WABCO

SERVICE MANUAL 5122

TIME CODE CONTROL SYSTEM

Type L-Form 506
and
Type L-Form 506-A

MAINTENANCE INSTRUCTIONS

April, 1979
B-79-500-2312-5

UNION SWITCH & SIGNAL DIVISION
AMERICAN STANDARD, INC.
Swissvale, PA 15218

TABLE OF CONTENTS

PART I

PART II

PART III

PART IV

PART V

LIST OF FIGURES

LIST OF TABLES

PART I

Diagrams for Reference

	506 System	506-A System
Circuit Diagram—Office Line-Coding Unit	D-2547 Sh. 1	Sh. 11
Circuit Diagram—Field Line-Coding Storage Unit	D-2547 Sh. 2	Sh. 8
Circuit Diagram—Office & Field Pyramid Unit	D-2547 Sh. 3	Sh. 9
Graphic Code Chart	D-2547 Sh. 4	Sh. 10
Circuit Diagram—Test Set	D-2547 Sh. 5	Sh. 5
Wiring Diagram—Office L-C Unit	C-9362 Sh. 523	Sh. 1919
Wiring Diagram—Field Storage Unit	C-9362 Sh. 524	Sh. 868
Wiring Diagram—Field L-C-S Unit	C-9362 Sh. 525	Sh. 869
Wiring Diagram—Field Pyramid Unit	C-9362 Sh. 526	Sh. 526

Circuit and Wiring Diagrams for Control Machine are special for each installation. Includes panel wiring, terminals and connecting frame, plug connectors, and storage units. (Only Test Set circuit diagram is included with this pamphlet.)

RECOMMENDED MAINTENANCE PROCEDURE

It is recommended that "Field Maintenance Tests" be made at regular intervals as outlined in Part III of this pamphlet.

If the timing or calibration of the equipment is outside of the field inspection limits given in the tables in Part III, the equipment should be removed from the field location and reshopped as directed in Part II.

Since traffic conditions vary so widely on different installations, no specific reshopping schedule can be generally applicable. However, all field units on an installation should be brought into the shop after the first one to two years of service (depending upon the density of traffic) and given a detail check and inspection.

The condition of these units as shown by the first shop inspection will enable the railroad to set up a suitable reshopping schedule.

The office line-coding units are subjected to more severe service than are the field units; therefore, it is recommended that the office line-coding units be reshopped approximately twice as often as the field units.

WABCO

PART II
RESHOPPING PROCEDURE FOR INTERCHANGEABLE UNITS and KP POLAR RELAYS

Office Line-Coding Units
Field Line-Coding Storage Units
Field Storage Units
Field Pyramid Units

GENERAL PROCEDURE

The following procedure is recommended for reshopping the interchangeable units and KP polar relays. Detailed information is provided in the paragraphs following the tabulation below.

1. Connect unit to the Test Set and take cycle recorder tapes as record of condition of unit when removed from service.

2. Mechanically inspect and clean the units and included relays.

3. Check the electrical calibration of the Style "L" relays.

4. Check the electrical calibration of the Style KP polar relays.

5. Reconnect unit and KP relays to Test Set and proceed as follows.

6. Take cycle recorder tape to determine condition of timing.

7. Make timing adjustments if required.

8. Recheck electrical calibration of relays readjusted to obtain timing.

9. Test unit for operation on variable circuits as outlined on Test Set diagram.

10. Test unit for operation on voltage limits.

11. Check operation of "CO" thermal cutout.

12. Take final tapes of codes for record of timing. Sign and date the record and preserve for future reference.

13. Clean and seal the unit.

MECHANICAL INSPECTION OF UNITS AND INCLUDED RELAYS

Inspection From Back of Unit

1. Inspect wiring of equipment and top plate for evidence of heating or lightning shots. Test insulations of contacts involved in the line circuit, using an instrument which applies at least 100 volts between the contact members and the relay frame. A 500 volt megger is a very suitable instrument for this purpose.

Insulation tests may be made by meggering between terminal posts as tabulated below. A more detailed check should be made inside the unit when the megger tests indicate the presence of damaged insulation. All readings should be infinite except the reading between terminals 41 and 42 on the office line-coding units. When testing between these two terminals, the needle should dip to a low value at the beginning of the test and should then climb upwards reaching a final value greater than 20 megohms in a few seconds. (Note that if an a-c. type tester is used, a permanent low reading will be obtained on this test due to the impedance of the condenser.)

When any contact stack shows evidence of breakdown, all the bushings and insulating blocks in this stack should be replaced. Also, the contact springs should be carefully cleaned to eliminate any trace of carbonized material around the holes through which the bushings pass.

Test as follows:

Office Line Coding Units: (Make sure R relay is in the normal or clockwise position.)

41 to 19, 20, 42, 53, case
42 to 19, 20, 63, case
53 to 19, 20, 63, case
63 to 19, 20, case
19 to 20, case
20 to case

Field Line-Coding-Storage Units

91 to 17, 19, 20, 71, 92, 94, case
92 to 17, 19, 20, 71, case
17 to 71, case
94 to 19, 20, case
17 to 19, 20, case
71 to 19, 20, case
19 to 20, case
20 to case

2. Inspect all connections for tightness and proper soldering.

3. Inspect mounting of equipment on mounting strips for tightness.

4. Inspect contact stacks to see if any are loose.

Inspection From Front of Unit

1. Inspect and clean relay armatures, cores and backstraps in accordance with Service Specification 3701 for Style "L" relays.

2. Inspect relays for burned or pitted contacts and check contact adjustment. With the exception of the contacts listed below, it is not necessary to gauge and adjust each contact accurately. On each relay one contact which meets the values specified in Service Specification 3701 may be used as a guide in making a visual comparative check of the adjustments of the remaining contacts. Each of the contacts listed below should be

accurately gauged and adjusted. See wiring diagrams for piece numbers of these relays. On relays with nomenclature tags, the piece number will be found on the tag holder, under the tag.

All BT contacts—Identified by black line on heel springs*

All Continuity Contacts—These contacts may be identified by their special construction.

506 SYSTEM

Office LC Unit—PC relay, contacts B2, B5, A5 and C5*

Field LCS Unit—MSP relay, contact A2 (continuity contact)

M relay, contact C3*

506-A SYSTEM

Office LC Unit—PC relay, contacts A2 and C2 (continuity contacts)

Field LCS Unit—S relay, contact B1 (continuity contact)

M relay, contact C3*

*These contacts have special adjustments. These adjustments, as well as those for continuity contacts, are listed and explained in Service Specification 3701 under "Special Contact Adjustments".

STYLE "L" RELAYS

The Style L-1 and L-3 relays used in Time Code Control Systems are direct current neutral relays. Style L-1 relays are equipped with a "round" armature and are ordinary acting. Style L-3 relays have a "square" armature and a double magnetic circuit and, therefore, are adaptable as slow release relays when shunted by a rectifier. These "square" armature relays are employed principally for code impulse timing.

These Style "L" relays are housed in groups in sheet metal cases. Those groups used at the field locations (field line-coding-storage units and field storage units) and the group in the office which is common to all the stations (office line-coding unit) are plug connected for convenience in changing out the units. Generally, the individual Style "L" relays are not plug connected.

There are two methods of designating the relays in the units as to nomenclature and piece number. On relays built prior to the middle of 1945, the nomenclature was stencilled on the front of the armature. Relays built since that time carry a separate nomenclature tag fastened to the front of the relay. On these relays the piece number of the relay is stencilled on the tag holder and may be seen by removing the tag from the holder. In both cases, the piece number of the relay is stencilled on the relay backstrap below the contacts. Also, in both cases, the piece numbers and nomenclatures are shown on the wiring diagram for the unit.

Calibration

Style "L" relays should be repaired, readjusted, and recalibrated when necessary in accordance with Service Specification 3701.

STYLE "KP" POLAR RELAYS

The Style KP relay is a polar direct current two-position relay. Two differently operating types of relays are provided; namely, "stick" and "biased". The stick type relays are operated into alternate positions (normal or reverse) by opposite polarities, and the contacts remain made in the last operated position when the coils are deenergized. The biased type relays are operated into the normal position by normal polarity, but the contacts return to the reverse or "biased" position when the relay is deenergized and remain in that position when reverse polarity is applied. Thus the biased relay functions similar to a neutral relay except that it will operate on only one polarity.

All KP relays are individually housed in bakelite cases, with all operating parts fully enclosed and sealed. All contacts are visible through the front cover glass. Contacts are moulded in bakelite, and the contacts are of silver to silver multiple button type. The field line and starting relays are the biased type and have two normal and two reverse independent contacts. The contact opening of this type of relay is approximately 0.030". The office line relay is the stick type and has two normal and two reverse independent contacts. The contact opening of this type of relay is approximately 0.040". The field function relays and office traffic control relays are of the stick type and have four normal and four reverse non-independent contacts. The contact opening of this type of relay is approximately 0.050".

All KP relays have two coils which may be used either independently or in series to suit requirements. The coil resistances vary with requirements.

All KP relays are individually plug connected for quick and easy replacement. Means have been provided in the relay case and plug connectors to prevent the plugging-in of a given relay into any but the correct position. A combination pin plate is associated with each pair of plug connectors. The plate contains five pins in various combinations, so that each separate piece number relay has an individual combination assignment. Slots are milled in the base of each relay to match this assignment. As a result, none but the correct relay, having slots matching pin positions, can be plugged into a given position in the relay rack.

The ten possible pin positions are numbered consecutively from left to right looking at the front of the relay, and the numbers remaining on the base of the relay after slots have been cut identify the code combination for that relay.

Reshopping

When the field inspection (see Field Maintenance Tests in this pamphlet) indicates the necessity for it, the KP relays should be reshopped according to Service Specification 3623.

If, during reshopping, the specified calibration values cannot be obtained, or if any of the relay operating parts (such as coils, contacts, connecting springs, etc.) require replacement, the relay should be returned to the factory for repair.

DESCRIPTION OF APPARATUS AND SET-UP FOR MAKING OPERATION, TIMING AND VOLTAGE TESTS ON COMPLETE UNITS

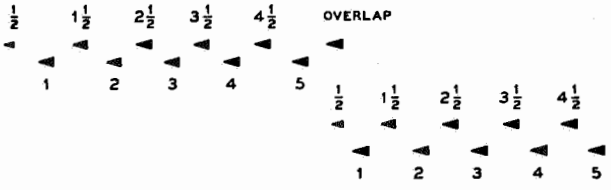
Test Set

Complete test set hook-up is shown on Drawing D2547, Sh.5, in the back of this booklet. In addition to the test set hook-up, the drawing shows complete interconnections between test set and standard C.T.C. units. A tabulated procedure for testing is also given.

Cycle Recorder

This instrument provides a convenient means for measuring and recording short time intervals such as code impulses. The two punch recorder gives a complete record of a whole code on one tape. Odd-numbered impulses are recorded by one punch magnet on one line and even-numbered impulses by the other punch magnet on a second line, as shown below. When the tape record shifts from one line to the other, there should not be an overlap of more than one perforation. (This overlap will occur when the shift in the record from one impulse to the next occurs just as the A.C. timing wave reaches the point where both punch magnets will operate.) An overlap of more than one perforation, or loss of perforations, indicates that the cycle recorder needs adjustment.

The tape record below shows a correct tape. In reading a cycle recorder tape, count each perforation as ½ cycle. Disregard the overlap punch in the count.



To obtain the timing in terms of seconds, divide the recorder reading by the frequency (in cycles per second) of the power source used.

When the only AC source available has a voltage of 220 volts, the recorder may be used by connecting a 1500 ohm resistor in series with terminal CX.

Cycle recorder tape is "National Cash Register Tape Size C", Ref. 2, Plate T-575, or it may be bought at any National Cash Register Supply Store.

Cycle Recorder Connections

Figure 1 shows Cycle Recorder connections for measuring the timing of units either in the multiple code line installation or in the Test Set. The right-hand punches are for odd-numbered pulses and the left-hand punches are for even-numbered pulses.

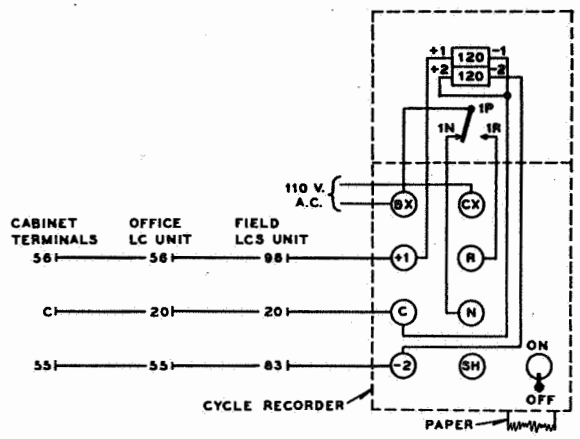


Fig. 1. Cycle Recorder Connections to Code Units.

In addition to determining the timing of code units, as shown in Fig. 1, the cycle recorder may be used to determine release times of individual relays as illustrated in Service Specification 3701 under "Release Timing".

Adjustment of Cycle Recorder

If, after continued use, the cycle recorder gets out of adjustment, it should be readjusted in accordance with instructions in Service Specification 3688.

THERMAL CUTOUT ON 506 SYSTEM UNITS

After the unit has been at rest for at least 5 minutes, check the action of the "CO" thermal cutout by repeated coding (starting switch up) until the thermal unit stops the coding action. This should require from 12 to 15 codes. Note that the unit codes again after being inactive approximately 10 seconds, and transmits two or three codes before again cutting out. This test should be made with the field battery switch set at point 16 (field voltmeter should read 16 to 17 volts).

If adjustment of the thermal cutout is required, the silver contact strips forming the contact of the relay should be bent. *Never bend the bi-metallic strip.*

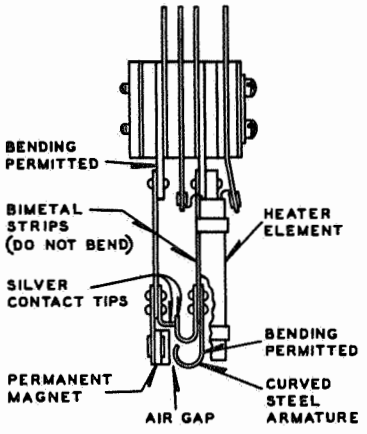
THERMAL CUTOUT ON 506-A SYSTEM UNITS

A. Timing Check Using Test Set

After the unit has been at rest (with CO de-energized) for at least 12 minutes, set the field battery switch at point 16 (the field voltmeter should read 16 to 17 volts) and check the timing of the CO by setting the line test switch to position 4 and operating the field starting switch. The CO should open its contacts in from 100 to 140 seconds after operation of the starting switch. If the timing is within these limits, no adjustment should be attempted. However, if the timing is not within these limits, the CO should be adjusted to open in a nominal time of 125 seconds. Adjustment should be made by following the procedure outlined in paragraphs "B" and "C".

B. Contact Spring Adjustment Check

To determine whether the contact spring members have become misadjusted, place a small magnetic shunt (such as soft iron or transformer steel—not more than 0.013" thick) in the air gap across the permanent magnet poles opposite the curved steel armature, both of which are attached to the extreme ends of the contact members. See Fig. 2. When the contact tips just make, there must be a small air gap perceptible between the steel shunt and the permanent magnet curved armature. With the shunt in place, practically all contact pressure due to attraction between magnet and armature is relieved and the silver



SNAP ACTION THERMAL CUTOUT
PLAN VIEW
Fig. 2

tips should have light barely perceptible between them. In making adjustment to meet this requirement, apply a bending tool to the *heavy* member which supports the bimetal strip to which the permanent magnet is attached, applying it between the insulating blocks and the first rivets. *Never* bend the bimetal strips in any way. Check to see that the silver tips meet squarely. Remove the magnetic shunt and repeat the timing check per paragraph "A".

C. Timing Adjustment

Make final timing adjustment, if necessary, by changing the air gap between the permanent magnet and its armature. Apply a small bending tool to the straight portion of the curved steel armature, hold the contact firmly so the bimetal strip will not be bent, and bend the armature toward or away from the magnet. (A very slight change in air gap makes a marked difference in timing.) To *lengthen* the time required to open the contact, *decrease* the air gap; to *shorten* the time, *increase* the air gap. Allow the full cooling period of 12 minutes before each timing check. IMPORTANT: When correctly adjusted, the curved armature must not come in contact with the permanent magnet at any time during operation.

D. Service Test

Directions for field testing of the CO thermal cutout are included under "Field Maintenance Test"—Part III of this pamphlet.

For Reference Only

If the initial opening time of the thermal cutout is within the correct values, it will reclose its contacts in 100 to 145 seconds and will reopen them in not less than 60 seconds, provided the ST relay is kept reversed.

CODE TIMING

Short Impulses

A short odd-numbered impulse (line relay contacts counterclockwise) is timed by the pick-up of a counting relay, release of T, and the pick-up of R.

A short even-numbered impulse (line relay contacts clockwise) is timed by the pick-up of a counting relay, release of a counting relay, pick-up of T, and the release of R. These values are in general fixed with the type of relay.

Speed of Counting Chain

If all contacts are properly adjusted and the armatures and cores are free from dirt, the counting relays will follow a speed of about 24 pulses per second at normal voltage. A test for the counting chain, as well as the rest of the unit, can easily be made by varying the voltage as outlined under "Tests of Units on Voltage Limits", Page 6. If a unit will work properly with this voltage variation, ample margin is provided in the counting chain.

In timing a unit, it is an aid to remember that 1L, being odd-numbered, determines the length of all odd-numbered long impulses and controls registry circuits over contacts on the odd-numbered counting chain relays 1-3-5-7. Relay 2L, being even-numbered, determines the length of all even-numbered long impulses, and controls those registry circuits which are taken over the even-numbered chain relays 2-4-6-8. In each case the time of LP is added to that of 1L or 2L to produce the long impulse at the transmitting station. At the receiving station the time of LP does not enter into the registry of the long step.

Conditions and Set-up for Checking Timing

When timing checks and adjustments are made with the unit operating in the test set-up, timing shall be measured with unit sending codes under normal line current conditions, local operating voltage of 16-18 volts D.C., and nominal temperature (70° F.). The procedure shown on D2547-sh.5 should be followed.

Order of Making Timing Measurements and Adjustments in Shop

If it is necessary to change the timing of any relay, the air gap, stroke, etc., should be adjusted as illustrated in Service Specification 3701. After making any timing adjustment, the electrical calibration of the relay should be rechecked.

1. Check the timing of the short odd-numbered impulses. If necessary to correct timing, adjust T relay.

2. Check the short even-numbered impulses. If incorrect, check stroke and contact adjustment of relay T and counting chain relays. Resistor R4 (in 506 system) or T (B) (in 506-A system) can be inserted or cut out to further vary timing.

3. Check the release time of 1L and 2L. To do this insert a piece of paper to insulate contacts A3 and C3, on LP relay, thus eliminating the LP relay from the timing. Check the timing of the long odd-numbered impulses in last half of code (impulses 9, 11, 13, 15). Readjust 1L if necessary. Check the timing of the long even-numbered impulses in last half of code (impulses 10, 12, 14). Readjust 2L if necessary.

4. To check the release time of LP, remove the insulation from contacts of relay LP and check timing of the long odd and even impulses in last half of code. Readjust LP if necessary.

5. Time the interval between two consecutive codes to check the cascade release times of relays LB and LBP. Consecutive codes are sent by operating code starting switches upward. In the field unit, insulate MSP contact C5 (in 506 system) or B6 (in 506-A system) to eliminate relay SS for this test. If the time between codes is incorrect, readjust the timing of relays LB and LBP, keeping as much time as possible in the LB relay.

To have office codes take precedence over field codes, the time between control codes should be adjusted toward the lower limits, and the time between indication codes should be adjusted toward the higher limits.

6. Check that relay LB will hold up when the unit is transmitting on 12-13 volts. If it is necessary to adjust the LB relay to meet this requirement, test 5 (above) should be repeated and, if necessary, relay LBP should be readjusted.

7. To check release time of relay SS, remove insulation from contact of relay MSP and time the interval between two consecutive indication codes with SS operating.

When checking extra field storage units, the only timing required is SS relay (count 7), using a correctly timed LCS unit.

8. In units for 506-A system send a manual recall code and check the length of the 9th impulse.

Table 1-Approximate Release Time of Slow Release Relays

Relay Nomenclature	Approx. Cycles Release	Approx. Air Gap—Inches
T	4	0.012"
1L	11	0.002"
2L	11	0.002"
LP	6	0.015"
LB	18	0.002"
LBP	12	0.002"
SS	20	0.002"
PCP	19	0.002"
Office M	8	0.002"

When measuring the timing of units in the test set, the various counts given in the Timing Table can be determined from cycle recorder tapes as follows:

Tape No. 1—Having max. number of short impulses—Counts 1 and 2

Tape No. 2—Having max. number of long impulses—Counts 3 and 4

Tape No. 3—Having max. number of long impulses—Counts 5, 6, 10, 11, 12 and 13.

Tape No. 4—Consecutive Codes—Count 7A or 7B

Tape No. 5—Consecutive Codes—Count 8

Tape No. 6—Manual Recall Control Code—Count 9

NOTE: Where adjustments required to obtain correct timing values for one test affect values previously checked, the results of the previous tests should be rechecked to assure that they are still within the specified limits.

For timing of the field units in the installation see Part III of this pamphlet.

TESTS OF UNITS ON VOLTAGE LIMITS

As an overall check to insure ample margin on the timing of the relays, operate the field on 13 volts, and the office on 13 to 24 volts, and note that proper selections are made. Then operate the office on 13 volts and vary the field from 13 to 24, and note results. Use codes 234 and 678 for these tests.

Table 2-Timing Table

TIMING TABLE—Time Code Control System Type L—Forms 506 & 506-A

Timing with Units Connected in Test Set—Timing in Cycles (60 Cycles = 1 Second)
Test Conditions—Local Battery 16-18 V.—Nominal Line Current—Temperature 70° F. Approx.

Count No.	IMPULSES	Timing Limits: Timing Within These Limits Requires No Adjustments Min.	Timing Limits: Timing Within These Limits Requires No Adjustments Max.	Timing Limits: Retime When Necessary To These Limits Min.	Timing Limits: Retime When Necessary To These Limits Max.	Operation to Obtain Timing Measurements	Adjustment Required To Obtain Timing
1	3-5-7-9-11-13-15 Shorts	4.5	6.5	5.0	6.0		Time T Relay
2	2-4-6-8-10-12-14 Shorts	4.5	6.5	4.5	6.5		Calibrate T & Chain Relays
3	9-11-13-15 Longs (Without LP)	13	17	14	16	Insulate LP Contacts A3 & C3	Time 1L Relay
4	10-12-14 Longs (Without LP)	11	15	12	14	Insulate LP Contacts A3 & C3	Time 2L Relay
5	9-11-13-15 Longs (With LP)	Add 5 to 7 to Count No. 3				Remove LP Contact Insulations	Time LP Relay
6	10-12-14 Longs (With LP)	Add 5 to 7 to Count No. 4				Remove LP Contact Insulations	Time LP Relay
7A	Between Consecutive Codes 16 (Office)	57	61	58	60		Time LB & LBP Relays
7B	Between Consecutive Codes 16 (Field—Without SS)	59	63	60	62	Insulate MSP Front Contact C5 (or B6)	Time LB & LBP Relays
8	Between Consecutive Codes 16 (Field—With SS)	75	85	77	83	Remove MSP Contact Insulation	Time SS Relay
9	9th Impulse of Manual Recall Code	57	61	58	60	Operate Manual Recall Button	Time Office M Relay
No Timing Required		These Values Are For Reference Only					When Values Exceeded
10	No. 1 Impulse (Control)	Add 2 to 4 to Count No. 5					Calibrate 1L & 2L
11	No. 1 Impulse (Indication)	Add 4 to 6 to Count No. 1					Calibrate 1L-2L-LP LB-LBP
12	3-5-7 Longs	Add 1 to 2 to Count No. 5					Calibrate F-G-S
13	2-4-6-8 Longs	Add 1 to 2 to Count No. 6					Calibrate F-G-S

PART III

FIELD MAINTENANCE TESTS

GENERAL

At the time a unit is replaced, the operator should make a complete operating check of the new unit to assure that it is functioning properly.

The field tests for coding units outlined in the following paragraphs should be made periodically (quarterly or semi-annually) to anticipate trouble before delays are actually caused. It is also recommended that the maintainer make a periodic visual inspection of relay contacts and operation.

TIMING OF UNITS IN SERVICE
(As Measured From Office)

The timing of a field unit in service may be checked from the office by recalling indication codes and recording them by means of a cycle recorder (with relay) as shown in Figure 1. These recorder tapes should be checked against the values shown in the accompanying "In Service" timing tables. Note that there is a separate table for "In Service" timing of field units on carrier controlled sections when the timing is measured at the office. These values must be used to obtain a true indication of the timing of the field units under these conditions. A suggested form for conveniently recording timing data is included in the back of this pamphlet.

The timing values covered by counts 1, 2, 5, 6, 7A, 7B, 9, 10, 11, 12, and 13 in the table may be obtained from the recorder tapes of individual codes from the unit being tested. The 16th impulse at the end of a control code followed by a second control code provides count 7A for the office unit. The 16th impulse at the end of a control code or the 10th impulse at the end of a manual recall code followed by an indication code provides count 7B for the field unit. Count 8, if desired, can be obtained by having a second person at the field location send consecutive indication codes or can be obtained by taking the cycle recorder to the field location and connecting it to the field LCS unit as shown in Figure 1. Repeating indication codes may be initiated by removing the wire from Post 42 of the LCS or S unit in question. Units are adjusted for timing at a temperature of approximately 70° F. The timing will vary somewhat with difference in temperature. Therefore, timing records taken in service at temperatures other than 70° F. should be corrected for temperature in accordance with the accompanying table.

If a tape shows a unit to be outside the limits shown in the proper timing table, two additional tapes of the same code should be taken, and if either of them shows the steps in question to be within the specified limits, the unit may be considered satisfactory for service. Any unit which these tests show to be definitely outside the specified timing limits should be removed from service and reshopped in accordance with Part II of this pamphlet.

Table 3

In Service Timing of Office Units and Field Units in D. C. Code Sections—Values in Cycles at Various Temperatures (f = 60)

Count No.	Impulses	105° F.		70° F.		35° F.		15° F.		0° F.	
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1	3-5-7-9-11-13-15 Short	4.5	6.5	4.5	6.5	4.5	6.5	5.0	7.0	5.0	7.0
2	2-4-6-8-10-12-14 Short	4.5	6.5	4.5	6.5	4.5	6.5	5.0	7.0	5.0	7.0
5	9-11-13-15 Long	18.5	23.5	19	24	19.5	24.5	20	25	21	26
6	10-12-14 Long	16.5	21.5	17	22	17.5	22.5	18	23	19	25
7A	Between Codes (Office)	...	...	57	61	...	...	...	...	...	...
7B	Between Codes (Field-No SS)	58.5	62.5	59	63	60	64	62	66	64	68
8	Between Codes (Field-with SS)	74	84	75	85	77	87	79	89	82	92
9	9th Impulse of Manual Recall Code	...	...	57	61	...	...	...	...	...	...
No Timing Required		These values are for reference only									
10	No. 1 Impulse (Control)	...	...	21	28	...	...	...	...	...	...
11	No. 1 Impulse (Indication)	8.5	12.5	8.5	12.5	8.5	12.5	9.0	13.0	9.0	13.0
12	3-5-7 Long	19.5	25.5	20	26	20.5	26.5	21	27	22	28
13	2-4-6-8 Long	17.5	22.5	18	24	18.5	24.5	19	25	20	26

Timing at other temperatures can be determined by interpolating values in the table above.

Table 4

In Service Timing of Field Units as Measured at the Office for Coded Carrier Controlled Sections—Values in Cycles at Various Temperatures (f = 60)

Count No.	Impulses	105° F.		70° F.		35° F.		15° F.		0° F.	
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1	3-5-7-9-11-13-15 Short	5.0	7.5	5.0	7.5	5.0	7.5	5.5	8.0	5.5	8.0
2	2-4-6-8-10-12-14 Short	3.5	6.0	3.5	6.0	3.5	6.0	4.0	6.5	4.0	6.5
5	9-11-13-15 Long	19.0	24.5	19.5	25	20	25.5	20.5	26	21.5	27
6	10-12-14 Long	15 5	21.0	16	21.5	16.5	22.0	17	22.5	18	24.5
7B	Between Codes (Field-No SS)	62.5	67.5	63	68	64	69	66	71	68	73
8	Between Codes (Field-with SS)	74	84	75	85	77	87	79	89	82	92
No Timing Required		These values are for reference only									
11	No. 1 Impulse (Indication)	9.0	13.5	9.0	13.5	9.0	13.5	9.5	14.0	9.5	14.0
12	3-5-7 Long	20.0	26.5	20.5	27	21	27.5	21.5	28	22.5	29
13	2-4-6-8 Long	16.5	22.0	17	23.5	17.5	24.0	18	24.5	19	25.5

Timing at other temperatures can be determined by interpolating values in the table above.

FIELD INSPECTION OF KP POLAR RELAYS

The field function and office traffic control KP relays (105/105 ohm or 120/120 ohm stick type) should be field inspected with approximately the same frequency as standard relays (at approximately two year intervals). The sensitive biased relays used as line and starting relays in the field should have more frequent inspections. It is suggested that they be inspected once or twice a year initially and that the frequency of subsequent inspections be determined by the results of these initial inspections.

The office line relay is inside the office line coding unit and should be inspected at the time this unit is reshopped.

The field inspection should include:

(a) Observation of the general condition of relay operating parts visible through the cover glass.

(b) Check of calibration values.

If the observed condition warrants it or if the calibration values are outside the field limits as specified under "Calibration", the relay should be reshopped as specified in Part II of this pamphlet.

Calibration

KP relay calibrations should be checked in a circuit similar to that shown in Fig. 3. The calibration values

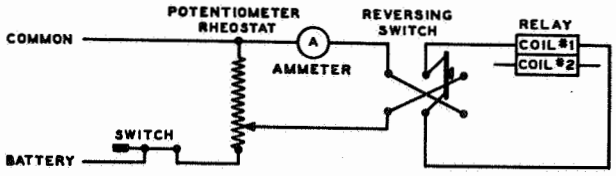


Fig. 3

should be taken on each coil separately in accordance with the accompanying tabulation on page 28.

The biased relay should first be charged at normal polarity to approximately four times maximum pick-up value and the current then gradually reduced until the relay releases to determine the release value. Open the circuit momentarily, and then close it and gradually increase the current until the relay closes its front contacts to determine the pick-up value. Further increase the current until the armature core pins touch the pole pieces to determine the full-stroke value.

The stick relay should first be charged at one polarity to approximately four times maximum pick-up value and the current then gradually reduced to zero. Reverse the polarity, then gradually increase the current until the relay reverses position to determine the pick-up value. The relay should go to full stroke at this same value. This calibration should be obtained on both polarities, with operation to both normal and reverse positions. The relay should remain at full stroke when deenergized.

SERVICE TESTS FOR THERMAL CUTOUT IN 506A UNITS

If desired, the CO timing may be checked at the field location under service conditions provided it is permissible for the station to be inoperative during the time of the tests. To check the CO timing under service conditions, remove the field R relay from its plug connector for the duration of the test, remove the ST relay from its plug connector and, making sure that the unit has not coded for at least 12 minutes, replace it. The time from replacement of the ST relay until the CO opens its contacts should be within the limits of 100 to 140 seconds, provided the field battery voltage is 16-17 volts. Under this test the M relay will be picked up whenever the CO is energized. Therefore, operation of the CO can be followed by observing the operation of the M relay.

CAUTION: If the installation is equipped with "Field Station Disconnect", a jumper must be connected between terminals 47 and 18 on the LCS unit plug connector. Also, the "Disconnect" relays (RP and RPP) will be deenergized at the end of this test and must be picked up by having the operator send a control code to that station.

PLUG CONNECTORS

Plug Connectors are used on all of the code equipment where interchangeability is desired. When removing a plug connector from a unit, a small wooden pry about ½"x½"x12" will be found handy.

To inspect a plug connector, take an individual socket or female member (or special test socket shown on plate T 575—page 12) and slide it over each wire spring in turn. If the spring does not seem to make good contact, insert

Table 5

KP Polar Relay Calibration

						Relays received from the U.S.&S. Co. or readjusted in R.R. shop should be within these limits.				Values at which relays should be taken out of service.			
Relay Nomenclature	Type	Piece No.	Code No.	Relay Coils		Pick-up Milliamperes			Minimum Release	Milliamperes		Contacts	
				Location	Ohms Res.	Max.	Min.	Full Stroke		Max. Pick-up	Min. Release	Type	Approx. Opening
Function Stick and Traffic Control	Stick	217122	12347	Upper Lower	105 105	40.0 40.0	25.0 25.0	... ...	... ...	55.0 55.0	....	4 Transfer	0.050"
Field R and ST	Biased	191481	57890	Upper Lower	1070 1070	5.25 5.25	3.75 3.75	6.5 6.5	1.75 1.75	6.5 6.5	1.0 1.0	2N-2R Ind.	0.030"
Office R	Stick	231412	12357	Upper	75	12.6 20.0	9.4 15.0	←(Counterclockwise)→ ← (Clockwise) →		15.6 24.0	....	2N-2R Ind.	0.040"
				Lower	33	18.9 29.4	13.1 21.6	←(Counterclockwise)→ ← (Clockwise) →		23.9 36.9	....		

CAUTION: When calibrating KP relays, care should be taken to insure that no iron or steel is within two inches of the relay in a vertical direction.

the bit of a screw driver into the loop of the spring and twist first one way and then the other. This will increase the tension. The screw driver should be inserted in the two loops, and not between the two loops in such a way that they become separated. A properly adjusted connector should require a force of not less than 1 lb. or more than 2 lbs. to remove it from the socket. If a connector is found to be faulty in any way, or if one side of the spring loop is broken off, it should be replaced with a new one.

When placing a plug connector back on the unit, care should be taken to see that all of the wire springs are properly started into the sockets before it is pressed into place.

To check KP relay plug connectors, insert a metal strip $\frac{1}{32}$"x$\frac{1}{4}$"x3" into each spring slot and note that plug connector spring bears against insert with reasonable pressure, requiring 1 to 2 lb. pull to remove insert. A faulty plug connector should be replaced.

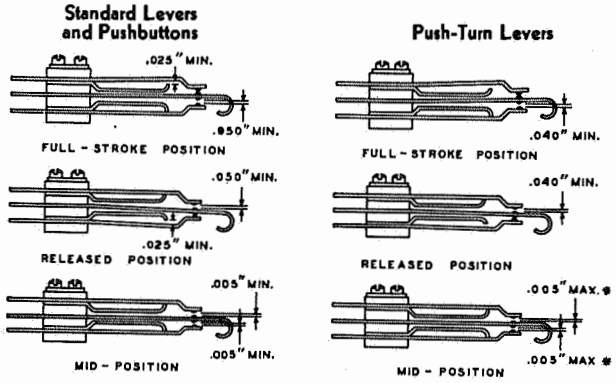
PART IV

INSPECTION PROCEDURE FOR CONTROL CABINET

OFFICE STORAGE UNITS

The relays in the Office Storage Units should be given the same inspection as the relays in the coding units. This includes mechanical inspection, contact adjustment, and electrical calibration. Adjustment will be easier if operating conditions permit the removal of battery from the storage unit during test.

CONTACT ADJUSTMENTS



*NOTE: *Contacts identified by a horizontal black line on heel spring loop to be adjusted to approximately 0.010" overlap.*

Fig. 4

LEVERS AND PUSHBUTTONS

Contacts on levers and pushbuttons should have approximately the same adjustments as contacts on relays, except that the openings should be as shown in Fig. 4.

AUTOMATIC TRAIN GRAPH

At the option of the purchaser, the control machine is equipped with an Automatic Train Graph which automatically records occupancy of "OS" sections, or other information, on a continuous chart.

Complete instructions for the operation and maintenance of the train graph mechanism are provided in Instruction Pamphlet U-5463. Copies of this information are supplied with each Automatic Train Graph. (NOTE: Instruction Pamphlet U-5463 describes and illustrates train graph mechanisms manufactured subsequent to January, 1946. Instructions covering earlier train graph mechanisms are provided in Appendix I of Instruction Pamphlet U-5121.)

PART V

GENERAL INFORMATION

Relay contact stacks are numbered A-B-C-D-E from left to right facing front of relay, which in the type "L" relay is the armature end. If a space for a stack is left vacant, the space is lettered as if the stack were present. Contact spring members are counted from top to bottom, only the members appearing in the stack being counted. Coil connectors are counted as a contact member, unless they are in the same space with the contact.

In soldering connections, wireman faces rear of the relay, so that his lettering is from right to left with "A" stack at the right, No. 1 being top member of each stack.

Relay Racks:—The relay spaces of each strip are numbered from left to right, facing front, or relay armature end of the rack or control unit. Relay mounting strips are lettered A-B-C-D-E-F from top to bottom.

Wiring diagrams show the rear of the relay rack, control unit, or control panel, hence the wiring diagrams should be read from right to left with No. 1 space at the right.

Table 6-Relay Wiring Diagram Nomenclature

Relay as shown on Circuit Plan	Contact Arrangement Rear View of Relay			Relay as shown on Wiring Diagram - Wired According to Color Code		
	C	B	A			
+A5	C1*		A1**	Bk.		G.S.
+B4	C2	B1	A2	Bu.S.	Bu.	O.G.
+C3	C3	B2	A3	O.W.	R.S.	G.
+A3	C4	B3	A4	S.W.	S.	
+B2	C5	B4	A5	R.Bu.	R.	O.
+C3	C6	B5	A6	O.S.	Y.	R.G.

*Coil Common **Coil Control

Only the heel contact members on the circuit plan are numbered and may therefore be identified on the wiring diagrams by their positions as shown in the above example. A color code scheme is used for wiring, and both solid and flex wire are used. Flex wire is identified on the wiring diagrams by a letter F after the color. On any one relay no two circuits have the same color of wire.

KP polar relays have their contacts numbered as shown below.

On those KP relays which have independent contacts, 1 and 3 are normal contacts while 2 and 4 are reverse contacts.

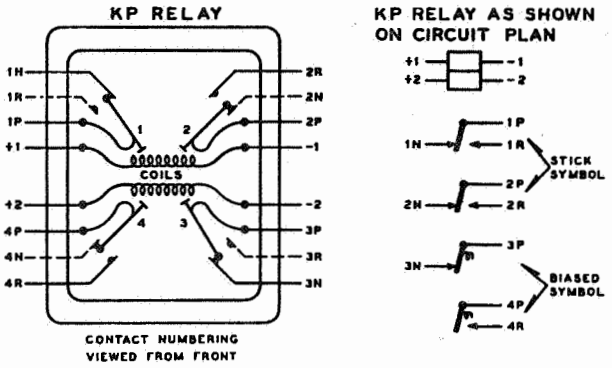


Figure 5

Table 7

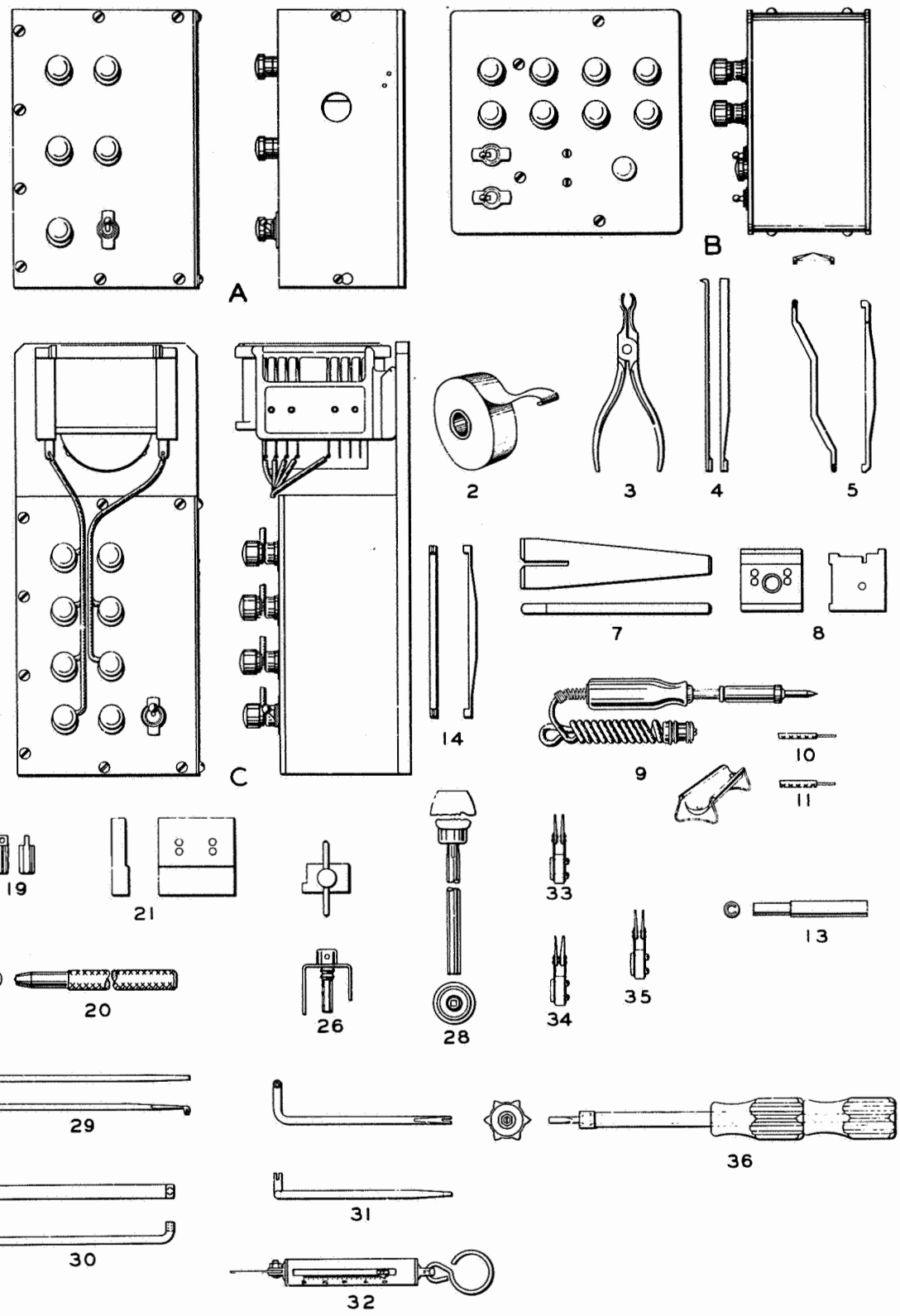
Field Code-Setting Connections

Station Code Number	For Sending Codes			For Receiving Codes		
	Connect Post 70 to Post	Connect Post 80 to Post	Connect Post 45 to Post	Connect Post 50 to Post	Connect Post 60 to Post	Connect Post 40 to Post
234	72	73	84	52	53	64
235	72	73	85	52	53	65
236	72	73	86	52	53	66
237	72	73	87	52	53	67
238	72	73	88	52	53	68
245	72	74	85	52	54	65
246	72	74	86	52	54	66
247	72	74	87	52	54	67
248	72	74	88	52	54	68
256	72	75	86	52	55	66
257	72	75	87	52	55	67
258	72	75	88	52	55	68
267	72	76	87	52	56	67
268	72	76	88	52	56	68
278	72	77	88	52	57	68
345	73	74	85	53	54	65
346	73	74	86	53	54	66
347	73	74	87	53	54	67
348	73	74	88	53	54	68
356	73	75	86	53	55	66
357	73	75	87	53	55	67
358	73	75	88	53	55	68
367	73	76	87	53	56	67
368	73	76	88	53	56	68
378	73	77	88	53	57	68
456	74	75	86	54	55	66
457	74	75	87	54	55	67
458	74	75	88	54	55	68
467	74	76	87	54	56	67
468	74	76	88	54	56	68
478	74	77	88	54	57	68
567	75	76	87	55	56	67
568	75	76	88	55	56	68
578	75	77	88	55	57	68
678	76	77	88	56	57	68

When field pyramid units are used, other code-setting connections are required. These are given in special drawings.

WABCO

PLATE T-575



CYCLE RECORDERS, TOOLS AND SUPPLIES

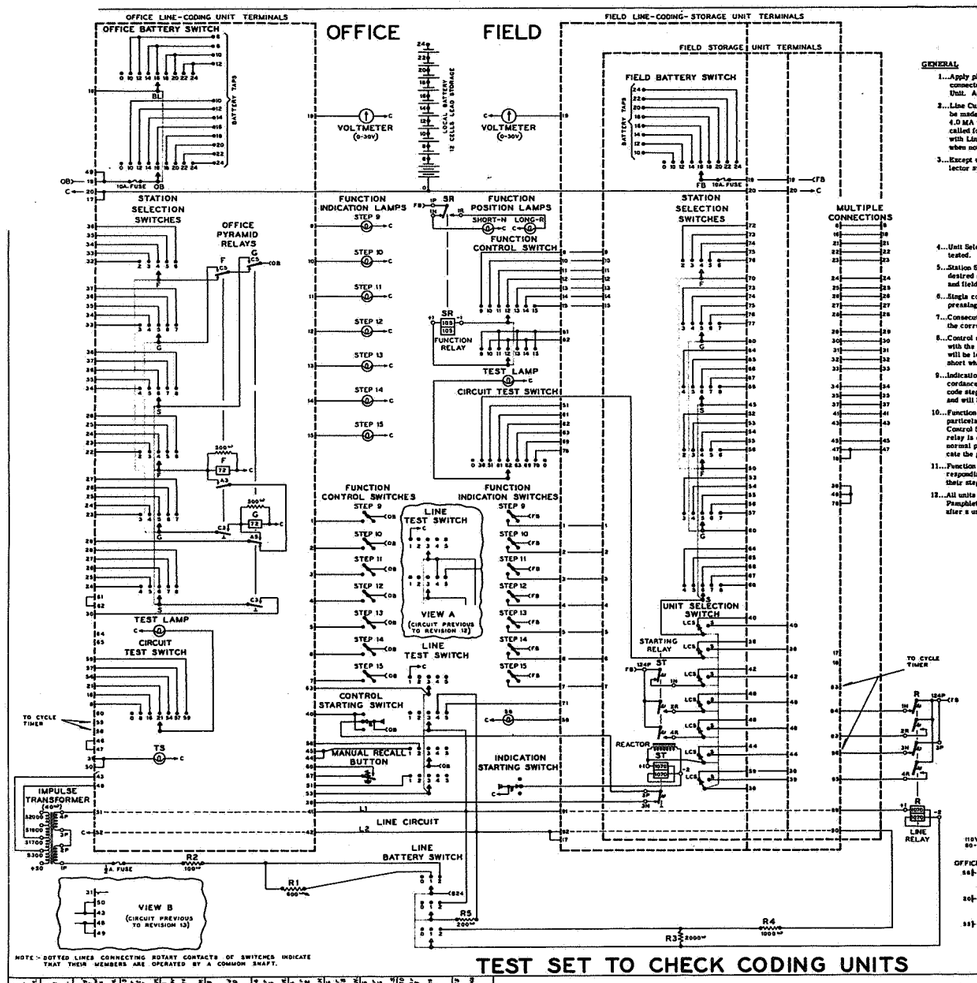
PLATE T-575

CYCLE RECORDER, TOOLS AND SUPPLIES FOR MAINTENANCE

Order by Plate, Piece, Reference and Abbreviated Description Given in Heavy Face Type Only

PIECE	REF.	DESCRIPTION	DWG. REF.
UN102949	A	**DOUBLE PUNCH CYCLE RECORDER** (When ordering state installation for which required)(Used with 16 Step 504 Time Code Systems)	C-9299-3
	B	**SINGLE PUNCH CYCLE RECORDER** (When ordering state installation for which required)(Used with 14 Step Time Code Systems)	C-9299-1
UN231678	C	**DOUBLE PUNCH CYCLE RECORDER** (When ordering state installation for which required)(Used with 16 Step 506 Time Code Systems)	C-9299-4
	2	**ROLL SIZE "C" PAPER FOR CYCLE RECORDER** (10 per package)	
UJ39826	3	**PLIERS FOR REMOVING LAMP CAPS**	
UJ39864	4	**OFFSET SCREW DRIVER** for removing Relay Armatures	
UM164375	5	**BENDER (OFFSET)** for Contact Springs	A-2586-15
UM273829	7	**SWEDGE AND TWISTING TOOL** for Adjusting Relay Armatures	A-2586-95
UM164393	8	**ANVIL** for Adjusting Relay Armatures	A-2586-78
UJ39069	9	**3/8" ELECTRIC SOLDERING IRON WITH STAND**	
	10	**NO. 22 B. & S. GAUGE SOLID COPPER WIRE** in color code for wiring control machine and control units (Orders should specify quantity and color desired).	
	11	**NO. 20 B. & S. GAUGE FLEXIBLE COPPER WIRE** in color code for wiring control machine and control units (Orders should specify quantity and color desired).	
	11a	**NO. 22 B. & S. GAUGE FLEXIBLE COPPER WIRE** in color code for wiring control machine and control units (Orders should specify quantity and color desired).	
UM108099	12	**PUNCH** (Used with Eyelet Rivets to attach Armature Bakelite to Relay Armatures (Not shown)	A-2586-34
UM177803	13	**TOOL** for removing Lamps	A-2586-21
UM172481	14	**BENDER (STRAIGHT)** for Contact Springs	A-2586-14
UJ82103	15	**GRAM GAUGE W. E. 68B** for measuring contact pressures (Not shown)	
UJ39892	16	**BURNISHING TOOL W. E. 265C** for cleaning contacts (Not shown)	

PIECE	REF.	DESCRIPTION	DWG. REF.
	17	**RESIN CORE SOLDER** for making soldered connections (Do not use acid core or acid soldering paste or fluid). (Not shown)	
UM106100	18	**ANVIL** (Used with eyelet Rivets to attach Armature Bakelite to Relay Armatures) (Not shown)	A-2586-34
UM243028	19	**SOCKET** for adjusting Spring Tension of C. T. C. type plug Connectors	A-2586-60
UM244733	20	**PUNCH.** Used with Tubular Rivets to attach Armature Bakelite to Relay Armatures	A-2586-72
UO245029	20a	**PUNCH AND ANVIL SET** (Includes 1-20 and 1-21)	A-2586-72
UO255604	20b	**REPAIR SET FOR RELAY ARMATURES** (Includes 1-7, 1-8, and 1-20)	A-2586-72
UM244732	21	**ANVIL.** Used with Tubular Rivets to attach Armature Bakelite to Relay Armatures	A-2586-72
	23	**6" LONG-NOSE PLIERS** (Not shown)	
	24	**5" DIAGONAL CUTTING PLIERS** (Not shown)	
	25	**3" SCREW DRIVER** (Not shown)	
UN259590	26	**KEY AND CLAMP** for compressing Spring on Push Turn Lever	A-2586-82
UM170241	28	**KEY** for Push Turn Lever assembly	6803-96
UM262051	29	**BENDER** (Right Hand) for Contact Strips	A-2586-106
UM262634	30	**BENDER** for Thermal Cutout	A-2586-84
UM243059	31	**BENDER** for KN and KP Relays	A-2586-69
UN320728	32	**SPRING TESTER** for LP-53, LP-56 and LP-70 Relay Bases	A-2586-39
UN243000	33	**ARMATURE POSITIONING GAUGE** for Biased KP Relay (2 Required).	A-2586-65
UN243001	34	**ARMATURE POSITIONING GAUGE** for Stick KP Relay with 4 Transfer Contacts (2 Required)	A-2586-65
UN243002	35	**ARMATURE POSITIONING GAUGE** for Stick KP Relay with 2N and 2R Contacts (2 Required)	A-2586-65
UJ39720	36	**TUNING WRENCH** for Carrier Equipment	A-2586-105



TEST SET TO CHECK CODING UNITS

TESTING PROCEDURE

GENERAL

1...Apply plug connectors "A" and "B" to Office Line Coding Unit and plug connectors "C", "D", "E" and "F" to the Field Line-Coding-Storage Unit. Apply plug connectors "G" and "H" to the Field Storage Unit.

2...Line Current Settings. Except where otherwise noted, all tests should be made with Line Battery switch in position 1. (Line current will be 4.0 MA when not coding and 32 MA during indication codes). When called for, tests for operation with high line current should be made with Line Battery switch in position 2. (Line current will be 72 MA when not coding and 170 MA during indication codes.)

3...Except where otherwise specified, all tests should be made with selector switches in positions called for below.

SWITCH	POSITION
Office Battery	16
Field Battery	18
Line Battery	1
Line Test	3
Circuit Test (Office)	0
Circuit Test (Field)	0

4...Unit Selection switch should be set to agree with the type of unit being tested.

5...Station Selection switches for both office and field should be set to the desired station call number. Unless otherwise specified, both office and field should be set to the same digits.

6...Single control or indication codes may be initiated by momentarily depressing the corresponding starting switch.

7...Consecutive control or indication codes may be initiated by operating the corresponding starting switch to the "up" position.

8...Control code steps for function control are long or short in accordance with the positions of the Function Control Switches. These code steps will be long when their respective switches are to the right and will be short when their respective switches are to the left.

9...Indication code steps for function indication are long or short in accordance with the positions of the Function Indication Switches. These code steps will be long when their respective switches are to the right and will be short when their respective switches are to the left.

10...Function relay 5R operates on steps 9 to 15 of Control codes. The particular step being tested must be selected by operating the Function Control Switch to the position corresponding with the step number. The relay is operated to the reverse position by a long impulse and to the normal position by a short impulse. The function position lamps indicate the position (normal or reverse) of the relay.

11...Function Indication Lamps 9 to 15 will be illuminated when their corresponding indication code steps are long. They will remain dark when their steps are short.

12...All units should be timed and adjusted in accordance with Instruction Pamphlet U-5122. The following operational checks should be made after a unit has been properly timed and adjusted.

OPERATING TESTS FOR OFFICE LINE-CODING UNITS

Connect unit into Test Set and position switches in accordance with paragraphs 1, 2, 3 and 4 under "General" Then proceed with operating tests as follows. After each test, switches should be returned to normal.

TEST	MANIPULATION	INDICATION
1. Station Selection	Set Station Selection Switches to 346, 357 and 468 in sequence. Set Office Circuit Test Switch to the 16 position. Transmit control and indication codes.	Note that at the end of each control code the 8th relay in the field L.C.S. unit picks up. Note that at the end of each indication code the Office Test Lamp lights.
2. Transmission of Function Controls.	Operate Field Function Control Switch to the 9 position. Transmit a control code with 9th step long.	Observe that the "Long" Function Position Lamp is illuminated.
	Transmit a control code with 9th step short.	Observe that the "Short" Function Position Lamp is illuminated.
	Repeat above tests for steps 10 to 15 inclusive.	Same as above for 9th step.
3. Reception of Function Indications.	Transmit indication codes with Function Indication Switches positioned for long and short code steps.	Function Indication Lamps will be lighted when their corresponding code steps are long. They remain lighted until the end of the code.
4. Code Disagreement	Set Office Station Selection Switches to 234. Set Field Station Selection Switches to 345. Transmit an indication code.	The "2" relay in the office should operate to interrupt the code.
	Repeat above with field set to 346.	Same as above.
5. Operation on Voltage Limits	Set Office Battery Switch to position 14 and Field Battery Switch to position 24 and check that office unit transmits and receives complete codes on station selections 357 and 468. Then set Office Battery Switch to position 24 and Field Battery Switch to position 14 and again check that office unit transmits and receives complete codes on station selections 357 and 468.	Same as for test 1 with Office Circuit Test Switch in the 16 position.
6. Operation on High Line Current	Operate Line Battery Switch to position 2 and repeat tests under 5.	Same as for test 5.
7. General Circuit Tests (a)(b) TS Relay Circuit check	(a) Transmit indication code.	(a) "TS" lamp should flash on the 1st, 2nd and 16th steps. (b) "TS" lamp should remain dark.
(c) Check of SF relay stick circuit over 48 chain relay	(b) Transmit control code.	
(d) Check of delivery circuit	(c) Place Office Circuit Test Switch to position 9. Transmit a control and an indication code.	(c) Office Test lamp should be lighted continuously except during the 8th. step of control code.
(e) Check of "F" pick up circuit	(d) Place Office Circuit Test Switch to position 16. Transmit an indication code.	(d) Office Test lamp should be lighted on 16th step of indication code.
(f) Check of carrier reset circuit	(e) Place Office Circuit Test Switch to position 51. Transmit control and indication codes.	(e) Office Test lamp should be lighted on first step of any code.
	(f) Place Office Circuit Test Switch to position 54. Place Line Test Switch to position 1. Transmit control code. (return Line Test Switch to position 3)	(f) Office Test lamp should be lighted on 16th step of control code.
(g) Check of M front contact (Term. 57)	(g) Place Office Circuit Test Switch to position 57. Transmit Control code.	(g) Office Test lamp should be lighted during control code.
(h) Check of LSR (rear contact (Term. 59)	(h) Place Office Circuit Test Switch to position 59. Transmit codes.	(h) Office Test lamp should be lighted during any code.
(i) Check of Line bleeder contacts on T relay	(i) Place the Line Test Switch in position 1. Transmit control code. Note: Line Test Switch should be wired as shown to test Pc. 336010 O. L. C. units. To test Pc. 237587 or Pc. 228789 O. L. C. units with wiring as shown connect a jumper between posts 42 and 52 for this test. Test sets wired per view "A" will test Pc. 237587 or Pc. 228789 units without using the jumper but will not completely test Pc. 336010 units.	(i) Note that the field line relay remains energized during this test.
(j) Check of R locking and resetting circuits	(j) Operate Line Test Switch to position 2 and immediately back to position 3.	(j) The office "R" relay should operate reverse (counter clockwise) and, after approximately one second, return to the normal (clock wise) position.
(k) Check of Manual recall circuits (506-A units only)	(k) Operate Control Starting Switch and Recall Button simultaneously.	(k) Note that only 10 steps of the control code are transmitted.

OPERATING TESTS FOR FIELD STORAGE UNITS

Connect into Test Set with L. C. and L. C. S. Units and position switches in accordance with paragraphs 1, 2, 3 and 4 under "General". Then repeat Tests 2, 3, 4, 5 and 12b above.

TO TEST FIELD PYRAMID UNIT

Field Pyramid Unit circuits are checked by applying battery to certain terminals to operate relays, and by checking other circuits with Buzzer, Test Lamp, etc. These circuits are shown on drawing D2547-Sh. 3, or other special drawings.

OPERATING TESTS FOR FIELD LINE-CODING-STORAGE UNITS

Connect unit into Test Set and position switches in accordance with paragraphs 1, 2, 3 and 4 under "General". Then proceed with operating tests as follows. After each test, switches should be returned to normal position.

TEST	MANIPULATION	INDICATION
1. Station Selection	Set Station Selection Switches to 234, 345, 456, 567 and 678 in sequence. Set Office Circuit Test Switch to the 16 position. Transmit control and indication codes.	Note that at the end of each control code, the 8th relay in the field L.C.S. Unit picks up. Note that at the end of each indication code the Office Test lamp lights.
2. Reception of function Controls.	Operate Field Function Control Switch to the 9 position. Transmit a control code with the 8th step long.	Observe that the "Long" function position lamp is illuminated.
	Transmit a control code with 8th step short.	Observe that the "Short" function position lamp is illuminated.
	Repeat above tests for steps 10 to 15 inclusive.	Same as above for 8th step.
3. Transmission of function indications	Transmit indication codes with Function Indication Switches positioned for long and short code steps.	Function indication lamps should be lighted when their corresponding indication steps are long. They should remain dark when the steps are short.
4. Operation on voltage limits	Set Office Battery Switch to position 14 and Field Battery Switch to position 24. Check that field unit transmits and receives complete codes on station selections 237 and 468. Set Office Battery Switch to position 24 and Field Battery Switch to position 14 and check that field unit transmits and receives complete codes on station selections 357 and 468.	Same as for test #1 (with Office Circuit Test Switch in position 16)
5. Operation on High Line Current	Operate Line Battery Switch to position 2 and repeat tests listed under 4 above.	Same as for 4.
6. Control Code Preference Circuit	Set Line Test Switch to the 5 position. Transmit an indication code.	The "CD" relay should pick up on the first step to interrupt the code.
7. Station Lockout Circuit	Set Line Test Switch to position 4. Operate Field Starting Switch.	Observe that field "M" relay cannot pick up.
8. Station Elimination Circuit	Set Station Selection Switch in office to 234. Set Station Selection Switch in field to 248. Transmit an indication code.	Note that "CD" relay in the field L. C.S. unit operates to interrupt the code.
9. CO Timing (a) 506A Units	(a) Remove the field "R" relay from its plug connector. Operate the Field Starting Switch.	(a) Check that the "CO" operating time is as specified in U-5122.
Bd 506 Units	(b) Operate the Field Starting Switch to the up position.	(b) Check that the proper number of codes are transmitted as specified in U-5122.
10. General Circuit Tests (a) #8 Selection Circuit for Pyramid Unit	(a) Set Station Selection Switches to 678. Set Field Circuit Test Switch to the 78 position. Transmit control and indication codes.	(a) The 58 lamp should flash on 8th step of all codes. The Field Test lamp should be lighted on 8th step of indication codes.
(b) MSP back contact to post 36	(b) Set Field Circuit Test Switch to position 36. Transmit an indication code.	(b) Field Circuit Test lamp should be lighted continuously except during indication codes.
(c) "E" pick up circuit for Pyramid Unit	(c) Set Field Circuit Test Switch to position 51. Transmit control and indication codes.	(c) Field Test lamp should light on 1st step of any code.
(d) "A" and "B" back contact circuits (Terms. 61 and 62)	(d) Set Field Circuit Test Switch to positions 61 and 62 in turn. Transmit control and indication codes in each case.	(d) Field Test lamp should flash during all codes with switch in either position.
(e) "G" pick up circuit for Pyramid Unit (Term. 63)	(e) Set Field Circuit Test Switch to position 63. Transmit control and indication codes.	(e) Field Test lamp should flash on first station selection step of any code.
(f) "E" stick circuit for Pyramid Unit (Term. 69)	(f) Set Field Circuit Test Switch to position 69. Transmit control and indication codes.	(f) The Field Test lamp should be lighted except during the first station selection step.
11. Check of Storage Unit Operating Circuits in L.C.S. Unit.	Connect a storage unit to the test set, set Unit Selection Switch to "S" and repeat tests 3 and 3 above.	Same as for 2 and 3 above.

CIRCUIT DIAGRAMS FOR 506—506A

OFFICE LC AND S UNITS	D2547-SH. 1, SH. 7&11
FIELD LCS AND S UNITS	D2547-SH. 2, SH. 8
PYRAMID UNITS AND LINE CIRCUIT	D2547-SH. 3, SH. 9
TIME CHART	D2547-SH. 4, SH. 10

FOR PLUG CONNECTOR AND CABLE WIRING SEE C9362-SH. 670-671
FOR PANEL WIRING SEE C9362-SH. 669
FOR TEST CABINET COMPLETE SEE D2491-SH. 5

CIRCUIT DIAGRAMS
TIME CODE CONTROL SYSTEM
TYPE L FORM 506-506A 35 STATION BASIS
U. S. S. CO. SWISSVALE, PA.

D2547 SH. 5 CONT. ON SH.

ASSEMBLY	BEGUN BY	DATE	TEST SET
DETAILS	FINISHED BY	DATE	
REQ.	TRACED BY	DATE	
SCALE	CHECKED BY	DATE	

UNIT
PIECE NO._____
SERIAL NO._____

SUGGESTED FORM FOR RECORDING TIMING DATA

STEP NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		Temperature ° F.	Date	Date Unit was placed in Service at Present Location	Date of Last Shop Test	Data Taken By	REMARKS (Such as unusual conditons)
Max. & Min. Length of Long and Short Code Steps, measured in Cycles, at 70° F. with Local Batt. 16-18 Volts (Freq. = 60 Cycles) (See Notes Below)	Short (Ind. Code)	Short	Short	Short	Short	Short	Short	Short	Short	Short	Short	Short	Short	Short	Short	Between Consecutive Codes							
	8.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	Control Codes 57-61							
	12.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5								
	Long (Control Code)	Long	Long	Long	Long	Long	Long	Long	Long	Long	Long	Long	Long	Long	Long	Indication Codes							
	21	18	20	18	20	18	20	18	19	17	19	17	19	17	19	Without SS 59-63	With SS 75-85						
	28	24	26	24	26	24	26	24	24	22	24	22	24	22	24								
Location of Unit	Measured length of code steps																						

NOTES

1. All tapes for field tests may be taken at the office. (To obtain timing with SS relay, someone must be present at the field location to initiate consecutive indication codes. However, since the SS relay timing is not critical, it need not necessarily be checked every time that field tests are made).
2. Specification limits for allowable length of each code step are shown at the top of the column for the code step to which they apply. These limits are specified in terms of cycles (60 cycles = 1 second) and based on temperature of 70° F. When making tests, actual temperature of unit being tested should be recorded. Timing data should be corrected for temperature in accordance with table in Instruction Pamphlet U-5122 , when actual temperature of unit differs from 70° F. by more than 35° F.
   When frequency used in obtaining timing data is other than 60 cycles per second, specified timing values should be evaluated in terms of the new frequency as follows:

$$\text{Specified timing values} \times \frac{\text{new frequency}}{60}$$

3. If the timing of a particular code step is within 1/2 cycle of the limits, take a second tape and record the longest count.

Values shown are those obtained when unit is in service on a D.C. code line or when timing is measured at field. For timing of field units (measured at office) for carrier controlled sections see proper table under Field Maintenance Tests.

An **American-Standard** Company

UNION SWITCH & SIGNAL DIVISION
WESTINGHOUSE AIR BRAKE COMPANY
Swissvale, PA 15218