TYPE O AND ON CARRIER TELEPHONE SYSTEMS—TERMINALS AND JUNCTIONS

GENERAL INFORMATION—MAINTENANCE CONSIDERATIONS

CONTENTS PAGE

1. GENERAL

1.01 This section describes the methods of testing and adjusting the terminal and junction equipment of the O and ON carrier telephone systems.

1.02 This section is reissued to reflect current requirements on interchangeability of O units, to update other maintenance considerations, and to make minor changes and corrections. Since this reissue is a general revision, arrows ordinarily used to indicate changes have been omitted.

1.03 ***Interchange of Channel Unit Subassemblies:*** Interchangeability of channel subassemblies for N, O, and ON carrier telephone systems is given in Table A. A unit must not be used other than in its designated position.

1.04 ***Equipment Mounting:*** The channel units must be plugged carefully into the terminals, since the spring fingers of the small jack terminals of the multicontact jacks are easily bent out of shape. If a spring finger is bent, it may prevent good contact in the jack and, because of improper seating of the connector, may prevent proper contacts in the other jack terminals of the jack assembly. To avoid this damage: (1) check that the Dzus fastener slot on each upper plug-in unit is turned vertically at the start and that the stud enters its hole and engages its spring in the terminal mounting, thus ensuring proper centering; (2) on the unit (whether upper or lower), "feel" for the proper positioning of the connector with its jack assembly; and then (3) release the hold on the handle and, with a single fingertip on the face of the handle, push it into place. If greater pressure must be exerted, remove the unit and examine the connector and jack assembly for bent or broken parts.

1.05 Damaged individual jack terminals can be replaced without replacing the whole jack assembly, as covered in Section 032-305-801.

1.06 The upper plug-in units and the coverplate must be placed carefully on the terminal mountings so that the stud and the spring wire of the Dzus fastener are not damaged when the fastener is locked. A quarter turn only is required to reach the locking point and the stud should not be forced further.

1.07 If a unit is removed from a terminal or junction mounting for more than a few hours and power is left on the other units, the heater supply should be readjusted to maintain an average of 38.5 volts on the heaters. ***For repeaters, the fuses through which the heater current flows must always be removed before a unit or electron tube is removed.*** These precautions are necessary to prevent damage to the tube heaters by excessive voltage.

1.08 There is one projecting lug on the carrier subassembly of the channel unit and another, slightly offset from this one, in the expandor subassembly near the plug and jack. Lugs are arranged similarly between the compressor and the expandor subassemblies. When these components must be disconnected, remove the screws in the face of the unit and insert a screwdriver between the lugs to pry apart the connector block. If this procedure is not used, the pins and jacks may be damaged.

1.09 The die-cast and fabricated models of the O and ON system terminal mounting fuse panels and of the ON system junction fuse panel are interchangeable. However, at ON junctions, only the die-cast oscillator model can fit in the die-cast junction fuse panel and only the fabricated oscillator model can fit in the fabricated fuse panel.

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1.10 Tube pullers, such as the Rubber Tip Sure Grip Tube Puller or the KS-13753 tool, are available for the removal of hot tubes. Use of JE13 (7-pin) and JE15 (9-pin) pin straighteners is also recommended. One each of these straighteners should be mounted on the bay channel close to the type O equipment, and a tube should be inserted into the appropriate straightener each time before it is inserted into its socket. To prevent damage of the mercury relay during removal, the 603A tool should be used.

1.11 There are many exposed points at plate potential above the framework (ground) of plug-in units that have been removed from the terminal mounting and energized for testing by use of an appropriate cord. Therefore, since the terminals underneath the handle are close to the front edge, the handle should be gripped at the sides rather than from beneath when the unit is pulled out.

1.12 When tests are performed at the terminal and the coverplate is removed, the upper units must be kept locked in place and the lower units must not be pulled out of good jack contact when cords are pulled from the pin jacks. Incomplete contact between connector blocks and jacks may cause errors.

1.13 KS specification carrying cases are available for plug-in units of the type O carrier system. Protection is adequate for transportation except for shipment by a common carrier; here, the carrying cases should be packed in an outer case providing a "floating" type of packing.

1.14 ***System Lineup:*** System lineup tests are performed either when the system is first lined up terminal to terminal, or when significant changes in transmission due to such effects as aging or temperature have been observed that indicate that a lineup is necessary or desirable. If the lineup is made when the outdoor temperature is below 30°F or above 80°F, the cable section should be realigned when the temperature is between these values. Lineup tests should not be made during emergency battery conditions or when sleet is on the open-wire line. Coverplates must be locked in place before lineup is begun.

1.15 The two directions of transmission do not have to be lined up at the same time. Transmitting terminal tests may be performed simultaneously at both terminals, but both terminals should be lined up before junction or repeater tests are begun. The components of the O and ON systems should be lined up in the following order:

(1) Group oscillators, twin channels (transmitting direction), and group transmitting units

(2) Repeaters and junctions, in sequence, starting at transmitting end and proceeding to receiving end

(3) Group receivers and twin channels (receiving end)

> ***Note:*** The group receiving units can be initially lined up by looping the group transmitting unit output to the group receiving unit input, using the loop-test unit (see 2.07 through 2.13).

(4) Channels, including transmission, signaling, noise, and alarm tests.

The procedures to be followed when these tests are performed are covered in associated sections in this division. Refer to Section 362-101-300 for an overall list.

1.16 Channel noise measurements should be made at the secondary testboard or at the VF patch bay if jack appearances are available and if the level is known. Otherwise, the measurements should be made on a bridging basis at the E1 and E2 jacks of the channel unit with the circuit terminated in 600 ohms at the testboard or equivalent. The VF IN leads at the distant terminal should also be terminated in 600 ohms at the secondary testboard, or equivalent, and the channel should be placed in the OFF HOOK condition by application of battery to the M lead at the distant terminal. The channel units at both ends should be in their normal positions in the terminal mountings so that any possible effects of low-frequency inductive fields are included in the measurements. Where it is impractical to terminate the circuit at the testing end, the bridging measurement can be made with only a small error (1 dB or less), provided the loss in the REC potentiometer is 12 dB or more. If noise measurements are made during periods of static, higher values may be experienced occasionally.

TABLE A

N, O, AND ON CARRIER INTERCHANGEABLE CHANNEL UNIT SUBASSEMBLIES

O AND ON CARRIER CHANNEL UNITS																											N CARRIER CHANNEL UNITS																											GROUP NUMBER
							THROUGH CHANNEL UNIT			SPL SRVS CHANNEL UNIT			CHANNEL UNIT WITHOUT SIGNALING													SCHED C AND D PROG	THROUGH CHANNEL UNIT								SPL SRVS CHANNEL UNIT WITHOUT COMPANDOR AND SIGNALING							CARRIER WITHOUT SIGNALING				MESSAGE CHANNEL UNITS								
							J98705AF-1			J98705AP-1			J98705AS-1													J98705AT-1	J98703AH-1	J98703AH-2							J98703AM-1	J98703AM-2						J98703AP-1				J98703F-1	J98703FA-1	J98703FA-2	J98703FA-3					
L17	L23	L25	L26	L27	L28	L29	L1	L4	L6	L1	L4	L6	L1	L4	L6	L7	L9	L12	L13	L14	L15	L16	L18	L21	L22	L1	L1-L13	L1-L26	L28-L40	L41	L42-L54	L55	L60-L72	L76-L88	L1-L13	L1-L26	L28-L40	L41	L42-L54	L55	L60-L72	L41	L55	L56	L73	L15	L72	L72	L41	L55	L70	L71	L72	
													✓	✓																																								G2
															✓																																							G4
																✓																										✓	✓								✓	✓	✓		G5
																	✓			✓																																		G6
																		✓			✓																																	G7
✓																			✓			✓																																G8
	✓																						✓																					✓		✓	✓	✓				✓	✓	G9
		✓																																										✓									G11
					✓																			✓	✓																													G13
																																																					G2
																																																					G4, E
																																																					G5, E
																																																					G8, E
			✓	✓	✓	✓	✓			✓			✓																																									G1
																																																					G2
																																																					G1
																																																					G3
✓																																																					G4
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																																																					G7
		✓																																																			G10
			✓																																																		G12
				✓																																																	G13
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						✓																																															G15
							✓			✓		✓	✓	✓		✓			✓				✓	✓																													G1
								✓			✓				✓																																						G2
							✓	✓																		✓	✓	✓		✓		✓	✓																				G1
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									✓	✓																								✓	✓	✓		✓		✓													G1
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																✓							✓	✓																													G4
																	✓	✓																																			G5
																									✓																												G1
																									✓																												G1
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o 4-wire resistance hybrids.

TABLE A

N, O, AND ON CARRIER INTERCHANGEABLE CHANNEL UNIT SUBASSEMBLIES

CHANNEL UNIT SUBASSEMBLIES	GROUP NUMBER	O AND ON CARRIER CHANNEL UNITS																																																			
		MESSAGE CHANNEL UNITS																									THROUGH CHANNEL UNIT			SPL SRVS CHANNEL UNIT			CHANNEL UNIT WITHOUT SIGNALING													SCHED C AND D PROG	THROUGH CHANNEL UNIT						
		J98705D-1								J98705D-2																	J98705AF-1			J98705AP-1			J98705AS-1													J98705AT-1	J98703AH-1	J98703AH-2					
		L1	L4	L6	L19	L20	L21	L22	L25	L1	L4	L6	L7	L9	L10	L13	L14	L15	L16	L17	L23	L25	L26	L27	L28	L29	L1	L4	L6	L1	L4	L6	L1	L4	L6	L7	L9	L12	L13	L14	L15	L16	L18	L21	L22	L1	L1-L13	L1-L26	L28-L40	L41	L42-L54	L55	L60-L7
ED-92317-30 Compressor (See Note)	G2	✓	✓							✓	✓																						✓	✓																			
	G4			✓								✓																							✓																		
	G5												✓																							✓																	
	G6														✓																						✓			✓													
	G7				✓		✓									✓			✓																			✓			✓												
	G8					✓		✓									✓			✓																			✓			✓											
	G9																				✓																						✓										
	G11								✓													✓																															
	G13																								✓																			✓	✓								
ED-92318-31 Expandor and Signaling	G2	✓	✓	✓																																																	
	G4, E				✓	✓																																															
	G5, E						✓	✓																																													
	G8, E								✓																																												
ED-92604-30 Carrier	G1									✓													✓	✓	✓	✓	✓			✓			✓																				
	G2												✓																																								
Ed-92906-30 Expandor and Signaling	G1									✓		✓																																									
	G3												✓																																								
	G4													✓				✓	✓																																		
	G5														✓																																						
	G6															✓	✓																																				
	G7																	✓																																			
	G10																					✓																															
	G12																						✓																														
	G13																							✓																													
	G14										✓														✓																												
	G15																									✓																											
ED-97012-30 Carrier	G1		✓	✓							✓	✓			✓													✓			✓		✓	✓	✓		✓			✓				✓	✓								
	G2																												✓			✓				✓																	
ED-92802-30 Through Channel*	G1																										✓	✓																			✓	✓	✓		✓		✓
	G2																												✓																					✓		✓	
ED-92933-30 Spl Srvs	G1																													✓	✓																						
	G2																															✓																					
ED-92972-30 Expandor Without Signaling	G2																																✓	✓	✓					✓													
	G3																																			✓																	
	G4																																				✓						✓	✓									
	G5																																					✓	✓														
ED-97014-30 Sched C and D Prog Comp	G1																																													✓							
ED-97015-30 Sched C and D Prog Exp	G1																																													✓							
ED-97016-30 Sched C and D Prog Carr	G1, A																																													✓							

Note: G2 units have 4-wire resistance hybrids. G4 through G13 units have no 4-wire resistance hybrids.

1.17 Routine pulsing tests should be made wherever possible between testboards or patch bays so that channel units will not have to be removed from their mountings. Thus, the circuit can be tested under normal temperature conditions and sticking relays will not be jarred. When channels are found to be out of limits, the BRK potentiometer should ***not*** be readjusted until an overall check has been made to determine the reason for the change. If a relay or subassembly must be replaced or if the channel unit must be left out of the mounting for an extended period, the percent break should be checked after the channel unit has been returned to the terminal mounting for approximately 3 hours.

1.18 Loop testing is accomplished during trouble conditions by holding the TST A key on the terminal mounting operated while operating the TST B key intermittently. A 3700-Hz signaling tone is transmitted intermittently over channel 1 to the distant terminal and back. If the TST lamp lights whenever the TST B key is operated, the circuit has returned to normal. The REST SYS key can then be safely operated, thus restoring the alarm circuit and the system to normal.

1.19 If the alarm panel for terminating the alarm circuit from a pole-mounted repeater is installed in the office, the ACO key must be restored after the trouble is cleared if it has been operated to silence the alarm. Failure to restore the key prevents the audible alarm from sounding if another repeater trouble occurs.

2. TESTING EQUIPMENT

2.01 ***All meters and tests sets should be kept in accurate calibration,*** as covered in practices describing the equipment.

2.02 ***Channel Unit Test Stand:*** (Refer to Section 103-467-100 for description) The J98705M channel unit test stand is used to obtain access to some of the potentiometers and test points of the channel and twin channel units during lineup. To use the test stand, the unit must be removed from the terminal mounting and placed in the stand; the S1 switch turned to the N1-O1 NORM position; and the P19A cord connected to the test stand and then to the jack from which the unit was removed.

Caution: Do not insert or remove the unit from the test stand when the cord is connected to the terminal mounting.

2.03 Jacks are provided in the test stand for connection to external apparatus, such as an oscillator, a measuring set, or a signaling test set. When a plug is inserted into the E_B jack, the G lead of the channel being tested is opened at the output of the channel unit and grounded.

2.04 Some error may be introduced into the reading of channel unit output because of coupling between leads of the P19A cord. This error varies from channel to channel, and can be as much as 1 dB. Therefore, all measurements should be rechecked after the terminal unit is returned to its mounting.

2.05 The stainless steel guides on the test stand may have to be adjusted on its initial use to obtain a proper fit between the units and the stand and to prevent damage to the 20-conductor jack. Hole clearances on the four screws that hold each of the brackets mounting the 20-conductor jacks allow the guides to be adjusted to a limited extent to provide a free fit to the die-cast slides of the units and to adjust the depth of engagement of the plug into the jack. Proper fit greatly increases the life of the jacks.

2.06 For the stand to operate, fuse holders on the stand require 3/4- and 1/8-amp AG-type fuses.

2.07 ***Loop-Test Unit:*** The J98705T loop-test unit can be used with the channel unit test stand for initial testing of an O carrier terminal alone, without the use of another terminal.

2.08 The loop-test unit (Fig. 1) is plugged into the N1 CH jack of the channel unit test stand to provide power for the repeater oscillator. The regular repeater oscillator for OB, OC, or OD terminals is plugged into the loop-test unit REP OSC jack. For an OA terminal, a special loop-test oscillator in accordance with SD-95158-01 is required.

2.09 The P19A test cord provided with the test stand is used to connect from the TEST jack on the test stand to the channel unit jack on the terminal mounting.

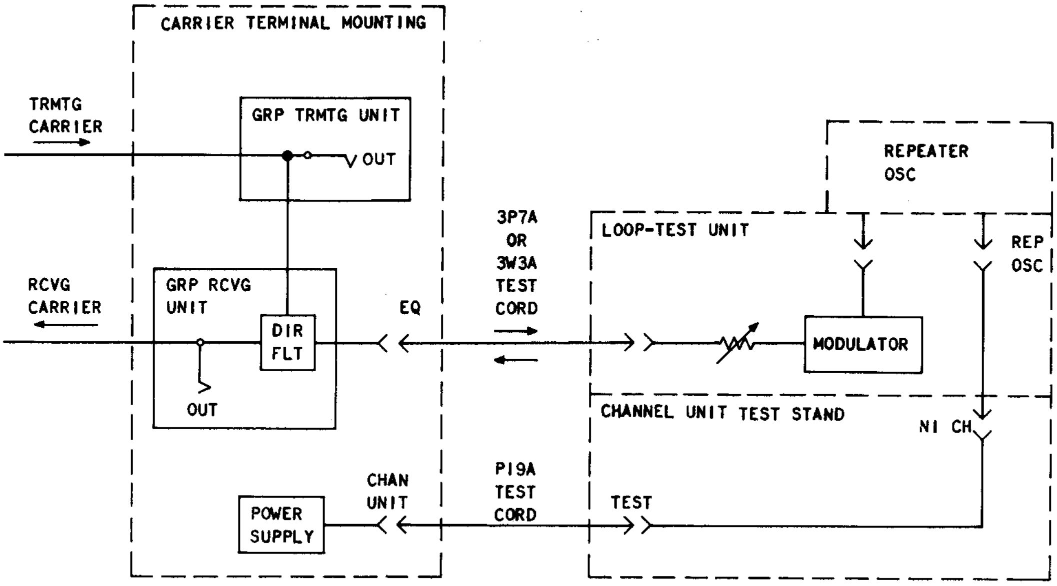

Fig. 1—Loop-Test Unit Setup

2.10 To make loop adjustments to the terminal, a patch cord is connected from the EQ TEST jack on the loop-test unit to the EQ jack on the terminal group unit.

2.11 The carrier level at the OUT jack on the group transmitting unit must first be adjusted to the proper level according to the procedures of Section 362-130-502.

2.12 The transmitted carrier goes through the directional filter in the group receiving unit, through the variable pad, and to the modulator. The modulator converts the transmitted carrier to the received carrier frequency. The received carrier is fed back through the variable pad and the directional filter.

2.13 The value of the variable pad is adjusted by the OA-OB, OC, OD switch and by the HI-LO LOSS key on the loop-test unit. The LOSS key must be set to the LO position before the group receiving unit output level is checked.

2.14 With the loop-test unit connected as shown in Fig. 1, a group receiving carrier of the correct level is fed back into the group receiving unit. The output can be adjusted according to the procedures of Section 362-135-501.

2.15 The regulation of the group receiving unit output can be checked by turning the LOSS key on the loop-test unit to the HI position. This action simulates a drop in the level of the received carrier. The level of the output of the group receiving unit can be monitored and the regulation can be adjusted according to the procedures of Section 362-130-502.

2.16 ***Voltmeters:*** The Weston Model 1 voltmeter, where available, can be used instead of the Model 931. However, the Model 1 meter is a laboratory-type instrument that requires extra care to prevent damage to it, whereas the Model 931 meter is a well-shielded meter of more rugged construction and can be handled and transported with less likelihood of damage. When the Model 1 meter is used, it should be kept at least 12 inches away from iron (eg, a table or a bay) and from strong magnetic fields.

2.17 The Model 280 or 281 voltmeters with 1-percent accuracy can be used; but if used to adjust heater voltages, may impair tube life.

2.18 ***Signaling Test Sets:*** When the 2B signaling test set is used, it should have been recently calibrated and the J98703P, L1 and J98703Q, L3 equipment are required. The 2B set should have W option wiring.

2.19 Unmodified 2A and 2B sets with the V option are inapplicable unless a regulated 24-volt power supply is accessible at the type O or ON carrier bay. When the pulse repeating test set and the pulsing test set are used, J98703Q, L2 equipment must be used instead of the equipment listed in 2.18 for the 2B set.

2.20 Operating procedures for the 2B set are not covered in this section for type O or ON application, but are similar to operating procedures in Section 179-217-501.

2.21 Operating procedures for the pulse repeating test set and for the pulsing test set are not covered in this section for type ON application, but are similar to operating procedures in Section 040-011-711. The 310-type plug of a 2P27A cord is placed in the RLY jack of the pulse repeating test set, and the 327A plug is placed in the E and M jacks of the test stand with the knurling left (toward the E_B or E jack).

2.22 When signaling converters are used, testing arrangements require that the M jack of the test stand always be used when the M lead is conditioned for off-hook or on-hook. ***No sources of external battery or ground should be applied to the M pin jack on the channel unit on any circuit using signaling converters, since such applications can cause a signaling fuse to blow or can put an undue load on the protective signaling lamp.*** However, the M pin jack of the channel unit can be used when the test stand is not available if battery and ground are removed from the converter circuit. If this procedure is not practical and testing procedures require battery or ground on the M lead, the A relay in the signaling converter can be blocked to apply −48 volts from the converter.

2.23 For the usual type of converter where tone is applied only in the signaling condition, the A relay should be blocked operated for conditions requiring on-hook and blocked nonoperated for conditions requiring off-hook. For converters that apply tone at all times except during the signaling condition, the blocking arrangements for the A relay should be reversed. The blocking tools should be removed at the completion of the test.

2.24 When terminal mountings are located back to back or against a wall, supporting details in accordance with ED-92717-01, G1 should be used when work is required on the wiring side of the 01 alarm relay panel on the terminal mounting. Each twin channel unit is removed and a supporting detail placed in the twin channel unit position. The alarm relay panel can then be placed, wiring side up, on the supports.

2.25 For O and ON systems, at the terminal, the 2J repeater test set is useful for monitoring to determine the presence of any speech or signaling tones during maintenance tests. The same set can be used with both N and O systems. If there is no requirement for using the cord attached to the set for type N carrier tests, the cord can be coiled up inside the case. For tests on repeaters, the 400C or 400D vacuum tube voltmeter, if already available, can be used instead of the 2J set. When the 400C or 400D meter is used, the meter readings obtained should be 6.5 dB less than those specified for the 2J set, thus correcting for scale difference due to the different calibrating impedance levels for the two meters.

3. MODIFICATION OF ON CHANNEL UNITS

3.01 The following procedure can be used to modify J98705D-1 or J98705D-2 message channel units that have unnecessary built-in signaling components, if other signaling methods are used.

STEP	PROCEDURE
1	Remove tubes V41 and V42 and relay K41 from the expandor and signaling subassembly.
2	Mount a 400-ohm 5-watt resistor across terminals PB-5 and PB-10 to provide a filament load in place of V45.
3	Remove tube V45.