-circuited secondary turns. When any one of these defects occurs in a current transformer, then an appreciable part of the total appreciable part of the total available ampere-turns are diverted into the short, and the current to the watt-hour meter is less than the total secondary current of the transformer.

2.3 If now the burden of the Field Test Set is added in series with the watt-hour meter by depressing the push button, the additional high impedance in the meter circuit will divert still more current into the shunt path provided by the shorted turn or turns, and the meter current should decrease by a large amount. This would immediately show on the Test Set ammeter as a sudden and large decrease in the meter reading every time the switch is depressed.

The Catalog 1043 is also the means for locating and determining the nature of defects in the external secondary circuits. Defects which may exist in external secondary circuits are high-resistance connections in the secondary wiring, grounding of normally ungrounded secondary wiring or high-resistance internal connections in meters.

A high resistance at any point in the secondary circuit is the equivalent of an added high burden. Aside from the heating effect at the point of high resistance, this instrument will reveal the presence of such a defect because the current transformer is now operating at a much higher flux density due to the increased voltage necessary to force current through the hot spot in the wiring.

2.4 At high flux densities, the ratio of the current transformer drops off, and the addition of the extra burden in the Test Set will cause a greater change in the current than when the current transformer is operating normally at low flux density. This would immediately show on the Test Set ammeter as a sudden and large decrease in the meter reading every time the switch is depressed.

2.5 Short-circuited secondary wiring or grounding of normally ungrounded secondary winding will usually show no discernible reading on the ammeter. It should not be assumed at this point, however, that the wiring is shorted or grounded as the same result will be obtained from an open secondary circuit. In such a case, there can be a dangerously high voltage present at some point in the

secondary circuit. Whenever a zero ammeter reading is obtained, its cause should be positively determined before any other work is done on the circuit.

2.6 In all work involving the secondary of a customer's current transformer, this circuit must never be opened due to the high voltage hazard.

Consequently, the test switch should be opened and the transformer secondary shorted out when the Test Set is first connected as in Figure 1.

When connecting directly to the current transformer ahead of the test switch, the necessary shorting jumpers should be used so that the secondary circuit remains closed at all times, either through a jumper or through the Test Set.

Extensive precautions have been taken in the design of the Test Set so that there will be a continuous and closed path in the meter current circuit at all times, and the secondary of the customer's current transformer will not be opened by accident.

All internal connections within the instrument which carry the metering current are permanently soldered joints.

The rotary tap switches which select the current and burden ranges are of the shorting or bridging type, with duplicate contacts connected in parallel.

USING THE CATALOG 1043 CURRENT TRANSFORMER FIELD TEST SET

3.1 The Catalog 1043 Current Transformer Field Test Set shall be used when making periodic tests, complaint tests and installation tests or inspections.

3.2 The Catalog 1043 shall be connected in series with the secondary of the metering current transformer, at the test switch. The test switch shall be opened and the transformer secondary shorted out when the Catalog 1043 is first connected. The total length of test set leads shall not exceed 10 feet (12 AWG).

3.3 When starting a test, the ammeter shall be set on the maximum range and the setting decreased until at least one half scale deflection is obtained.

3.4 To prevent overheating of the Catalog 1043, the "Push to add burden" switch shall be depressed for no longer than 2 seconds in duration in 10 second intervals.

3.5 Each current transformer shall be tested first at the maximum burden and if the current reading drops, the burden shall be decreased until no change is observed.

Any significant drop in current reading (1/2 division or more) shall be recorded for local supervision. Also, in these cases, record the transformer type, rating, company number and load current. The quantity of meters and the total circuit feet of secondary leads, including the Test Set leads, shall be noted.

PROCEDURES

4.1 Set the “current range” selector switch at 10 amperes. Set the “ohms burden” selector switch at the proper burden for the current transformer being checked. For window-type current transformers, including similar current transformers equipped with primary bars, use the .2 ohm burden when the secondary current is 2 amperes or more. When the secondary current is less than 2 amperes, the .5 ohm burden may be used. For most all other current transformers, the 2 ohm burden is usually suitable.

4.2 Connect the Catalog 1043 at the test switch as shown in Figure 1 and open the test switch at this point by whatever means the test switch affords. (A series type test plug may be used in lieu of the method illustrated if the test switch is constructed for test plug adaptation). Check the ammeter reading and note whether it is 1) zero; 2) more than 5 amperes; 3) 5 amperes or less.

4.3 If the reading is zero and it is known that the current is flowing in the current transformer primary winding, the secondary circuit is either open or “dead” shorted. For operator safety, make the assumption that the secondary circuit is open and high voltage is present. Restore the test switch to normal and connect the Catalog 1043 as shown in Figure 2.

If a reading is obtained on the ammeter, there is an open somewhere in the secondary circuit beyond this point. If, however, the ammeter reading is still zero, close the short-circuiting device on the current transformer. Disconnect the normally ungrounded wire from the current transformer and connect the Catalog 1043 as shown in Figure 3. Open the short-circuiting device. If a reading is obtained, there is a short, ground or open in the secondary wiring. If the reading is still zero, the current transformer secondary winding is open, necessitating replacement of the current transformer.

4.4 If the reading is more than 5 amperes, the current transformer is overloaded and should be replaced (Except 600 Volt Class – 10 Amps.).
4.5 If the reading is 5 amperes or less, turn the “Current Range” selector switch until the reading is obtained in the upper half of the ammeter scale. Then depress the burden button. If the ammeter reading does not change, the current transformer is intact and the secondary circuit is free of shorts, accidental grounds and high resistance connections. Should the ammeter reading diminish, however, it is an indication of a defect somewhere in the current transformer or in the secondary circuit. Restore the secondary circuit to normal and disconnect the Catalog 1043.

4.6 Connect the Catalog 1043 across the secondary circuit at the bottom of the test switch and disconnect the normally ungrounded wire at the top of the test switch, as shown in Figure 4. Leave all test switch blades in the normal, closed position. Depress the burden button. If there is no change in

the reading, the current transformer and that part of the secondary circuit between it and the Catalog 1043 are intact. Should the ammeter reading diminish, a further test is necessary to determine whether the defect is in the current transformer or the secondary circuit. Restore the secondary circuit to normal and disconnect the Catalog 1043.

4.7 Close the short-circuiting device on the current transformer. Disconnect the normally ungrounded wire from the current transformer, leaving the normally grounded wire connected. Connect the Catalog 1043 as shown in Figure 3 and open the short circuiting device. If the ammeter reading diminishes when the burden button is depressed, the current transformer is defective and should be replaced. If the ammeter reading does not change, the current transformer is intact and the defect is in the wiring between it and the test switch.

4.8 Once it has been determined that a current transformer is intact, a physical inspection is usually all that is necessary to locate a defect in the external secondary circuit. In cases, however, where considerable dismantling would be necessary to do this, the Catalog 1043 may be used to pinpoint the section of the secondary circuit where the defect is located. For Example, to check the watt-hour meter for loose internal connections or accidental ground, connect the Catalog 1043 to the test switch as shown in Figure 5 and disconnect both leads from the meter, thus isolating it from the circuit.

If the ammeter reading does not change when the burden button is depressed, the defect is in the meter. To determine whether the defect is a loose connection or a ground, reconnect the normally ungrounded wire to the meter as shown in Figure 6. If the defect is a loose connection, the ammeter reading will not change when the burden is depressed. If it is a ground, some of the current will be shunted away from the Catalog 1043, resulting in a diminished ammeter reading even before the burden button is depressed. Depressing the button will cause the ammeter reading to diminish still more.

4.9 Similarly, other parts of the secondary circuit, such as wires in the conduit runs, can be checked for defects by isolating them from the circuit. Suggested procedure for doing this is to close the short-circuiting device on the current transformer, isolate the normally ungrounded wire and install a temporary wire in its place. Connect the Catalog 1043 as shown in Figure 1 and open the short-circuiting device.

If testing now shows the circuit clear of defects, the isolated wire is defective and should be corrected or replaced. If the defect still exists, repeat this procedure throughout other sections of the circuit until the defect is located.

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Figure: 1

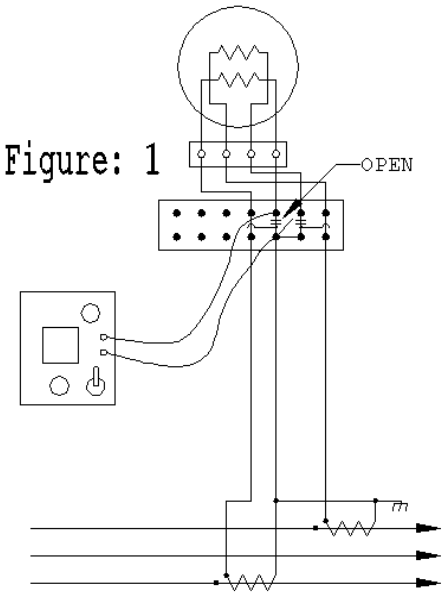
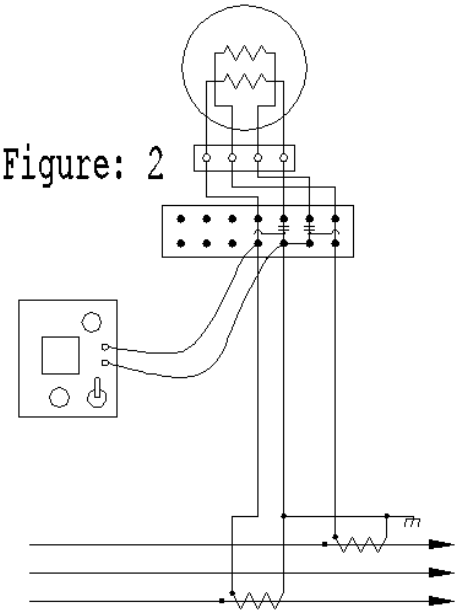


Figure: 2



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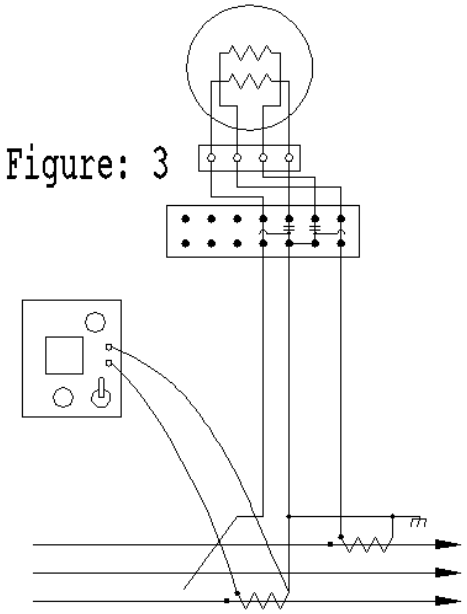

Figure: 3

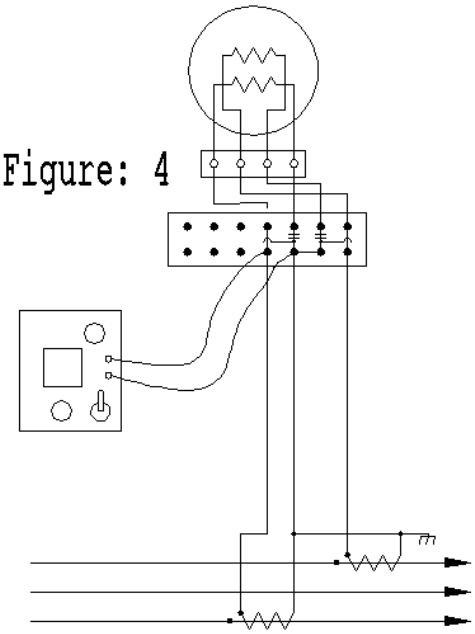

Figure: 4

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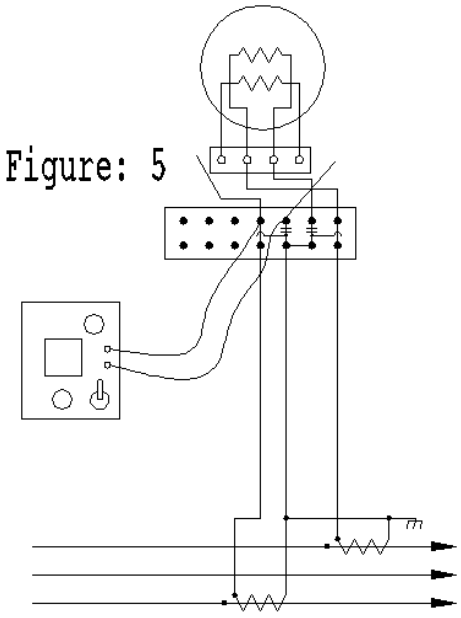

Figure: 5

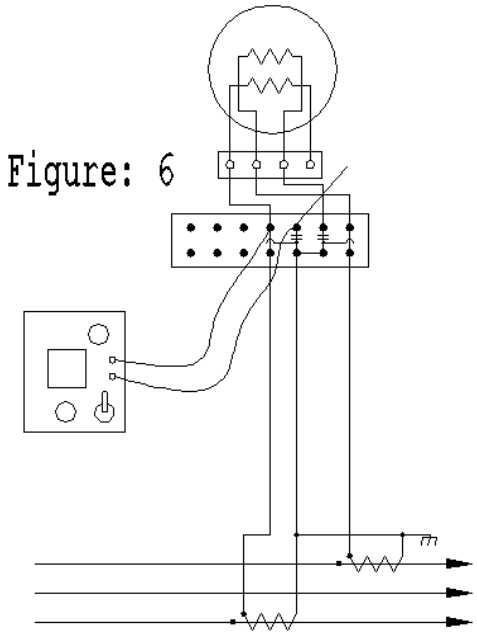

Figure: 6

EVALUATING RESULTS

5.1 The following example of data and Table 1 shall be referred to for evaluating the results obtained with the Field Test Set.

Example:

a. 200 AMP C.T. with 1 meter and less than 12 circuit feet of leads in the secondary.

b. Assume secondary current of 4.0 AMPS.

c. Test Set current reading drops on 4 OHMS Burden Range, but not on 2 OHM Range.

d. Therefore from Table 1, this transformer is performing satisfactorily considering its burden rating of B-0.2.

5.2 The maximum allowable test burden for installations with several meters and long secondary leads shall be determined as follows:

Let R = Allowable test Resistance (OHMS)

B_T = Rated Burden of Current Transformer (volt-amperes)

B_M = Burden of Total Number of Meters at 2.5 volt-amperes per meter.

B_L = Burden of Total Length of Leads in Feet at 0.02 volt-amperes per foot.

I = Load Current (Amperes)

Then $R = \frac{B_T - B_T - B_T}{I^2}$

5.3 Using the formula above and the values in the example below, calculate for the allowable Test Resistance.

Example:

a. 400 AMP C.T. with Burden Rating of B-0.5.

b. 2 Meters and 50 feet of leads

c. Secondary current of 3.0A

d. Test Set current reading drops on 1 OHM burden range, but not on 0.5 OHM range.

B_T = 12.5 VA (From Table 1)

B_M = 2.5 X 2 = 5

B_L = 0.02 X 50 = 1.0 VA

Then $R = \frac{B_T - B_T - B_T}{I^2}$

$= \frac{12.5 - 5.0 - 1.0}{(3)^2}$

= 0.72 OHM

If the Test Set burden range immediately below this calculated value produced a drop in current, a defect probably exists. Since the 0.5 OHM range did not produce a drop, this transformer is performing satisfactorily as 0.72 OHM is less than 1 OHM and greater than 0.5 OHM.

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TABLE 1

Standard Burdens for 5-Ampere Secondary Current Transformers

Designation of Burden	Standard Burden Characteristics		Burden Impendence, Voltamperes, and Power Factor for 60 Hz and 5-Ampere Secondary Current		
	Resistance, Ohms	Inductance, Millihenrys	Impedence, Ohms	Volt-Amperes	Power Factor
B-0.1	0.09	0.116	0.1	2.5	0.9
B-0.2	0.18	0.232	0.2	5.0	0.9
B-0.5	0.45	0.580	0.5	12.5	0.9
B-0.9	0.81	1.044	0.9	22.5	0.9
B-1.8	1.62	2.088	1.8	45.0	0.9
B-1.0	0.5	2.3	1.0	25.0	0.5
B-2.0	1.0	4.6	2.0	50.0	0.5
B-4.0	2.0	9.2	4.0	100.0	0.5
B-8.0	4.0	18.4	8.0	200.0	0.5

* Standard burdens for meter applications are B-0.1, B-0.2, B-0.5, B-0.9, and B-1.8

ACCESSORIES

Catalog #1046	Carrying Case for Catalog 1043 with compartment for leads.
Part #J-35-XXC	Lead Set (72") #12 AWG with Mueller #27C clips and insulators.
Part #J-35-XXT	Lead Set (72") #12 AWG with Catalog 1077 Test Plug for TESCO Test Switches.

WARRANTY

The Catalog 1043 Current Transformer Field Test Set is guaranteed to be free from defects in material and workmanship for a period of 90 days from the date of shipment. During the Warranty period, the Catalog 1043 will either be repaired or replaced, solely at TESCO's discretion. Damages due to improper packing or abuse due to shipment or handling will not be covered under Warranty.

Return all equipment Prepaid for Repair or Warranty Repair to:

TESCO – The Eastern Specialty Company
925 Canal Street
Bristol, PA 19007
RA# _____

Call our Sales Dept. for a Return Authorization Number prior to its return. A Purchase Order must accompany all items for repair. State if an estimate is required. In extreme cases, an estimate will be provided for Customers approval before proceeding with repairs.

USEFUL INFORMATION

The Catalog 1043 Current Transformer Field Test Set used with voltmeter, ammeter, and wattmeter or phase angle becomes a useful tool in determining the correctness of wiring of an installation.

A Catalog 841 (LED) or a Catalog 843 (LCD) Single Phase A.C. Analyzer is a single unit that replaces all of the aforementioned devices with one efficient easy to use instrument.

TESTING SAFETY/HAZARDS

The Catalog 1043 C.T.F.T.S. is used to simply check the condition of a current transformer installation. These tests must be performed while the C.T. is connected to the service and energized.

At various points in this manual, types of leads to be used are discussed and step-by-step procedures are pointed out, while stressing safety. Particularly, any tests on the current transformer's secondary and the hazards of high voltage being present and any necessary precautions are discussed. This can never be discussed too many times.

> IF ANY PROCEDURES GIVEN HERE DO NOT AGREE WITH YOUR COMPANIES PROCEDURES, CHECKWITH YOUR SUPERVISOR BEFORE PROCEEDING. THE PROCEDURES OUTLINED IN THIS SECTION ARE NOT INTENDED TO REPLACE THOSE ESTABLISHED BY YOUR COMPANY BUT ENHANCE THEM WHILE EMPHASIZING SAFE
>
> TESTING TECHNIQUES AND THE CORRECT APPLICATION OF THE CATALOG 1043. TO ACCOMPLISH THIS, A DISCUSSION OF CURRENT TRANSFORMER TESTING SAFETY IS INCLUDED IN THIS MANUAL.

Testing current transformers while they are in service can be a dangerous operation if certain safety precautions are not followed. The secondary loop of the current transformer must NEVER BE OPENED when service current is present in the primary. When there is current in the primary, and the secondary of a current transformer is open circuited, the voltage across the secondary can rise to several thousand volts.

The high voltage that is present on the open secondary of an energized current transformer generates two great hazards. The first hazard is ELECTRICAL SHOCK TO TESTING PERSONNEL. The second hazard is THE BREAKDOWN OF THE CURRENT TRANSFORMER INSULATION. These hazards can be avoided provided that the secondary of the current transformer is never opened.

Current transformer installations having a Test Switch as part of the secondary loop are the safest to test. The Test Switch device will facilitate inserting instrumentation into the current transformer's secondary loop without danger of opening the circuit.

This is accomplished by using leads terminated with a Test Switch Plug. This provides a "make-before-break" connection to prevent accidental opening of the current transformer's secondary loop.

On installations not having a Test Switch included in the current transformer's secondary loop, THE SECONDARY TERMINALS OF THE CURRENT TRANSFORMER MUST BE SHORTED before the loop is opened for insertion of the Catalog 1043 and once again shorted before its removal.

TEST LEADS SAFETY/HAZARDS

Test leads for the connection of the Catalog 1043 into the service are optional and are left to the discretion of the user. These leads connect to the Catalog 1043 via binding posts. These binding posts facilitate banana plugs or spade lugs.

A test lead terminated on the instrument end with a banana plug is quick and convenient, but they are NOT SAFE. The banana plug pushes into the input post and can be accidentally jerked out, causing an open current transformer secondary and creating a HAZARD. A solidly captured connector, such as a spade lug, should be used.

For connection into the current transformer secondary where a test switch is installed, the safest termination for the test lead is a test plug. This allows safe insertion and should it be accidentally removed from the circuit, avoids an open circuit due to the test switch's "make-before-break" construction.

Other lead terminations could be spade or ring lugs bolted down to the test switch terminals or other bolted connections in the circuit. Spring clip terminations should be avoided as they are not mechanically solid and could be pulled off accidentally and open the secondary circuit. Sometimes this type of connection cannot be avoided; EXTREME CAUTION must then be used.

Note: Using proper equipment is not all that is required. Thorough training in the hazards and safety precautions are necessary as well as proper dress, such as safety glasses, insulated gloves, and long sleeve shirts.

Remember to examine the circuit, make your connections, check them and check them again. You can never be TOO SAFE!