RC-3087
(Tentative)
March 25, 1977

INSTRUCTION FOR TYPE TA-3M TEST ACCESSORY (FOR FBK-HST UNITS) (76 HS)

Introduction

Type TA-3M Test Accessory is intended for quick evaluation of HST operational status and performance. Its use is also recommended during initial stages of installation or trouble-shooting.

The accessory contains:

(1) DC Ammeter, 0-5A
(1) AM reversing switch
(1) On-Off Switch, maintained type
(1) Fuse
(1) Fuse plug (test connector) with 2-conductor leads
(2) Test probes; terminating in (2) test jacks.

The accessory permits controlled application of operating power to a HST unit without opening the battery power switch or pulling fuses within the breaker cubicle. Ammeter is inserted in a control power lead to observe HST behavior under charging, testing and tripping conditions. The accessory checks HST power path up to and including tripping but is not provided to ascertain signal or automatic trip calibration. The latter should be verified during bench testing, using appropriate methods and instruments.

HST units contain a large energy storage capacitor. Ammeter readings therefore, will normally show initial peak input current which gradually decays and settles at a steady scate value corresponding to HST requirements during idle time. Test trip causes the charging cycle to repeat. If HST unit is of "No trip on CP loss" kind, reapplication of battery power will not produce peak currents until capacitor discharges.

Test Procedures

Most tests will not require removal of HST units from breaker frames unless card replacement or inspection is contemplated.

1. Open TA-3M On-Off Switch (Down).
2. Remove HST fuse and insert TA-3M fuse plug.
3. Insert fuse in TA-3M.
4. Close frame power switch, if open.

5. Close TA-3M switch (up) and note ammeter readings. If meter polarity wrong, reverse AM switch.

6. Optional: connect TA-3M test leads to HST test points of interest and an appropriate voltmeter or oscilloscope to TA-3M binding posts.

TA-3M fuse should be of the same type and rating as HST fuses, i.e., for 125Vdc units:

Slow-acting, time-delay type

3/4A, 250V, size 3AG-SB
Little Fuse - Slo-Blo #313.750S
or Bussman - type MDL

If currents remain at high values for 4-5 seconds, HST malfunction is suspected and TA-3M switch can be opened after AM reading and before TA-3M fuse blows. If current magnitude and inverter hum are normal, more time can be spent on further observations unless other symptoms dictate a more careful approach.

Press test push buttons and verify proper HST operation.

HST units contain a HV resistance divider with a low voltage output proportional to charging high voltage. Divider voltage offers additional information and can be measured with a DC voltmeter having 20,000 ohm per volt or higher input resistance. Conect TA-3M test leads to test points TP1 on PC 400 and TPG on PC 500 or HST enclosure. To gain access to cards, temporarily remove HST nameplate (four screws).

Prolonged energization of a malfunctioning HST unit is not recommended as it may lead to secondary failures (i.e. damage to other components). Malfunctioning unit should be taken off the battery power and either be replaced or reported to the factory with pertinent problem or symptom identifications.

Evaluation

Current readings identify HST behavior under various conditions and provide additional clues for further investigations, if required.

Use Table I as a guide to detect causes of malfunctions, if any. The table shows typical values based on laboratory investigations of a standard uncharged HST unit with purposely introduced malfunctions at 125Vdc. The listed cases have been arbitrarily selected to show relation of currents or voltages to causes and to facilitate understanding of TA-3M procedures.

Field readings may depend on battery or charger voltages but will follow the indicated trends. Charging time of HST units with (2) HV capacitors on 8-10 kA breakers will be corresponding longer.

If symptoms are inconclusive, check other test points (see IB-16.4.1.7-2) or consult factory for assistance.

Use of TA-3M accessory is recommended during initial control power energization of a new HST unit to verify its status.

Corrective Action

Identifications of problems and causes will help in planning the corrective action.

If spare cards or HST units are available, they can be interchanged providing the catalog or manufacturing numbers are the same. Replacement of components on cards or stationary panels is not recommended as it may lead to warranty cancellation and unless personnel were trained in proper methods and calibration.

Bench testing or troubleshooting should proceed with equal care. For example, oscilloscopes or instruments which are grounded should not be connected to HST circuits. Use 120V/120V isolation transformers on their power side. Reversal of wire connections on Q101 pins will lead to the transistor damage upon control power application. Do not use fuses of higher rating than recommended. Some repairs should be followed with a calibration and operational checks.

HST units are factory tested and do not require field calibration.

If testing by means of TA-3M accessory verifies that HST unit is responding properly but breakers occasionally trip in service, HST trip settings should be evaluated.

Trip occurrences should be related to time, breaker loads or specific feeders. Should HST trip settings be at limits, consult factory for special calibration.

Some signals within HST units are proportional to bus currents. If bus ammeters are not provided and currents are not known, connect an oscilloscope to HST test points as follows:

(a) To obtain bus current related signals - TP1 on PC 300 to TPG on PC 500 or enclosure (0 + 5V range).

(b) To obtain rate-of-rise of starting currents - PC 800 test receptacle S850, pin B to pin E (0 + 2V range).

See also IB-16.4.1.7-2 for additional discussion of rate-of-rise settings. Refer to RC-3086 instructions for further information.

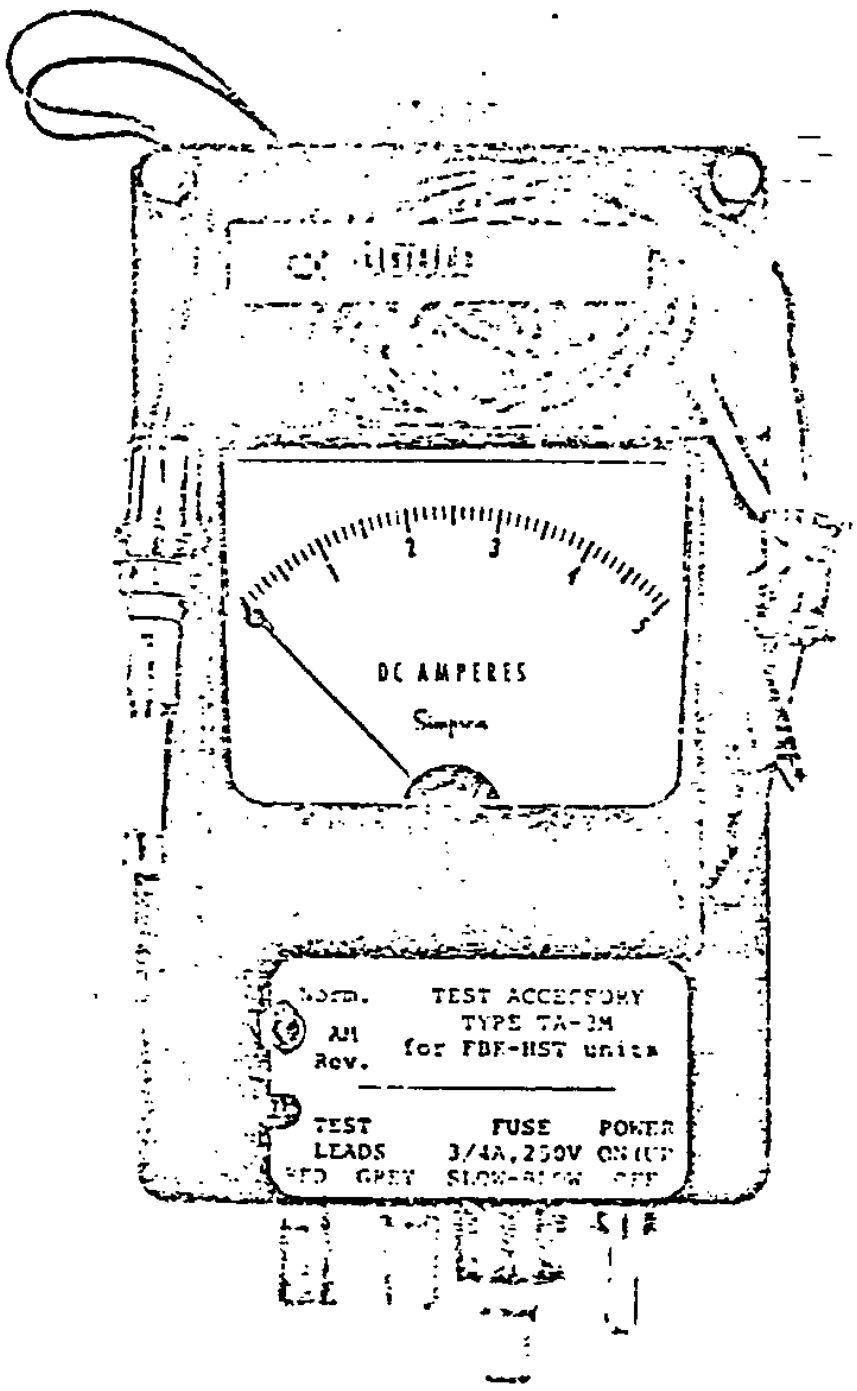

Fig. 1. Test Accessory Type TA-3M
for FBK-HST Units

TABLE I. HST EVALUATION TROUBLESHOOTING GUIDE
(TA-3M Test Accessory)

Abbreviations:

sv - steady value, constant
p> - peak decaying to ...
Divider - test points TP1 (PC 400) to TPG (PC 500) or enclosure.
HV - high voltage across capacitor C1
IT - instantaneous trip (OC)
R/R - rate-of-rise trip
NTPL - "A-C No trip on CP loss" HST
TPL - "A-B Trip on CP loss" HST
CB - circuit breaker
HST - High Speed Trip Unit (76 HS)
PC - printed circuit board assembly
CP - control power
C600 - high voltage panel assembly
Q403, D501, R604 - component device No's.

CONTROL CURRENT & CONDITIONS	CHECK & SYMPTOMS	POSSIBLE CAUSES
1.0 1.4-1.7A p> 0.3A. sv in 4-5 sec. Fuse intact. HST hums. Meas. and waveforms normal.	1.0 Press Test PB to verify normal recharging cycle. Divider: 11 Vdc. HV 2200-2400 Vdc.	1.0 Normal operation Inverter frequency 450-500 Hz.
2.0 1.4-1.7A p> 0.3A. sv Fuse intact. HST hums. CB cannot be closed.	2.0 Test PB's oper. normally. Divider: 11V. HV normal. Relay does not pick up at 1800V (divider: approx. 9V)	2.0 Misadjusted R412 Replace PC 400.
3.0 1.4-1.7A p> 0.3A. sv HST discharges intermittently or hum changes.	3.0 HST sensitive to shock.	3.0 Cards not plugged in properly. Poor cable or wiring connections. Fuse contact intermittent.
4.0 1.4-1.7A p> 0.3A. sv Fuse intact. HST hums. CB closing normal.	4.1 IT Test PB inoperative. Divider: 11V. HV normal.	4.1 Q301 or others. Replace PC 300 or PC 300X.
	4.2 R/R Test PB inoperative.	4.2 Q801 or others. Replace PC 800

CONTROL CURRENT & CONDITIONS	CHECK & SYMPTOMS	POSSIBLE CAUSE
5.0 <u>1.4-1.7A p> 0.3A. sv</u> Fuse intact. HST hums. CB cannot be closed.	5.1 Test PB's inoperative. Divider: 1.0V HV & LV supplies normal. 5.2 In NTPL units: Divider: 0.8V. -15V supply defective. 5.3 In TPL units: Divider: 1.8V. +15V supply defective. 5.4 In NTPL units. Divider: 9.5V. +15V supply defective.	5.1 Q403 or others. Replace PC 400. 5.2 D502 or others. Replace PC 500. 5.3 D501 or others. Replace PC 500. 5.4 D501 or others. Replace PC 500.
6.0 <u>Current off scale</u> Fuse opens instantaneously.	6.0 Inspect HST wiring.	6.0 Harness or connector short. Consult factory.
7.0 <u>2.5-3A sv</u> Fuse opens in 2-4 sec.	7.0 Divider: zero. Regulator input defective.	7.0 D105, C101, RV101 (MOV) or others. Do not replace PC 100 unless Case 8.0 can be excluded.
8.0 <u>2.3-2.5A sv</u> Fuse opens in 3-5 sec.	8.0 Divider: zero. Regulator defective.	8.0 Q101 (Heat sink) and D101. Remove PC 100. Check Q101 and D101 with an ohmmeter (IX Scale) Consult factory.
9.0 <u>1.8-2A sv</u> Fuse opens in 5-8 sec.	9.0 Divider: zero. C600 (HV) defective.	9.0 T601, C1 (HV) or other shorts. Consult factory.

CONTROL CURRENT & CONDITIONS	CHECK & SYMPTOMS	POSSIBLE CAUSES
10.0 1.6-1.8A sv Fuse opens in 5-10 sec.	10.0 Divider: 2-3V. HV or inverter defective.	10.1 Q201 or others. Replace PC 200. 10.2 D601, Q601 (spark gap) or others. Consult factory.
11.0 1.6-1.8A p> after fast decay to 0.6-0.7A. sv in 2 sec. may jump to 2.3-2.5A. Erratic hum. Fuse intact, but may blow.	11.0 Divider voltage rises rapidly. Deenergize immediately to prevent Case 8.0. Regulator defective.	11.0 Q101 (collector-emitter). Remove PC 100. Check Q101 with an ohmmeter (IX Scale). Consult factory. (See Case 8.0)
12.0 1.2-1.3A p> 0.4A sv in 7-8 sec. Fuse intact. Noise starts at high pitch, settles at low hum.	12.0 Test PB's operational. Divider: 11V. HV normal. Inverter frequency 100-200 Hz.	12.0 D103 or others. Replace PC 100.
13.0 0.9A p> 0.4-0.5A sv Fuse intact. HST hums.	13.0 Test PB's operational. Divider: 12.5-13V or 9-10V. Inverter load single-sided.	13.0 T601, wiring or others. Replace PC 200. Consult factory.
14.0 0.25A sv Fuse intact. HST hums.	14.0 Test PB's inoperative. Divider: fast rise to 9.5-10V. HV (C1) zero.	14.0 R604. Consult factory.
15.0 0.05A sv Fuse intact. HST hums.	15.0 Test PB's inoperative. Divider: zero. HV zero. LV supplies zero.	15.0 T601 or wiring. Consult factory.

CONTROL CURRENT & CONDITIONS	CHECK & SYMPTOMS	POSSIBLE CAUSE
16.0 1.4-1.7A p> 0.3A sv Fuse intact. HST hums. CB does not trip.	16.0 Test PB's drop divider and HV normally. HST recharges.	16.0 HV cable not connected.
17.0 Zero Current Fuse holder not lit. CB cannot be closed.	17.0 HST unit not energized.	17.0 LV cable not connected. Frame fuse or switch open.
18.0 1.4-1.7A p> 0.3A sv Fuse intact. HST hums. CB closing normal. NTPL unit trips on CP loss.	18.0 Testing normal. Review switchboard wiring and system operation.	18.0 Replace PC 400. PC 400 jumper should be A-C.
19.0 1.4-1.7A p> 0.3A sv Fuse intact. HST hums. CB closing normal. TPL unit does not trip on CP loss.	19.0 Testing normal. Trip circuit not connected to divider.	19.0 Replace PC 400. PC 400 jumper should be A-B.
20.0 Charging normal. CB trips while in service.	20.0 Testing normal. No power system faults.	20.0 Observe bus (load) ammeters during car or train startup and HST response. Change tap plug settings.