

MASTER TIMING CIRCUIT SD-25633-01

OPERATION TESTS

STEP-BY-STEP OFFICES ARRANGED FOR AMA

AND STEP-BY-STEP INTERTOLL DIALING OFFICES ARRANGED FOR CAMA

1. GENERAL

PAGE

1.01 This section describes a method of testing the master timing circuit SD-25633-01.

1.02 This section is reissued to remove fuse alarm relay FA1 from Test P, add Test Q, and generally bring it up to date. Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

1.03 The tests covered are:

PAGE

A. Time Indication Check: This test checks that the selectors of the master timing circuits are in the correct positions, with reference to the month, day, hour, and minute. 5

B. End-of-Tape Features: The following features are checked. (1) That the master timing circuit provides the correct information in the proper sequence when perforating the recorder tapes for recorder transfer, make-busy, or window patterns. (2) That perforator lead information and progress indications are transmitted to the trouble ticketer when the master timing circuit is blocked because of a trouble condition. (3) That recorder transfer, make-busy, or window patterns cannot be made during the last 12 seconds of any hour when "ZD" wiring option is provided in the master timing circuit. (4) That the length of splice pattern is increased when a tape window is encountered while perforating the splice pattern of a recorder transfer or make-busy pattern. (5) That an additional splice pattern and tape identity group is perforated when a tape window is encountered during the perforation of the second tape identity group of a recorder transfer or

make-busy pattern. (6) That the master timing circuit furnishes the end-of-tape information under local control after a time-out has occurred due to the inability of the master timing and recorder circuits to complete the perforation of an end-of-tape pattern in the regular manner. 5

C. Routine End-of-Tape Record: This test checks the ability of the master timing circuit to control the perforation of the 3:00 A.M. End-of-Tape entries and also checks the recorder start sequence for all recorders with which it is normally associated. 13

D. Grouping Features: This test checks the grouping features in which the functions of providing perforating information for recorders under conditions of transfer, make busy, splice, and end of tape are taken over by one master timing circuit when the other master timing circuit is busy. 14

E. Selector Position and Check Lamp Features: This test checks the following features of the master timing circuit. (1) That correct information is provided to the recorders for every position of every selector with respect to month, day, and hour. (2) That the check lamps provide the correct indication for each position of the selectors. (3) That the correct information is provided for the hour and minutes on the trouble ticket. (4) That unsynchronized selectors in the master timing circuit may be synchronized. 15

F. Preference and Lock-Out Features: This test checks the preference and lock-out features of the start relays. Also, a check is made of the start chain circuit for continuity and freedom from crosses. 23

	PAGE		PAGE
G. Selector Exercise Features: This test checks the operation of the master timing circuit selectors by using the exercise keys.....	25	M. Time-Out Alarm Features: The following features are checked. (1) That an alarm is indicated at the trouble ticketer frame upon failure to complete the recording of a make-busy transfer, window splice or a 3:00 A.M. End-of-Tape pattern. (2) That the long time-out feature as applied to make-busy transfer and window splice patterns brings in the major alarm in 18 to 30 seconds. (3) That the splice pattern of 3:00 A.M. End-of-Tape patterns is timed for a 66- to 78-second period. (4) That the long time-out feature as applied to the 3:00 A.M. End-of-Tape pattern brings in the trouble ticketer within 78 to 90 seconds in case of failure of the short time-out feature. (5) That the auxiliary long time-out feature will provide a trouble indication in 2 to 5 minutes when a failure occurs in the long time-out as applied to a 3:00 A.M. End-of-Tape pattern.....	31
H. Pulse Failure Alarm: This test checks that an alarm will operate when the TE or TO timer fails to provide a pulse every 6 seconds to step the selectors of the master timing circuits and the recorders. A check is made that the audible part of the alarm may be silenced when desired.....	26	N. Perforator Lead Cross-Detection Feature: This test checks the ability of the master timing circuit to: (1) Detect false battery or ground on the perforator leads to the recorders. (2) Detect false ground on the perforator leads within the master timing circuit. (3) Call in the trouble ticketer to register trouble conditions detected by the standing test. (4) Make itself busy under control of the AR key when it has detected a trouble on one or more of the perforator leads.....	34
I. Transfer Control Features and Timer Synchronism Failure Alarm: This test checks that an alarm will be brought in if the TE and TO timers are out of synchronism. A check is made that the audible part of the alarm may be silenced when desired. A check is also made of the feature that drops a pulse when a transfer from one master timing circuit to the other is made at a time when the TE and TO timers are out of synchronism.....	26	O. End-of-Tape Failure Alarm Test: This test checks that a major alarm sounds in case the master timing circuit fails to start the 3:00 A.M. End-of-Tape record.....	36
J. Selector Synchronism Check and Selector Synchronism Check Failure Alarms: This test checks that the selectors are checked for synchronism each minute and that an alarm will be brought in if one or more selectors associated with a master timing circuit or recorder are out of synchronism with the corresponding selector of the controlling master timing circuit. Checks are made that the hour entry will not be perforated when a selector synchronism failure alarm occurs and that the audible part of the alarm may be silenced when desired.....	28	P. Fuse Alarm Relays (FA) and Make-Busy Feature: This test checks that the master timing circuit is made busy when one of its 48-volt supply fuses or its +130 volt supply fuse operates.....	37
K. Both Master Timing Circuits Make-Busy Alarm: This test checks that an alarm will be brought in if the CMBE and CMBO keys are both operated at the same time.....	30	Q. LT1- LT9 (Long Timer) Test: This test checks the LT1- LT9 chain circuit of the master timer.....	38
L. Timer Start Control: This test checks the ability of the TE or TO timer to start and run in synchronism with its mate timer when one of the timers has been stopped.....	30		

1.04 Tests covered in this section should not be made during the time any recorders are perforating the 3:00 A.M. End-of-Tape entry.

1.05 The performance of Tests B, E, and M can result in the loss of charge records for service calls.

1.06 Tests B, D, E, M, and N require actions and verifications at the trouble ticketer frame and the master timing frame at the same time.

1.07 A different recorder should be used each time that Test B is performed so that eventually all recorders will have been tested.

1.08 If Test B or M indicates trouble in the timing network of the SP or TM2 cold cathode tube, check the timing interval as covered in the circuit requirements table.

1.09 The term "trouble record" used in this section means a printed trouble ticket.

1.10 Reference should be made to Section 227-455-300 which covers precautions to limit stoppages at the accounting center caused by central office tape irregularities.

1.11 A regular recorder should not be transferred to the emergency recorder during the interval from 5 minutes before to 5 minutes after any hour or more than once during the same hour.

1.12 Before starting any test which will cause the perforation of transfer, make-busy, window splice patterns, or trouble entries on the associated tape, use a red china marking pencil and draw a line across the unperforated tape at the point where it enters the chute. On completion of testing, proceed as follows at the associated perforator.

- (1) Raise the slack alarm and hook it over the catch provided.
- (2) Pull back some slack in the tape and disengage the tape from the tape guides.
- (3) Using a red china marking pencil, place two large crosses on the smooth side of the tape over the lower of the two diamond patterns, that is, the diamond pattern farthest from the perforator drum.

(4) Find the red mark placed on the tape at the start of testing. Then mark two large crosses on the smooth side of the tape so that the center of the crosses is 4-1/2 inches from the red mark in a direction away from the perforator drum.

(5) Replace the tape in the tape guides and remove the slack tape arm from the catch.

(6) Record on the accounting center notification form the recorder group, recorder number, date, time, and a note that the tape was marked with red crosses to indicate that all entries between these crosses should be skipped.

1.13 In Part 3 of this section, only those trouble verifications, lamps and alarms requiring verification as part of the test are listed.

1.14 To silence trouble ticketer alarm and to extinguish the associated TTR or TT lamp, momentarily operate the TRR-AR or AR key. The alarm release may be handled by remote control also. This is done by patching the AR jack to the SP jack at the trouble ticketer and test frame. To restore the alarm, momentarily insert a 349A plug into the SP jack associated with the frame at which the test is being made.

1.15 In some step-by-step offices, instead of a major alarm as herein indicated, a minor alarm will result.

1.16 **Lettered Steps:** A letter a, b, c, etc, added to a step number in Part 3 of this section indicates an action which may or may not be required, depending on local conditions. The condition under which a lettered step or series of lettered steps should be made is given in the ACTION column, and all steps governed by the same condition are designated by the same letter within a test. Where a condition does not apply, all steps designated by that letter should be omitted.

2. APPARATUS

2.01 The apparatus required for each test is shown in Table A. The details of each item are covered in the paragraph indicated by the number in parentheses.

TABLE A

APPARATUS	TESTS														
	A	B	C	D	E	F	H	I	J	M	N	O	P	Q	
322A (Make-busy) Plug	√	√	√	√	√	√	—	√	—	√	—	—	—	—	
KS-3008 Stopwatch or Equivalent	1	1	—	—	—	—	1	1	1	1	—	—	—	—	
32A (Remote Control) Test Set	—	1	—	—	1	—	—	—	—	1	—	—	—	—	
Cord (2.02)	—	—	—	—	—	2	—	—	—	—	—	—	—	—	
Cord (2.03)	—	1	—	—	—	—	1	—	1	—	—	—	—	—	
Cord (2.04)	—	—	—	—	—	—	—	—	—	1	—	—	—	1	
Cord (2.05)	—	—	—	—	—	—	—	—	—	—	1	1	—	—	
Test Receiver (2.06)	—	—	—	—	—	1	—	—	—	—	—	—	—	—	
Red Pencil (2.07)	—	1	—	—	1	—	—	—	—	1	—	—	—	—	
Tools (2.08)	—	√	—	—	√	√	√	√	—	√	√	—	√	√	
Cord (2.09)	—	—	—	—	—	—	—	—	—	—	√	—	√	—	
349A Plug	—	√	—	—	√	—	—	—	—	—	√	—	—	—	

√ As required.

2.02 Testing cord, 893 cord, 6 feet long, equipped with two 360A tools (1W13B cord), one KS-6278 tool, and one 509A tool (for use in establishing test connections to relay windings).

2.03 Testing cord, 893 cord, 6 feet long, equipped with two 360A tools (1W13B cord), one KS-6278 tool, and one 419A tool (for use in establishing test connections to relay springs).

2.04 Testing cord, 893 cord, 3 feet long, equipped with two 360A tools (1W13A cord) and two 419A tools (for use when interconnecting relay springs).

2.05 Testing cord, 893 cord, 6 feet long equipped with two 360A tools (1W13B cord), one KS-6278 tool, and one 411A tool (for use in establishing momentary test connections to relay springs and selector brushes).

2.06 716C receiver, attached to a W2AB cord, equipped with two 360A tools (2W21A cord), one KS-6278 tool, and one 411A tool (for use in checking the presence or absence of battery or ground).

2.07 Red china marking pencil.

2.08 Blocking and insulating tools as required. Use tools and apply, as covered in Section 069-020-801.

2.09 Testing cord, 893 cord, 6 feet long, equipped with two 360A tools (1W13B cord), one KS-6278 connecting clip, and one 411A tool (test pick used for applying battery and ground to terminal strip punchings).

3. METHOD

STEP	ACTION	VERIFICATION
A. Time Indication Check		
1	At master timing frame — Operate CKL key.	M-, DT-, DU-, HT-, HU- lamps lighted. Check lamps indicate correct month, day tens, day units, hour tens, hour units, respectively.
2	Start stopwatch precisely at beginning of any minute as shown on building master clock or other time source known to be accurate, note time in minutes on clock.	
3	At moment when U- check lamp is extinguished — Stop stopwatch.	Note H-, T-, U- lamps lighted. Check whether time in minutes and seconds on stopwatch plus time in minutes noted on building master or reference clock agree within 30 seconds of time indicated by lighted H-, T-, U- lamps.
4	Restore CKL key.	
5a	If time indication is incorrect by more than 30 seconds — Reset master timing circuits to correct time as described in Section 227-400-300 under "Pulse Failure Alarm".	

B. End-of-Tape Features

Caution: *The charge records on recorder tapes for service calls made during the time this test is in progress cannot be properly processed by the accounting center, and the tapes are marked for the accounting center to disregard the tape area covering both service call entries as well as improper test entries.*

1	Select an AMA recorder associated with master timing circuit to be tested, mark tape as indicated in 1.12.	
2	At master timing circuit under test — Block nonoperated P3A relay.	
3	At trouble ticketer frame — Insert 322A plug into recorder MB jack associated with AMA recorder being used for testing. At master timing circuit when TIB relay operates — Remove blocking tool from P3A relay.	Trouble record with indications as listed in Table F for P3A relay.

SECTION 227-400-500

STEP	ACTION	VERIFICATION
4	At master timing circuit under test — Block nonoperated P4A relay.	
5	At trouble ticketer frame — Remove 322A plug inserted in Step 3. At master timing circuit under test when TIB relay operates — Remove blocking tool from P4A relay.	Trouble record with indications as listed in Table F for P4A relay.
6	At master timing frame under test — Block nonoperated P5A relay.	
7	At trouble ticketer frame — Insert 322A plug into recorder MB jack associated with AMA recorder being used for testing.	
8	Remove 322A plug inserted in Step 7.	At master timing frame under test — MO relay operates, releases twice.
9	At AMA recorder being used for testing — Block nonoperated U relay.	
	<i>Note:</i> This may cause a selector synchronism failure alarm (at master timing frame, SSF lamp lighted). If this occurs, momentarily operate the ACO key at the master timing frame to retire the audible alarm.	
10	Repeat Step 3, substituting P5A relay for P3A relay.	Trouble record with indications as listed in Table F for P5A relay.
11	At AMA recorder being used for testing — Remove blocking tool from U relay.	
12a	If SSF lamp is lighted at master timing frame — Momentarily operate AR key.	SSF lamp extinguished.
13	Repeat Steps 4 and 5, substituting P6A for P4A relay.	Trouble record with indications as listed in Table F for P6A relay.
14	Repeat Steps 2 through 5, substituting P7A for P3A relay and P8A for P4A relay.	Trouble record with indications as listed in Table F for P7A and P8A relays.
15	Repeat Steps 2 and 3, substituting COP for P3A relay.	Trouble record with indications as listed in Table F for COP relay.
16	At master timing circuit under test — Block nonoperated SS relay.	

STEP	ACTION	VERIFICATION
17	At trouble ticketer frame — Remove 322A plug from recorder MB jack associated with AMA recorder being used for testing.	
18	At master timing circuit under test — Remove blocking tool from SS relay and simultaneously start stopwatch.	
19	When TSP relay operates — Stop stopwatch.	Elapsed time within 2.5 to 4.5 seconds.
20	Repeat Steps 2 and 3 substituting P1A for P3A relay.	Trouble record with indications as listed in Table F for P1A relay.
21b	If P2A relay is provided — Repeat Steps 4 and 5 substituting P2A for P4A relay.	Trouble record with indications as listed in Table F for P2A relay.
22c	If P2A relay is not provided — Remove 322A plug from recorder MB jack associated with AMA recorder being used for testing.	
23	At perforator associated with emergency recorder, or the other regular recorder where trunk transfer is used — Mark tape as indicated in 1.12.	
24	At trouble ticketer frame — Insert 322A plug into recorder TN or RTN jack associated with AMA recorder being used for testing.	At master timing circuit under test — MO relay operates, releases four times. At emergency recorder frame — EW lamp lighted.
25	Remove 322A plug inserted in Step 24.	At master timing circuit under test — MO relay operates, releases four times. At emergency recorder frame — EW lamp extinguished.
26	At master timing circuit under test — Block nonoperated P5A relay.	
27	At trouble ticketer frame — Insert 322A plug into recorder TN or RTN jack associated with AMA recorder being used in testing. At master timing circuit when TIB relay operates — Remove blocking tool from P5A relay.	Trouble record with following indications: perforator magnets A- through F- representing numerals 285500, TV, PT, PAK, P1, RD, A, RT, BSP, DA, HR, SC, and SY, also P (if XA wiring is provided), or Table F B27.

SECTION 227-400-500

STEP	ACTION	VERIFICATION
28	At trouble ticketer frame — Remove 322A plug inserted in Step 27.	
29	At master timing circuit under test — Block nonoperated P5A relay.	
30	At AMA recorder used for testing — Block nonoperated U relay.	
	<i>Note:</i> This may cause a selector synchronism failure alarm (at master timing frame, SSF lamp lighted). If this occurs, momentarily operate the ACO key at the master timing frame to retire the audible alarm.	
31	At trouble ticketer frame — Insert 322A plug into recorder TN or RTN jack associated with AMA recorder being used for testing. At master timing circuit under test, when TIB relay operates — Remove blocking tool from P5A relay.	Trouble record with following indications: perforator magnets A- through F- representing numerals 285700, TV, PT, PAK, P1, RD, A, RT, BSP, DA, HR, SC, and NS, also P (if XA wiring is provided), or Table F, B31.
32	At AMA recorder being used for testing — Remove blocking tool from U relay.	
33a	If SSF lamp is lighted at master timing frame — Momentarily operate AR key.	SSF lamp extinguished.
34	At trouble ticketer frame — Remove 322A plug inserted in Step 31.	
35	At master timing circuit under test — Block nonoperated P6A relay.	
36	At trouble ticketer frame — Insert 322A plug into recorder TN or RTN jack associated with AMA recorder being used for testing. At master timing circuit under test when TIB relay operates — Remove blocking tool from P6A relay.	Trouble record with following indications: perforator magnets A- through F- representing numerals 2805XX with XX representing the recorder number; also the TV, PT, PT1, PAK, P1, RD, A, RT, BSP, DA, HR, SY, SC, and RN, also P (if XA wiring is provided), or Table F, B36.
37	At master timing circuit under test — Block nonoperated P6A relay.	

STEP	ACTION	VERIFICATION
38	At trouble ticketer frame — Remove 322A plug inserted in Step 36. At master timing circuit under test when TIB relay operates — Remove blocking tool from P6A relay.	Trouble record with following indications: perforator magnets A- through F- representing numerals 2806XX with XX representing the recorder number; also the TV, PT, PT1, PAK, P1, RD, B, RT, BSP, DA, HR, SY, SC, and RN also P (if XA wiring is provided), or Table F, B38.
39	At trouble ticketer frame — Insert 322A plugs into recorder MB and recorder TST or T jacks associated with the emergency recorder or the other regular recorder where trunk transfer is used.	
40	Insert plug of 32A test set into R jack.	
41	Momentarily depress white button of 32A test set.	RUT lamp lighted while test entries are perforated.
42	When RUT lamp is extinguished — Depress white button of 32A test set.	RUT lamp lighted while test entries are perforated.
43	When RUT lamp is extinguished — Remove plugs from recorder MB and recorder TST or T jacks and plug of 32A test set from R jack inserted in Steps 39 and 40.	
44	At perforator associated with emergency AMA recorder or the other regular recorder where trunk transfer is used — Mark tape and proceed as indicated in 1.12.	
45d	At master timing frame — If "ZD" option is provided — Operate TT key to O position, operate CMBE key.	
46d	Insulate 9-10B of PE relay.	
47d	Block nonoperated HRT relay.	
48d	Operate, release UH relay successively until U selector reaches position 9.	
49d	Operate, release TH relay successively until T selector reaches position 10.	

SECTION 227-400-500

STEP	ACTION	VERIFICATION
50d	Operate, release HH relay successively until H selector reaches position 6.	SR, PRE relays operated.
51d	Operate, release HH relay successively until H selector reaches position 13.	SR, PRE relays operated.
52d	Operate, release HH relay successively until H selector reaches position 20.	SR, PRE relays operated.
53d	Operate, release TH relay successively until T selector reaches position 20.	SR, PRE relays operated.
54d	Block nonoperated TH relay.	
55d	Operate, release UH relay successively until U selector reaches position 10.	SR, PRE relays operated.
56d	Operate, release UH relay successively until U selector reaches position 19.	SR, PRE relays operated.
57d	Operate, release UH relay to step U selector to position 20.	SR, PRE relays operated.
58d	Remove blocking tool from HRT relay.	HRT relay operated.
59d	Remove blocking tool from TH relay and insulator from PE relay.	
60d	Operate CKL key.	
61d	Momentarily operate S key.	SO lamp lighted.
62d	When SO lamp is extinguished — Restore CMBE and CKL keys.	
63d	Operate TT key to E position and operate CMBO key.	
64d	Insulate 9-10B of PO relay.	
65d	Block nonoperated HRT relay.	
66d	Repeat Steps 48d through 58d for odd master timing circuit.	SR, PRO relays operated.
67d	Remove blocking tool from HRT relay and insulator from PO relay.	
68d	Operate CKL key.	
69d	Momentarily operate S key.	SE lamp lighted.

STEP	ACTION	VERIFICATION
70d	When SE lamp is extinguished — Restore CMBO and CKL keys.	
71	Block nonoperated P3A relay.	
72	At AMA recorder used for testing — Momentarily operate SP relay. At master timing circuit under test when TIB relay operates — Remove blocking tool from P3A relay.	Trouble record with following indications: perforator magnets A- through F- representing numerals 2821XX with XX representing the day tens and day units corresponding to the day of the month; also the TV, PT, PAK, P1 RD, SP, RT, BSP, DA, and SY, or Table F, B72.
73	At AMA recorder used for testing — Block operated SP relay.	At AMA recorder frame — NP lamp lighted. Aisle pilot lamp lighted. Major alarm sounded.
74	Remove blocking tool from SP relay.	
75	Momentarily operate AR key.	NP lamp extinguished. Aisle pilot lamp extinguished. Major alarm silenced.
	<i>Note:</i> Steps 76 and 77 should be performed in rapid succession.	
76	At trouble ticketer frame — Insert 322A plug into recorder MB jack associated with AMA recorder used for testing.	At master timing circuit under test — SS relay operated.
77	At master timing circuit under test — When SS relay operates — Immediately start stopwatch.	TSP relay operated momentarily.
78	When TSP relay operates — Immediately stop stopwatch.	Note elapsed time on stopwatch.
79	At trouble ticketer frame — Remove 322A plug from recorder MB jack inserted in Step 76.	At master timing circuit under test — SS relay operated.
80	At master timing circuit under test — When SS relay operates — Immediately start stopwatch and 1.5 seconds later, operate SP relay.	TSP relay operated momentarily.
81	When TSP relay operates — Immediately stop stopwatch.	Elapsed time indicated on stopwatch is 1.5 seconds greater than elapsed time noted in Step 78.

SECTION 227-400-500

STEP	ACTION	VERIFICATION
82	Block operated ESP relay.	
83	Connect ground to 10B of RLS relay.	
84	Operate, release RCT relay.	ROS, SP relays operated, then released.
85	Remove test connection from RLS relay.	
86	Remove blocking tool from ESP relay.	
	<i>Note:</i> Steps 87 and 88 should be performed in rapid succession.	
87	At trouble ticketer frame — Insert 322A plug into recorder MB jack associated with AMA recorder used for testing.	At master timing frame — ESP relay operated.
88	At master timing circuit under test — When ESP relay operates — Momentarily operate ROS relay immediately.	ESP relay operated second time.
89	Insulate 8B of LC1 relay.	
90	At trouble ticketer frame — Remove 322A plug inserted in Step 87.	Trouble record with following indications: perforator magnets A- through F- representing numerals 2821XX with XX representing the day tens and day units; also the TV, PT, PAK, P1, RD, E, RT, BSP, DA, and SY, or Table F, B90.
91	At master timing circuit under test — Remove insulator from LC1 relay.	
92	At trouble ticketer frame — Insert 322A plugs into recorder MB and recorder TST or T jacks associated with AMA recorder being used for test.	
93	Insert plug of 32A test set into R jack.	
94	Momentarily depress white button of 32A test set.	RUT lamp lighted while test entries are perforated.
95	When RUT lamp is extinguished — Momentarily depress white button of 32A test set.	RUT lamp lighted while test entries are perforated.

STEP	ACTION	VERIFICATION
96	When RUT lamp is extinguished — Remove 322A plugs from recorder MB and recorder TST or T jacks and plugs of 32A test set from R jack inserted in Steps 92 and 93.	
97	At perforator associated with AMA recorder being used for testing — Mark tape and proceed as indicated in 1.12.	

C. Routine End-of-Tape Record

Caution: Do not make this test during the 5 minutes before or after any hour.

1a	If testing even master timing circuit — At master timing frame — Insert 322A plug into RETE jack.	At trouble ticketer frame — RCDR- or R- lamp for highest even-numbered recorder lighted for approximately 5 seconds followed by similar action for each of lower even-numbered recorders. Also MTE lamp lighted during entire period of test.
		Note: If any initial, answer, or disconnect entries for service calls occur during this test, they may be distinguished from the end-of-tape entries by the lighting of the RCDR- or R- lamp for a period of less than 1 second and should be disregarded.
2a	At master timing circuit — Remove plug from RETE jack.	
3b	If testing odd master timing circuit — At master timing frame — Insert 322A plug into RETO jack.	At trouble ticketer — RCDR- or R- lamp for highest odd-numbered recorder lighted for approximately 5 seconds followed by similar action for each of lower odd-numbered recorders and the EMG RCDR R or EMG R lamps; also MTO lamp lighted during entire period of this test.
		Note: If any initial answer or disconnect entries for service calls occur during this test, they may be distinguished from the end-of-tape entries by the lighting of the RCDR- or R- lamp for a period of less than 1 second and should be disregarded.
4b	At master timing circuit — Remove plug from RETO jack.	

STEP	ACTION	VERIFICATION
D. Grouping Features		
Caution: Do not make this test during the 5 minutes before or after any hour.		
1	At master timing frame — Operate CMBE key.	At master timing frame — CMBE lamp lighted. At trouble ticketer frame — CMBE lamp lighted.
Caution: This test requires the use of both master timing circuits, therefore, do not make this test if the CMBE or CMBO key is found operated. Determine if satisfactory to restore operated key, or clear the trouble, then restore the operated key before proceeding with the test.		
2	Insert and immediately remove 322A plug from RETO jack.	At trouble ticketer frame — RCDR-, EMG RCDR R, R-, or EMG R lamp lighted for approximately 5 seconds for each recorder in following sequence. Highest odd-numbered recorder to lowest odd-numbered recorder, emergency recorder, highest even-numbered recorder to lowest even-numbered recorder.
3	At trouble ticketer frame — Insert 322A plug into recorder MB jack for an even-numbered recorder.	At master timing frame — MO relay in odd master timing circuit operates and releases twice.
4	At trouble ticketer frame — Remove plug from recorder MB jack.	
5	At master timing frame — Restore CMBE key.	CMBE lamp extinguished.
6	Operate CMBO key.	At master timing frame — CMBO lamp lighted. At trouble ticketer frame — CMBO lamp lighted.
7	At master timing frame — Insert and immediately remove 322A plug from RETE jack.	At trouble ticketer frame — RCDR-, EMG RCDR R, R-, or EMG R lamp lighted in same sequence as for Step 2.
8	At trouble ticketer frame — Insert 322A plug into recorder MB jack for an odd-numbered recorder.	At master timing frame — MO relay in even master timing circuit operates, releases twice.

STEP	ACTION	VERIFICATION
9	Remove plug from recorder MB jack.	
10	At master timing frame — Restore CMBO key.	CMBO lamp extinguished.

E. Selector Position and Check Lamp Features

Caution: *The charge records on recorder tapes for service calls made during the time this test is in progress cannot be properly processed by the accounting center, and the tapes are marked for the accounting center to disregard the tape area covering both service call entries as well as improper test entries.*

- 1a If testing even master timing circuit —
Operate TT key to E position.
- 2b If testing odd master timing circuit —
Operate TT key to O position.

Caution: *Do not perform the following steps during the 5 minutes before or after any hour to prevent interference with the placing of the hour record on the recorders. If the test is in progress at 55 minutes after the hour, or it becomes necessary to apply a make-busy or transfer pattern to any of the recorders served by the master timing circuit not under test, operate the TT key to the opposite position to that established for the test. The test may be resumed 5 minutes after the hour, or when the transfer or make-busy operation is completed by again operating the TT key to the position established for the test.*

- 3a If testing even master timing circuit —
Examine unperforated tape of each odd-numbered AMA recorder and of the emergency recorder or the other regular recorders where trunk transfer is used, if it is serving in place of an odd recorder, for a distance of approximately 3 feet from input chute.
- Absence of splices in unperforated tapes.

SECTION 227-400-500

STEP	ACTION	VERIFICATION
4b	If testing odd master timing circuit — Examine unperforated tape of each even-numbered AMA recorder and of the emergency recorder or the other regular recorders where trunk transfer is used, if it is serving in place of an even recorder, for a distance of approximately 3 feet from input chute.	Absence of splices in unperforated tapes.
5c	If splice in unperforated tape is found — At trouble ticketer frame — Insert, remove 322A plug from recorder MB jack associated with AMA recorder, as required, to advance splice beyond perforator drum.	
6	Select AMA recorder associated with master timing circuit to be tested, mark associated tape as indicated in 1.12.	
7	At master timing frame — Operate CKL key.	
	Note: While performing the following steps, the selectors of all recorders and the master timing circuit not in control will be out of synchronism with the master timing circuit under test, thereby bringing in the SSF alarm and lighting the OS- lamps for all recorders and the OSE or OSO lamp. When the major alarm sounds and the SSF lamp lights, operate the ACO key at the master timing frame momentarily to silence the alarm.	
8	At master timing circuit under test — Block nonoperated P7A relay.	
9	Operate, release MOH relay successively until M selector reaches position 1.	M1 check lamp lighted.
10	At trouble ticketer frame — Insert 322A plug into recorder MB jack associated with AMA recorder being used for testing. At master timing circuit under test when TIB relay operates — Remove blocking tool from P7A relay.	Trouble record with following indications: perforator magnets A- through F- representing numerals 283X01 (X representing day units and may be disregarded for this test). (Trouble ticket — magnets A- through F- are in positions 24 through 29.)
11	At trouble ticketer frame — Remove 322A plug inserted in Step 10.	

STEP	ACTION	VERIFICATION
12	Repeat Steps 8 through 11 for each of M selector positions 2 through 12.	Same as Steps 9, 10 with M-check lamp and E, F indications corresponding to position of M selector.
13	At master timing circuit under test — Block nonoperated P3A relay.	
14	Operate, release DTH relay successively until DT selector reaches position 1.	DT0 check lamp lighted.
15	Operate, release DH relay successively until DU selector reaches position 1.	DU1 check lamp lighted.
16	At trouble ticketer frame — Insert 322A plug into recorder MB jack associated with AMA recorder being used for testing. At master timing circuit under test when TIB relay operates — Remove blocking tool from P3A relay.	Trouble record with following indications: perforator magnets A- through F- representing numerals 282101. If trouble recorder is provided — Perforations representing day tens 0 and day units 1 also. (Trouble tickets — magnets A- through F- are in positions 24 through 29.)
17	Momentarily operate RL key.	
18	At trouble ticketer frame — Remove 322A plug inserted in Step 16.	
19	At master timing circuit under test — Block nonoperated P7A relay.	
20	At trouble ticketer frame — Insert 322A plug into recorder MB jack associated with AMA recorder being used for test. At master timing circuit under test when TIB relay operates — Remove blocking tool from P7A relay.	Trouble record with following indications: perforator magnets A- through F- representing numerals 2831XX (digits represented by XX may be disregarded). (Trouble ticket — magnets A- through F- are in positions 24 through 29.)
21	Momentarily operate RL key.	
22	At trouble ticketer frame — Remove 322A plug inserted in step 20.	
23	At master timing circuit under test — Block nonoperated P8A relay.	

SECTION 227-400-500

STEP	ACTION	VERIFICATION
24	At trouble ticketer frame — Insert 322A plug into recorder MB jack associated with AMA recorder being used for test. Remove blocking tool from P8A relay.	Trouble record with following indications: perforator magnets A- through F- representing numerals 28+0XX (digits represented by XX may be disregarded, digit represented by + is 4 in local offices and 9 in toll offices). (Trouble ticket magnets A- through F- are in positions 24 through 29.)
25	Momentarily operate RL key.	
26	At trouble ticketer frame — Remove 322A plug inserted in Step 24.	
27	Repeat Steps 13 through 18 but set the DU selector in position 2 as indicated in Table B.	DT-, DU- check lamps lighted and perforator magnet indications A- through F- as listed in Table B.
28	Repeat Steps 13 through 22 but set the DU selector in position 3 as indicated in Table B.	DT-, DU- check lamps and A- through F- indications as listed in Table B.
29	Repeat Steps 13 through 18 for each of DU selector positions 4 and 5 as indicated in Table B.	DT-, DU- check lamps and A- through F- indications as listed in Table B.
30	Repeat Steps 13 through 22 but set the DU selector in position 6 as indicated in Table B.	DT-, DU- check lamps and A- through F- indications as listed in Table B.
31	Repeat Steps 13 through 18 for each of DU selector positions 7, 8, 9 as indicated in Table B.	DT-, DU- check lamps and A- through F- indications as listed in Table B.
32	Repeat Steps 13 through 26, but set the DU selector in position 10 as indicated in Table B.	DT-, DU- check lamps and A- through F- indications as listed in Table B.
33	Repeat Steps 13 through 18 for each of DU selector positions 11 through 19 and the DT selector in position 2 as indicated in Table B.	DT-, DU- check lamps and A- through F- indications as listed in Table B.
34	Repeat Steps 13 through 18, 23 through 26, but set DT selector in position 3 and DU selector in position 20 as indicated in Table B.	DT-, DU- check lamps and A- through F- indications as listed in Table B.

TABLE B

REPAY BLOCKED NONOPERATED	POSITION OF SELECTORS		CHECK LAMPS LIGHTED		PERFORATOR MAGNET INDICATIONS A- THROUGH F-*	DAY INDICATIONS	
	DT	DU	DT	DU		DT-	DU-
P3A	1	1	0	1	282101	0	1
P7A	1	1	0	1	2831XX		
P8A	1	1	0	1	28+0XX		
P3A	1	2	0	2	282102	0	2
P3A	1	3	0	3	282103	0	3
P7A	1	3	0	3	2833XX		
P3A	1	4	0	4	282104	0	4
P3A	1	5	0	5	282105	0	5
P3A	1	6	0	6	282106	0	6
P7A	1	6	0	6	2836XX		
P3A	1	7	0	7	282107	0	7
P3A	1	8	0	8	282108	0	8
P3A	1	9	0	9	282109	0	9
P3A	2	10	1	0	282110	1	0
P7A	2	10	1	0	2830XX		
P8A	2	10	1	0	28+1XX		
P3A	2	11	1	1	282111	1	1
P3A	2	12	1	2	282112	1	2
P3A	2	13	1	3	282113	1	3
P3A	2	14	1	4	282114	1	4
P3A	2	15	1	5	282115	1	5
P3A	2	16	1	6	282116	1	6
P3A	2	17	1	7	282117	1	7
P3A	2	18	1	8	282118	1	8
P3A	2	19	1	9	282119	1	9
P3A	3	20	2	0	282120	2	0
P8A	3	20	2	0	28+2XX		
P3A	4	11	3	1	282131	3	1
P8A	4	11	3	1	28+3XX		

Note

Digits represented by XX may be disregarded.

Digits represented by + are as follows: No. 1 step-by-step offices -4; Step-by-step intertoll offices -9.

*Trouble ticket: magnets A- through F- are in positions 24 through 29.

STEP	ACTION	VERIFICATION
35	Repeat Steps 13 through 18, 23 through 26 but set the DT selector in position 4 and DU selector in position 11 as indicated in Table B.	DT-, DU- check lamps and A- through F- indications as listed in Table B.
36	At master timing circuit under test — Block nonoperated P4A relay.	
37	Operate, release HTH relay successively until HT selector reaches position 1.	HT0 check lamp lighted.

SECTION 227-400-500

STEP	ACTION	VERIFICATION
38	Operate, release HUH relay successively until HU selector reaches position 1.	HU0 check lamp lighted.
39	At trouble ticketer frame — Insert 322A plug into recorder MB jack associated with AMA recorder being used for test. At master timing circuit under test when relay operates — Remove blocking tool from P4A relay.	Trouble record with following indications: perforator magnets A- through F- representing numerals 281100. Indications representing hours ten 0 and hours units 0 also. (Trouble ticket — magnets A- through F- are in positions 24 through 29; hour tens and hour units are in positions 37 and 38, respectively.)
40	Momentarily operate RL key.	
41	At trouble ticketer frame — Remove 322A plug inserted in Step 39.	
42	Repeat Steps 36 through 41, but set HT selector in positions 1, 2, 3 successively and HU selector in positions 2 through 10 successively as indicated in Table C.	HT-, HU- check lamps lighted and perforator magnet indications A- through F- listed in Table C. HT-, HU- indications are listed in Table C.
43	At master timing circuit under test — Operate, release successively HH, TH, UH relays until H, T, U selectors reach position 1.	H0, T0, U0 check lamps lighted.
44	Repeat Step 43 for each of the H, T, U selector positions as indicated in Table D.	H-, T-, U- check lamps lighted as indicated in Table D.
45	Block nonoperated P3A relay.	
46	Operate, release successively HH, TH relays until H, T selectors reach position 1.	
47	At trouble ticketer frame — Insert 322A plug into recorder MB jack associated with AMA recorder being used for test. At master timing circuit under test when relay operates — Remove blocking tool from P3A relay.	Trouble record with following indications: MT0, MU0 as listed in Table E.
48	At trouble ticketer frame — Remove 322A plug inserted in Step 47.	
49	Repeat Steps 45 through 48 for each of the H and T selector positions.	Trouble record with MT-, MU- indications as listed in Table E.

TABLE C

POSITION OF SELECTORS		CHECK LAMPS LIGHTED		PERFORATOR MAGNET INDICATIONS A- THROUGH F-*	TROUBLE RECORD HOUR INDICATIONS	
HT	HU	HT	HU		HT-*	HU-*
1	1	0	0	281100	0	0
2	2	1	1	281111	1	1
3	3	2	2	281122	2	2
1	4	0	3	281103	0	3
1	5	0	4	281104	0	4
1	6	0	5	281105	0	5
1	7	0	6	281106	0	6
1	8	0	7	281107	0	7
1	9	0	8	281108	0	8
1	10	0	9	281109	0	9

*Trouble ticket — magnets A- through F- are in positions 24 through 29; hours tens and hours units are in positions 37 and 38, respectively.

TABLE D

H, T, OR U SELECTOR POSITIONS	CHECK LAMPS LIGHTED		
	H-	T-	U-
1	0	0	0
2	1	1	1
3	2	2	2
4	3	3	3
5	4	4	4
6	5	5	5
7	+	6	6
8	0	7	7
9	1	8	8
10	2	9	9
11	3	0	0
12	4	1	1
13	5	2	2
14	+	3	3
15	0	4	4
16	1	5	5
17	2	6	6
18	3	7	7
19	4	8	8
20	5	9	9
21	+	+	+
22	+	+	+

+ Indicates positions from which the selector steps automatically.

SECTION 227-400-500

STEP	ACTION	VERIFICATION
50	Operate CMBE key, operate TT key to O position.	
51	Momentarily operate S key.	SO, OSE lamps lighted.
52	When SO and OSE lamps are extinguished — Restore CKL, CMBE keys.	
53	Operate CMBO key, operate TT key to E position.	
54	Momentarily operate S key.	SE, OSO lamps lighted.
55	When SE, OSO lamps are extinguished — Restore CKL, CMBO keys.	

TABLE E

H AND T SELECTOR POSITIONS	TROUBLE RECORD MINUTE INDICATIONS*	
	MT-	MU-
1	0	0
2	1	1
3	2	2
4	3	3
5	4	4
6	5	5
7	+	6
8	0	7
9	1	8
10	2	9
11	3	0
12	4	1
13	5	2
14	+	3
15	0	4
16	1	5
17	2	6
18	3	7
19	4	8
20	5	9
21	+	+
22	+	+

+ Indicates positions from which the selector steps automatically.

*Trouble ticket — Minute tens and minute units are in positions 39 and 40, respectively.

STEP	ACTION	VERIFICATION
56	Momentarily operate AR key.	SSF lamp extinguished.
57	At trouble ticketer frame — Insert 322A plugs into recorder MB and re- recorder TST or T jacks associated with AMA recorder being used for testing.	
58	Insert plug of 32A test set into R jack.	
59	Momentarily depress white button of 32A test set.	RUT lamp lighted while test entries are being perforated.
60	When RUT lamp is extinguished — Momentarily depress white button of 32A test set.	RUT lamp lighted while test entries are perforated.
61	When RUT lamp is extinguished — Remove 322A plugs from recorder MB and recorder TST or T jacks and plug of 32A test set from R jack inserted in Steps 57, 58.	
62	Momentarily operate RL key.	
63	At master timing circuit under test — Momentarily operate S key.	S lamp lighted.
64	At perforator associated with AMA recorder being used for testing — Mark tape, proceed as indicated in 1.12.	

F. Preference and Lock-Out Features

***Caution: Do not make busy or transfer any
recorders while this test is in progress.***

1	At master timing frame — Block nonoperated SCO relay	
2	Connect battery to BF of EST relay.	EST relay operated. Absence of battery on 9T, 3B, 6B of EST relay.
3	Connect battery of BF to ST1 relay.	ST1 relay operated. EST relay remains operated.
4	Open 1-2T of EST relay.	EST relay released. Absence of battery on 9T, 3B, 6B of ST1 relay.
5	Remove test connection from EST relay.	

SECTION 227-400-500

STEP	ACTION	VERIFICATION
6	Connect battery to BF of ST3 relay.	ST3 relay operated. ST1 relay remains operated.
7	Open 1-2T of ST1 relay.	ST1 relay released. Absence of battery on 9T, 3B, 6B of ST3 relay.
8	Remove test connection from ST1 relay.	
9	Repeat Steps 6 through 8 on all higher odd-numbered ST- relays in succession.	Higher odd-numbered ST- relays operate. Lower odd-numbered ST- relays remain operated. Absence of battery on 9T, 3B, 6B of higher odd-numbered ST- relays after lower numbered ST- relays have released.
10	After testing highest odd-numbered ST- relay — Remove test connection from this relay.	
11	Block nonoperated SCE relay.	
12	Connect battery to BF of ST0 relay.	ST0 relay operated. Absence of battery on 9T, 3B, 6B of ST0 relay.
13	Connect battery to BF of ST2 relay.	ST2 relay operated. ST0 relay remains operated.
14	Open 1-2T of ST0 relay.	ST0 relay released. Absence of battery on 9T, 3B, 6B of ST2 relay.
15	Remove test connection from ST0 relay.	
16	Repeat Steps 13 through 15 on all higher even-numbered ST- relays in succession.	Higher even-numbered ST- relays operate. Lower even-numbered ST- relays remain operated. Absence of battery on 9T, 3B, 6B of higher even-numbered ST- relays after lower-numbered ST- relays have released.
17	After testing highest even-numbered ST- relay — Remove test connection from this relay.	
18	Operate CMBE key.	
19	Connect battery to BF of highest even-numbered ST- relay.	Highest even-numbered ST- relay operated. Absence of battery on 9T, 3B, 6B of highest even-numbered ST- relay.

STEP	ACTION	VERIFICATION
20	Connect battery to BF of EST relay.	EST relay operated. Highest even-numbered ST- relay remains operated.
21	Open 1-2T of highest even-numbered ST-relay.	Highest even-numbered ST- relay releases. Absence of battery on 9T, 3B, 6B on EST relay.
22	Remove test connection from ST-, EST relays.	
23	Restore CMBE key.	
24	Remove blocking tools from SCE, SCO relays.	

G. Selector Exercise Features

1a	If testing odd master timing circuit — Operate TT key to E position, operate CMBO, CKL keys.	
2a	Operate, hold operated EXM key.	M selector steps steadily and uniformly throughout its arc.
3a	After approximately 10 seconds — Release EXM key.	
4a	Operate, hold operated EXD key.	DT, DU selectors step steadily and uniformly throughout their arcs
5a	After approximately 10 seconds — Release EXD key.	
6a	Operate, hold operated EXH key.	HT, HU selectors step steadily and uniformly throughout their arcs.
7a	After approximately 10 seconds — Release EXH key.	
8a	Momentarily operate S key.	SE lamp lighted while selectors resynchronize.
9a	When SE lamp is extinguished — Restore CMBO, CKL keys.	
10b	If testing even master timing circuit — Operate TT key to 0 position, operate CMBE, CKL keys.	

SECTION 227-400-500

STEP	ACTION	VERIFICATION
11b	Repeat Steps 2a through 7a except for even master timing circuit.	Stepping of selectors in even master timing circuit.
12b	Momentarily operate S key.	SO lamp lighted while selectors resynchronize.
13b	When SO lamp is extinguished — Restore CMBE, CKL keys.	

H. Pulse Failure Alarm

1	At master timing frame — Operate TT key to E position.	
2	Connect ground to 8B of PE relay, immediately start stopwatch.	After 6 to 11 seconds, PF lamp lights. Major alarm sounds. Aisle pilot lamp lights.
3	Momentarily operate ACO key.	Major alarm silenced. Aisle pilot lamp extinguished.
4	Remove test connection from PE relay.	
5	Momentarily operate AR key.	PF lamp extinguished.
6	Insulate 8B of PE relay, immediately start stopwatch.	After 6 to 11 seconds, PF lamp lights. Major alarm sounds. Aisle pilot lamp lights.
7	Remove insulator from PE relay.	
8	Momentarily operate AR key.	PF lamp extinguished. Aisle pilot lamp extinguished. Major alarm silenced.
9	Operate TT key to O position.	
10	Repeat Steps 2 through 8 substituting PO for PE relay.	

I. Transfer Control Features and Timer Synchronism Failure Alarm

1	At master timing frame — Operate TT key to E position.	
2	Insulate 4T of PO relay.	CSY relay releases. TSF lamp lights. Major alarm sounds.
3	When CSY relay releases — Block nonoperated CSY relay.	

STEP	ACTION	VERIFICATION
4	Momentarily operate ACO key.	Major alarm silenced.
5	Remove insulator from PO relay.	
6	Operate CKL key.	
7	Operate TT key to 0 position, start the stopwatch.	Within 1 minute, SSF, OS- lamps for each recorder lighted.
8a	If emergency recorder or the other regular recorder where trunk transfer is used is substituting for regular recorder — At the master timing frame — Momentarily operate S key.	SO lamp lighted while selectors of regular recorder are stepping. OS- lamp extinguished when selectors are synchronized.
9	At trouble ticketer frame — Insert make-busy plug into emergency recorder MB jack.	
10	At master timing frame — Momentarily operate S key.	SO lamp lighted while selectors of emergency recorder are stepping. EM OS lamp extinguished when selectors are synchronized.
11	At trouble ticketer frame — Remove plug from emergency recorder MB jack.	
12a	If emergency recorder or the other regular recorder where trunk transfer is used is substituting for regular recorder — Insert make-busy plug into recorder MB jack for one of the recorders with lighted OS- lamp.	
13a	At master timing frame — Momentarily operate S key.	SO lamp lighted while selectors of regular recorder are stepping. OS- lamp extinguished when selectors are synchronized.
14a	At trouble ticketer frame — Remove plug from recorder MB jack.	
15a	Repeat Steps 12a, 13a, 14a for each of the remaining regular recorders with lighted OS- lamp.	

STEP	ACTION	VERIFICATION
16b	<p>If emergency recorder or the other regular recorder where trunk transfer is used is not substituting for regular recorder — Insert make-busy plug into recorder TN or RTN jack for one of the recorders with lighted OS- lamp.</p> <p>Caution: <i>While making this test, do not make more than one transfer from the same recorder during the same hour period since it may not be possible for the accounting center to associate the entries for two or more calls on the same district junctor or trunk which have their initial entries on one tape and the answer and disconnect entries on the other tape.</i></p>	
17b	<p>At master timing frame — Momentarily operate S key.</p>	<p>SO lamp lights while selectors of regular recorder are stepping. OS- lamp extinguished when selectors are synchronized.</p>
18b	<p>At trouble ticketer frame — Remove plug from recorder TN or RTN or recorder MB jack.</p>	
19b	<p>Repeat Steps 16b, 17b, 18b for each of the remaining recorders with lighted OS- lamp.</p>	
20	<p>At master timing frame after next hour entry has been perforated — Operate TT key to E position.</p>	<p>Within 1 minute, SSF, OS- lamps for each recorder lighted.</p>
21	<p>Repeat Steps 8a through 19b.</p>	
22	<p>Remove blocking tool from CSY relay.</p>	
23	<p>Momentarily operate AR key.</p>	<p>TSF, SSF lamps extinguished.</p>
24	<p>Restore CKL key.</p>	

J. Selector Synchronism Check and Selector Synchronism Check Failure Alarms

- 1 At master timing frame —
 Operate TT key to E position.

Caution: *This test requires the use of both master timing circuits. Therefore, do not make this test if the CMBE or CMBO key is found operated. Determine if satisfactory to restore operated key, or clear the trouble, then restore the operated key before proceeding with the test.*

STEP	ACTION	VERIFICATION
2	Restore CKL key if operated.	At master timing frame — M-, DT-, DU-, HT-, HU-, H-, T-, U- check lamps light momentarily once each minute.
3	At master timing frame — Operate, release UH relay of odd master tim- ing circuit, start stopwatch.	Within 1 minute, SSF check lamp lights. Major alarm sounds.
4	Operate CKL key.	OSO lamp lights. OSE lamp remains extinguished.
5	Momentarily operate ACO key.	Major alarm silenced.
6a	If "ZD" wiring option is provided — Connect ground to 3T of TCE relay.	HE relay not operated.
7a	Remove test connection from TCE relay.	
8	Operate CMBO key.	CMBO lamp lighted.
9	Momentarily operate S key.	SE lamp lighted while odd master timing cir- cuit selectors are stepping. OSO lamp extinguished when selectors are synchronized.
10	Momentarily operate AR key.	SSF lamp extinguished.
11	Restore CMBO, CKL keys.	CMBO lamp extinguished.
12	Repeat Steps 3 through 5, 8 through 11 for each of TH, HH, HUH, HTH, DTH, MOH relays in succession.	
13	Operate TT key to 0 position.	M-, DT-, DU-, HT-, HU-, H-, T-, U- check lamps light momentarily once each minute.
14	Operate, release UH relay of even master tim- ing circuit, and start the stopwatch.	Within 1 minute, SSF check lamp lights. Major alarm sounds.
15	Operate CKL key.	OSE lamp lights. OSO lamp remains extinguished.
16	Momentarily operate ACO key.	Major alarm silenced.
17a	If "ZD" wiring option is provided — Connect ground to 3T of TCO relay.	HO relay not operated.
18a	Remove test connection from TCO relay.	
19	Operate CMBE key.	CMBE lamp lighted.

SECTION 227-400-500

STEP	ACTION	VERIFICATION
20	Momentarily operate S key.	SO lamp lighted while even master timing circuit selectors are stepping. OSE lamp extinguished when selectors are synchronized.
21	Momentarily operate AR key.	SSF lamp extinguished.
22	Restore CMBE, CKL keys.	CMBE lamp extinguished.
23	Repeat Steps 14 through 16, 19 through 22 for each of TH, HH, HUH, HTH, DTH, MOH relays in succession.	

K. Both Master Timing Circuits Make-Busy Alarm

1	At master timing frame — Operate CMBO key.	CMBO lamp lighted.
2	Operate CMBE key.	CMBO lamp remains lighted. CMBE lamp lighted. MBE relay not operated. Major alarm sounds.
3	Restore CMBO key.	CMBO lamp extinguished. Major alarm silenced.
4	Operate CMBO key.	CMBO lamp lighted. Major alarm sounds. MBO relay not operated.
5	Restore CMBE, CMBO keys.	CMBE and CMBO lamps extinguished. Major alarm silenced.

L. Timer Start Control

1	At master timing frame — Operate TT key to E position.	
2	Operate MSO key to STP position.	TSF lamp lighted. Major alarm sounds. TO timer stopped. Within 1 minuee, SSF lamp lighted.
3	Momentarily operate ACO key.	Major alarm silenced.
4	Operate CMBO, CKL keys.	
5	Grasp the hub of TO timer, manually turn the camshaft very slowly in the direction in which it normally rotates until the small cam passes under and beyond the contact operating finger and clears it by approximately 3/32 inch.	

STEP	ACTION	VERIFICATION
6	At any time except when U8 or U9 lamp is lighted — Operate MSO key to ST position.	Within 1 minute, TO timer starts to run.
7	Operate MSO key to R position.	
8	Momentarily operate S key.	SE lamp lighted while odd master timing circuit selectors are stepping to synchronized positions.
9	When SE lamp is extinguished — Momentarily operate AR key.	TSF, SSF lamps extinguished.
10	Restore CMBO key.	
11	Operate TT key to O position.	
12	Proceed as in Steps 2 through 10 on the TE timer, use MSE, CMBE keys in place of MSO, CMBO keys.	SO lamp lighted while even master timing circuit selectors are stepping to synchronized position.
13	Restore CKL key.	

M. Time-Out Alarm Features

Caution: *The charge records on recorder tapes for service calls made during the time this test is in progress cannot be properly processed by the accounting center, and the tapes are marked for the accounting center to disregard the tape area covering both service call entries as well as improper test entries.*

1	Select an AMA recorder associated with master timer to be tested and mark tape as indicated in 1.12.	
2	At master timing circuit under test — Block nonoperated P3A relay.	
3	At trouble ticketer frame — Insert 322A plug into recorder MB jack associated with AMA recorder being used for testing and at the same time start stopwatch At master timing circuit under test when TIB relay operates — Remove blocking tool from P3A relay.	Trouble record within 4 to 7 seconds.
4	At trouble ticketer frame — Remove 322A plug inserted in recorder MB jack in Step 3.	

SECTION 227-400-500

STEP	ACTION	VERIFICATION
5	At master timing circuit under test — Block nonoperated P3A, TMR, TM5, TM6 relays.	
6	At trouble ticketer frame — Insert 322A plug into recorder MB jack associated with AMA recorder being used for testing.	At master timing circuit under test — TM2 relay operated.
7	When TM2 relay releases — Start stopwatch.	
8	When TM2 relay reoperates — Stop stopwatch.	Elapsed time on stopwatch is 2 to 4 seconds. TM6 relay not energized.
9	Remove blocking tool from TM5 relay, start stopwatch when TM2 relay releases.	
10	When TM2 relay reoperates — Stop stopwatch.	Elapsed time on stopwatch is 2 to 4 seconds. TM5, TIB relays operated. TM6 relay energized.
11	Remove blocking tool from TMR, P3A relays.	
12	When TM1 relay releases — Remove blocking tool from TM6 relay.	
13	At trouble ticketer frame — Remove 322A plug from recorder MB jack inserted in Step 6.	
14	At master timing circuit under test — Block nonoperated P3A relay.	
15	Make trouble ticketer busy to master timing circuit under test.	
16	Insert 322A plug into recorder MB jack associated with AMA recorder being used for testing. At master timing circuit under test when TIB relay operates — Remove blocking tool from P3A relay.	At trouble ticketer frame — CMB-, MT- display lamps associated with master timer under test lighted. At master timing frame — CMB-, TA-, ETF lamps associated with master timer under test lighted. Major alarm sounded.
17	At trouble ticketer frame — Remove 322A plug from recorder MB jack inserted in Step 16.	
18	Momentarily operate alarm release key.	Display lost lamp extinguished.

STEP	ACTION	VERIFICATION
19	At master timing circuit under test — Momentarily operate AR key.	CMB-, TA-, ETF- lamps associated with master timer under test extinguished. Alarm silenced.
20	Block nonoperated TM1 relay.	
21	Insulate 8-9T of ET1 relay, 1-2T of LTB relay.	
22	At trouble ticketer frame — Insert 322A plug into recorder MB jack associated with AMA recorder being used for testing, at same time start stopwatch.	At master timing circuit under test — In 18 to 30 seconds, TSP relay operates. In 66 to 78 seconds, TSP relay operates. In 78 to 90 seconds, LT9 relay operates. Major alarm and various lamps lighted, may be disregarded.
23	At master timing circuit under test — Connect 10B to 11B of ET1 relay.	TM1 relay energized.
24	Insulate 7-8B of LT9 relay.	TM1 relay not energized.
25a	If "E" wiring option is used — Remove insulator from LTB relay.	In 2 to 5 minutes, TM1 relay energized.
26b	If "B" wiring option is used — Remove insulator from LTB relay.	In 2 to 5 minutes, TM6 relay energized.
27	Remove test connection from ET1 relay.	
28	Remove insulators from LT9, ET1 relays.	
29	Remove blocking tool from TM1 relay.	TM1 relay operated momentarily.
30	After TM1 relay releases — Remove blocking tool from TM6 relay.	
31	At trouble ticketer frame — Remove 322A plug from recorder MB jack inserted in Step 22.	
32	At master timing circuit under test — Momentarily operate LT4 relay.	At master timing frame — CMB-, TA-, ETF lamps associated with master timer under test lighted. Major alarm sounded. At trouble ticketer frame — CMB-, MT- lamps associated with master timer under test lighted.

SECTION 227-400-500

STEP	ACTION	VERIFICATION
33	At master timing frame — Momentarily operate AR key.	At master timing frame — CMB-, TA-, ETF- lamps extinguished. Major alarm silenced. At trouble ticketer frame — CMB-, MT- lamps extinguished.
34	At trouble ticketer frame — Insert 322A plugs into recorder MB and re- recorder TST or T jacks associated with AMA recorder under test.	
35	Insert plug of 32A test set into R jack.	
36	Momentarily depress white button of 32A test set.	RUT lamp lighted while test entries are perforated.
37	When RUT lamp is extinguished — Momentarily depress white button of 32A test set.	RUT lamp lighted while test entries are perforated.
38	When RUT lamp is extinguished — Remove 322A plugs from recorder MB and recorder TST or T jacks and plug of 32A test set from R jack inserted in Steps 34, 35.	
39	At perforator associated with AMA recorder being used for testing — Mark tape, proceed as indicated in 1.12.	

N. Perforator Lead Cross-Detection Feature

1	At master timing frame — Momentarily connect ground to 02 of "A" terminal strip (located at top of frame).	At master timing frame — CMBE lamp lighted. At trouble ticketer frame — CMBE lamp lighted. Trouble record with XPL indication (trouble ticket 0 printed in position 11).
2	At master timing frame — Momentarily operate AR key.	CMBE lamp extinguished.
3	Block nonoperated PLXE relay.	
4	Momentarily connect ground, in turn, to ter- minals of "A" terminal strip as follows: 3, 4, 10, 11, 12, 13, 14, 20, 21, 22, 23, 24, 30, 31, 32, 33, 34, 40, 41, 42, 43, 44, 50, 51, 52, 53, 54.	XPE relay operated in each case while ground is applied.
5	Momentarily connect battery to 02 of "A" terminal strip.	XPE relay operated while battery is applied.

STEP	ACTION	VERIFICATION
6	Remove blocking tool from PLXE relay.	
7	Momentarily connect ground to 02 of "C" terminal strip (located at top of frame).	At master timing frame — CMBO lamp lighted. At trouble ticketer frame — CMBO lamp lighted. Trouble record with XPL indication (trouble ticket 0 printed in position 11).
8	At master timing frame — Momentarily operate AR key.	CMBO lamp extinguished.
9	Block nonoperated PLXO relay.	
10	Momentarily connect ground, in turn, to terminals of "C" terminal strips as follows: 3, 4, 10, 11, 12, 13, 14, 20, 21, 22, 23, 24, 30, 31, 32, 33, 34, 40, 41, 44, 50, 51, 52, 53, and 54.	XPO relay operated in each case while ground is applied.
11	Momentarily connect battery to 02 of "C" terminal strip.	XPO relay operated while battery is applied.
12	Remove blocking tool from PLXO relay.	
13	At RC terminal strip for even master timing circuit — Momentarily connect ground to terminal 02 (located adjacent to RCO, RCE relays).	At master timing frame — CMBE lamp lighted. At trouble ticketer frame — CMBE lamp lighted. Trouble record with XPL indication (trouble ticket 0 printed in position 11).
14	At master timing frame — Momentarily operate AR key.	CMBE lamp extinguished.
15	Block nonoperated PLXE relay.	
16	Momentarily connect ground, in turn, to terminals of RC terminal strip for even master timing circuit as follows: 3, 4, 10, 11, 12, 13, 14, 20, 21, 22, 24, 30, 31, 32, 33, 34, 40, 41, 42, 43, 44, 50, 51, 52, 53, and 54.	XPE1 relay operated while ground is applied.
17	Remove blocking tool from PLXE relay.	
18	At RC terminal strip for odd master timing circuit — Momentarily connect ground to terminal 02.	At master timing frame — CMBO lamp lighted. At trouble ticketer frame — Trouble record with XPL indication (trouble ticket 0 printed in position 11).

SECTION 227-400-500

STEP	ACTION	VERIFICATION
19	At master timing frame — Momentarily operate AR key.	CMBO lamp extinguished.
20	Block nonoperated PLXO relay.	
21	Momentarily connect ground, in turn, to terminals of RC terminal strip for odd master timing circuits as follows: 3, 4, 10, 11, 12, 13, 14, 20, 21, 22, 23, 24, 30, 31, 32, 33, 34, 40, 41, 42, 43, 44, 50, 51, 52, 53, and 54.	XPO1 relay operated while ground is applied.
22	Remove blocking tool from PLXO relay.	

O. End-of-Tape Failure Alarm Test

1	At master timing frame — At U selector of even master timing circuit — Momentarily connect ground to brush on arc 2 when selector reaches terminal 5 or 15.	At master timing frame — ETFO lamp lighted. Major alarm sounded.
2	Momentarily operate AR key.	ETFO lamp extinguished. Major alarm silenced.
3	At U selector of odd master timing circuit — Momentarily connect ground to brush on arc 2 when selector reaches terminal 5 or 15.	ETFE lamp lighted. Major alarm sounded.
4	Momentarily operate AR key.	ETFE lamp extinguished. Major alarm silenced.
5	Operate CMBO key.	
6	At U selector of even master timing circuit — Momentarily connect ground to brush on arc 2 when selector reaches terminal 5 or 15.	ETFE lamp lighted. Major alarm sounded.
7	Momentarily operate AR key.	ETFE lamp extinguished. Major alarm silenced.
8	Restore CMBO key.	
9	Operate CMBE key.	

STEP	ACTION	VERIFICATION
10	At U selector of odd master timing circuit — Momentarily connect ground to brush on arc 2 when selector reaches terminal 5 or 15.	ETFO lamp lighted. Major alarm sounded.
11	Momentarily operate AR key.	ETFO lamp extinguished. Major alarm silenced.
12	Restore CMBE key.	

P. Fuse Alarm Relay (FA) and Make-Busy Feature

1	At master timing frame — Apply battery to terminal 120 on (MISC) terminal strip.	At master timing frame — FA, CMBE lamps lighted. At transverter trouble indicator, trouble recorder, or trouble ticketer frame — CMBE lamp lighted. Major alarm sounded.
2	Remove test connection of Step 1.	At master timing frame — ALE lamp lighted. CMBE lamp remains lighted. FA lamp extinguished. Major alarm silenced.
3	Momentarily operate AR key.	CMBE, ALE lamps extinguished.
4	Repeat Steps 1 through 3 on odd master timing circuit. Apply battery to terminal 123 on (MISC) terminal strip.	Observe ALO, CMBO lamps instead of ALE, CMBE lamps.
5a	If "R" wiring option is provided — Block nonoperated MTO relay.	CMBO lamp lighted.
6a	Remove blocking tool from MTO relay.	CMBO lamp extinguished.
7a	Block nonoperated MTE relay.	CMBE lamp lighted.
8a	Remove blocking tool from MTE relay.	CMBE lamp extinguished.
9b	If "S" wiring option is provided — Momentarily release MTO relay.	CMBO lamp lighted.
10b	Momentarily operate AR key.	CMBO lamp extinguished.
11b	Momentarily release MTE relay.	CMBE lamp lighted.
12b	Momentarily operate AR key.	CMBE lamp extinguished.

SECTION 227-400-500

STEP	ACTION	VERIFICATION
-------------	---------------	---------------------

Q. LT1-LT9 Relays (Long Timer) Test

Caution: Do not perform the following steps during the 5 minutes before or after any hour to prevent interference with the placing of the hour record on the recorders.

- | | | |
|-----|--|--|
| 1a | If even timer is to be tested —
At master timing frame —
Operate TT key to O position. | OT lamp lighted. |
| 2a | Operate CMBE key. | CMBE lamp lighted. |
| 3a | At even master timing circuit —
Block operated ST- relays. | |
| 4b | If odd timer is to be tested —
Operate TT key to E position. | ET lamp lighted. |
| 5b | Operate CMBO key. | CMBO lamp lighted. |
| 6b | At odd master timing circuit —
Block operated ST-, EST relays. | |
| 7 | Block nonoperated ET1 relay. | |
| 8 | Short Contacts 4, 5B of ET1 relay, using 893 cord. | LT1 relay operates.
Every 4 seconds the succeeding LT- relay will operate and the preceding LT- relay will release.
Approximately half way through test —
Major alarm sounds.
TAO or TAE lamp lighted. |
| 9 | Momentarily operate AR key. | Alarm silenced.
TAO or TAE lamp extinguished. |
| 10 | Remove connections from 4, 5B of ET1 relay. | |
| 11c | If necessary to repeat test —
Repeat Steps 8 through 10. | |
| 12 | Remove blocking tools from ST-, ET1 relays. | |
| 13b | If testing odd timer —
Remove blocking tool from EST relay. | |
| 14b | Restore CMBO key. | CMBO lamp extinguished. |
| 15a | If testing even timer —
Restore CMBE key. | CMBE lamp extinguished. |

TABLE F — FOR TROUBLE TICKETER

RELAY BLOCKED NONOPERATED														
TEST AND STEP	MASTER TIMING CIRCUIT	AMA RECORDER CIRCUIT	TICKET POS	➤	1	5	10	15	20	25	30	35	42	SEE NOTE
B3	P3A	—					--0-0	-*---	-*-1	01-28	21DD-	-1--1		1, 2, 6
B5	P4A	—					--0-1	-*---	-*-1	01-28	11HH-	-1--*		2, 6
B10	P5A	U					--1-0	-*---	-*-1	01-28	5600-	-11-*		2, 6
B13	P6A	—					--0-1	-*---	-*-1	0*-28	05RR-	11--*		2, 5, 6
B14	P7A	—					--0-0	-*---	-*-1	0-28	3DXX-	*1--*		2, 3, 6
B14	P8A	—					--0-1	-*---	-*-1	0-28	9DRR-	*1-0*		2, 4, 6
B15	COP	—					--0-0	-*---	-0-1	0--08	1010-	-0-1-		2, 6
B20	P1A	—			** (0/1)-R		--0-0	-*---	-*-1	01-08	1010-	-0-1-	-HHMM**	2, 6
B21b	P2A (if provided)	—					--0-1	-*---	-*-1	01-28	6000-	-001-		2, 6
B27							--01-	-*---	-*-1	01-28	5500-	-11--		2, 6
B31							--11-	-*---	-*-1	01-28	5700-	-11--		2, 6
B36							--01-	-*---	-*-1	01-28	05RR-	111-		2, 5, 6
B38							--0--	-*---	-*-1	11-28	06RR-	111-		2, 5, 6
B72							--00-	1*---	-*-1	01-28	21DD-	-1--1		1, 2, 6
B90							--0--	-*---	-*-1	01-28	21DD-	-1--1		1, 2, 6

- Notes:**
1. DD = Day Tens and Units.
 2. R = Recorder No. (0-4).
HH = Hour Tens and Units.
MM = Minute Tens and Units.
 3. D = Day Units.
XX = Month Tens and Units.
 4. D = Day Tens.
RR = Recorder group No.
 5. RR = Recorder No. in recorder group.
 6. *normally indicates two pieces of information present (except positions 1, 2, 41, 42).