IB 6.1.1.7

Installation/Maintenance Instructio

Micro Power Shield & Test

Test Set
Type 607

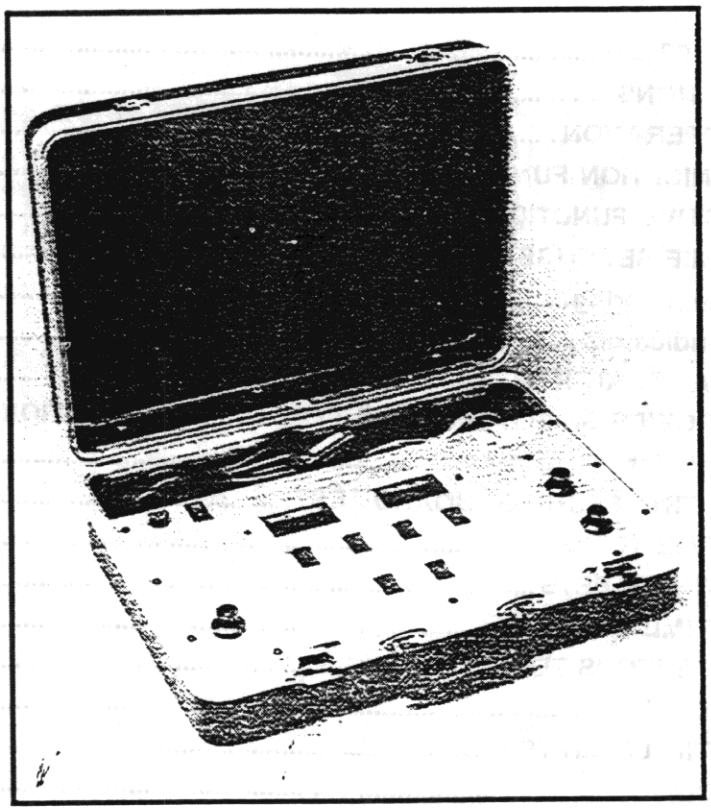


ABB Power T&D Company Inc.
ABB Power Distribution

CONTENTS

Read this Instruction Book carefully before starting any testing. Be sure to observe the precautions stated throughout this book.

WARNING: There are no user serviceable parts inside either the Micro PowerShield trip system or the Type 607 Micro PowerShield Test Set. Refer to the Distribution Systems Division or your local ABB factory authorized service center when service is necessary. Disassembly of either unit voids all written or implied warranties.

INTRODUCTION

The Micro PowerShield (MPS-C) unit is a microprocessor based solid state trip system which provides state-of-the-art protection for power systems. It is supplied as an integral part of Asea Brown Boveri low voltage AC power circuit breakers.

For overload and fault protection, four basic trip elements within the Micro PowerShield are available: long-time, short time, instantaneous, and ground. Models with various combinations of these functions are available. Additionally, the short-time and ground elements feature the I^2t characteristic; this characteristic is standard on ground and switchable on short-time. Also included is unique discriminating circuitry which responds to low level arcing faults by summing the erratic currents associated with this arcing. When any one of the trip elements trip the circuit breaker, trip indicators, which are standard on the MPS-C trip system, flip to indicate which trip element was responsible. Other than making the adjustments dictated by the application coordination study, no other adjustments need be made prior to placing the breaker in service. There are no user serviceable parts inside the MPS-C trip system.

Electrical tests, using the 607 Test Set or primary current injection methods, are fully described in this book. Either of these tests are suitable as part of a routine test and inspection program. The frequency of testing in such a program will vary from user to user depending on many factors. A typical interval of one year is suggested.

PRECAUTIONS

The following precautions should be observed before placing the unit in service:

1. Select the proper sensor rating with the Range Selector. This switch influences all other settings except ground pickup.
2. Select the proper settings of long-time, short-time, instantaneous and ground (as applicable) as required by the coordination study of the circuit breaker application. **Note:** The function switch is operable only with the Type 607 Test Set; its setting does not influence the other settings when the circuit breaker is in service.
3. Check that the multi-pin connector from the sensors and magnetic latch is properly seated on the side of the

MPS-C ELECTRONIC TRIP SYSTEM

This electronic, microprocessor-based trip system incl the sensors, the MICRO Power Shield Communica (MPS-C) electronic trip device, the magnetic latch, an interconnecting wiring. A current sensor is integrally mou on each phase of the circuit breaker to supply a valu current flowing in the trip unit which is directly proport to the current passing through the primary circuit. W the value of current in the primaries exceeds the trip setting thresholds for a given time in long-time, short- and/or ground, then tripping occurs by sending a sign the magnetic latch. Instantaneous tripping occurs, i same manner, without time delay. On a three phase, wire, wye system, provisions are made for input from a s rately mounted sensor to obtain a residual connection four sensors for sensitivity to ground currents.

MICRO PowerShield Communication Trip Unit

BASIC OPERATION

The MPS-C trip unit (Figure 1) is visible on the fro the circuit breaker. It is completely self-powered, takin tripping energy from the primary current passing thr the circuit breaker without the need for any additional p supply. To cope with modern power systems where monics in the system can cause cable and busway heating, the MPS-C long-time trip element samples the rent in a unique algorithm, then calculated the root square (RMS) value of the system current, providing ping when the RMS current is above the trip thres Overheating in cable and busway is thus avoided wit MPS-C trip system. Short-time and instantaneous tri remains based on peak sensing methods, avoiding u essary delay in tripping caused by the RMS calculatio

COMMUNICATION FUNCTIONS

The MPS-C trip system also includes all the connec and software for performing communication duties connected to the PRICOM or PRICOM-PLUS commu tions systems. This is a standard feature for all forms MPS-C trip device. Although a breaker may not be nected to a communication system when it is instal will not require any modification to be connected to th work Interface Module (NIM) in the PRICOM system at future time. This unique feature allows for future expa without incurring additional up-front expenses. Th cable is connected to the nine-pin connector behind t pin connector at the side of the MPS-C trip device. ditional connector is provided for the Voltage Interface ule (VIM) which attaches directly to the bottom side MPS-C unit. The VIM connector is accessed by remo white adhesive label. Do not remove this label unles installation is planned. See bulletin 3.1.3-2A for adc details about the PRICOM communication system.

PROTECTIVE FUNCTIONS

Four basic elements within the MPS-C trip unit perform the protective functions: long-time, short-time, instantaneous, and ground. MPS-C types with various combinations of these protective elements are shown in Figure 2. Selection of type is dependent upon the protection and coordination requirements for the specific power circuit. Since there are no mechanical devices which may have lost adjustment during shipment and the MPS-C trip unit is completely tested prior to shipment, no readjustments, other than making the required settings, need to be make prior to placement in service. The following trip characteristics are available: long-time settings and delay bands, short-time settings and delay bands with switchable I^2t characteristic, instantaneous setting, and ground setting and delay bands with switchable I^2t characteristic.

The MPS-C trip unit must be properly set, as required by the individual circuit based on a coordination study performed for the system, in order to provide the necessary protection. The MPS-C trip device is shipped with standard shipping settings; THE SHIPPING SETTINGS DO NOT CORRESPOND TO THE REQUIREMENTS OF SYSTEM IN WHICH THE BREAKER IS INSTALLED. DETERMINE WHAT THE CORRECT SETTINGS ARE FOR THE ELECTRICAL SYSTEM IN WHICH THE BREAKER IS INSTALLED PRIOR TO CLOSING THE CIRCUIT BREAKER INTO THAT SYSTEM. Nuisance tripping or inadequate protection may result from failure to properly adjust the circuit breaker trip device. To set the MPS-C trip device, remove the device clear cover, being sure to capture the mounting hardware for future re-use. A small screwdriver may be used for making the setting and delay adjustments for each of the trip elements provided. Trip elements are provided in accordance with circuit breaker requirements determined prior to circuit breaker order entry to suit the application intended for it.

The MPS-C trip unit elements, with the exception of ground, will cause the circuit breaker to trip at a value equal to the ampere range selector position times the threshold setting of the various protective elements. The ground trip settings are marked on the face plate in primary amperes.

AVAILABLE SETTINGS AND STANDARD FEATURES

Ampere Range Selector Switch

Select the range which corresponds to the required trip element settings. With the range selector pushed to your right, the full sensor rating is selected. The left position selects one-half the sensor size. Except for ground, all the other trip settings are multiples of this switch setting.

WARNING • WARNING • WARNING

When making long-time, short-time, instantaneous, and/or ground settings, and all delay settings, make sure that the selection is in a detented position. There are no settings between the marked settings; attempts to

LONG-TIME

The long-time setting may be 0.5, 0.6, 0.7, 0.8, 0.9, o 1.0 times the range selector setting. The tolerance on the threshold (pick-up) is minus 0%, plus 10% to assure tha the breaker will carry its rated maximum continuous curren without tripping when set on the 1.0 multiplier. Minimun (MIN), intermediate (INT), and maximum (MAX) delay band are also provided. Refer to time current curve TD-9650 o TD-9651.

SHORT-TIME

The available short-time settings are 2, 3, 4, 6, 8, and 1 times the range selector setting. Tolerance on short-tim threshold is plus or minus 15%. Three delay bands ar provided: minimum, intermediate, and maximum time de lay. A slide switch labeled "IN" and "OUT" selects the I inverse time tripping characteristic. The I^2t characteristi applies when the switch is in the "IN" position. See tim current curves TD-9651 for I^2t "OUT", TD-9653 for I^2t "IN"

INSTANTANEOUS

The instantaneous trip settings are 3, 4, 5, 7, 10, and 1 times the range selector setting. A plus or minus 20% tole ance applies on pick-up. See curve TD-9650 or TD-965 for trip characteristics.

GROUND

There are three ranges of ground settings available base on the frame size of the circuit breaker on which the t device is installed. The settings are shown in the table figure 5. These settings are marked on the face plate primary amperes. A plus or minus 15% tolerance appli on pick-up. Three delay bands are provided: minimu intermediate, and maximum time delay. A slide switch beled "IN" and "OUT" selects the I^2t inverse time trippi characteristic. The I^2t characteristic applies when the swit is in the "IN" position. See time current curves TD-965 Additional unique programming in the MPS-C trip unit sponds to low level arcing faults by summing the erra currents associated with arcing, then providing a trip wh that sum is above the trip threshold for a preprogramm period of time. Therefore, the response time of this featu is dependent on the frequency of occurrence of the arci fault and the setting of the ground trip element.

SELF MONITORING

Continuous monitoring of the microprocessor functio programmed into the MPS-C. "Watchdog" circuits gu against the possibility of microprocessor dysfunction du "endless loops". A red light emitting diode (LED) moun on the MPS-C nameplate indicates the condition of the croprocessor. Normal operation is shown by a blink rat one flash per second when approximately six percent of sensor current rating is flowing through the primaries. **LED does not blink*** when the current level passing thro

Figure 1

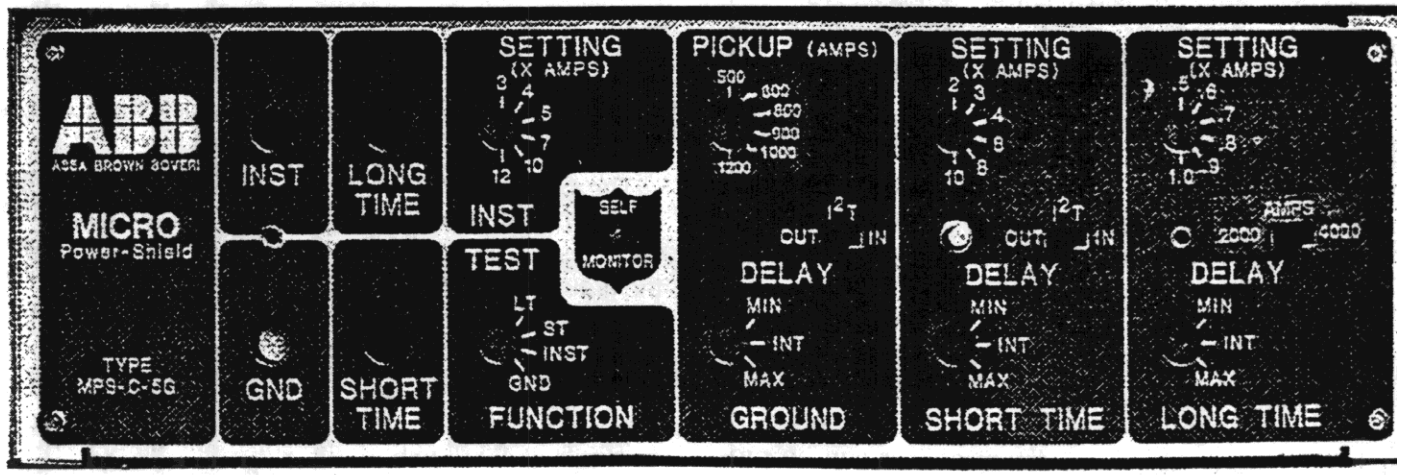


Figure 2 - AVAILABLE MPS-C TRIP UNITS

ADJUSTABLE PROTECTIVE TRIP ELEMENTS

TYPE	LONG-TIME		SHORT-TIME		INSTANTANEOUS	GROUND		CHARACTERISTIC CURVES		
	SETTING	DELAY	SETTING	DELAY	SETTING	SETTING	DELAY	OVCT.	I²t	GROU
MPS-C-3	X	X	---	---	X	---	---	TD9650	---	---
MPS-C-3G	X	X	X	X	X	X	X	TD9650	---	TD9
MPS-C-4	X	X	X	X	---	---	---	TD9651	TD9653	---
MPS-C-4G	X	X	X	X	---	X	X	TD9651	TD9653	TD9
MPS-C-5	X	X	X	X	X	---	---	TD9651	TD9653	---
MPS-C-5G	X	X	X	X	X	X	X	TD9651	TD9653	TD9

CURRENT SENSORS AND CIRCUIT BREAKER RATINGS

SENSOR RATING	AMPERE RANGE SELECTOR SETTING	GROUND PRIMARY AMPERES SETTING	AVAILABLE ON CIRCUIT BREAKER TYPES
200	100, 200	100, 200, 300, 600, 900, 1200	K 800M, K DON 800M
800	400, 800	100, 200, 300, 600, 900, 1200	K 800M, K DON 800M, K 1600M
1600	800, 1600	300, 400, 600, 800, 1000, 1200	K 1600M, K DON 1600M, K 2000
2000	100, 2000	300, 400, 600, 800, 1000, 1200	K 200M

required either when the LED remains lit but does not blink, or when it does not illuminate at current levels above 6% of the sensor rating. When the long-time trip element "picks-up", indication is provided by a fast blink rate of the self monitor LED. When this is observed, the MPS-C long-time trip element is in the timing mode and breaker tripping is imminent.

*The PROCOM communication system can "power up" the MPS-C to read the current levels below 6%, but the self monitor will not blink during this communication.

TARGETS

Trip operation indicators, or targets, are provided as standard equipment on all types of MPS-C trip units. One trip target is provided for each trip element provided on the MPS-C electronic trip device; a maximum of four can be provided. Then the MPS-C determines that a trip is necessary, it will both signal the magnetic latch and display the appropriate trip target with an orange "day-glow" color. Since the target is a mechanical device, it does not require power to retain its indication. This indication is resistant to shock and vibration, and will remain as long as the breaker is open. Targets are automatically reset by the microprocessor within two seconds after breaker closure (as long as at least 6% of sensor current is flowing through the circuit breaker phases). In situations where a circuit breaker is closed into a circuit where a trip condition still exists, the previous target will be reset instantaneously, and the new target displayed when the breaker re-trips. New circuit breakers unpacked from the factory will have one of the targets displayed; this is a result of the factory testing performed on the breaker prior to shipping. This target will reset when the circuit breaker is closed and primary current is flowing.

OPTIONAL FEATURES

When the MPS-C trip system is not connected to a PRICOM communication system, the MPS-C trip system can be connected to either of two different types of alarm services which provide contact closure for remote annunciation. The High Load alarm device works in conjunction with the long-time trip element; the Ground alarm device indicates ground tripping. Requiring separate control power, these alarm devices may be specified with 48 V dc, 125 and 250 V dc, plus 120 and 240 V ac. These alarm devices feature electrically separate normally open and normally closed contacts rated 30 amperes-momentary, 5 amperes-continuous, or 0.3 amperes-inductive break. These can also be specified with automatic or manual reset of the alarm contacts, manual reset is provided by a customer-mounted remote push button.

The High Loan alarm provides contact change of state (normally open to closed, normally closed to open) when the current passing through the circuit breaker exceeds the breaker remains closed for automatic reset models; th change of state remains on manual reset models until manu ally reset or control power is lost. Should the current de crease and the long-time trip element reset, the High Loa alarm will also reset if the device has automatic reset spec fied; the manually reset option will require manual reset c the alarm device.

The Ground alarm functions in a similar way to provid remote indication or ground tripping. Because the trip de lay times are quite short for the MPS-C ground trip elemen the ground alarm is triggered when the trip signal is given t the magnetic latch and will provide remote annunciation un the circuit breaker trips or is manually reset.

SELECTING TRIP SETTINGS

The settings of current threshold and delay bands mu be determined by an analysis of the protection and coord nation requirements of the power system. After selectir the proper range of sensor settings with the range selecto the other settings are made using a small screwdriver select the multiples of range selector amps in the long-tim short-time and instantaneous trip elements. Selections primary current amps are selected with the ground select switch. Delays for long-time, short-time, and/or ground a make in a similar fashion. Slide switches allow selection the I^2t characteristic on shirt-time and ground.

Here is an example of breaker settings:

Given:	800 ampere K-800M with 800 ampere senso
Long-time setting required:	480 amperes
Instantaneous setting required:	8000 amperes
Ground setting required:	200 amperes

1. Set RANGE SELECTOR at "800"
2. Set LONG-TIME SETTING to 0.6 setting (0.6 x 800 = 48(
3. Set INSTANTANEOUS to "10" setting (10 x 800 = 8000)
4. Set GROUND to 200 setting
5. Set the DELAY on long-time, short-time, and/or ground a required.

Micro-Power Shield Test Set Type 607

INTRODUCTION

The type 607 Test Set is a secondary current injec tester specifically designed to test only Micro-Power Sh (Type MPS-C) solid state trip systems. All the connec cables required for testing are permanently attached to are stored within the portable case.

The type 607 Test Set can be used to determine thre old currents on the instantaneous element as well as thre old currents and time delays on the long-time, short-ti and ground functions. In addition to these tests, the MP internal toroid board can be checked. The Test Set also confirm that the magnetic latch and the remainde the circuit breaker's trip mechanism is functioning by

Description of Features

CIRCUIT BREAKER - Three ampere, push to reset.

POWER SWITCH - Applies power to the Test Set. Leave switch in the "OFF" position until all connections to the MPS-C box and circuit breaker have been made.

POWER ON INDICATOR - Glows when power switch is in the "ON" position.

TIMER DISPLAY - Displays time in seconds, 00.00.

CURRENT DISPLAY - Displays input current (simulated sensor current) into MPS-C box (00.00). To obtain current value in terms of primary current, multiply the display times 1000.

THRESHOLD INDICATOR - Illuminates when the MPS-C box threshold is surpassed. It will remain on while the MPS-C system is timing on long-time, short-time, and ground. This light will illuminate when the instantaneous threshold is reached, then extinguish.

INPUT POWER SWITCH - Allows high current evaluation of MPS-C system toroid board. Spring return to the "LOW" setting from "HIGH" position is provided; all other tests are performed in this "LOW" position.

GROUND DEFEAT SWITCH - Defeats the ground element of the MPS-C system when the "Test Selection" switch is in the "Phase" position. This allows the long-time element to be evaluated in "Phase" tests.

TEST SELECTION - Allows selection of "PHASE" for long-time, short-time, and instantaneous, "Ground" for ground.

MAGNETIC LATCH SWITCH - When in the "OFF" position, it permits the MPS-C system to be tested on the breaker without having to charge and close the circuit breaker after each trip. "Normal" position allows the maglatch to trip when required by the MPS-C trip system. "Test" allows the simulation of a worst case condition when minimum voltage is available for the internal firing circuitry to fire the maglatch.

CIRCUIT BREAKER SENSOR AMPS - Allows selection of the sensor size which corresponds to the breaker being tested.

PHASE SELECTION - Allows each phase input to the MPS-C trip system to be evaluated.

START TEST - Resets the timer and applies test current to the solid state trip unit.

TEST REPORT - Stops test in progress. This switch does not reset the timer display.

INPUT CURRENT ADJUSTMENT - Sets the level of the test current corresponding to the sensor amps selected. Clockwise rotation of the adjusting knob increases current. Ten complete revolutions of this knob are possible.

LINE CORD - Connects 607 Test Set to 120V AC, 60Hz grounded source. Do not remove the ground blade of the three-prong plug.

MPS-C SYSTEM UMBILICAL - Connects the 607 Test Set to the breaker mounted MPS-C trip system.

MAGLATCH UMBILICAL - Connects the 607 Test Set to the circuit breaker harness. This harness completes the connect this cable if a bench test of the MPS-C solid s trip unit is being conducted.

Test Preparation: Tests on the MPS-C trip system be performed on the "racked out" breaker in its own cul or performed on the breaker outside its switchgear er sure.

A. To retain control power on electrically oper circuit breakers, rack the circuit breaker to "Test" position following instructions in the cuit breaker installation and maintenance b tin.

Manually operated breakers may be racked to "Test" or "Disconnect" position. To ass breaker stability during manual spring charg DO NOT RACK TO THE OUT POSITION OR MA ALLY CHARGE BREAKER SPRINGS WITH CUIT BREAKER SITTING ON EXTENDED CRA RAILS.

WARNING • WARNING • WARNING

THE CIRCUIT BREAKER MUST NEVER BE TESTED THE "CONNECTED" POSITION. SERIOUS INJURY C RESULT WHEN TESTING WITH THE BREAKER CO NECTED TO THE PRIMARY POWER CIRCUIT. DAMA TO BREAKER CURRENT SENSORS WILL ALSO OCCU

B. Remove the two nylon screws joining the ci breaker harness to the MPS-C solid state bo provided), and unplug the harness from the of the box.

C. Remove the front clear plastic cover from MPS-C trip system.

D. After familiarization with the controls, displ and test cables of the type 607 Test Set, con the MPS-C SYSTEM UMBILICAL to the MI box. Make sure the plug is oriented properly fore attempting to push it in; it should only one way.

E. If tests on the maglatch are also desired, nect the MAGLATCH UMBILICAL to the ci breaker wiring harness.

F. If the breaker has been taken our of servic these tests, make a note of the MPS-C sy settings so they can later be restored to t settings.

G. Making sure the POWER SWITCH is "OFF", the power cord in a 120V AC, 60Hz source.

H. With the Input Current Adjustment at the mum fully counterclockwise position, switc the Type 607 Test Set. The POWER ON IND TOR, TIMER DISPLAY, AND CURRENT DISI should illuminate with zeroes in the two di windows. (The INPUT CURRENT DISPLAY

display.)

The SELF MONITOR light on the MPS-C system should begin blinking at approximately one blink per second. If an orange trip indicator (target) was showing on the solid state box before the power was turned on, it should reset automatically within a few seconds.

If the 607 Test Set and MPS-C Trip System function as described above, any or all of the following threshold and time delay tests may be performed.

CAUTION • CAUTION • CAUTION

COMPLETE THE TEST PREPARATION PROCEDURE BEFORE ATTEMPTING ANY OF THE FOLLOWING TESTS.

TOROID TRANSFORMER BOARD TEST

A. Position the 607 Test Set switches as follows:
- POWER: ON
- INPUT POWER: LOW
- GROUND DEFEAT: ON
- TEST SELECTION: PHASE
- MAGNETIC LATCH: Either OFF or NORMAL as desired
- CIRCUIT BREAKER SENSOR AMPS: SAME AS SENSOR ON TESTED
- CIRCUIT BREAKER PHASE SELECTION: 01
- INPUT CURRENT ADJUSTMENT: MINIMUM (FULLY CCW)

B. Position the MPS-C System front panel switches as follows:
- RANGE SELECTOR: LOWER POSITION
- LONG-TIME SETTING: .5
- LONG-TIME DELAY: MIN
- I^2t: OUT
- SHORT-TIME SETTING: 10
- SHORT-TIME DELAY: MAX
- GROUND PICK-UP: 1200 (FULLY CCW)
- GROUND DELAY: MAX
- INST SETTING: 12
- TEST FUNCTION: LT

C. With the 607 Test Set and MPS-C System Set as shown above, switch the INPUT POWER switch to HIGH and hold it. The threshold light should light and remain on, as the TIMER begins its count. After three to six seconds of elapsed time on the timer, the LONG-TIME TARGET should flip to orange. (The maglatch should trip the breaker if the MAGNETIC LATCH switch is in the NORMAL position.) Immediately release the INPUT POWER switch allowing it to return to LOW. Failure to do so within two seconds after TARGET indication may cause the MPS-C system internal clock to time out, thus stopping the blinking of the SELF MONITOR light. If this occurs, turn the 607 Test Set OFF, MPS-C System. It may be necessary to turn off the teste after each test to reset the tester.

D. Wait until the LONG-TIME TARGET resets, then re peat Step C twice with the PHASE SELECTION switch o 02, then 03, respectively.

If tests on the three phase inputs of the Toroid Board ar satisfactory, the PHASE SELECTION switch can be left i the 02 position for the remainder of the tests in this proce dure.

E. For MPS-C Systems with the GROUND option, repo sition the following switches from their settings in A & above:
- 607 TEST SET
  - GROUND DEFEAT: OFF
- MPS-C TRIP SYSTEM
  - TEST FUNCTION: GROUND GROUND SETTING 600 amp position on 800 ampere breakers and b low, 800 amperes on 1600 ampere breaker and higher
  - GROUND DELAY: MINIMUM

F. Conduct the ground test by depressing the INPU POWER switch to HIGH and hold momentarily until the ange TARGET flips to orange. Immediately release t switch. The target should reset to orange in a few seconc

G. The timer display for this ground test should indica approximately 0.15. Holding the INPUT POWER swit too long may require MPS-C box reset as in "C" above.

LONG-TIME TESTS

A. Position the 607 Set switches as follows:
- POWER: ON
- INPUT POWER: LOW
- LOW GROUND DEFEAT: ON
- TEST SELECTION: PHASE
- MAGNETIC LATCH: OFF or NORMAL
- CIRCUIT BREAKER SENSOR AMPS: MATCH CIRCUIT BREAKER SENSOR
- PHASE SELECTION: 02
- INPUT CURRENT ADJUSTMENT: MINIMUM

B. Position the MPS-C System front panel switches follows:
- TEST FUNCTION: LT
- RANGE SELECTOR: UPPER
- LONG-TIME SETTING: 1
- LONG-TIME DELAY: MAX FOR THRESHOLD TE MIN, INT, or MAX FOR TIME TESTS
- FOR THRESHOLD TESTS,

C. Depress the START TEST button. The elapsed t

(for threshold tests, the time reading is irrelevant). Slowly increase the INPUT CURRENT ADJUSTMENT clockwise until the 607 Test Set THRESHOLD LIGHT lights. The current value that lights the THRESHOLD LIGHT represents 1 times the RANGE SELECTOR setting. (Example: On an 800 amp breaker with Range Selector UP, the threshold would be at approximately 800; if the RANGE SELECTOR is down, threshold would occur at approximately 400.) The other values of the LONG-TIME SETTING can be confirmed in a similar manner by first returning the INPUT CURRENT ADJUSTMENT to minimum, then resetting the solid state trip system to any other LONG-TIME SETTING. All long-time thresholds should be equal to or greater than 10 percent of the long-time setting.

If, during any of these tests the elapsed time meter stops, the MPS-C system has timed out indicating trip has occurred; push START TEST to resume testing. The elapsed time meter can be stopped by pushing TEST RESET.

D. For long-time delay tests, reposition MPS-C System front panel switches as in (B) above. Preset the INPUT CURRENT ADJUSTMENT to 300 percent of the LONG-TIME SETTING. Press START TEST. The threshold indicating will illuminate as the elapsed time meter begins its count. For input currents set as above, the times for the three time delay bands are as follows:

MPS-C 3	**MIN.**	**8-13 SEC.**
MPS-C 4	**INT.**	**20-33 SEC.**
& MPS-C 5	**MAX.**	**61-100 SEC.**

After the approximate time delay, the long-time Target will show, and maglatch will operate (if NORMAL is selected). On the 607 Test Set, the THRESHOLD LIGHT will extinguish and the elapsed time meter will show the trip time. Other current settings will yield different delay times (refer to the time-current curves in the appendix of this book); all of these can be verified using the above procedure. However, it is recommended that the 607 Test Set current setting always be a multiple greater then one of the LONG-TIME SETTING. This will yield times that are easy to read from the curves, removing any doubt about times that may fall in the "knee" of the time-current curve, TD-9650.

NOTE: With the RANGE SELECTOR at its minimum setting and the LONG-TIME SETTING at its lowest setting, the threshold values may be below the expected threshold by approximately five percent. This occurs at this very lowest setting.

SHORT-TIME TESTS

INPUT POWER: LOW
GROUND DEFEAT: ON
TEST SELECTION: PHASE
MAGNETIC LATCH: OFF or NORMAL
CIRCUIT BREAKER SENSOR AMPS: MATCH CIRCUIT BREAKER SENSOR
PHASE SELECTION: 02
INPUT CURRENT ADJUSTMENT: MINIMUM

B. Position the MPS-C System front panel switche follows:

TEST FUNCTION: ST
RANGE SELECTOR: UP
SHORT-TIME SETTING: 2
SHORT-TIME DELAY: MIN, INT, OR MAX for ti tests
I^2t: OUT (Initially)

C. For threshold tests, depress the START TEST bu The elapsed time meter will begin timing indicating tha test is in progress. The TIMER will continue to run unt short-time threshold is reached. When that point is reac the MPS-C System will time out, then display the short TARGET, the threshold light is disabled after the targ shown. Therefore, care must be taken to increase th PUT CURRENT slowly to avoid overshooting the thr old. The threshold current in the CURRENT DISPLA be the RANGE SELECTOR setting times the SHORT-T SETTING (x.001). The other short-time settings ca verified using this method.

D. Before performing the delay tests, reposition the M C System front panel switches according to (B) above. I^2t SWITCH should remain "OUT" with SHORT-TIME LAY on "MIN". Preset the current on the 607 Test S 150 percent of the product of the RANGE SELECTOR ting times the SHORT-TIME setting (x.001). Press ST TEST. The short-time trip TARGET should flip in the r shown in the table below. Intermediate (INT) and (M time delays can be verified at the same current pres selecting either of those on the 607 Trip System, the pressing the START TEST push button.

MPS-C &	**MIN.**	**0.080-0.170 SEC.**
MPS-C 5	**INT.**	**0.200-0.320 SEC.**
Without I^2t	**MAX.**	**0.350-0.500 SEC.**

E. For evaluation of the I^2t function, the same cu presets can be used. Switch I^2t switch to "IN". Pres START TEST push button. Again, the short-time trip GET should flip after the appropriate time delay. The time delays with I^2t may be evaluated in a like manner

MPS-C 4 &	MIN.	0.160-0.250 SEC.
MPS-C 5	INT.	0.520-0.780 SEC.
WITH I^2t	MAX.	0.910-1.350 SEC.

SHORT-TIME TIME DELAYS

*Time shown applies only to SHORT-TIME SETTINGS OF 2x with INPUT CURRENT at 150 percent of 2x setting.

NOTES ON TESTING:

As with the LONG-TIME evaluation, input currents above one simplify testing by keeping times out of the "knee" of the curve.

The I^2t function operates between two times and four times the RANGE SELECTOR setting. Therefore, delay times for threshold settings of 6, 8, or 10 times can be read from curve TD-9651. If multipliers other than 2 are used with the I^2t in, read the new time values from curve TD-9653.

INSTANTANEOUS TEST

A. Position the 607 Test Set switches as follows:

POWER: ON
INPUT POWER: LOW
LOW GROUND DEFEAT: ON
TEST SELECTION: PHASE
MAGNETIC LATCH: OFF or NORMAL
CIRCUIT BREAKER SENSOR AMPS: MATCH CIRCUIT BREAKER SENSOR
PHASE SELECTION: 03
INPUT CURRENT ADJUSTMENT: MINIMUM

B. Position the MPS-C System front panel switches as follows:

TEST FUNCTION: INST
RANGE SELECTOR: UP
INSTANTANEOUS SETTING: 4X

(LOWER INSTANTANEOUS THRESHOLDS ARE RECOMMENDED FOR TESTING TO AVOID DAMAGE TO MPS-C SYSTEM COMPONENTS DUE TO PROLONGED EXPOSURE TO THE HIGH CURRENTS THAT A HIGHER THRESHOLD WOULD REQUIRE. IF HIGHER THRESHOLDS MUST BE TESTED, KEEP THE TIME. THESE HIGHER CURRENTS ARE APPLIED BRIEF.)

C. To determine the instantaneous threshold, depress the START TEST button. The elapsed time meter will begin timing, indicating that the test is in progress. The timer will continue to run until the instantaneous threshold is reached, at which time the instantaneous TARGET will flip. The THRESHOLD light is disabled after the target is shown, making careful increases of input current necessary to obtain Once threshold is reached, the current indication in the CURRENT DISPLAY should be the product of the RANGE SELECTOR setting times the INSTANTANEOUS SETTING (x.001).

NOTE: Although circuit breaker coordination schemes never attempt coordination with the instantaneous trip element, the instantaneous trip element reaction time is sometimes measured in the field. The Type 607 should not be used to make these measurements because it does not include the contribution of the breaker mechanism in the time from fault initiation to contact part and arc extinction.

Instantaneous trip times, moreover, cannot properly be evaluated with primary current injection test sets. These devices, though quite accurate, can yield results that may appear to raise doubts about the trip system when, in fact, the percent errors of the ammeter and timer of the test set have influenced the result. Oscillographic measurement techniques are the most reliable measure of instantaneous times.

GROUND TEST

A. Position the 607 Test Set switches as follows:

POWER: ON
INPUT POWER: LOW
GROUND DEFEAT: ON (even for ground tests)
TEST SELECTION: GROUND
MAGNETIC LATCH: OFF or NORMAL
CIRCUIT BREAKER SENSOR AMPS: MATCH CIRCUIT BREAKER SENSOR
PHASE SELECTION: 03
INPUT CURRENT ADJUSTMENT: MINIMUM

B. Position the MPS-C System front panel switches as follows:

TEST FUNCTION: GND
RANGE SELECTOR: UP OR DOWN (does not influence ground setting)
GROUND SETTING: 600
GROUND DELAY SETTING: MAXIMUM (INITIAL

C. For ground threshold tests, depress the START TEST butting. The elapsed time meter will begin its count indicating that the test is in progress. Increase the INPUT CURRENT slowly until the THRESHOLD light glows. GROUND TARGET will flip after the maximum time of setting and the timer will stop. Other thresholds at ground settings can be verified using this method.

As with the SHORT-TIME and Instantaneous tests, the threshold is reached and the GROUND DELAY t out, the THRESHOLD light will extinguish as the targ displayed. If the ground threshold is passed too quic may be necessary to turn off the 607 Test Set, wait b then turn it on to restart the tests.

D. For GROUND DELAY tests, reposition MPS-C System GROUND DELAY SETTING to MIN (minimum). Postition the GROUND SETTING to the minimum available current threshold setting.

E. Adjust the INPUT CURRENT ADJUSTMENT so that the test current is 150% of the GROUND SETTING. Push the START TEST push-button, then observe that the THRESHOLD light illuminates. The MPS-C trip system target will flip when the appropriate time delay has elapsed. Observe the time delay shown on the TIMER DISPLAY; it should be within the range shown below for the test current selected.

	DELAY SETTING	SENSORS		
		200-800A	1600-2500	3000-4200
ALL MPS-C TYPES	MIN.	0.68-1.3 SEC.	0.07-0.18 SEC.	0.05-0.17 SEC.
	INT.	2.1-4.2 SEC.	0.24-0.47 SEC.	0.20-0.32 SEC.
	MAX.	5.2-9.5 SEC.	0.59-1.2 SEC.	0.35-0.50 SEC.

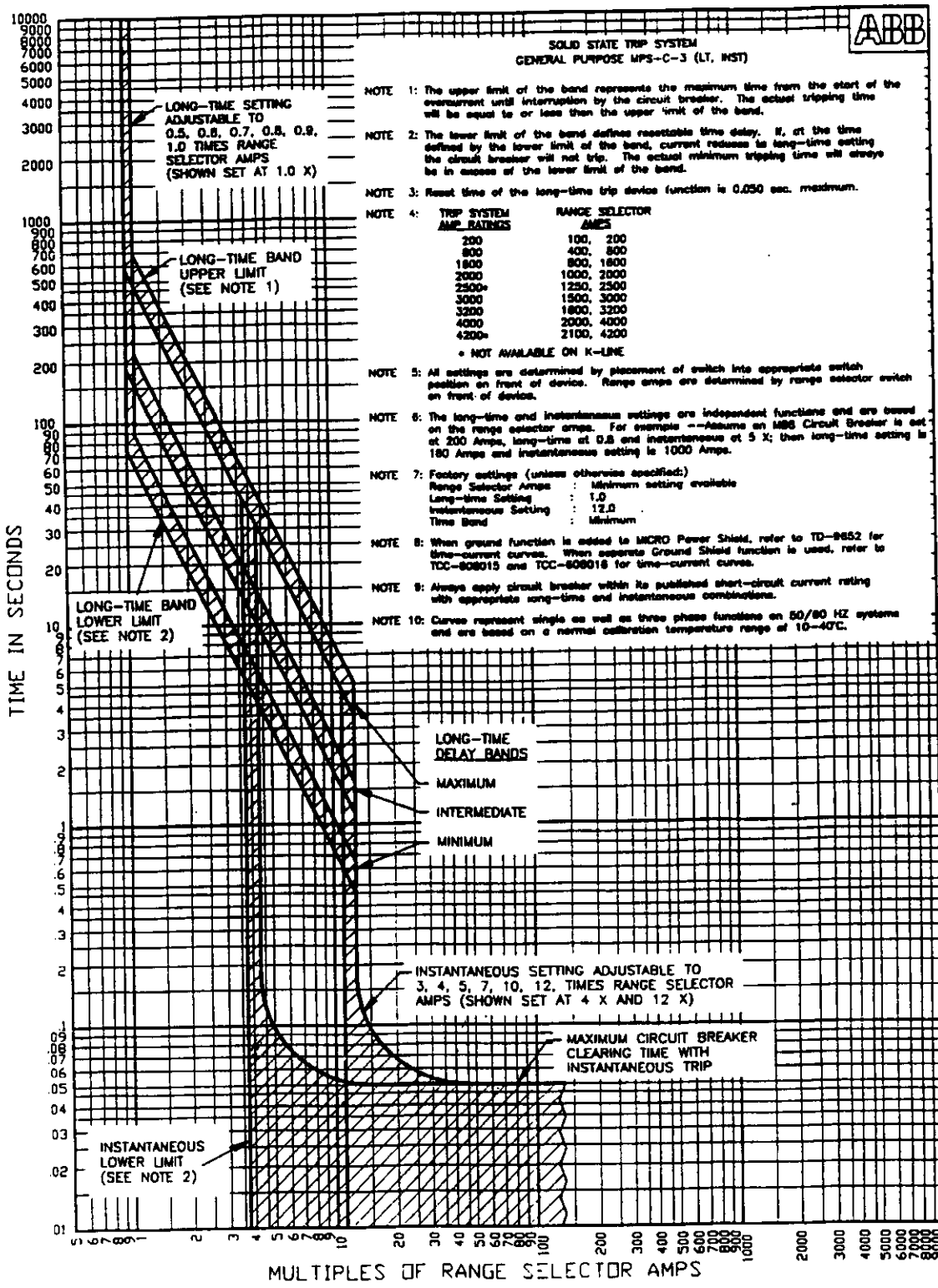
Other threshold settings can be evaluated using the 607 Test Set; the times delays can be determined from time current curve TD-9652. (See appendix)

MAGNETIC TEST LATCH

The magnetic latch on the breaker can be evaluated two ways:

1. When the MAGNETIC LATCH test switch is in the NORMAL position, the magnetic latch is operated by the MPS-C solid state box when the MAGNETIC LATCH UMBILICAL is connected to the circuit breaker (the circuit breaker must be closed prior to each test). Any test described above can be used to also test the magnetic latch when the MAGNETIC LATCH test switch is in the NORMAL position.
2. The magnetic latch can be tested at any time regardless of the settings on the MPS-C box by moving the MAGNETIC LATCH switch to the TEST position. This test represents the worst case trip threshold where tripping would be required (long-time set at 0.5 with the RANGE SELECTOR in the lower position).

The MPS-C solid state box must be connected to its 607 Test Set umbilical for this test. These tests cannot be repeated in rapid succession on the magnetic latch due to recharging time for trip system capacitor.



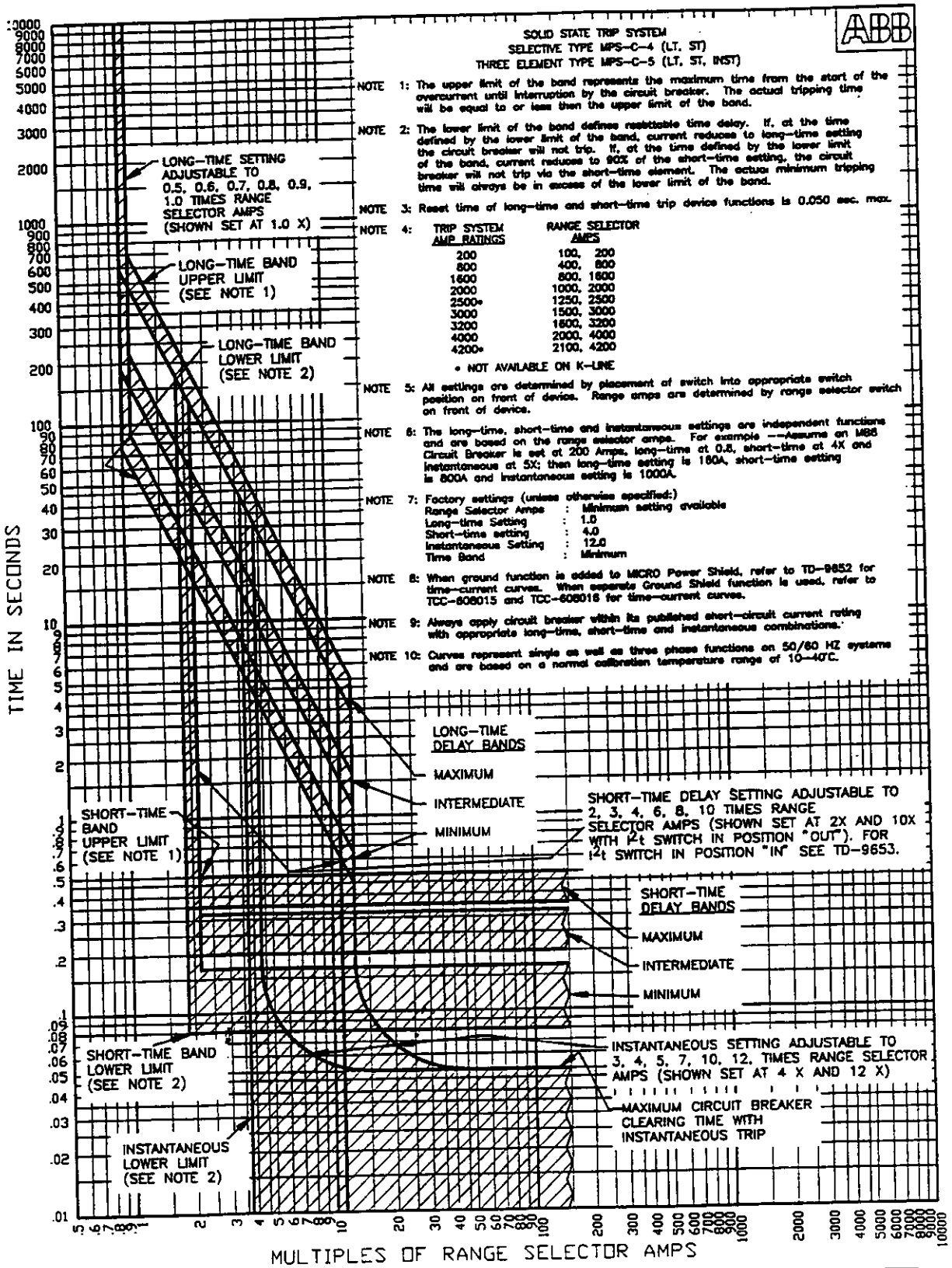
TIME-CURRENT CHARACTERISTIC CURVES. Solid State Trip System Type MPS-C-3 Long-time and Instantaneous For Type LK, LKE, LKD, K-LINE, K 3/4, K-DON, MB, MBE, and MBD Low Voltage Power Circuit Breakers.

POWER DISTRIBUTION INC. CIRCUIT BREAKER DIVISION

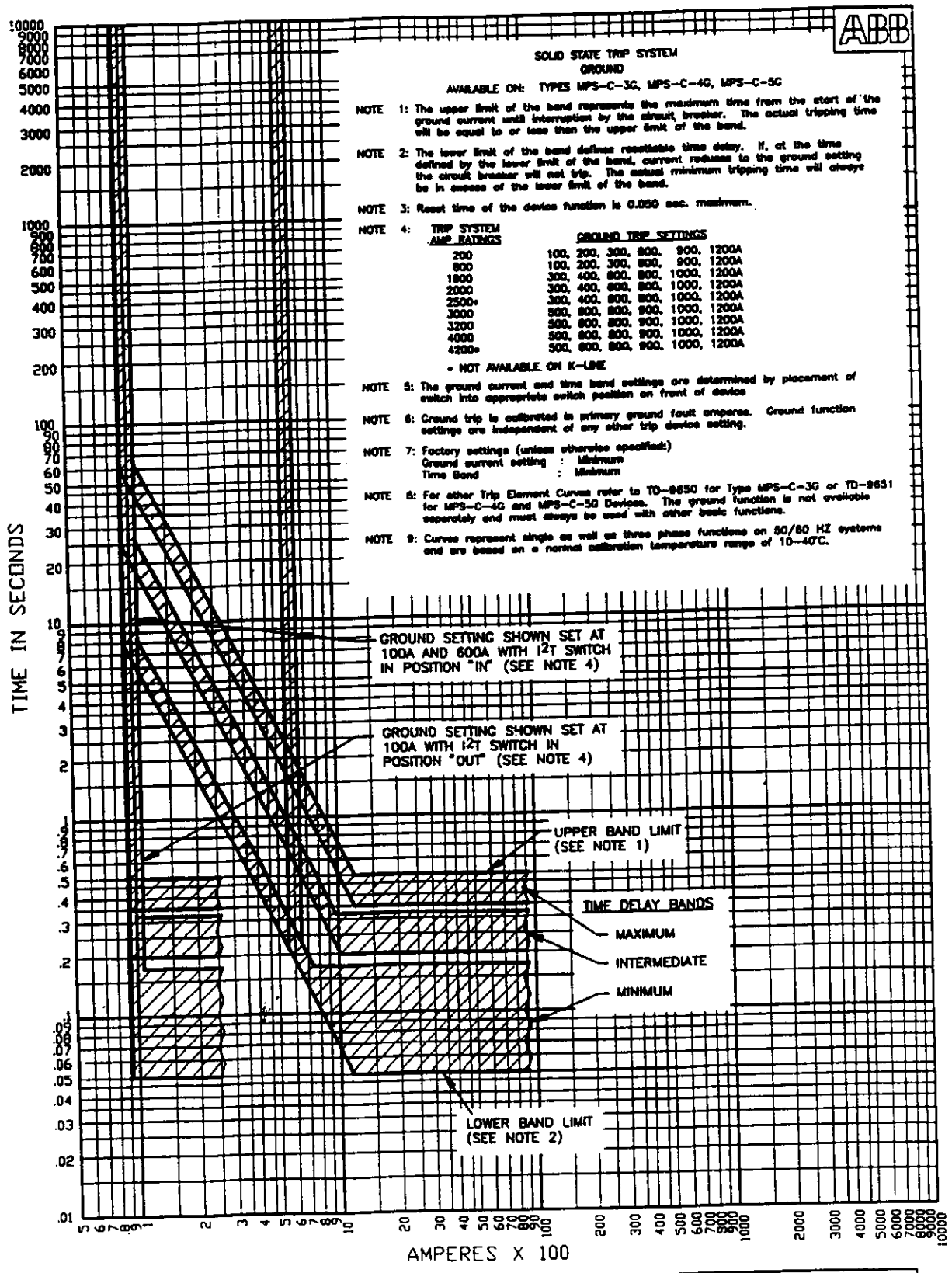
DRN. BY MKJ DATE 9-9-91

APPR. BY _____ DATE _____

NO TD-9650 REV. 0



TIME-CURRENT CHARACTERISTIC CURVES. Solid State Trip System Types: MPS-C-4 Long-time and Short-time, Selective MPS-C-5 Long-time, Short-time and Instantaneous, Three Element. For Type LK, LKE, LKD, K-LINE, K 3/4, K-DON, MB, MBE, and MBD Low Voltage Power Circuit Breakers. With I²t Switch in "OUT" Position.	ABB POWER DISTRIBUTION INC. CIRCUIT BREAKER DIVISION DRN. BY MKJ DATE 9-9-91 APPR. BY ____ DATE ____ NO. TD-9651 REV. 0



TIME-CURRENT CHARACTERISTIC CURVES. Solid State Trip System for Ground Function Types: MPS-C-3G, MPS-C-4G, MPS-C-5G, for Type LK, LKE, LKD, K-LINE, K 3/4, K-DON, MB, MBE, and MBD Low Voltage Power Circuit Breakers.	ABB POWER DISTRIBUTION INC. CIRCUIT BREAKER DIVISION
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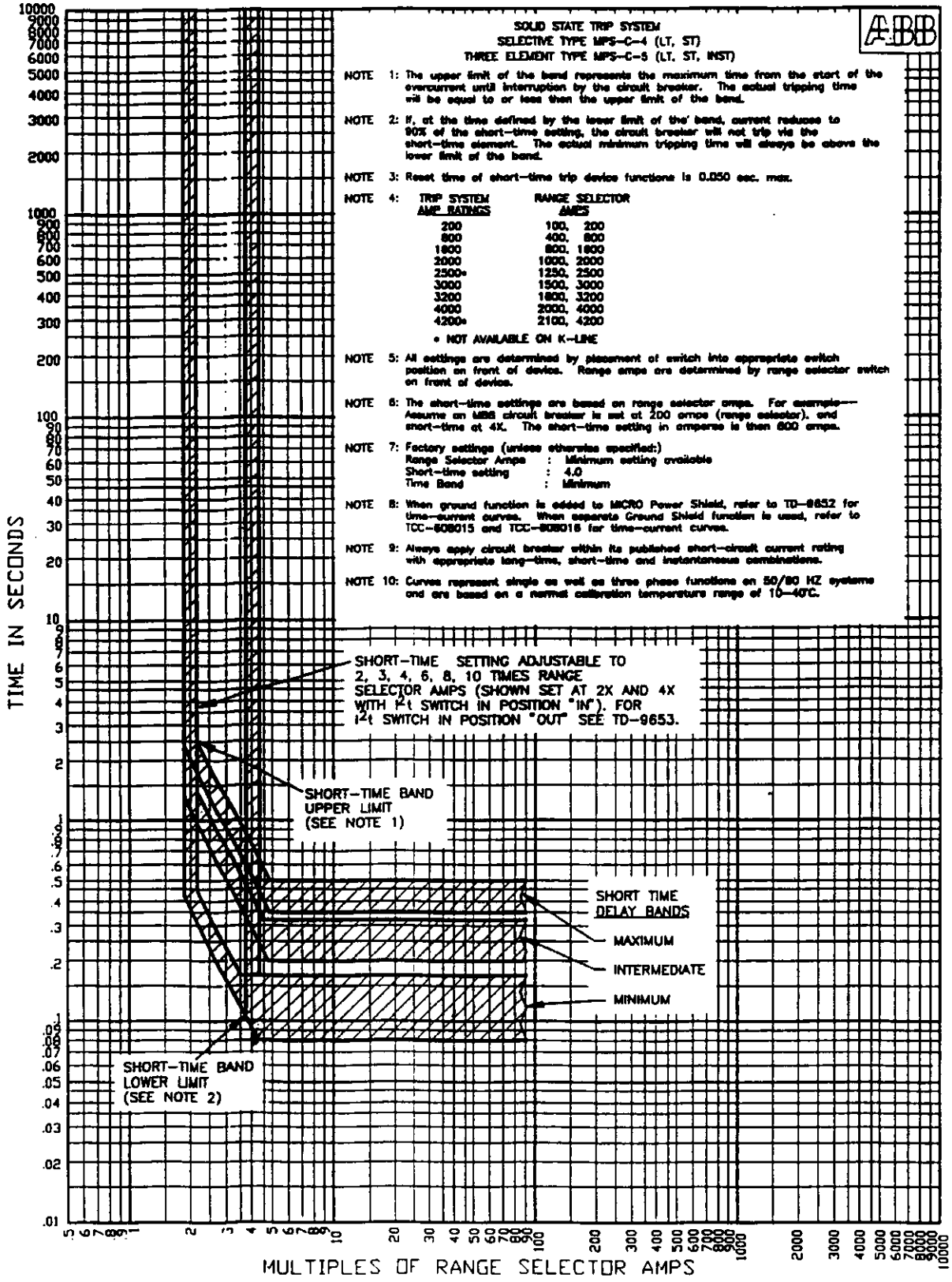

TIME–CURRENT CHARACTERISTIC CURVES. Short–time Curves for Types MPS–C–4 and MPS–C–5 Solid State Trip Systems on Type LK, LKE, LKD, K–LINE, K 3/4, K–DON, MB, MBE, and MBD Power Circuit Breakers. Shown with I²t Switch in the "IN" Position.	POWER DISTRIBUTION INC. CIRCUIT BREAKER DIVISION
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