

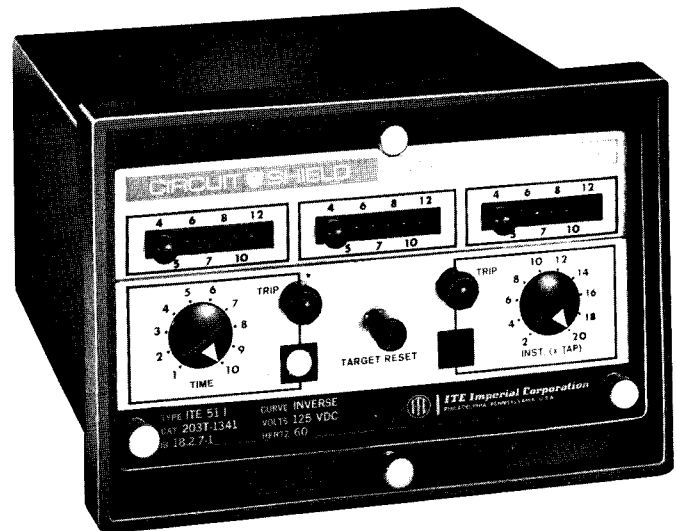
SOLID-STATE OVERCURRENT RELAYS

INSTRUCTIONS

CIRCUIT-SHIELD™

DRAWOUT SEMI-FLUSH MOUNTED
SINGLE-PHASE AND THREE-PHASE RELAYS

INVERSE	ITE-51I	SHORT TIME	ITE-51S
VERY INVERSE	ITE-51Y	LONG TIME	ITE-51L
EXTREMELY INVERSE ...	ITE-51E	DEFINITE TIME	ITE-51D
INST ONLY	ITE-50		



ITE Imperial
CORPORATION



**INSTRUCTIONS FOR CIRCUIT-SHIELD SOLID-STATE RELAYS
DRAWOUT SEMI-FLUSH MOUNTED
SINGLE-PHASE AND THREE-PHASE**

INTRODUCTION

These instructions contain the information required to properly install, operate, and test the complete CIRCUIT-SHIELD line of solid-state overcurrent relays.

The CIRCUIT-SHIELD overcurrent relay is housed in a semi-flush drawout relay case suitable for conventional panel mounting.

All connections to the relay are made at terminals located on the rear of the case and clearly numbered, one (1) through twelve (12).

CURRENT, TIME, and INST. pickup controls are located on the front panel behind a removable clear plexiglass cover.

TIME and INST. target indicators are also mounted on the front panel. Both targets are reset by means of a pushbutton extending through the relay cover.

RECEIVING, HANDLING, STORAGE

Upon receipt of the CIRCUIT-SHIELD relay (when not included as part of a switchboard) examine for shipping damage. If damage or loss is evident, file a claim at once and promptly notify the nearest I-T-E Imperial Corporation Sales Office. Use normal care in handling to avoid mechanical damage. The CIRCUIT-SHIELD system has no vital moving parts and if kept reasonably clean and dry, has no practical limit to its operating life.

MAINTENANCE AND RENEWAL PARTS

No maintenance is required on the CIRCUIT-SHIELD relay. Should the relay be damaged physically or electrically due to improper connections or applications, it is recommended that a new relay be ordered from the factory. When ordering, state the type relay, catalog number, control voltage, and serial number.

APPLICATION

CIRCUIT-SHIELD overcurrent relays provide overcurrent protection phase-to-phase or phase-to-ground. They are designed to be operated by standard five (5) ampere secondary current transformers. The output circuit (trip circuit) will operate conventional circuit breaker trip coils at the DC voltage specified on the relay nameplate.

These relays can be used for all applications where conventional electromechanical relays are used. They come in six different time-current curve families, INVERSE (51I), VERY INVERSE (51Y), EXTREMELY INVERSE (51E), SHORT TIME (51S), LONG TIME (51L), and DEFINITE TIME (51D). An INSTANTANEOUS function can be furnished as an option with any one of the above time families or as a separate INST. (50) relay.

Both single-phase and three-phase relays are offered with three available pickup tap ranges, 0.5-2 amps, 1.5-6 amps, and 4-12 amps.

Range†	Taps‡	Burdens*
0.5-2.0 A	0.5, 0.6, 0.8, 1.0, 1.2, 1.5, 2.0	1.1 VA
1.5-6.0 A	1.5, 2.0, 2.5, 3, 4, 5, 6	1.1 VA
4-12 A	4, 5, 6, 7, 8, 10, 12	1.4 VA

† Special tap ranges are available for motor applications.
‡ When tap plug is removed, affected setting reverts to the maximum pickup.
* Burden is based on minimum pickup. Burden is uniform for all time curves and remains low at high multiples of current.

Any one of five control voltages can be obtained, 48 Vdc, 125 Vdc, 250 Vdc, 120 Vac (175 Vdc capacitor trip) and 240 Vac (350 Vdc capacitor trip).

TOLERANCES

- TIME PICKUP ±5% of tap setting
- TIME DELAY ±2% at 300% (factory cal.)
dial #10 (2-20 multiples) ±5%
dial #1 (2-20 multiples) 10 ms or ±10%
(whichever is larger)
- INST. PICKUP ±10% of pickup amps
(tap x dial setting)

RATINGS

TEMPERATURE

- Nominal 25°C ambient
- Additional ± 5% tolerance ... -15°C to + 55°C
- Must operate -30°C to + 70°C

FREQUENCY

- Nominal 60 Hertz
- Additional ± 5% tolerance + 1 to - 3 Hertz

INPUT CIRCUIT

- Phase one (1) current—terminals 1 and 2.
- Phase two (2) current—terminals 3 and 4.
- Phase three (3) current—terminals 5 and 6.

The current input for single-phase relays is made at terminals 3 and 4.

Each input current is fed to a tapped transformer primary. The secondary winding produces a voltage across a burden resistor. This voltage is rectified and supplied to the static circuitry.

The pickup of the static circuit is adjusted to the desired pickup current by tap selection of the transformer primary turns.



INPUT CURRENT RATINGS

Time	Tap Range, A	Input Current, 1 ϕ or 3 ϕ (CT Secondary Amperes)
1 Second	0.5-2	300 multiples of pickup tap setting or 235 A rms, whichever is less.
	1.5-6	300 multiples of pickup tap setting or 235 A rms, whichever is less.
	4-12	300 multiples of pickup tap setting or 390 A rms, whichever is less.
Continuous	All Ranges	1.5 multiples of pickup tap setting.

OUTPUT CIRCUIT

The CIRCUIT-SHIELD overcurrent relay energizes the breaker trip coil by means of an output SCR. Two SCR's are provided, one for the time delay and one for the instantaneous circuit as indicated in the wiring diagram shown in Figure 1.

As shown, relay terminal 7 is connected to the control power positive, with the trip coil connected to relay terminal 12 through a 52/a contact.

SCR A is gated by the time delay circuit, while SCR B is gated by the instantaneous circuit.

It should be noted that once an SCR is gated (turned on), it will remain in conduction till its anode current falls below its holding current which typically is 5 to 20 milliamperes. Consequently, the trip coil current must be interrupted with the 52/a contact.

It should also be noted that a diode is connected from trip bus terminal 12 to negative terminal 8 to prevent transient voltages across the SCR when trip coil current is interrupted (diode anode connected to terminal 8).

NOTE: Special care must be taken to connect control power in the proper polarity. Reversing plus (+) and minus (-) control power connections will result in a short circuit through the above mentioned diode if the trip control switch CS/T is closed.

OUTPUT TRIP CIRCUIT RATINGS

Nominal Voltage	Range of Operation	Max. Current, Amps DC		
		6 Cycles	1 Second	Continuous
48 Vdc 125 Vdc 250 Vdc 120 Vac 240 Vac	28-60 70-140 140-280 175 Vdc Cap. Trip 350 Vdc Cap. Trip	30	15	1

INSTALLATION

MOUNTING

The outline dimensions and panel drilling and cutout information is given in Figure 3.

CONNECTIONS

External connection diagram is shown in Figure 1. Terminals 9 and 10 must be externally shorted for the

INST. function to be operable. Instantaneous relay operation can be cancelled for reclosing applications by using an external supervisory contact connected to these terminals.

SETTINGS

Current Pickup Taps

A tap block for each phase is located on the relay front panel. Each tap block provides for seven (7) pickup settings which are marked in CT secondary amperes. When a pin is pulled out, that phase switches to the maximum tap setting.

Time Dial

One of ten (10) time-current curves is selected by means of the potentiometer dial on the left side of the relay front panel. The dial is labeled "TIME", with markings one (1) through ten (10). Intermediate settings can be made and verified by test.

Instantaneous

Instantaneous pickup is selected by means of the potentiometer dial on the right side of the relay front panel. The dial is labeled "INST." with markings two (2) through twenty (20). The markings indicate multiples of the pickup tap setting.

For example, if the phase one (1) tap is set at six (6) amperes and the INST. dial is set at eight (8), the INST. setting is:

$$6 \text{ amps} \times 8 = 48 \text{ amps}$$

Consequently, an instantaneous trip will occur at 48 amps in phase one (1) of the relay.

PRECAUTION: The INST. CUTOFF LINK must be in place (when supplied) if the INST. unit is to be operable.

SOLID-STATE RELAY PRECAUTIONS

The following precautions should be taken when applying solid-state relays:

1. Do not apply high voltage tests to solid-state relays. If a control wiring insulation test is required, bond all terminals together and disconnect ground wire before applying test voltage.

2. Incorrect wiring will result in damage to solid-state relays. Be sure wiring agrees with the connection diagram for the particular relay before the relay is energized. Be sure control power is applied in the correct polarity before applying control power.

3. Apply only the rated control voltage marked on the relay front panel. Unlike conventional relay contacts, solid-state outputs are rated for a particular control voltage. If rectified AC voltage is used in place of a battery, proper filtering will be required to insure SCR "Holding Current".

4. Be sure the trip circuit is interrupted by an "a" contact to remove high currents from solid-state output circuits. Solid-state output circuits have inherently high momentary current ratings and low continuous current ratings. Never exceed the ratings.



5. When applying input current to solid-state relays, be sure to interrupt the input current immediately after the relay operates.

6. Be sure load (trip coils or auxiliary relays) draws at least 0.10 amps to insure operation. SCR's require a minimum current to remain conducting after triggering. Parallel resistance with a low current coil to guarantee the holding current, if necessary.

7. Do not touch or manually operate target vanes on CIRCUIT-SHIELD overcurrent relays. Although the targets return their indication under shock, they can be damaged by manual operation with a pencil or pointed object.

8. If the instantaneous circuit is to operate, be sure to have a jumper between terminals 9 and 10 on the rear of the relay. Unless the relay is applied in a reclosing scheme, no other wires should be connected to terminals 9 and 10.

9. Only the lower circuit board of the CIRCUIT-SHIELD overcurrent relay is removable. This board should insert smoothly. Do not use force.

10. It should be noted that removal of the tap block pin is equivalent to setting the highest tap.

11. Do not attempt to trouble-shoot or repair solid-state relays. Follow test instructions to verify that relay is in proper working order. If a relay is found to be defective, return to factory for repair. Immediate replacement of the removable element or the fixed element can be made available from the factory; identify by catalog number. It is suggested that a complete spare relay be ordered as a replacement, and the damaged unit repaired and retained as a spare.

TESTING

HIGH POTENTIAL TESTS

Do not apply high voltage tests to solid-state relay circuits. If a control wiring insulation test is required, bond all terminals together and disconnect grounding wire before applying test voltage.

TARGET CIRCUITS

The target indicators for the TIME and INST. circuits are polarity sensitive devices which are set by current flow through the corresponding trip SCR.

Target reset is accomplished by the control power connection (terminals 7 and 8 of Figure 1) through the TARGET RESET pushbutton.

A. OPERATIONAL-ACCEPTANCE TESTS

In general, it is not necessary to schedule periodic maintenance and testing of this relay. However, if tests are desired to confirm the proper functioning of the system, the following procedure can be used.

Mounted in Switchgear

Tests should be made on a de-energized main circuit. If tests are to be made on an energized circuit, be sure to take all necessary precautions.

It is customary to test the trip circuit of electro-mechanical overcurrent relays by manually closing the trip contacts to trip their associated circuit breakers. If the contacts are allowed to part before the seal-in contact closes, the relay contacts are eroded by the arc. Also, high transient voltages will appear from trip bus to positive.

This problem is avoided in the CIRCUIT-SHIELD overcurrent relay by the operational test feature. Separate pushbuttons labeled "TEST" are provided for the TIME and INST. functions. The pushbuttons are recessed to prevent accidental operations.

A portion of the control voltage is applied to the time circuit when the TIME pushbutton is depressed. The time delay circuit then produces an SCR gate signal, in a time corresponding to approximately two (2) multiples of input current (at nominal control voltage), and the TIME target operates.

Similarly, a portion of the control voltage is applied to the INST. circuit when the INST. pushbutton is depressed, operating the INST. target.

B. CALIBRATION TESTS (Also see Appendix A)

Connect the CIRCUIT-SHIELD relay to the test source proper DC control voltage (to match relay), and synchronous timer as shown in Figure 2. Also, set pickup tap to desired value.

TIME—Pickup

- 1) Set TIME dial to required value.
- 2) With DC source off, preset test current to 95% of pickup value.
- 3) With DC on, apply test current. No trip should occur.
- 4) With DC off, preset test current to 105% of pickup value.
- 5) With DC on, apply test current. The relay should trip and operate the TIME target. (Allow sufficient time.)
- 6) Reset target by pressing the RESET pushbutton.

TIME—Delay Curve

- 1) Set INST. dial to maximum position (20X).
- 2) Set TIME dial to required value, per time-current curves.
- 3) With DC off, preset test current to 300% of pickup value.
- 4) With DC on, apply test current. The relay should trip in a time within $\pm 10\%$ of the published curve time value.
- 5) Reset target by pressing the RESET pushbutton.

INST.—Pickup

- 1) Set INST. dial to required value.
- 2) With DC off, preset current to 90% of required value (TAP X INST. DIAL).
- 3) With DC on, apply test current. Relay should not trip on INST. (i.e. no INST. target indication).
- 4) With DC off, preset test current to 110% of required value.
- 5) With DC on, apply test current. Relay should trip giving INST. target.
- 6) Reset target by pressing the RESET pushbutton.

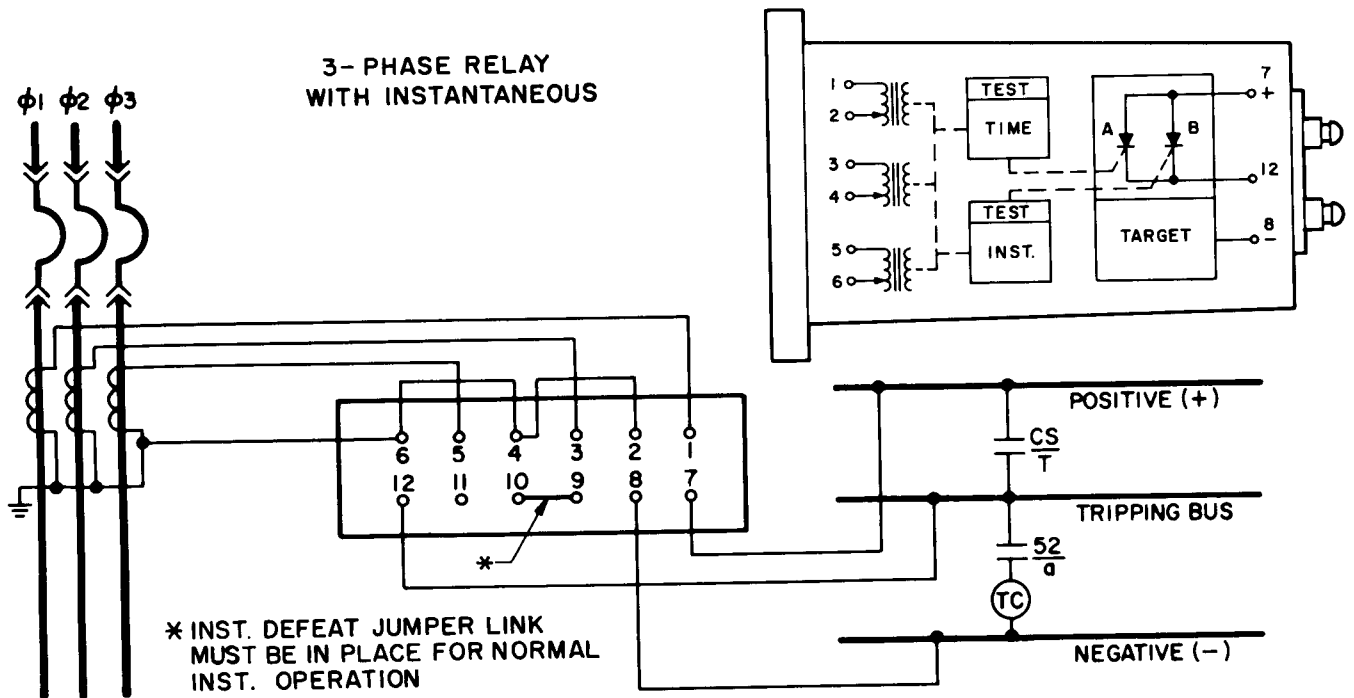
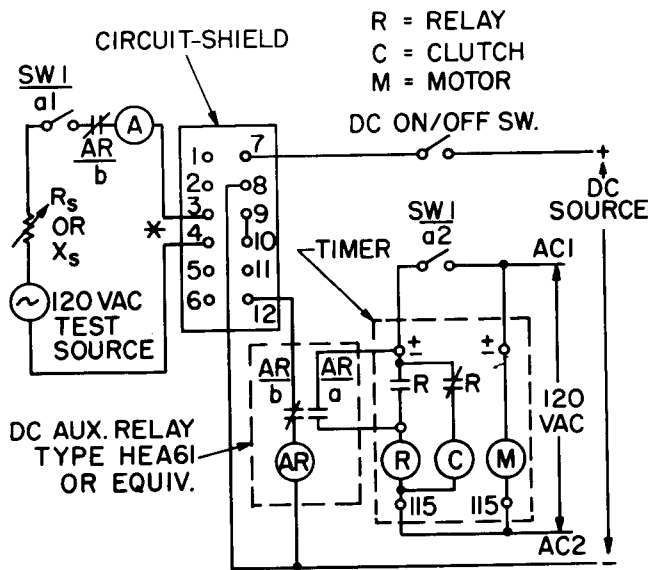


Fig. 1 — 3-Phase CIRCUIT-SHIELD Wiring Diagram



* NOTE: FOR 3-PHASE RELAYS, PHASES A & C CAN BE SIMILARLY TESTED BY ALTERNATELY CONNECTING THE TEST SOURCE TO 1-2 AND 5-6.

NOTE: Auxiliary relays with coil resistances greater than 10 ohms/volt must have a parallel resistor added across the relay coil. Size resistor to draw 100 ma current from DC source.

Fig. 2 — Calibration Test Circuit



DRAWOUT SEMI-FLUSH MOUNTED RELAY

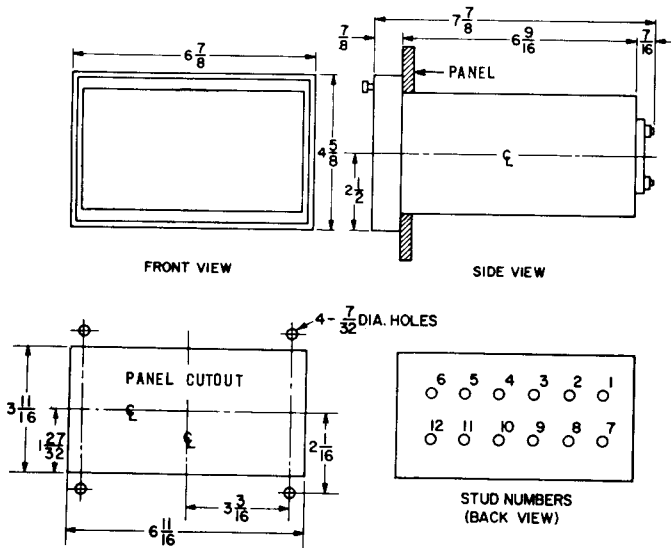
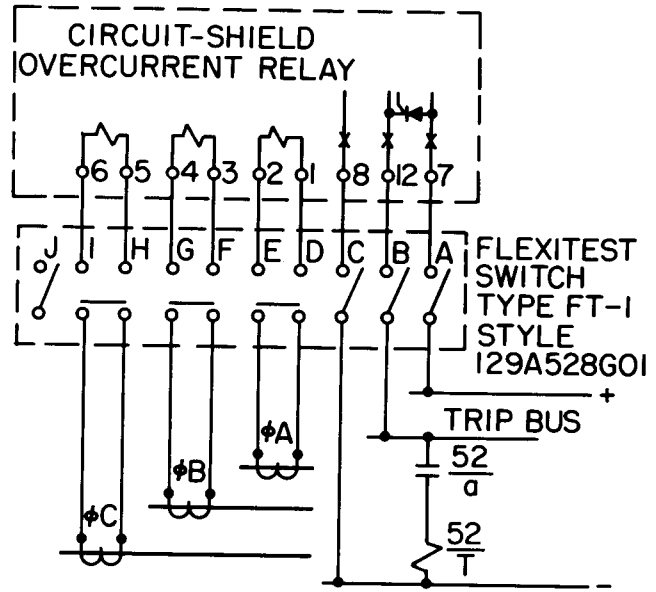


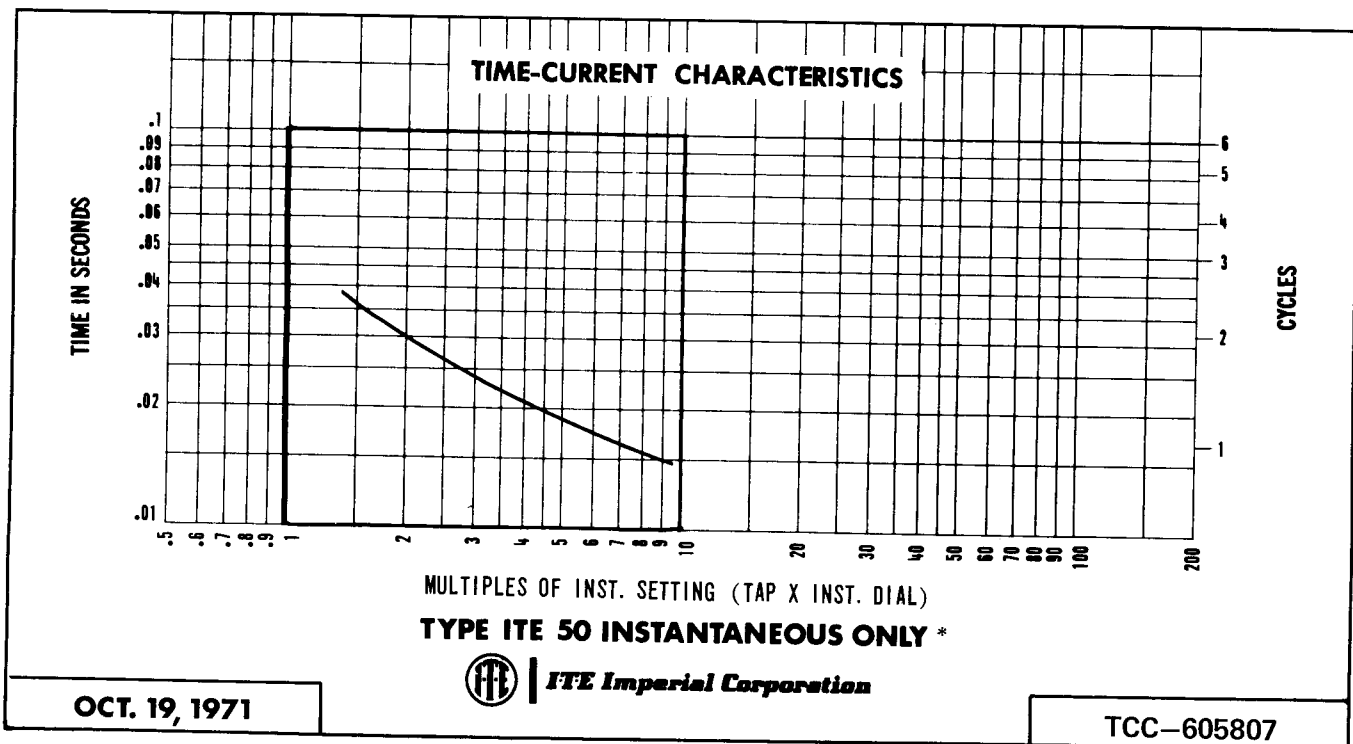
Fig. 3 — Overcurrent Relay Outline and Drilling



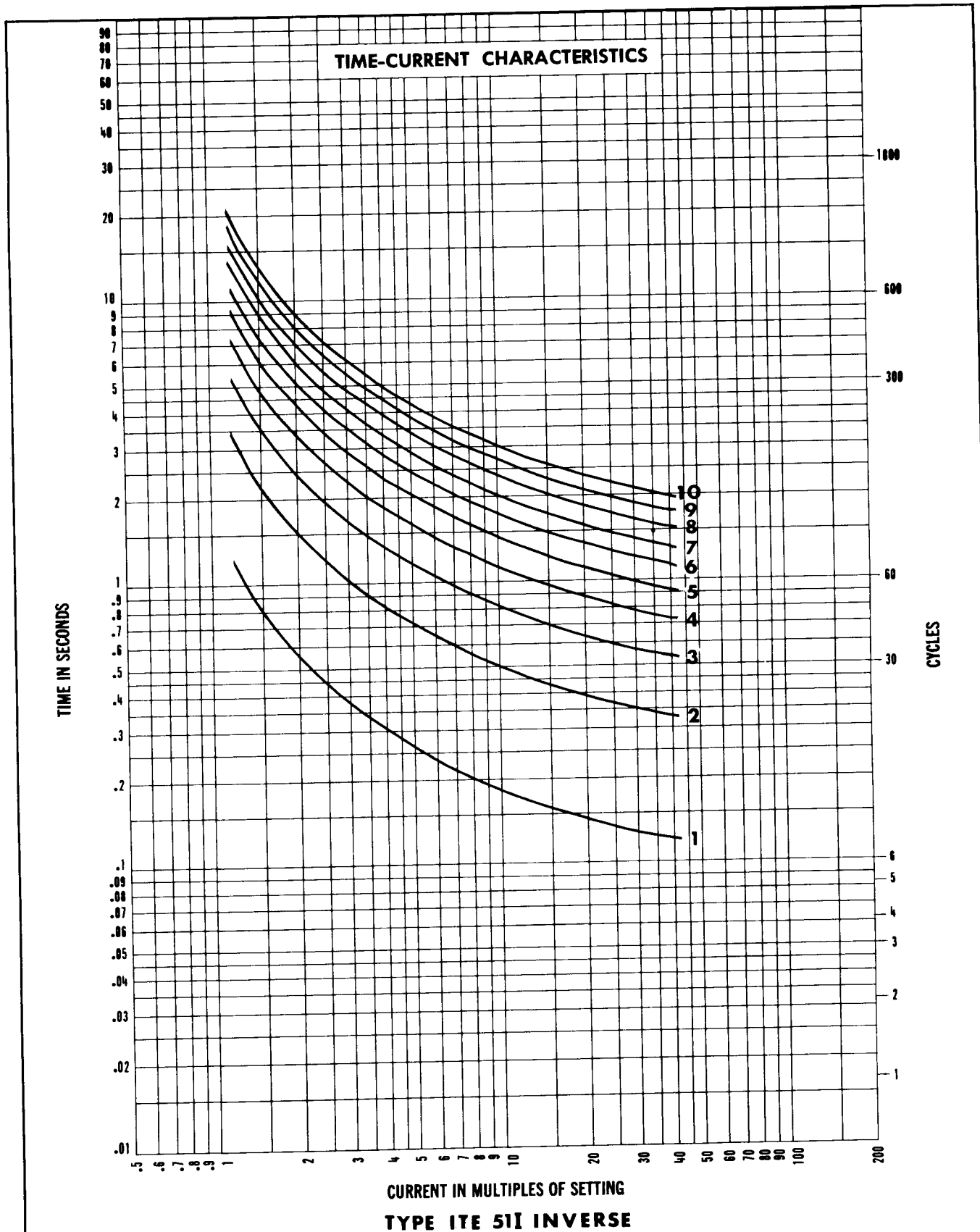
Suggested arrangement for drawout type test facilities to be used by those wishing to maintain their conventional test procedures when checking I-T-E's solid-state overcurrent relays.

This sketch shows Westinghouse's Flexitest Switch. However, G.E., States, Meter Devices, or other types can be used.

Fig. 4 — CIRCUIT-SHIELD Connections to FT-1 Flexitest Test Switch



* ALSO INST. ATTACHMENT TO TIME RELAYS



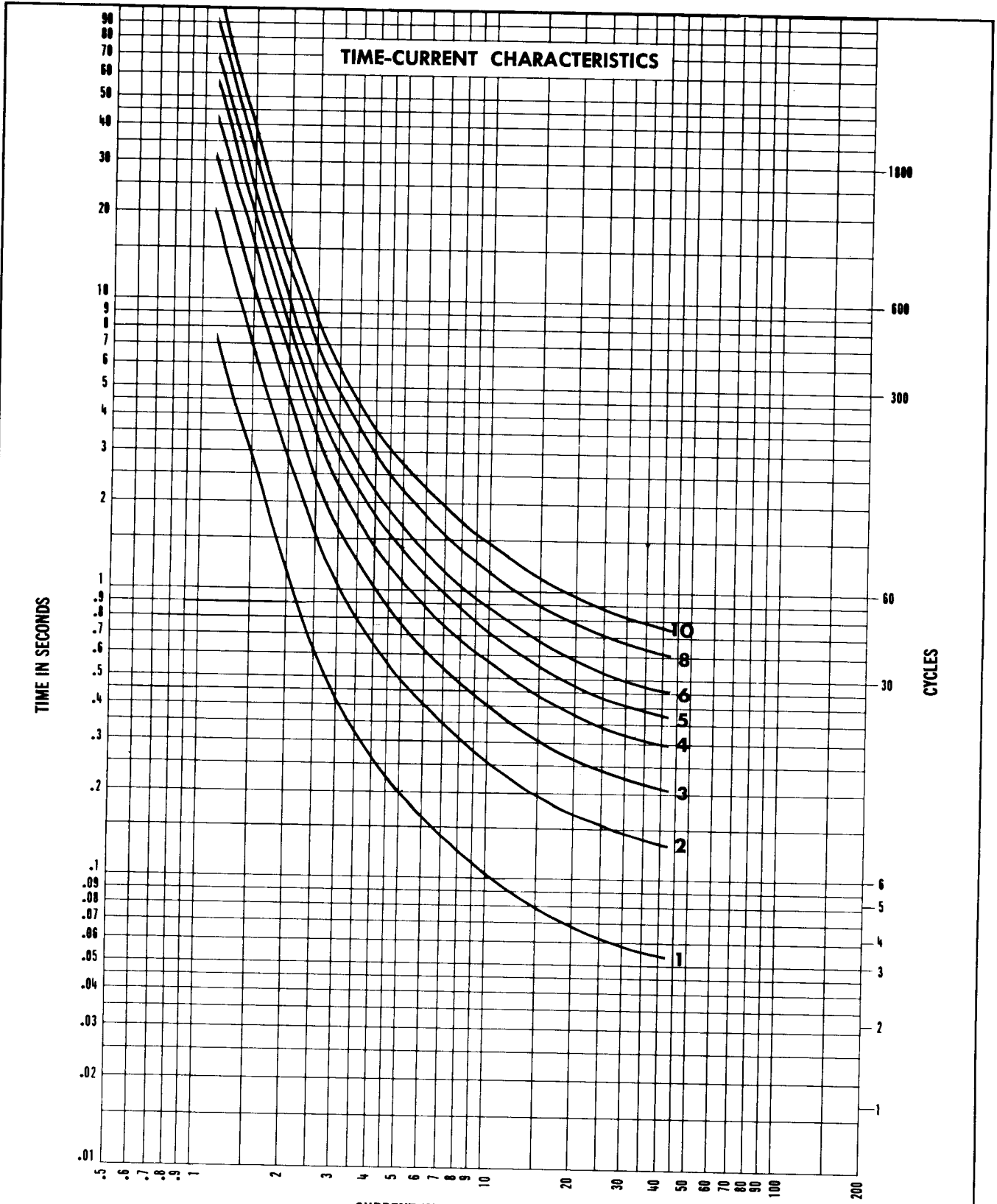
CURRENT IN MULTIPLES OF SETTING
TYPE ITE 51I INVERSE



ITE Imperial Corporation

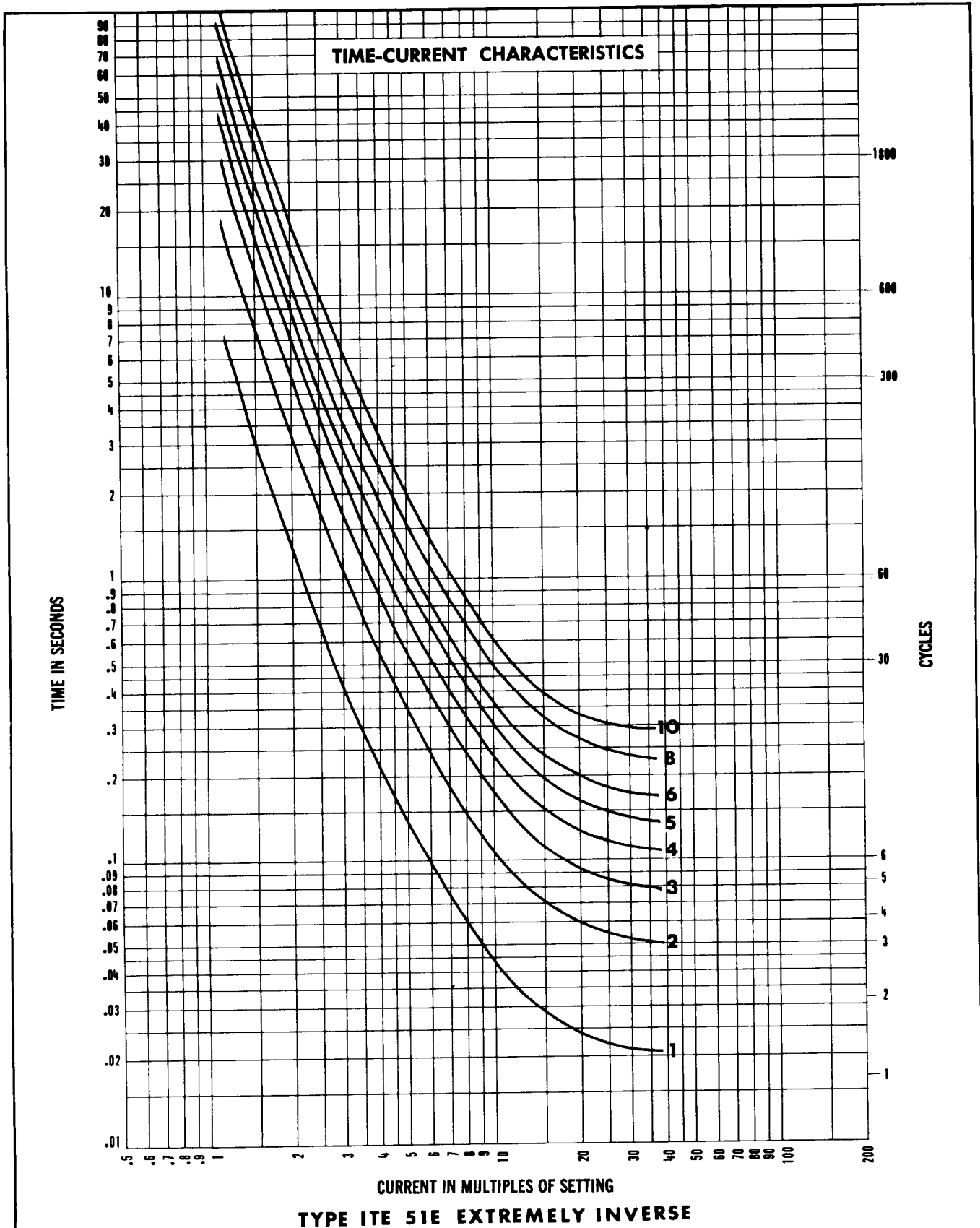
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CURRENT IN MULTIPLES OF SETTING
TYPE ITE 51Y VERY INVERSE





CURRENT IN MULTIPLES OF SETTING
TYPE ITE 51E EXTREMELY INVERSE

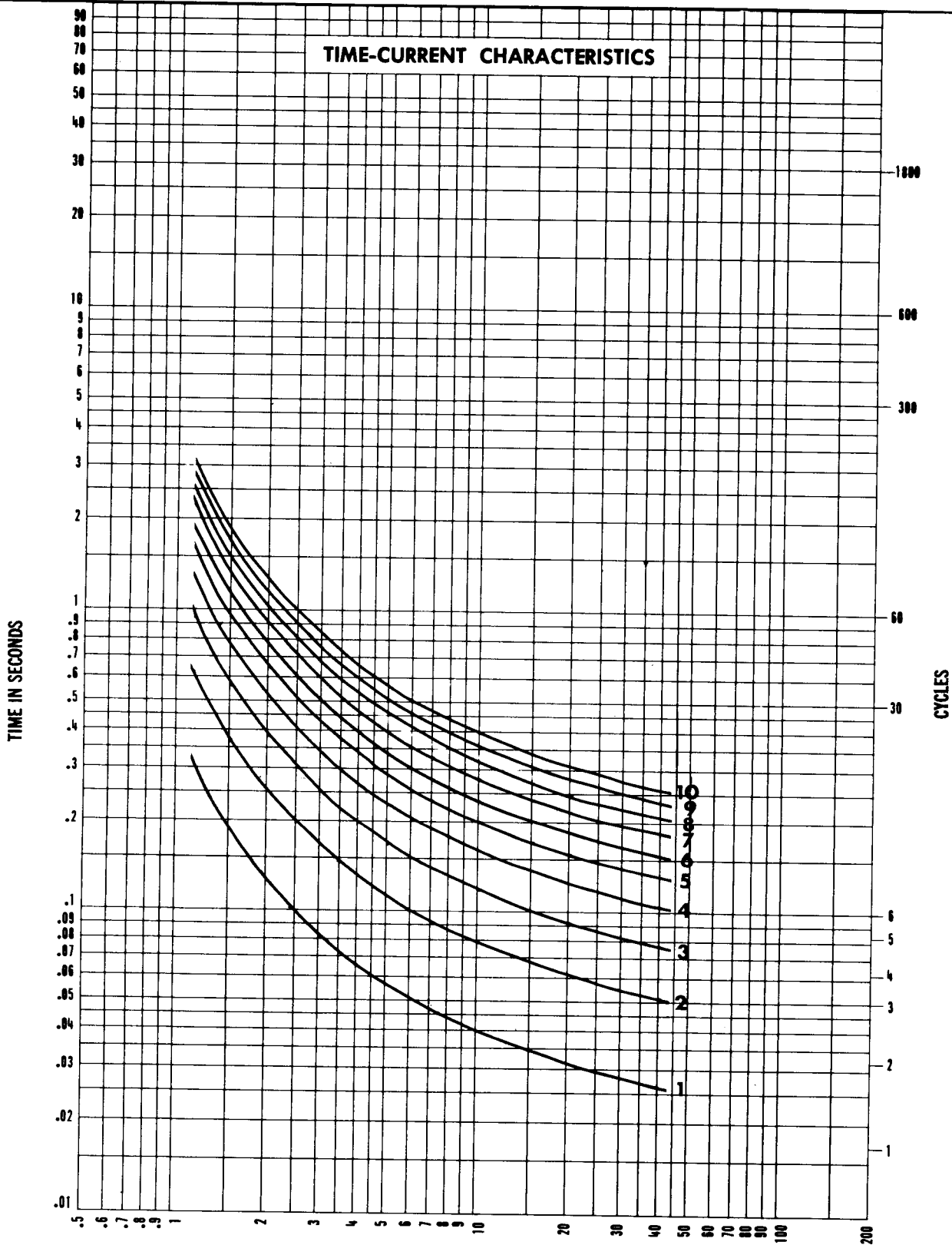


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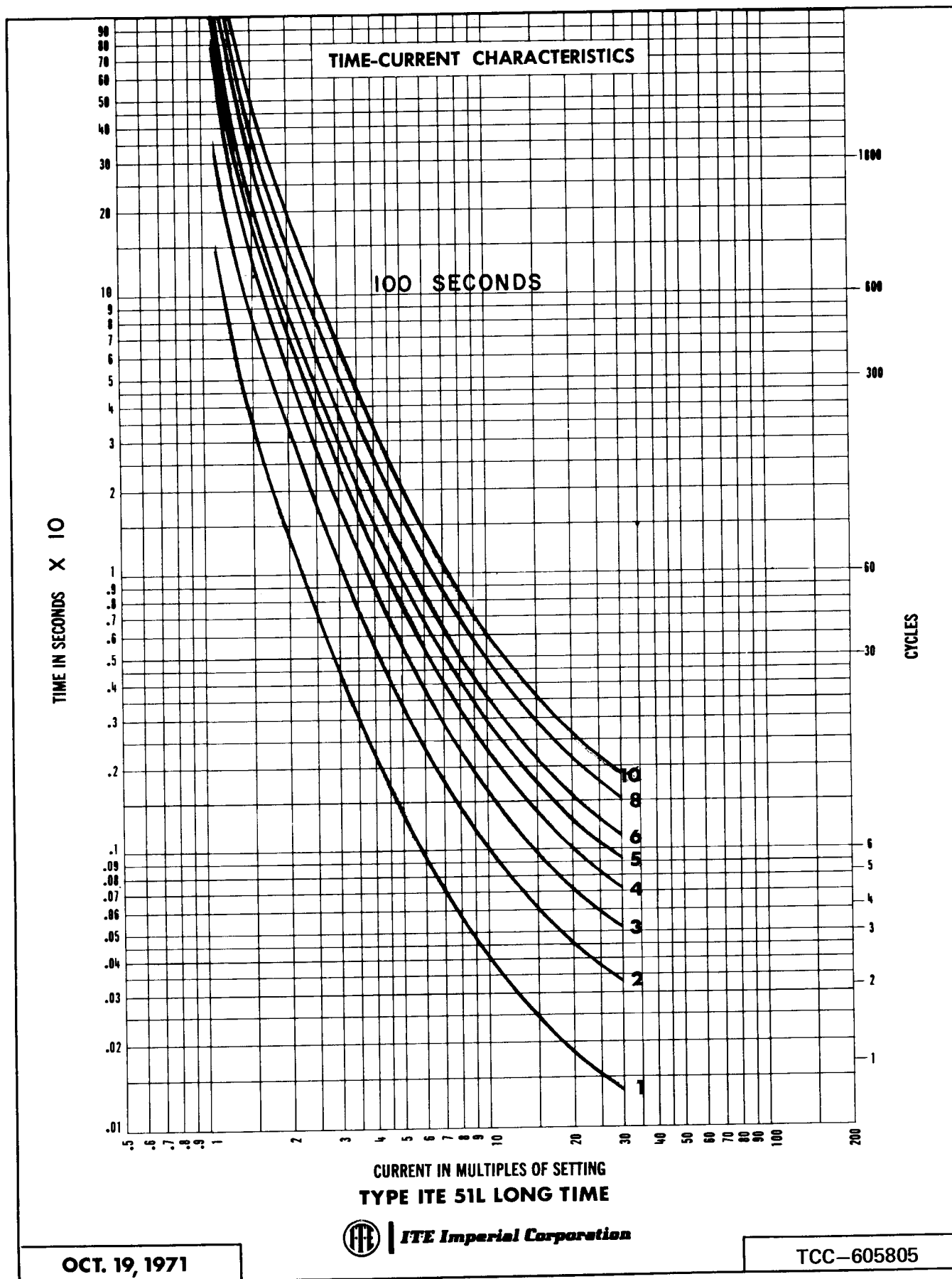


TIME-CURRENT CHARACTERISTICS



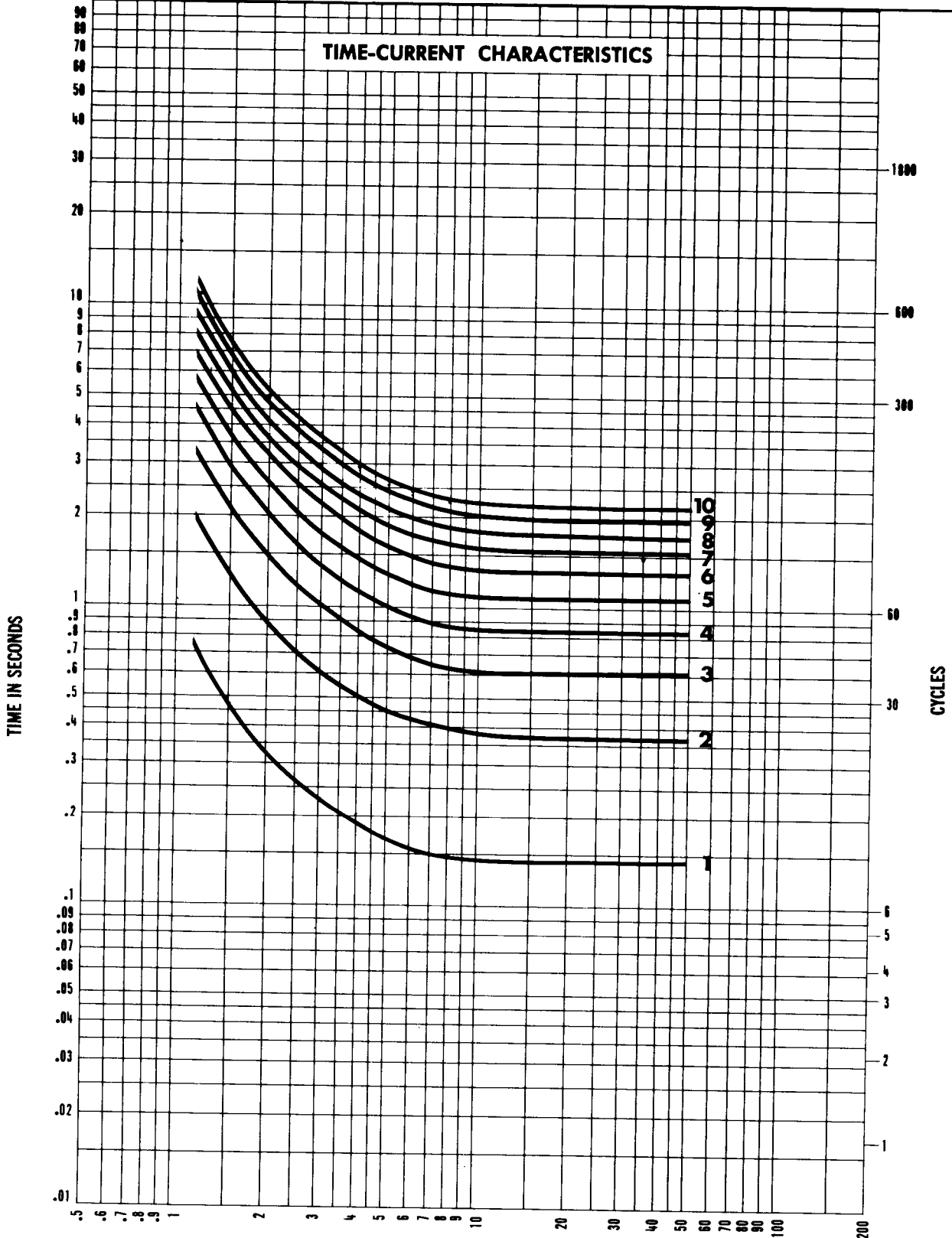
CURRENT IN MULTIPLES OF SETTING
TYPE ITE 51S SHORT TIME







TIME-CURRENT CHARACTERISTICS



CURRENT IN MULTIPLES OF SETTING
TYPE ITE 51D DEFINITE TIME



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APPENDIX A

CIRCUIT-SHIELD TEST TABLES

NOTE: It is not necessary to use these tables if it is desired to make the standard receiving calibration check as listed on page 4 in this instruction book.

When testing protective relays with test sources of limited capacity the accuracy of test results is affected by the wave shape of the test current. Where extremely accurate calibration tests are desired, the attached test Tables prepared under laboratory conditions with standard CIRCUIT-SHIELD relays can be used:

- Table 1—Resistance Testing
("STATES" resistance bank #33560.R)
- Table 2—Reactance Testing
("G.E." reactor, #6054975)
- Table 3—MULTI-AMP Unit (SR-51 test set)

It is to be noted that the test current wave distortion is more apparent at the low current tap setting (highest relay burden) and at high current multiples (lowest test source impedances).

CIRCUIT-SHIELD solid-state overcurrent relays have been designed with a low burden characteristic. This relay burden is such that the primary current transformer will not saturate at high fault current values if the CT is selected so that its saturation point is above one multiple of the relay pickup setting. This is accomplished by a specially designed input transformer in the relay which saturates at just above pickup current. In addition to improving the accuracy performance of the primary current transformer, this feature also effectively prevents internal solid-state components from being subjected to high currents and voltages under fault conditions.

TABLE 1

CIRCUIT-SHIELD OVERCURRENT RELAY
TEST CURRENT CORRECTION - RESISTANCE TESTING
120 VOLT SOURCE (FIXED)

(STATES #33560.R)

TEST CURRENT MULT.	0.5-2 AMP TAP RANGE				1.5-6 AMP TAP RANGE				4-12 AMP TAP RANGE							
	0.5	0.6	0.8	1.0	1.2	1.5	2.0	2.5	3	4	5	6	7	8	10	12
PICKUP	0.50	0.60	0.80	1.00	1.20	1.50	2.00	2.50	3.00	4.00	5.00	6.00	7.00	8.00	10.00	12.00
2X	1.02	1.22	1.62	2.02	2.42	3.02	4.02	5.02	6.02	8.02	10.00	12.00	14.00	16.00	20.00	24.00
3X	1.56	1.86	2.46	3.06	3.65	4.55	6.05	7.55	9.05	12.10	15.10	18.10	21.10	24.10	30.10	36.10
4X	2.12	2.51	3.31	4.11	4.91	6.11	8.11	10.10	12.10	16.10	20.10	24.10	28.10	32.11	40.10	48.10
5X	2.70	3.19	4.19	5.19	6.19	7.68	10.20	12.70	15.20	20.20	25.20	30.20	35.20	40.20	50.20	60.18
6X	3.30	3.89	5.09	6.28	7.48	9.28	12.30	15.30	18.30	24.30	30.30	36.30	42.30	48.30		
8X	4.57	5.36	6.94	8.53	10.10	12.50	16.50	20.50	24.50	32.50	40.50	48.50	56.50			
10X	5.95	6.92	8.88	10.90	12.90	15.80	20.80	25.80	30.80	40.81	50.80					
15X	9.94	11.30	14.20	17.10	20.00	24.50	31.90	39.40	46.90							
20X	14.90	16.50	20.10	23.90	27.80	33.70	43.60	53.50								

This table lists corrected test currents for one (1) to twenty (20) multiples of each tap setting available on CIRCUIT-SHIELD relays. These test currents cause the relay to produce the trip time corresponding to current transformer (CT) operation, as will be encountered in actual service.



TABLE 2

CIRCUIT-SHIELD OVERCURRENT RELAY
TEST CURRENT CORRECTION - REACTANCE TESTING
120 VOLT SOURCE (ADJUSTABLE)

(G. E. REACTOR #6054975)

TEST CURRENT MULT.	$X_S=24 \Omega$						$X_S=12 \Omega$						$X_S=6 \Omega$		$X_S=3 \Omega$	
	0.5	0.6	0.8	1.0	1.2	1.5	2.0	2.5	3	4	5	6	7	8	10	12
PICKUP	0.50	0.60	0.80	1.00	1.20	1.50	2.00	2.50	3.00	4.00	5.00	6.00	7.00	8.00	10.00	12.00
2X	1.08	1.21	1.61	2.00	2.40	3.00	4.00	5.00	6.00	8.00	10.00	12.00	14.00	16.00	20.00	24.00
3X	1.52	1.81	2.41	3.00	3.60	4.50	6.00	7.50	9.00	12.00	15.00	18.00	21.00	24.00	30.00	36.00
4X	2.05	2.41	3.20	4.00	4.80	6.00	8.00	10.00	12.00	16.00	20.00	24.00	28.00	32.00	40.00	48.00
5X	2.55	3.04	4.00	5.00	6.01	7.50	10.00	12.50	15.00	20.00	25.00	30.00	35.00	40.00	50.00	60.00
6X	3.06	3.64	4.90	6.00	7.20	9.05	12.05	15.00	18.00	24.00	30.25	36.00	42.00	48.00	60.00	72.00
8X	4.06	4.90	6.55	8.05	9.75	12.15	16.05	20.10	24.30	32.40	41.00	49.00	56.00	64.00	80.00	
10X	5.35	6.35	8.25	10.40	12.30	15.25	20.50	25.50	31.00	41.50	51.50	62.50	71.50	80.00		
15X	7.85	9.55	12.40	15.50	18.90	22.70	30.45	40.00	47.00	61.80	78.00					
20X	10.70	13.20	16.60	22.00	25.00	31.25	46.50	63.00	67.00							$X_S=0.5 \Omega$

0.5-2 AMP TAP RANGE 1.5-6 AMP TAP RANGE 4-12 AMP TAP RANGE

This table lists corrected test currents for one (1) to twenty (20) multiples of each tap setting available on CIRCUIT-SHIELD relays. These test currents cause the relay to produce the trip time corresponding to current transformer (CT) operation, as will be encountered in actual service.

When using a tapped reactance in series with a variable voltage source to test CIRCUIT-SHIELD relays, the desired test current should be set using the largest possible reactance, as indicated in the chart above for a 120 Vac source.

TABLE 3

For specific test instructions using MULTI-AMP SR-51 Test Set see page 15.

CIRCUIT-SHIELD OVERCURRENT RELAY
TEST CURRENT CORRECTION - MULTI-AMP TEST SET
80V AND 40V TAPS

(MULTI-AMP SR-51)

TEST CURRENT MULT.	0.5-2 AMP TAP RANGE						1.5-6 AMP TAP RANGE			4-12 AMP TAP RANGE						
	0.5	0.6	0.8	1.0	1.2	1.5	2.0	2.5	3	4	5	6	7	8	10	12
PICKUP	0.50	0.60	0.80	1.00	1.20	1.50	2.00	2.50	3.00	4.00	5.00	6.00	7.00	8.00	10.00	12.00
2X	1.55	1.58	1.87	2.25	2.59	3.15	4.10	5.05	6.10	8.10	10.00	12.00	14.20	16.00	20.00	24.30
3X	3.35	3.34	3.49	3.85	4.29	5.01	6.40	7.80	9.40	12.30	15.30	18.30	21.30	24.30	30.20	36.50
4X	5.10	4.89	5.09	5.45	6.00	6.90	8.70	10.40	12.30	16.50	20.40	24.50	28.50	32.00	40.50	48.80
5X	6.78	6.50	6.60	7.00	7.70	8.81	11.00	13.30	16.00	20.80	25.50	30.80	35.60	41.20	51.00	62.00
6X	8.10	7.90	7.95	8.50	9.30	10.50	13.30	16.00	19.00	25.00	30.60	37.00	44.20	49.50	61.80	74.00
8X	10.80	10.40	10.60	11.30	12.40	14.30	17.80	21.80	25.20	33.00	41.50	51.50	59.50	65.50		
10X	13.30	12.90	13.30	14.00	15.60	18.00	22.30	27.00	31.00	40.90	55.00	65.00	75.00	82.00		
15X	18.80	18.70	18.60	20.50	22.50	25.00	32.00	39.00	52.00	65.00	79.00					
20X	24.00	24.30	24.00	26.00	29.50	32.50	42.00	61.00	70.00	85.00						40 VOLT TAP

This table lists corrected test currents for one (1) to twenty (20) multiples of each tap setting available on CIRCUIT-SHIELD relays. These test currents cause the relay to produce the trip time corresponding to current transformer (CT) operation, as will be encountered in actual service.

The SR-51, which operates from a 120 Vac source, uses a transformer with step down taps to produce a wide range of currents useful in general relay testing. Since the series impedance of the transformer provides a fixed source impedance, a variable autotransformer is used to adjust the level of input current. This fixed source impedance is in general not large enough compared to the non-linear relay impedance to guarantee sine wave test current.



TESTING WITH MULTI-AMP SR-51 TEST SET

EQUIPMENT NEEDED

1. MULTI-AMP MODEL SR-51 RELAY TEST SET and
2. Small AUXILIARY RELAY with DC coil to match CIRCUIT-SHIELD relay voltage rating and with a set of normally open contacts. Auxiliary relays with coil resistances greater than 10 ohms per volt must have a parallel resistor added across the relay coil.

TEST PROCEDURES

ALWAYS REFER TO MANUFACTURER'S LITERATURE BEFORE TESTING.

TYPE OF TESTS

- Pickup—Timing Circuit
- Time/Current Characteristics
- Pickup—Instantaneous Circuit

SETUP OF CONTROLS BEFORE TEST

Control	Position
"Power ON" switch	OFF
"Timer Operation Selector" switch	Upper - "N.O. MOM" Lower - "CONT."
"Main Control"	Zero (counterclockwise)
"Aux. Power" switch	"INT."
"Voltmeter Range" switch	150
"Voltmeter Selector" switch	"DC"
"Aux. Selector" switch	"DC 150"
"Aux. Control"	Zero (counterclockwise)
"AC Range" switch	10A
"DC Range" switch	5A
"Main Ammeter Range" switch	So that desired test current will be read on upper 1/3 of meter scale.
"Voltage Relay Test (DET) switch	Set "NORM"
"Output #1-#2" switch	Output #1

PICKUP TEST — TIME CIRCUIT

1. Connect the Multi-Amp relay tester to a suitable source of power as indicated on the nameplate and ground. BE SURE THE MAIN SWITCH IS OFF. CHECK THE "POWER ON" LIGHT.

2. Connect relay input circuit (Relay Terminals 1-2, 3-4, or 5-6) to the right-hand common and the 80 volt tap of "Output #1" of test set.

3. Connect Relay Terminals 7-8 to "DC Output" binding posts of test set. **NOTE:** Relay Terminal 7 should be connected to positive (+). Reversed polarity can damage relay.

4. Connect output circuit of relay (Relay Terminals 8 and 12) to operating coil of the small DC auxiliary relay.

5. Connect normally open contacts of the DC auxiliary relay to the "Relay Contacts" binding posts of the test set.

6. Turn "Power ON" switch ON. "Power ON" light should glow.

7. Initiate unit by pressing and holding "Initiate" switch.

8. Rotate "Aux. Control" clockwise until DC voltage of relay under test is observed on voltmeter. Release "Initiate" switch.

9. Preset ammeter needle using "Pointer Preset" to 1/2 division below desired test current. Desired test current is relay tap value less 5%.

10. Set test current desired by joggng the "Initiate" switch and rotating "Main Control" (clockwise) to increase output until the ammeter needle quivers. Hold in "Initiate" switch and rotate the "Main Control" until test current is read on ammeter. Release "Initiate" switch.

11. Set "Timer Operation Selector" switch: Upper to "N.O. MAINT."; Lower to "TIMER".

12. Reset timer to zero with "Timer Reset" lever.

13. Initiate test set by pressing "Initiate" switch. Relay input circuit will "see" test current. Relay SHOULD NOT operate to de-energize test set under these conditions (allow 1-1 1/2 minutes). De-energize test set by turning "Power ON" switch OFF.

14. Remove one lead from "DC Output" binding posts.

15. Turn "Power ON" switch ON. Reset "Timer Operation Selector" switch: Upper to "N.O. MOM."

16. Repeat Steps 9 through 12 above, except test current should be relay tap value +5%.

17. Replace DC lead that was removed in Step 14.

18. Adjust "Timer Operation Selector" switch: Upper to "N.O. MAINT."

19. Initiate test set by pressing "Initiate" switch. Relay input circuit will "see" test current and SHOULD operate to de-energize test set and stop timer (allow sufficient time). Relay time target should operate.

20. Turn test set OFF.

TIME DELAY TEST

1. Reset "Timer Operation Selector" switch: Upper to "N.O. MOM."

2. Repeat Steps 1 through 9 under "PICKUP TEST—TIME CIRCUIT," except the value of test current should be obtained from Table 3.



3. Remove one lead from "DC Output" binding post.
4. Initiate unit by pressing "Initiate" switch.
5. Set test current desired by joggng the "Initiate" switch and rotating "Main Control" (clockwise) to increase output until ammeter needle quivers. Hold in "Initiate" switch and rotate "Main Control" to make final current adjustment. Release "Initiate" switch.
6. Replace DC lead that was removed in Step 3 above.
7. Set "Timer Operation Selector" switch: Upper to "N.O. MAINT."; Lower to "TIMER".
8. Reset Timer to zero with "Timer Reset" lever.
9. Initiate unit by pressing "Initiate" switch. Timer will run and test current will be indicated on ammeter. The relay test set will automatically cut off and the timer will stop when relay operates to fire the SCR which energizes the DC auxiliary relay to close its contacts. Relay time target should show.
10. Note the relay under test must be energized with DC to reset relay target.
11. Turn test set OFF.

PICKUP TEST — INSTANTANEOUS CIRCUIT

1. If test current will exceed 42 amperes, use 40 volt tap on test set "Output #1".
2. Jumper terminals 9 and 10 on relay.
3. Repeat Steps 1 through 8 under "PICKUP TEST—TIME CIRCUIT".
4. Preset ammeter needle using "Pointer Present" to

½ division below desired test current. Desired test current is relay instantaneous setting less 10%*. Obtain value of test current from Table 3.

5. Remove one lead from "DC Output" terminal.
 6. Set "Timer Operation Selector" switch: Upper to "N.O. MOM."; Lower to "FAST TRIP".
 7. Jog "Initiate" switch and rotate "Main Control" clockwise until test current is read on ammeter. Release "Initiate" switch.
 8. Replace DC lead removed in Step 5 above.
 9. Press and hold "Initiate" switch. Relay instantaneous circuit SHOULD NOT pick-up to stop timer (allow 0.30 second). Reset relay target.
 10. Remove one lead from "DC Output" terminal.
 11. Repeat Step 7, except that test current should be relay instantaneous setting +10%*. Obtain value of test current from Table 3.
 12. Replace DC lead removed in Step 10.
 13. Press and hold "Initiate" switch. Relay instantaneous circuit should pick-up, fire its SCR to energize the DC coil of auxiliary relay to stop timer. Relay instantaneous target should operate.
 14. Release "Initiate" switch.
- WARNING!!!** CURRENT INDICATED ON AMMETER IS PRESENT IN RELAY CIRCUIT UNTIL "INITIATE" SWITCH IS RELEASED. Therefore, it is important to perform this test rapidly.
15. Turn test set OFF.
 16. Record all test results.

***NOTE:** For 0.5-2 ampere tap range, the settings should be $\pm 20\%$ instead of $\pm 10\%$.

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes the matter should be referred to the I-T-E Imperial Corporation.



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