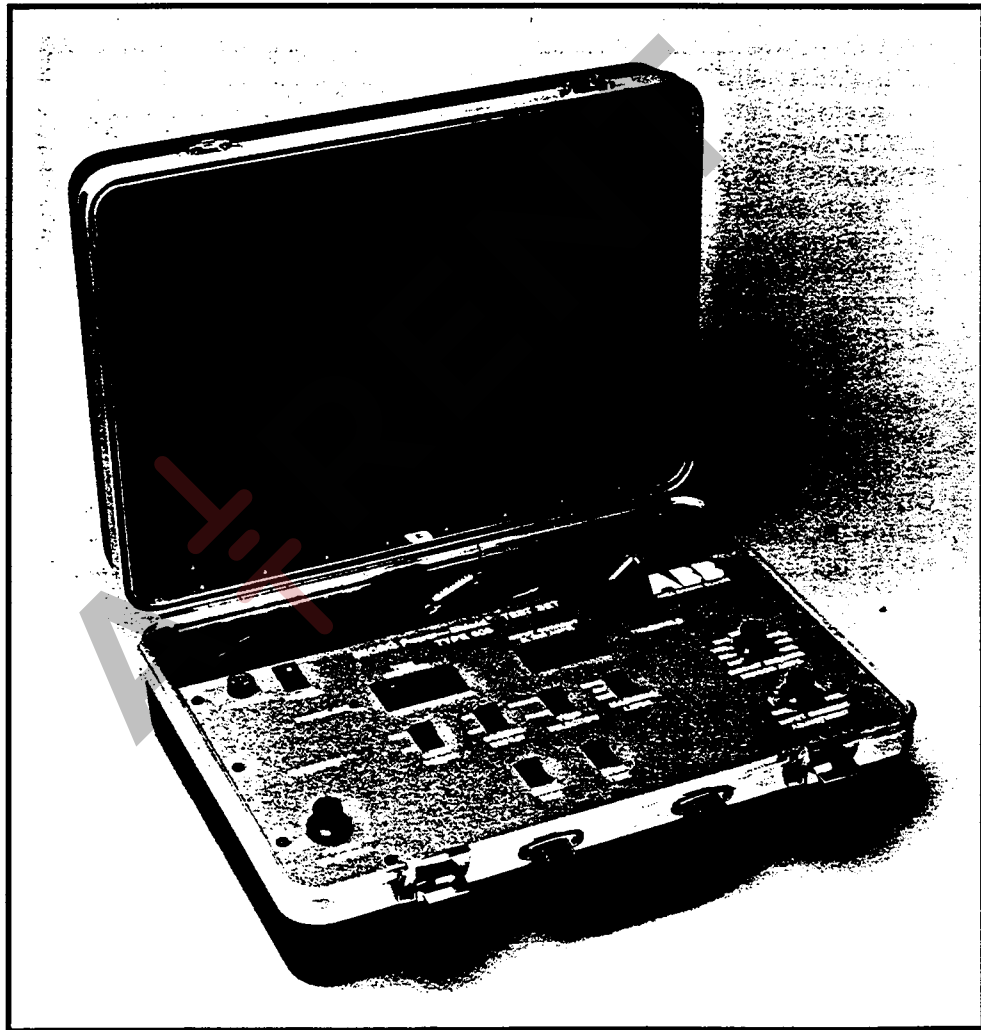


Installation/Maintenance Instructions
Micro Power Shield

*Test Set
Type 606*



**ABB Power Distribution, Inc.
Circuit Breaker Division**

ABB
ASEA BROWN BOVERI

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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 Power-Shield trip system or the Type 606 Micro Power-Shield Test Set. Refer to the Circuit Breaker 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 Power Shield (MPS) 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 type LK automatic trip low voltage AC power circuit breakers.

For overload and fault protection, four basic trip elements within the Micro Power Shield are available: long-time, short-time, instantaneous, and ground. Models with various combinations of these functions are available (see Table 1). Additionally, the short-time and ground elements feature the I²t 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 MPS trip systems, 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 trip system.

Electrical tests, using the 606 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 606 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 top of the solid state box.

OPERATING PRINCIPLES

The tripping system for the ABB power circuit breakers consists of three current sensors, a MPS solid state trip unit, a magnetic latch device to activate the breaker trip latch, and the interconnecting wiring. There is one current sensor mounted per phase of the circuit breaker. This trip system is a direct-acting trip device; that is, all power for sensing overload or fault conditions and for tripping the breaker is derived from the three current sensors.

In normal operation, current from the current sensors provide power for the microprocessor. A Self Monitor indicating eight on the solid state box front panel flashes to indicate that the microprocessor is functioning normally. During an overload or fault condition, the solid state trip unit compares the current flowing to the threshold (pickup) values set on the front panel for the various functions. Depending on the magnitude of the overcurrent, the breaker will either trip instantaneously or begin timing if the long-time, or short-time, or ground thresholds are exceeded. When trip occurs, the output circuit of the MPS trip system is triggered which in turn powers the magnetic latch. The plunger of the magnetic latch releases then engages the circuit breaker trip latch to trip the device.

During the time delay period of long-time, short-time, or ground, the trip system will reset and stop timing should the overload current drop below the trip element threshold value. In the case of low level arcing ground faults, reset is dependent on time and magnitude; trips will occur when the sum of the erratic currents exceed the ground threshold value for a time defined by a ramp function in the solid state box software.

*Threshold will be used in this bulletin in reference to what was once considered a "pickup" value. "Pickup" is more appropriately used in reference to electromechanical trip devices not solid state devices.

Available Settings (See Figure 1)

Range Selector Setting - This switch allows the breaker to be used at either 1.0 times its sensor rating or 0.5 times its sensor rating on all trip elements except ground.

See Table 2.

Long-Time Setting - The long-time protective element can be set at 0.5, 0.6, 0.7, 0.8, 0.9, and 1.0 times the Range Selector setting. Three delay bands, labelled MIN (minimum), INT (intermediate), and MAX (maximum) are featured.

Short-Time Setting - The short-time protective element has adjustable threshold settings of 2, 3, 4, 6, 8, or 10 times the Range Selector setting. Three selectable time delay bands, labelled like that of the long-time, are standard. A two-position I²t switch is also standard, labelled IN - OUT. The I²t characteristic can be switched IN to allow coordination with downstream devices.

| SOLID STATE TRIP DEVICE | ADJUSTABLE PROTECTIVE TRIP ELEMENTS | | | | TIME CURRENT CHARACTERISTIC CURVES | | |
|-------------------------|-------------------------------------|------------|---------------|--------|------------------------------------|----------------|---------|
| | LONG-TIME | SHORT-TIME | INSTANTANEOUS | GROUND | OVCT | I _t | GROUND |
| | | | | | | | |
| MPS 3 | X | | X | | TD 9601 | | |
| MPS 3G | X | | X | X | TD 9601 | | TD 9603 |
| MPS 4 | X | X | | | TD 9602 | TD 9604 | |
| MPS 4G | X | X | | X | TD 9602 | TD 9604 | TD 9603 |
| MPS 5 | X | X | X | | TD 9602 | TD 9604 | |
| MPS 5G | X | X | X | X | TD 9602 | TD 9604 | TD 9603 |

See the appendix of this bulletin for time current curves TD 9601 through TD 9604.

TABLE 1

| BREAKER RATING | SENSOR RATING | RANGE SELECTION SETTINGS | GROUND THRESHOLD SETTINGS |
|-----------------|---------------|--------------------------|--------------------------------|
| 800, 1600, 2000 | 200 * ** | 100, 200 | 100, 200, 300, 600, 900, 1200 |
| 800, 1600, 2000 | 800 | 400, 800 | 100, 200, 300, 600, 900, 1200 |
| 1600, 2000 | 1600 | 800, 1600 | 300, 400, 600, 800, 1000, 1200 |
| 2000 | 2000 | 1000, 2000 | 300, 400, 600, 800, 1000, 1200 |
| 2500 | 2500 † | 1250, 2500 | 300, 400, 600, 800, 1000, 1200 |
| 3000 | 3000 | 1500, 3000 | 300, 400, 600, 800, 1000, 1200 |
| 3200 | 3200 | 1600, 3200 | 500, 600, 800, 900, 1000, 1200 |
| 4000 | 4000 | 2000, 4000 | 500, 600, 800, 900, 1000, 1200 |
| 4200 | 4200 †† | 2100, 4200 | 500, 600, 800, 900, 1000, 1200 |

* On MB circuit breakers, only MB 1600 can be equipped with 200 and 800 amp sensors. MBE 1600 can only be specified with 1600 ampere sensors. MB 2000 breakers can use only 1600 or 2000 ampere sensors.

** On K-Line breakers, K1600M breakers can be specified with sensors no smaller than 800 amperes.

† 2500 ampere sensors are available on MB and LK only.

†† 4200 ampere sensors are not available on K-Line.

TABLE 2

Instantaneous Setting - The instantaneous threshold current can be set at 3, 4, 5, 6, 7, 10, or 12 times the range selector setting.

Ground Setting - The ground threshold setting vary with the breaker sensor rating.

See Table 2. These settings are marked in the actual current thresholds on the MPS box front cover. Three ground time delay bands are provided: MAX (maximum), INT (intermediate), and MIN (minimum).

WARNING WARNING WARNING WARNING

It is extremely important that the selector switches in each trip element of the MPS trip system be positioned in their detents. It is not possible to fine tune the threshold values by positioning the selector switches between the detented positions. Failure to position the "setting" selector switches in their detents will impair the performance of the trip element so adjusted. Selecting time delays between detents will automatically revert to the minimum time delay of that trip element.

Table 2: Range Selector and Ground Settings

*On MB circuit breakers, only MB1600 can be equipped with 200 and 800 ampere sensors. MBE 1600 can only be specified with 1600 ampere sensors. MB 2000 breakers can use only 1600 or 2000 ampere sensors.

**On K-Line breakers, K1600M breakers can be specified with sensors no smaller than 800 amperes.

2500 ampere sensors are available on MB and LK only. 4200 ampere sensors are not available on K-Line.

HOW TO MAKE SETTINGS

The values of threshold current and delay times to be set must be determined by an analysis of the protection and coordination requirements of the power system. As settings are placed closer to the normal equipment characteristics to obtain maximum protection, the more likely are nuisance operations (for example, due to motor inrush on starting). Therefore, as settings are calculated, appropriate compromises must be made between protection and continuity of service.

The Range Selector setting is made by means of the two position slide switch on the front panel of the trip unit. All other settings are made by rotary selector switches on the front panel. The long-time, short-time, and instantaneous trip functions are calibrated in multiples of the ampere tap setting. The ground function is calibrated directly in amperes. As an example of settings, consider the following: 800 ampere circuit breaker with MPS-5G trip unit. Long-time required: 800 amperes. Short-time required: 4800 amperes. Instantaneous required: 9600 amperes Ground required: 600 amperes.

(1) Set Range Selector at 800 amps. (Switch is in the upper position.)

(2) Set long-time selector at 1. (1 x 800 = 800)

(3) Set short-time selector at 6. (6 x 800 = 4800)

(4) Set instantaneous at 12 (12 x 800 = 9600)

(5) Set ground at 600.

STANDARD FEATURES:

Trip Indicators (Targets).

Trip indicators are furnished for long-time, short-time, instantaneous, and ground, as required, to match the trip elements featured on the solid state box. When a trip occurs, the indicator for the function which tripped will show orange. These indicators reset automatically approximately two seconds after the breaker is close assuming that the condition which caused the original trip has been cleared. Should the condition still exist or a new trip condition has developed, MPS trip system will trip in response to the condition and display the appropriate target.

I²t Function - I²t is switchable on a short time and standard on ground. The I²t function on short time operates between two times and four times the Range Selector Setting. See curve TD-9604 in the appendix of this bulletin.

Self Monitor Light - The Self Monitor Light is a red light emitting diode which blinks approximately one time per second when current is flowing through the closed circuit breaker. This light indicates that the internal microprocessor is functioning normally.

Low Level Arcing Ground Fault Trip - Unique discriminating circuitry responds to low level arcing ground faults by summing the erratic currents associated with arcing to ground. The breaker will be tripped by this feature when the sum of these low level faults exceeds the threshold setting of the ground element. The response time of this feature is dependent on the frequency of occurrence of the arcing fault and the setting of the ground trip element.

OPTIONAL FEATURES

Optional MPS trip system accessories include two types of load alarms. The High Load Alarm provides a contact change of state (normally open to normally closed, normally closed to normally open) when the long-time threshold is surpassed. The change of state lasts as long as the long-time threshold is surpassed. The change of state lasts as long as the long-time threshold is exceeded and the breaker remains closed. This alarm can provide advance indication that overcurrent trip is eminent.

Ground Alarm - The other type of load alarm, provides a momentary contact change of state when a ground trip occurs. A remote alarm circuit may be wired to this contact. The circuit breaker can be equipped with either a High Load alarm or a Ground Alarm. Both require control power; a 120/240 AC - 125/250V DC or a 48V DC unit are available.

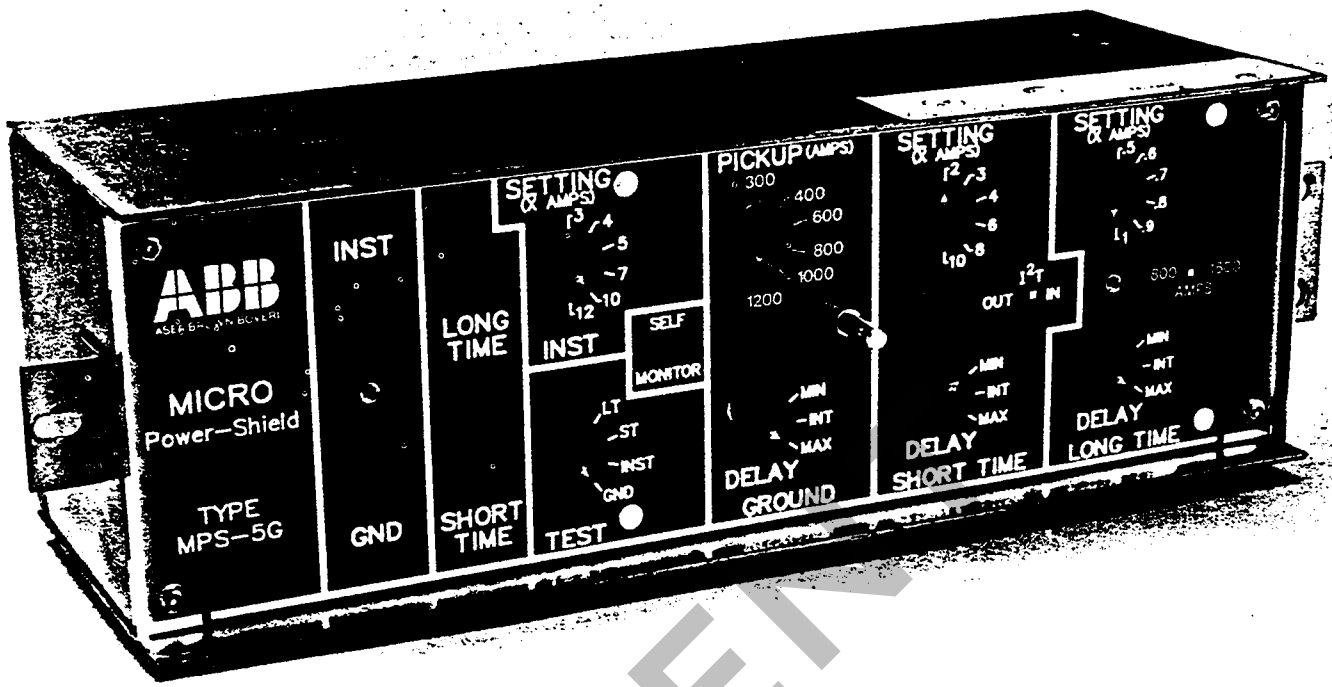


Figure 1

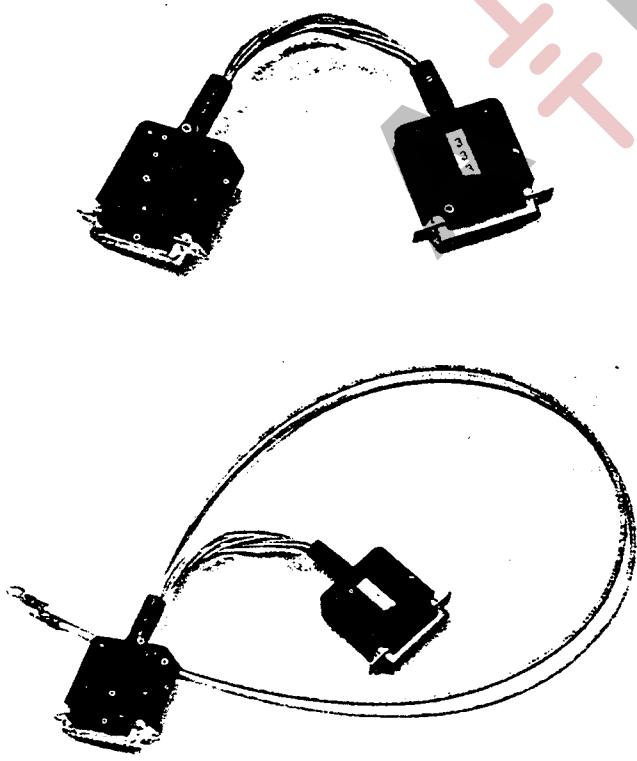


Figure 2

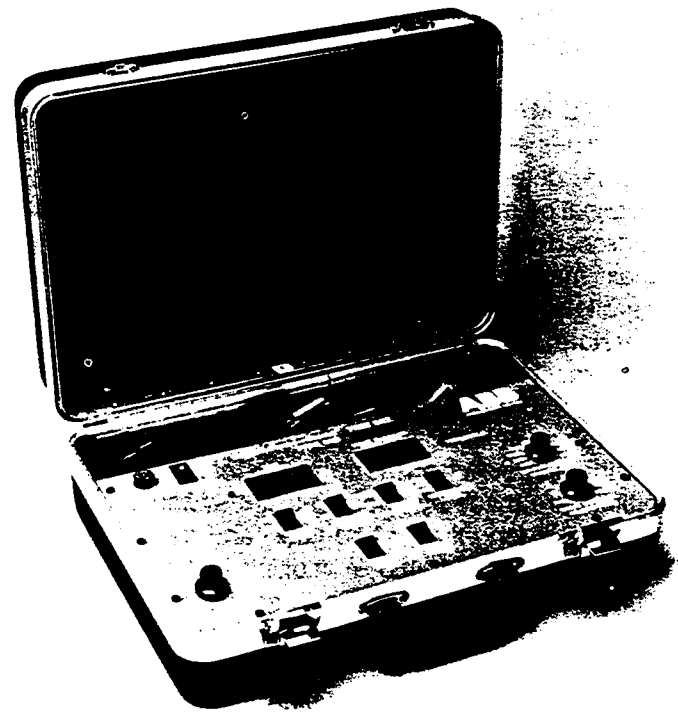


Figure 3

Load Alarm contacts are rated at 125V DC:
30 amperes momentary
5 amperes continuous
0.3 amperes break, inductive

These devices should be specified at the time of breaker order entry. Two types of connector cables can be purchased for aiding in primary current testing. The ground defeat test cable defeats the ground fault circuit when it is desirable to test long-time. A special four-wire/D.E.S.P. ground test cable can be specified when it is desirable to check the ground system with an externally connected current sensor. The ground defeat test cable is part number 713918-T09; the four-wire/D.E.S.P cable is 713918-T10. See Figure 2.

The final optional accessory, the 606 Test Set for secondary current injection testing is discussed in full detail elsewhere in this bulletin.

Micro-Power Shield Test Set Type 606

INTRODUCTION

The type 606 Test Set is a secondary current injection tester specifically designed to test only Micro Power-Shield (Type MPS) solid state trip systems. All the connecting cables required for testing are permanently attached to and are stored within the portable case.

The type 606 Test Set can be used to determine threshold currents on the instantaneous element as well as threshold currents and time delays on the long-time, short-time, and ground functions. In addition to these tests, the MPS internal toroid board can be checked. The Test Set can also confirm that the magnetic latch and the remainder of the circuit breaker's trip mechanism is functioning by tripping the breaker through the MPS unit.

Description of features (Refer to Figure 3)

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 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 box (00.00). To obtain current value in terms of primary current, multiply the display times 1000.

THRESHOLD INDICATOR - Illuminates when the MPS box threshold is surpassed. It will remain on while the MPS 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 system toroid board. Spring return to the "LOW" setting is provided; all other tests are performed in this "LOW"

position.

GROUND DEFEAT SWITCH - Defeats the ground element of the MPS 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 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 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 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. (Early models may be labelled "MIN" and "MAX" instead of "INCR" and "DECR".)

LINE CORD - Connects 606 Test Set to 120V AC, 60 Hz grounded source. Do not remove the ground blade of the three-prong plug.

MPS SYSTEM UMBILICAL - Connects the 606 Test Set to the breaker mounted MPS trip system.

MAGLATCH UMBILICAL - Connects the 606 Test Set to the circuit breaker harness. This harness completes the connection to the magnetic latch. It is not necessary to connect this cable if a bench test of the MPS solid state trip unit is being conducted.

Test Preparation: Tests on the MPS trip system can be performed on the racked out breaker in its own cubicle or performed on the breaker outside its switchgear enclosure.

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

Manually operated breakers may be racked to the "Test" or "Disconnect" position. To assure breaker stability during manual spring charging, DO NOT RACK TO THE OUT POSITION OR MANUALLY CHARGE BREAKER SPRINGS WITH CIRCUIT BREAKER SITTING ON EXTENDED CRADLE RAILS.

WARNING WARNING WARNING WARNING

THE CIRCUIT BREAKER MUST NEVER BE TESTED IN THE "CONNECTED" POSITION. SERIOUS INJURY CAN RESULT WHEN TESTING WITH THE BREAKER CONNECTED TO THE PRIMARY POWER CIRCUIT. DAMAGE TO BREAKER CURRENT SENSORS WILL ALSO OCCUR.

B. On LK, remove the top blue metal cover of the breaker to gain access to the MPS system harness plug. Retain all hardware for use in reattaching cover later. For K-Line and MB, go directly to Item C.

C. Remove the two nylon screws joining the circuit breaker harness to the MPS solid state box (if provided), and unplug the harness from the top of the box.

D. Remove the front clear plastic cover from the MPS trip system.

E. After familiarization with the controls, displays, and test cables of the type 606 Test Set, connect the MPS SYSTEM UMBILICAL to the MPS box. Make sure the plug is oriented properly before attempting to push it in; it should only go in one way.

F. If tests on the maglatch are also desired, connect the MAGLATCH UMBILICAL to the circuit breaker wiring harness.

G. If the breaker has been taken out of service for these tests, make a note of the MPS system settings so they can later be restored to these settings.

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

I. With the Input Current Adjustment at the minimum fully counterclockwise position, switch on the Type 606 Test Set. The POWER ON INDICATOR, TIMER DISPLAY, AND CURRENT DISPLAY should illuminate with zeroes in the two display windows (The INPUT CURRENT DISPLAY may show a value in the least significant digit of the display).

The SELF MONITOR light on the MPS 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 606 Test Set and MPS 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 606 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 System front panel switches as follows:

RANGE SELECTOR: LOWER POSITION

LONG-TIME SETTING: .5

LONG-TIME DELAY: MIN

Pr: OUT

SHORT TIME SETTING: 10

SHORT TIME DELAY: MAX

GROUND PICKUP: 1200 (FULLY CCW)

GROUND DELAY: MAX

INST SETTING: 12

TEST FUNCTION: LT

C. With the 606 Test Set and MPS 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 system internal clock to time out, thus stopping the blinking of the SELF MONITOR light. If this occurs, turn the 606 Test Set OFF, wait several seconds, then switch it back ON to reset the MPS System.

D. Wait until the LONG TIME TARGET resets, then repeat Step C twice with the PHASE SELECTION switch on 02, then 03, respectively.

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

E. For MPS System with the GROUND option, reposition the following switches from their settings in A & B above:

606 Test Set:
 GROUND DEFEAT: OFF

MPS Trip System:
 TEST FUNCTION: GROUND GROUND SETTING: 600
 amp position on 800 ampere breakers and below, 800
 amperes on 1600 ampere breakers and higher.
 GROUND DELAY: MINIMUM

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

G. The timer display for this ground test should indicate approximately 00.15. Holding the INPUT POWER switch too long may require MPS box reset as in "C" above.

LONG-TIME TESTS

A. Position the 606 Test Set switches as follows:

POWER: ON
 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 System front panel switches as follows:

TEST FUNCTION: LT
 RANGE SELECTOR: UPPER
 LONG-TIME SETTING: 1
 LONG-TIME DELAY: MAX FOR THRESHOLD TEST, MIN,
 INT, OR MAX FOR TIME TESTS
 FOR THRESHOLD TESTS,

C. Depress the START TEST button. The elapsed time meter will begin timing indicating that the test is in progress (For threshold tests, the time reading is irrelevant.) Slowly increase the INPUT CURRENT ADJUSTMENT clockwise until the 606 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 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 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 3, | MIN. | 8 - 13 SEC. |
| MPS 4, | INT. | 20 - 33 SEC. |
| & MPS 5 | MAX. | 61 - 100 SEC. |

After the appropriate time delay, the long-time Target will show, and maglatch will operate (if NORMAL is selected). On the 606 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 606 Test Set current setting always be at a multiple greater than 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 curve.

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 only occurs at this very lowest setting.

SHORT-TIME TESTS

A. Position the 606 Test Set switches as follows:

POWER: ON
 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

Position the MPS System front panel switches as follows:
 TEST FUNCTION: ST
 RANGE SELECTOR: UP
 SHORT-TIME SETTING: 2
 SHORT-TIME DELAY: MIN, INT, OR MAX for time tests
 I²t: OUT (Initially)

| | | |
|-----------------------|------|--------------------|
| MPS 4 & | MIN. | 0.160 - 0.250 SEC. |
| MPS 5 | INT. | 0.520 - 0.780 SEC. |
| With I ² t | MAX. | 0.910 - 1.350 SEC. |

C. For threshold tests, 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 short-time threshold is reached. When that point is reached, the MPS System will time out, then display the short-time TARGET, the threshold light is disabled after the target is shown. Therefore, care must be taken to increase the INPUT CURRENT slowly to avoid overshooting the threshold. The threshold current in the CURRENT DISPLAY will be the RANGE SELECTOR setting times the SHORT-TIME SETTING (x .001). The other short-time settings can be verified using this method.

D. Before performing the delay tests, reposition the MPS System front panel switches according to (B) above. The I²t SWITCH should remain "OUT" with SHORT-TIME DELAY on "MIN". Preset the current on the 606 Test Set to 150 percent of the product of the RANGE SELECTOR setting times the SHORT-TIME setting (x .001). Press START ST. The short-time trip TARGET should flip in the range shown in the table below. Intermediate (INT) and (MAX) time delays can be verified at the same current preset by selecting either of those on the 606 Trip System, then repressing the START TEST push button.

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

E. For evaluation of the I²t function, the same current presets can be used. Switch the I²t switch to "IN". Press the START TEST push button. Again, the short-time trip TARGET should flip after the appropriate time delay. The other time delays with I²t may be evaluated in a like manner with the same current preset. As with long-time delay, input current changes will influence short-time I²t time delays.

SHORT-TIME TIME DELAYS

* Time shown applies only to SHORT-TIME SETTING 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 I²t 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-9602. If multipliers other than 2 are used with the I²t in, read the new time values from curve TD-9604.

INSTANTANEOUS TEST

A. Position the 606 Test Set switches as follows:

- POWER: ON
- INPUT POWER: 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 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 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 an accurate evaluation.

Once threshold is reached, the current indicated 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 606 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 606 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 C.B. SENSOR
 PHASE SELECTION: 03
 INPUT CURRENT ADJUSTMENT: MINIMUM

B. Position the MPS 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 (INITIALLY)

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

As with the SHORT-TIME and instantaneous tests, once the threshold is reached and the GROUND DELAY times out, the THRESHOLD light will extinguish as the target is displayed. If the ground threshold is passed too quickly, it may be necessary to turn off the 606 Test Set, wait briefly, then turn it on to restart the tests.

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

E. Refer to table below for test current settings for the various sensors available. Adjust the INPUT CURRENT ADJUSTMENT to match that required by the table below. Push the START TEST push-button, then observe that the THRESHOLD light illuminates. The MPS 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 | MIN. | 0.68 - 1.3 SEC. | 0.07 - 0.18 SEC. | 0.05 - 0.17 SEC. |
| MPS | INT. | 2.1 - 4.2 SEC. | 0.24 - 0.47 SEC. | 0.20 - 0.32 SEC. |
| TYPES | MAX. | 5.2 - 9.5 SEC. | 0.59 - 1.2 SEC. | 0.35 - 0.50 SEC. |

Other threshold settings can be evaluated using the 606 Test Set; the times delays can be determined from time current curve TD-9603. (See appendix)

MAGNETIC LATCH TEST

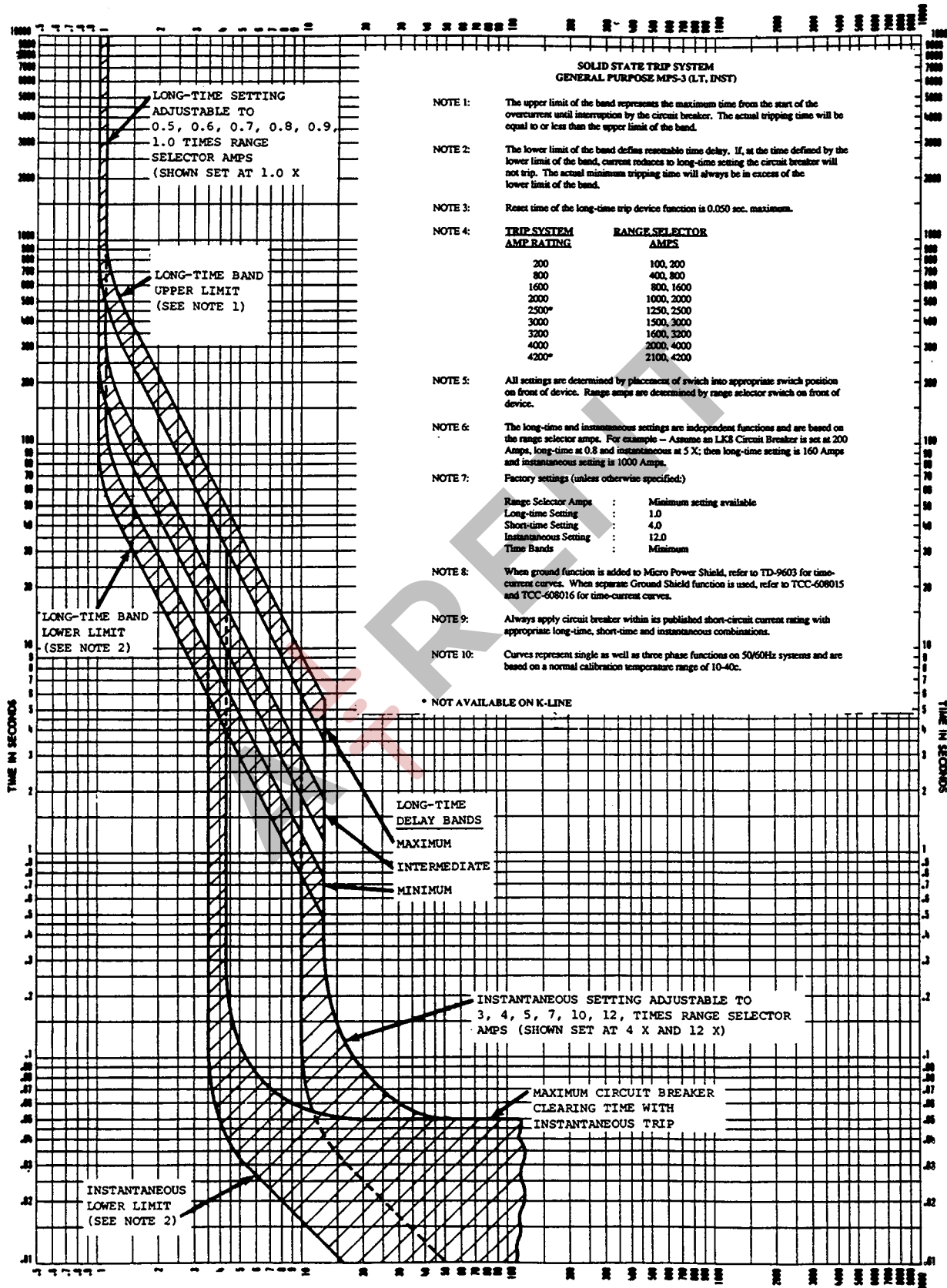
The magnetic latch on the breaker can be evaluated two ways:

1. Move to LH margin like (2) below. When the MAGNETIC LATCH test switch is in the NORMAL position, the magnetic latch is operated by the MPS 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 maglatch when the MAGNETIC LATCH test switch is in the NORMAL position.

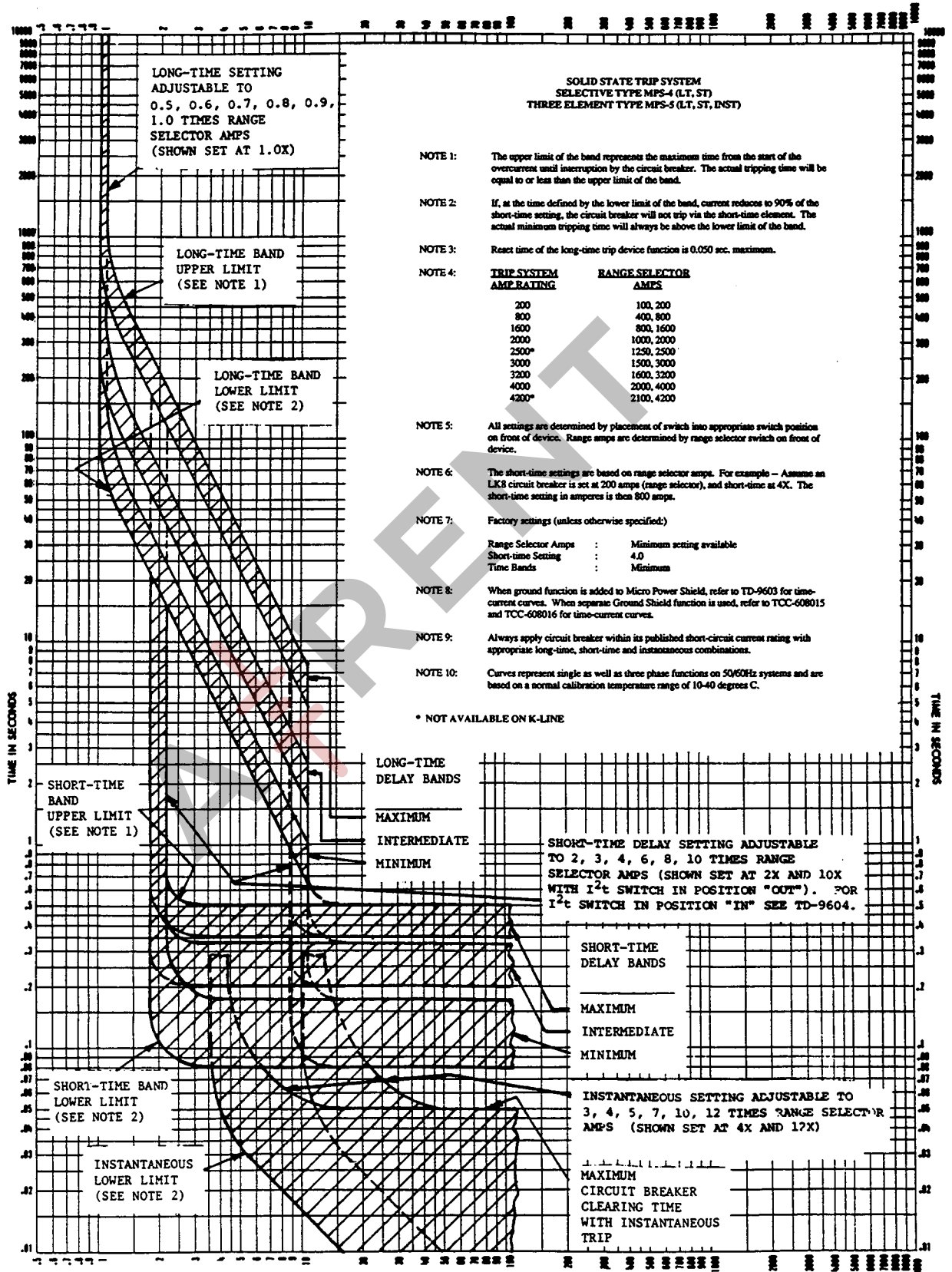
2. The magnetic latch can be tested at any time regardless of the settings on the MPS box by moving the MAGNETIC LATCH switch to the TEST position. This test represents the worst case trip threshold where tripping would be required (long-time set at .5 with the RANGE SELECTOR in the lower position).

The MPS solid state box must be connected to its 606 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.

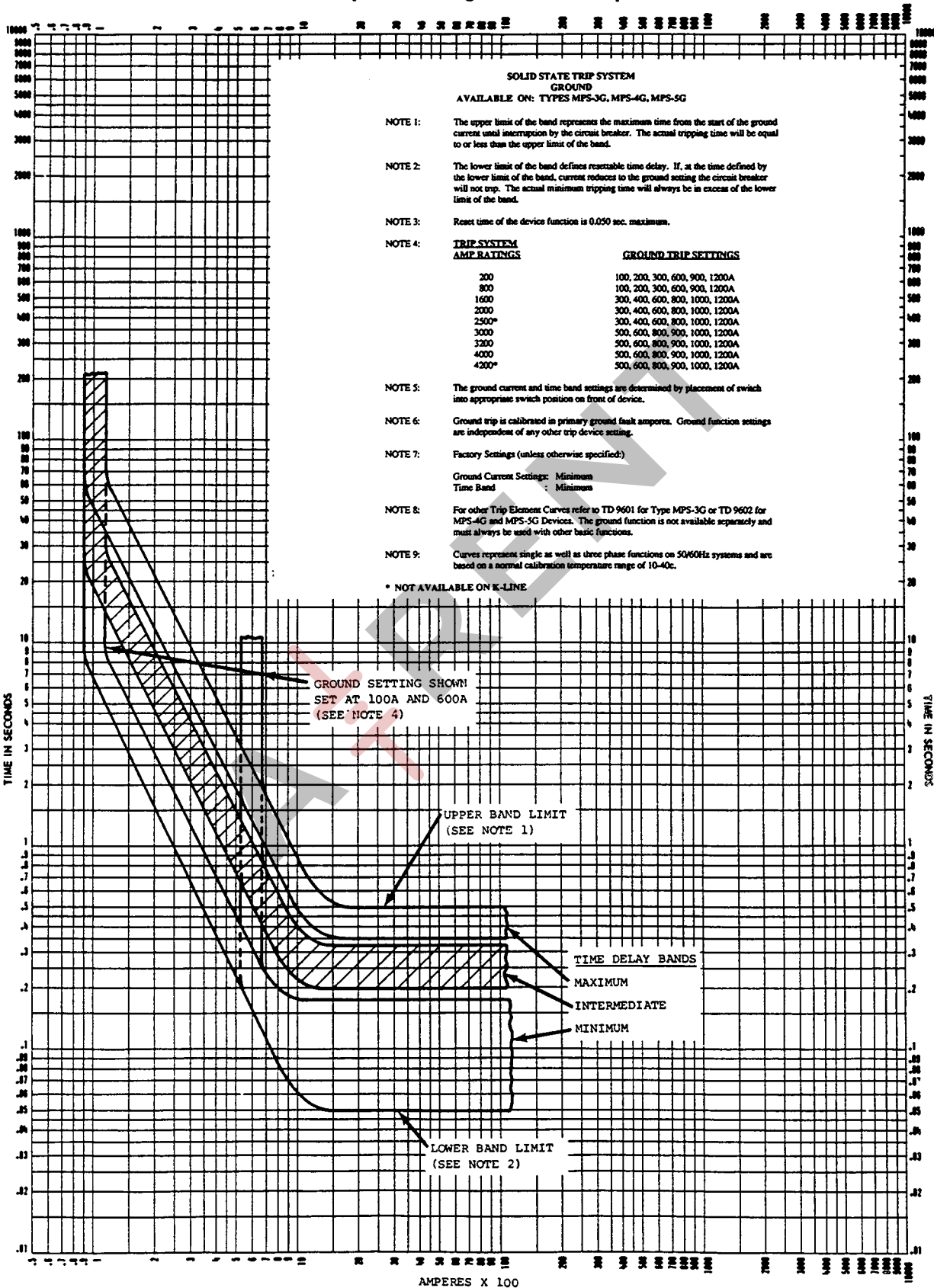
Multiples of Range Selector Amps



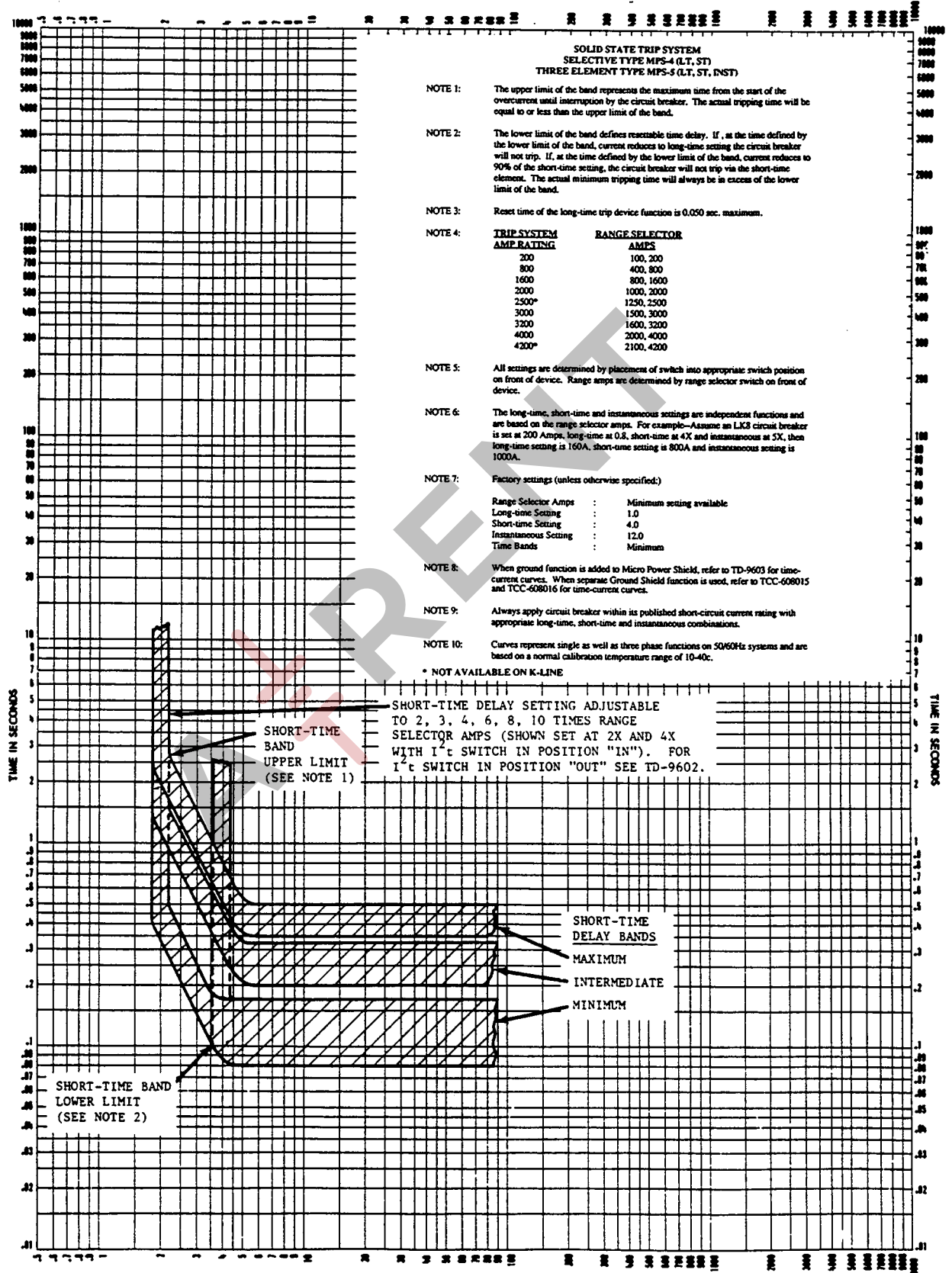
Multiples of Range Selector Amps



Multiples of Range Selector Amps



Multiples of Range Selector Amps



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