Station Installation Manual

JUNE 1976

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Continental Telephone System

CONTINENTAL TELEPHONE SYSTEM

STATION INSTALLATION MANUAL

June 1976

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This manual is intended for the use of installation craftsmen in their daily jobs. The information in this manual will also be of value to other craftsmen such as construction linemen, cable splicers, and key telephone installers.

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PART I
GENERAL PLANT

PLANT PRACTICES
NUMERICAL INDEX

1. GENERAL

1.01 This practice provides a numerical index of all subjects covered in all divisions of Continental Telephone System Practices—Plant Series.

1.02 Distribution Codes:

a. Distribution for all Plant Series practices will show the Roman numerals IV, followed by parenthetic alphabetical codes, as applicable. For example, a Plant Series practice to be used by Central Office and PABX personnel will show: Distribution IV (B C).

b. The established alphabetical distribution codes for Plant Series practices applicable to particular groups are:

A—Radio

B—Central Office

C—PBX

D—Outside Installer

E—Splicer

F—Construction

G—Management

H—Service Center

J—Warehouse

T—Teletype-Data

1.03 A dot (•) indicates an item that has been added since the issue of Supplement XXV.

1.04 An asterisk (*) indicates an item that has been replaced since the issue of Supplement XXV.

1.05 The Issue Number is one (1) unless otherwise indicated.

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		GENERAL PLANT		
		GENERAL		
400-000-000		Addendum—Continental Telephone System Plant Practices	1	A B C D E F G H J
400-000-000	4	Continental Telephone System Plant Practices—Numbering Plan		
400-000-001	4	Numerical Index—Division 400—General Plant	5	A B C D E F G H J
400-000-002		Plant Practices Numerical Index—Supplement XXVI	58	A B C D E F G H J T
400-000-003	3	Ordering Information, Continental Telephone System Practices—Plant Series	4	A B C D E F G H J
400-000-004		Plant Practice Preparation Format	5	A B C D E F G H J
400-000-005		Master Alphabetical Index—All Divisions	18	A B C D E F G H J
		PLANNED MAINTENANCE PROGRAM—EQUIPMENT MAINTENANCE LISTS (EML)		
400-001-200	2	Planned Maintenance Program—Administration	12	A B C
400-030-270		EML—Transmission Test Instructions	1	A B C
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400-100-001	2	Annoyance Calls	11	A B C D E F G H J
400-100-002WD		Daily Toll Transmittal Procedures DDD Tickets and Tapes	6	B
• 400-100-003		Secrecy of Communications	5	A B C D E F G H J
400-105-201WD	2	Material and Supplies—Purchase Requisition Procedures	14	A B C D E F J
400-105-202WD		Repeat Requisition	7	G
400-105-220WD	3	Outside Plant Construction Report	3	G
400-105-250WD	2	Addendum—Installation & Station Maintenance Work Account Numbers and Station Movement Inventory Instructions	15	C D
400-105-250WD	2	Station Installation & Maintenance Work Account Numbers and Station Movement Inventory Instructions	15	C D
400-150-001	2	Construction—Cost Estimating	34	F
• 400-190-001		Interconnection Record Keeping and Reporting Procedures for Customer Provided Equipment (CPE)	10	A B C D E F G H J
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• 400-200-005		Plant TWX Completion Call Routine	6	B D
• 400-210-010		Energy Conversation Guidelines	5	A B C D E F G H J
400-300-001		Coordination of Plant Forces	1	A B C D E F
400-300-002	2	Assignment of Circuit Numbers .	8	B G
400-300-003		Private Line Circuits—Station Equipment—Identification Sticker	1	C D
400-300-005		Special Investigations & Inspections—Inside Plant	2	B
400-300-007		SATT Tests, Number Identification on 1 & 2 Party Services for Inside & Outside Plant	2	B C D
400-300-008		Circuit Order Tests for all Message Trunks	12	B C
400-300-009		Private Line & Toll Message Circuits (Form 1616) Circuit Order Test	5	B C
400-300-010		Toll Message and Private Line Service—Outside Plant—Trouble Reporting	2	B C D E
400-300-013		Addendum—Toll Message and Private Line Service—Trouble Records and Reports	4	B C
400-300-019	2	Monitoring of Working Lines	2	A B C D E F
400-300-021		Reconditioning C. O. and PABX Equipment Damaged by Water	4	B C
400-300-028		Switching Machine Center, Method of Reporting Trouble	4	B
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400-300-701		Intertoll—1000 Hz & Multifrequency AML Tests	7	B
400-300-702		Toll Connecting Trunks—1000 Hz & Frequency Response AML Tests	9	B
400-300-703		Terminal Balance—Description & Theory of Operation	21	B C
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400-405-013		First Aid Rescue of Employee from Pole	4	D E F
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405-100-705		Model S Current Flow Test Set & Applique Meter	10	B C
405-100-706		Pulse Speed & Percent Break Test Set	10	B
405-100-707		Type TE-89 Varying Machine	21	B
405-100-708		Local Pulse Repeating Test Set	10	B
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405-100-711		Type 37 Dial & MF Test Set	3	B
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405-100-713		Selector C Relay Test Set	5	B C
405-100-715	2	Type 28 Semi-Automatic Routiner	13	B
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		STROMBERG-CARLSON CORP. TEST EQUIPMENT—TESTING		
405-100-720		XY Universal Switch Test Set	25	B C
405-100-721		Circuit Plate Test Set No. 11	10	B
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405-100-759		707B and 710-I Quik Chek Test Sets	9	B C
405-100-760		CMC 714 XY Quik Chek Test Set Test Procedures	8	B C
		N.E. ELECTRONICS TEST EQUIPMENT		
405-101-333		Model TTS 26B Pulse Signaling Test Set	2	A B
405-101-334		Model TTS 26BXC Circuit Panel Description	8	A B
405-101-335		Model TTS 26BXP Pulsing Panel Accessory for Model TTS 26B Pulse Signaling Test Set	16	B
405-101-336		N.E. TTS 26BXS Signal System Test Panel—Description	7	B
405-101-737		N.E. TTS 26B—Test Set Preparation & Calibration for Sending & Receiving	15	B
405-101-738		N.E. TTS 26B and BXC Test Set Preparation for Composite (CX) Circuits Toll and Local Pulse Repeaters	7	B
405-101-739		N.E. TTS 26B & BXC—Test Set Preparation for Simplex (SX) Circuits Toll & Local Pulse Repeaters	6	B
405-101-740		N.E. TTS 26B & BXC—Test Set Preparation for Loop & Leak Toll & Local Pulse Repeaters	9	B
405-101-742		N.E. TTS 26B, BXC & BXP—Test Set Preparation for % Break Method—Outgoing Repeaters	7	B
405-101-745		N.E. TTS 26B & BXS—Test Set Preparation for Single Frequency Signaling (SF) Sending & Receiving	5	B
405-101-750		N.E. TTS 26B, BXC and BXP Test Set Preparation—Loop, Leak and Magnet Method Step-By-Step Switches	5	B
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405-103-701		Prepay Coin Telephone Test Set TS-301 (Teltronics, Inc.) Test Procedures	3	B C D
405-105-701		Dial Speed and Spotter Pulse Testing Circuit Functional Test	4	B C D
405-105-705		North Electric NX-1D/UN-1—Dial Speed Tester—Functional Test	3	B
405-106-301		Dial Hand Test Set QSE4A and QSE4B Type Handsets—Description, Operation, and Maintenance	16	B
405-110-301		Addendum—Triplett Model 310C Volt-Ohm-Milliammeter	1	A B C D E F
405-110-301		Triplett Model 310C Volt-Ohm-Milliammeter	5	A B C D E F
405-110-328		Stromberg-Carlson Wire Chief's Test Set Type B 419086-018 and 419086-028 Description	30	B C D
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• 405-111-325		CMC 5310 Busi Matic Description and Operation	1	B
• 405-111-350		CMC 5334 Polar Probe Description and Operation	2	B
• 405-111-352		CMC 5687 Polarity Tester Description and Operation	1	C D E F
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405-200-001		TTS 37B Noise, Level & VU Measuring Set—N.E. Electronics Corp.—Description	11	A B
405-200-002		200CD Oscillator, Hewlett-Packard—Description of Operation	4	A B
405-200-003		400D Vacuum Voltmeter, Hewlett-Packard—Operation	6	A B C
405-200-004		TTS 34A-1 Electric Acoustical Test Set, N.E. Electronics—Description	2	C D
405-200-006		TTS 25A db Measuring Set, N.E. Electronics Corp.—Description	3	A B C D
		DESCRIPTION		
405-200-300		Vibroground Model No. 255 Ground Resistance Test Set, Associated Research Inc.	2	A B C D E F
405-200-305		TTS 28 Measuring Test Set, N.E. Electronics Corp.	7	B
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405-200-700		2B Signaling Test Set—W.E. Co.	2	A B C
405-200-701		Wheatstone Bridge No. 5430A—Portable	12	B E
405-200-703		Type 800 Hand Test Telephone—A.E. Co.	10	B C
405-205-701		North Electric NX-1D/UN-1—Directory Number Test Line—Functional Test	5	B
405-208-301		Wilcom T-136B Circuit Test Set Description and Operation	6	B C D
405-215-301		236A Telephone Test Oscillator—Description and Operation	7	A B C D E F
405-215-310		Model 3555B Transmission and Noise Measuring Set (Hewlett-Packard)—Description and Operation	23	B C D E
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405-220-301		Sierra Model 127C Frequency Selective Voltmeter Description	11	A B
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405-600-301		Rope—Description & Use	8	C D E F
405-600-302		Rope & Knots, Bends, Hitches, Serving & Splicing	16	C D E F
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405-600-305		Range Finder—Description & Use	4	F
405-600-306		Strand Shifters—Description & Use	6	F
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405-600-308		C Cable Lasher—Description, Care & Maintenance	4	F
405-600-309		F Cable Lasher—Description, Care & Maintenance	5	F
405-600-314		20C Cable Test Set—Description & Use	3	E
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405-600-375		Biddle Meg Type Insulation Testers Description	6	C D E F
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405-600-704		Cable Pair Identification—Exploro Busy Boy	5	E
405-600-710		Type 76 (Identification) Test Set—Maintenance & Test Procedures	11	E
405-600-711		KS 14103 (Breakdown) Test Set—Description, Maintenance & Test Procedures	12	E F
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405-600-735		Delcon 4912F Conductor Fault Locator—Test Procedures	15	E
405-600-740		Cable Locator—Description and Operation	3	D E
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405-601-303		Fabric Body Belts & Safety Straps—Description, Use & Maintenance	6	C D E F
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405-601-601		Leather Body Belts & Safety Straps—Care & Maintenance	3	C D E F J
405-602-305		Wood Boring Bits & Drills—Use & Maintenance	13	C D E F
405-602-307		Masonry Drills & Drill Holders	3	C D E F
• 405-650-310		Ground Rods Description and Use	3	A B C D F
405-700-001		Electric Soldering Iron, 60W Lightweight, Iron Clad Tip	2	A B C E

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405-700-300		Wire Wrap Tools—Description & Use	8	B C
405-700-301		Screwdrivers—Description, Use & Maintenance	6	A B C D E F
405-700-302		Power Assisted Hammer Drive Tool	10	C D E F
405-700-303		B Grounding Roller—Description & Use	4	F
405-700-304		Air Powered Impact Wrench, Thor Model W-37—Description, Operation & Maintenance	2	E F
405-700-305		Air Powered Backfill Tamper, Thor Model 55T—Description, Operation & Maintenance	2	F
405-700-312		Pump, Portable, 1-1/2 Inch Homelite Model 20S1-1/2—Description, Operation & Maintenance	5	E F
405-700-313		Pump, Portable 3 Inch Gorman-Rupp Model T-33—Description, Operation & Maintenance	9	E F
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405-700-321		Handlines—Description & Use	3	C D E F
405-700-325		Ladder Platforms & Supports—Description & Installation	5	E
405-700-340		Acetylene Torches—Description	5	E
405-700-360		Manhole Shields—Description & Use	2	E F
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405-700-600		Sleeve, Presser No. 17-2 Nicopress Tool—Description & Maintenance	1	C D E F
405-700-601		Sleeve, Presser Types 31 DC, 51PJ & 31DJ—Description & Maintenance	4	C D F
405-700-635		Insulating Gloves, Leather Protectors, Fabric Liners & Glove Bag	8	B C D E F
		TESTING		
405-700-700		Test Set 81AW—Identification & Continuity Tests	3	C D
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405-701-300		C Pressure Gauge	2	E
405-701-306		C Cable Drill	3	E
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405-701-308		Pressure Testing Regulator—Description & Use	4	E
405-701-309		Ultrasonic Leak Detectors—Description	2	E
405-701-709		Ultrasonic Leak Detector—Operation & Maintenance	3	E
405-701-720		Pressure Testing Manometers—Test Procedures	2	E
405-702-305		Slack Pullers—Description & Maintenance	3	E
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		CUSTOMER EQUIPMENT TOOLS & MATERIALS		
405-705-320		Portable Electric Power Tools—Grounding	4	B C D E
405-705-350	2	Miller Falls Model 185 Automatic Hand Drill	2	D
405-705-401		McBeam Clamp—Description & Installation	3	C D
405-705-402		UC250 Utility Clamp—Description & Installation	3	C D
• 405-710-310		UP-B4 Cable Cutter Description and Use	1	B C D E F G H J
• 405-710-350		Cable Stripper—Ideal Description and Use	2	C D E
• 405-710-355		B Cable Clip Description and Use	1	E
		TOOLS AND MATERIALS—SWITCHING SYSTEMS AND POWER		
405-800-310		Large Battery Maintenance Safety Board—Description	2	A B C D
405-800-311		Intermediate Battery Maintenance Safety Board—Description	2	A B C D
• 405-850-301		Central Office Vacuum Cleaner Model 615 Description	9	A B C J
		MISCELLANEOUS APPARATUS		
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410-000-000	5	Numerical Index—Division 410—Miscellaneous Apparatus	4	B C
		EQUIPMENT MAINTENANCE LISTS (EML)		
410-040-200		EML—Traffic Register & Recording Equipment Instructions	1	A B C
410-040-201	2	EML—Calculagraphs, Call Timing Switches, Clocks, Counters, Registers & Central Office Recorders	5	A B C
410-070-200		EML—Signaling Equipment Instructions	1	A B C
410-070-201	3	Equipment Maintenance List—Signaling Equipment	3	A B C
		CONTROLLERS—CONTROL UNITS, THERMISTORS, VARISTORS, REGULATORS, ELECTRON TUBES, TRANSISTORS, DIODES, RESISTORS & CAPACITORS, COILS & PADS		
410-100-001		Color Coding of Capacitors, Resistors & Transformer Leads	7	A B C
410-100-003		Capacitors, Electrolytic, Aluminum Type—Requirements & Procedures	4	A B C D
410-100-402		Electronic Components—Installation & Handling (Resistors, Capacitors, Varistors, Diodes & Transistors)	7	A B C
410-101-301	2	Saturable Inductors	16	B C D E H
410-110-301		Repeating Coils—Description	12	A B C

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		CALCULAGRAPHS, CALL TIMING SWITCHES, CLOCKS, COUNTERS, REGISTERS, DATA TIMERS, PERFORATORS & CENTRAL OFFICE RECORDERS		
		DESCRIPTION		
410-400-005		Calculagraph, Model 33—Repair, Parts Listing & Identification	20	B
410-400-300		Automatic Time Announcer Type B—Operating Procedures	8	B
410-400-301		Recorder-Announcer (Transistorized), Type SCC A.E. Co.	10	B C
		INSTALLATION		
410-400-400		Automatic Time Announcer, Type B A.E. Co.	6	B C
		MAINTENANCE		
410-400-600		Recorder-Announcer, Type SCC A.E. Co.	10	B C
410-400-601		Audichron Equipment—Changing Records, Setting Time, Reading Meters	7	B
410-400-602		Recorder-Announcer, Transistorized, Type SCC A.E. Co.	3	B
410-400-605		Calculagraph, Model 33	16	B
410-400-610		Recorders, Automatic Intercept A.E. Co.	18	B
410-400-621		Message Registers, Type U-2404 Federal	3	B C
410-400-623		Message Registers, Type 27 A.E. Co.	3	B C
410-400-624		Message Register, Type D-70269 A.E. Co.	4	B C
410-400-720		Traffic Message Registers—Testing Procedures	4	B
410-400-738	2	Peg Count Registers—Test Procedures North	13	B
410-400-923		Message Registers, Type 27 and D-70269 A.E. Co.	3	B C
		DESCRIPTION		
410-405-301		Code-a-Phone Model 210A	14	B
410-405-302		Code-a-Phone Model 210DC	16	B
410-405-305		Code-a-Phone Model 210FL	15	B
		INSTALLATION & OPERATION		
410-405-401		Code-a-Phone Model 210A	4	B
410-405-402		Code-a-Phone Model 210DC	4	B
410-405-405		Code-a-Phone Model 210FL	3	B
		MAINTENANCE		
410-405-601		Code-a-Phone Model 210A	11	B
410-405-602		Code-a-Phone Model 210DC	11	B
410-405-605		Code-a-Phone Model 210FL	9	B
		CONNECTORS, CORDS, CORD REELS, JACKS, RELAYS, KEYS, LAMPS, PLUGS & SOCKETS		
410-500-305		Cord Assemblies—General	33	B C
410-500-600		Switchboard Apparatus, Service Routines	2	B C
410-500-705		Lever, Push & Turn Keys—Adjustment A.E. Co.	9	B C
410-500-812		Switchboard Cords—Inspection & Repair	3	B C
410-500-910		Switchboard Plugs—Cleaning	2	B C
410-501-425		Jacks & Jack Multiples Installation	13	B C
410-502-602		Amphenol and Elco Connectors for Microwave and Carrier Systems Gauging, Adjusting and Cleaning	14	A B C

Practice No.	Issue No.	Title	No. of Pages	Distribution
		MISCELLANEOUS METHODS, EQUIPMENT, CLOTHS, FLUIDS, OILS & GREASES		
410-600-300		Protector Blocks, Rectangular Type	3	B C
410-600-305	2	Dielectric Compound, Dow Corning #103	2	B C
410-600-404		Radio Frequency Demodulation Suppressors	4	C D
410-650-410		Soldering Methods	11	A B C D E
410-650-825		Power Cable—Solderless Connectors Inspection	2	A B C
		SIGNALING UNITS		
		WESCOM		
410-700-312		688/E2L and E2L/A FX Single Frequency Signaling Unit Description and Operation	7	B
410-700-313		686 E2S and E2S/A FX Single Frequency Signaling Unit Description and Operation	5	B
410-700-314		665 FWA E & M Single Frequency Signaling Unit Description and Operation	5	B
410-700-315		696 E4D Loop Dial Single Frequency Signaling Unit Description and Operation	4	B
410-700-317		685 E4B E & M Single Frequency Signaling Unit Description and Operation	5	B
410-700-402		W702/2-E4B Inband Signaling System	4	B
410-700-403		W711-24V4B Telephone Repeater	17	B
410-700-404		W708-E2L and E2L-A 2600 Hz Inband Signaling System	7	B
410-700-405		W707-E1S and E1S-A 2600 Hz Inband Signaling System	6	B
410-700-408		650 Inband Signaling System General Installation Instructions	7	B
410-700-409		681-12 and 682-14 Mounting Assemblies Installation Instructions	4	B
410-700-412		688 E2L and E2L/A FX Single Frequency	2	B
410-700-413		686 E2S & E2S/A FX Single Frequency Signaling Unit Installation	2	B
410-700-414		665 FWA E&M Single Frequency Signaling Unit Installation	2	B
410-700-415		696 E4D Loop Dial Single Frequency Signaling Unit Installation	3	B
410-700-416		695 E4D Loop Dial Single Frequency Signaling Unit Installation	2	B
410-700-417		685 E4B E&M Single Frequency Signaling Unit Installation	2	B
410-700-602		W702/2-E4B Inband Signaling System	6	B
410-700-603		W711-24V4B Telephone Repeater	1	B
410-700-604		W708-E2L & E2L/A 2600 Hz Inband Signaling System	6	B
410-700-605		W707-E1S & E1S/A 2600 Hz Inband Signaling System	5	B
410-700-606		695-E4C Outgoing Loop Dial SF Signaling Unit Lineup	5	B
410-700-610		Wescom 452 FWA E&M Inband Signaling Equipment Lineup	4	B
410-700-612		688 E2L and E2L/A FX Single Frequency Signaling Unit Lineup	3	B

Practice No.	Issue No.	Title	No. of Pages	Distribution
		WESCOM (Continued)		
410-700-613		686 E2S and E2S/A FX Single Frequency Signaling Unit Lineup	3	B
410-700-614		665 FWA E & M Single Frequency Signaling Unit Lineup	3	B
410-700-615		696 E4D Loop Dial Single Frequency Signaling Unit Lineup	3	B
410-700-616		695 E4C Outgoing Loop Dial Single Frequency Signaling Unit Lineup	3	B
410-700-617		685 E4B E & M Single Frequency Signaling Unit Lineup	3	B
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410-702-301		927A Inband Signaling Equipment 41217/41218 Foreign Exchange Unit Description and Operation	19	B
410-702-302		927A Inband Signaling Equipment 41219 E & M Signaling Unit Description and Operation	6	B
410-702-303		927A Inband Signaling Equipment, 41207/41208 Foreign Exchange Unit Description and Operation	11	B
410-702-304		927A Inband Signaling Equipment 41205/41206 Loop Dial Signaling Units Description and Operation	11	B
410-702-305		927A Inband Signaling Equipment 32815 E & M Signaling Unit Description and Operation	6	B
410-702-306		927A Inband Signaling Equipment 32816 E & M Signaling Unit Description and Operation	3	B
410-702-307		927A Inband Signaling Equipment 41209 E & M Signaling Unit Description and Operation	9	B
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410-702-309		927A Inband Signaling Equipment 27817 E & M Signaling Unit Description and Operation	16	B
410-702-331		41215 2600 Hz Signaling Oscillator Description and Operation	2	B
410-702-332		41200 2600 Hz Signaling Oscillator Description and Operation	2	B
410-702-333		27819 2600 Hz Signaling Oscillator Description and Operation	2	B
410-702-334		32817 1600 Hz Signaling Oscillator Description and Operation	2	B
410-702-340		41223 SATT Signaling Filter Unit Description	2	B
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Practice No.	Issue No.	Title	No. of Pages	Distribution
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410-702-603		927A Inband Signaling Equipment 41207/41208 Foreign Exchange Signaling Units Lineup	4	B
410-702-604		927A Inband Signaling Equipment 42105/42106 Loop Dial Signaling Units Lineup	4	B
410-702-607		927A Inband Signaling Equipment 41209 E & M Signaling Unit Lineup	5	B
410-702-608		927A Inband Signaling Equipment 41216 E & M Signaling Unit Lineup	4	B
410-702-609		927A Inband Signaling Equipment 27817 E & M Signaling Unit Lineup	6	B
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410-703-601		8SU51C (E4B)—Inband Signaling Equipment—Lineup	4	B
410-703-603		8SU58A/8SU58B (E3B) Four-Wire—Inband Signaling Equipment—Lineup	4	B
410-703-605		8SU54A (E2L)/8SU55A (E2S) Foreign Exchange—Inband Signaling Equipment—Lineup	5	B
410-703-607		8SU56A (E2L)/8SU57A (E2S)—Loop or Ground Start Foreign Exchange—Inband Signaling Equipment—Lineup	6	B
410-703-609		8SU52A (E2C)/8SU53A (E2D) One-Way Loop Dial—Inband Signaling Equipment—Lineup	6	B
410-703-611		8SU74/8SU75 (B870) Superimposed Ringing—Inband Signaling Equipment—Lineup	5	B
410-703-615		8SU41A Two or Four Wire Outband E & M Signaling Equipment Lineup	3	B
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410-704-301		20D3-1MX E & M Inband Signaling Unit Description & Operation	14	B
410-704-302		20D5-1MX E & M Inband Signaling Unit Description & Operation	10	B
410-704-601		20D3-1MX E & M Inband Signaling Unit Lineup	7	B
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Practice No.	Issue No.	Title	No. of Pages	Distribution
		AMPLIFIERS, REPEATERS, VOICE FREQUENCY, REGULATORS & EQUALIZERS		
410-800-301		Amplifier, Altec S-17T—Description, Installation & Assignment	10	B
410-805-600		Repeater, Voice, R-651/R-651D, Lineup Procedures Lear Siegler	27	B
410-805-601		Repeaters, Voice Frequency, R-635/ R-635D Lear Siegler	4	B
410-850-610		Model NA-400 Ventilator for Telephone Equipment Cabinets—Installation and Maintenance	4	B C D
		POWER		
		GENERAL		
420-000-000	5	Numerical Index—Division 420—Power	3	B C
		EQUIPMENT MAINTENANCE LISTS (EML)		
420-010-200		EML—Power Equipment Instructions	1	A B C
420-010-201	2	EML—Power—Tone Supplies, Generators, Rectifiers & Charges	3	A B C
420-020-201	3	EML—Power Batteries	2	A B C
420-050-201	2	EML—Power Interrupters & Ringing Machines	3	A B C
420-060-201		EML—Power—Power Plants & Power Supplies (Power Board)	2	A B C
		GENERAL PROCEDURES		
420-099-001	2	Emergency Procedures Commercial Power Failure	3	B
420-099-050		Ringing Schemes	16	B C
		INSIDE PLANT—ALTERNATORS, ENGINE ALTERNATORS, GAS TURBINE ALTERNATORS, TONE ALTERNATORS, TONE MACHINES, RINGING & COIN CONTROL GENERATORS, CHARGING GENERATORS & MOTOR GENERATORS		
		DESCRIPTION		
420-100-325		Tone Supply, Transistorized MF or Dual Frequency A.E. Co.	4	B
420-100-340		Multifrequency Current Supply S-C Corp.	5	B C
		ADJUSTMENT		
420-100-600	3	Standby Generator Routine	1	B C
420-100-601		Multicycle Ringing Converter, D-55361 A.E. Co.	7	B C
420-100-602		Rectifier, Model U10KB Flotrol Lorain	3	B C
420-100-603		Rectifier, Model BE150B Lorain	5	B C
420-100-604		Rectifier, Model BE300B Flotrol Lorain	4	B C
420-100-605		Charger, End Cell (6.5V), Model 24E Flotrol Lorain	4	B C
420-100-606		Charger, End Cell (6.5V), Model 130E Flotrol Lorain	5	B C

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420-110-305		A.E. Co. Transistorized MF or Dual Frequency Tone Supply-Transfer Alarm and Resistance Distr. Unit (H-850243-A) Description and Operation	6	B
		OUTSIDE PLANT—ALTERNATORS, ENGINE ALTERNATORS, GAS TURBINE ALTERNATORS, CHARGING ALTERNATORS & MOTOR GENERATORS		
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• 420-405-615		Air Dryers Frigidryer Models 750, 1500, 3000, 5000 Maintenance	5	B C D E F
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420-500-400	2	Model LT-15 and Model LT-15R Sub-cycle Ringing Generator Installation Lorain	4	B C
420-500-401		Ringing Generator Control Panel, Type C20 Lorain	4	B C
420-500-402		Sub-Cycle Ringing Generator, Model T50 Lorain	3	B C
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420-500-600	2	Sub-Cycle Ringing Generator, Model LT-15 Lorain	3	B C
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420-625-401		Power Plants, Key Telephone Systems—Installation & Selection	8	C D
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• 430-002-605/ 530-725-605		Control of Atmospheric Environment for Telephone Switching System	5 5	A B C V
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430-010-201		EML—Linefinders & Lineswitches	4	A B C
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430-010-207		EML—SATT & Associated Equipment	21	A B C
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430-020-202	2	EML—Selectors	2	B C
430-020-203		EML—Connectors	2	B C
430-020-204		EML—Rotary Out Trunk Switches	2	B C
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430-020-210		EML—Miscellaneous Equipment	12	B C
430-020-211		EML—Switchboards and Testboards	3	B C
430-020-220		Switching System Equipment Maintenance List DDD Equipment S-C Automatic Message Accounting (SCAMA)	11	B C
430-080-200		Automatic Electric Company Leich Switching System Instructions	1	B C
430-080-201		Automatic Electric Company Leich Switching System Equipment Maintenance List—Finders and Linefinders	3	B C
		GENERAL PROCEDURES		
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430-095-210		Record of Equipment & Trunks Made Busy	3	B
430-096-001		Preventing Service Interruptions—Coordinating Responsibilities Prior to Installation Operations in Central Offices	2	A B C
430-096-005		Preventing Service Interruptions—Preparation Before Starting C.O. Installation Operations	3	A B C
430-096-007		Preventing Service Interruptions—Planning Ahead for Restoration of Service	1	A B C
430-096-010		Preventing Service Interruptions—General Causes of Service Interruptions	5	A B C
430-096-011		Preventing Service Interruptions—Precautions to be Observed During Installation Operations	4	A B C
430-096-012		Preventing Service Interruptions—Planning and Preparations Prior to Power Transitions	2	A B C
430-096-013		Preventing Service Interruptions—Precautions to be Taken to Prevent Personal Injury or Building Damage	4	A B C
430-096-014		Preventing Service Interruptions—Precautions to be Taken on Private Line Service Equipment	2	A B C

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430-096-015		Preventing Service Interruptions—Precautions to be Taken to Prevent Maintenance Problems	2	A B C
430-096-025		Preventing Service Interruptions—Coordination and Responsibilities Prior to Construction Activity	1	A B C
430-096-201		Central Office Equipment Installation and Maintenance Activity Observation and Coordination	3	A B C
• 430-099-025		Central Office Evaluation Procedures	29	B G
430-099-202		Central Office Verification & Acceptance Test Procedures	30	A B C
		AUTOMATIC ELECTRIC CO. SWITCHING		
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430-100-300		Test & Verification Switchtrain	4	B C
430-100-304		Reverting Call Equipment	20	B C
430-100-308		Intercept Service	21	B C
430-100-312		Step-by-Step Toll Switchtrain	9	B C
430-100-316		Rotary Stepping Switches	16	B C
430-100-324		The Linefinder	32	B C
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430-100-618	2	A.E. Co. Type 13 (25 Point) and Type 14 (50 Point) Rotary Switches Adjustment	6	B C
430-100-620		Rotary Switch, Type 26	5	B C
430-100-622	2	A.E. Co. Types 40 & 44 Rotary Switch Adjustment	11	B C
430-100-623	2	A.E. Co. Type 45 Rotary Switch Adjustment	12	B C
430-100-628		Master Switch	2	B C
430-100-629		Plunger Lineswitch, Self-Aligning	10	B
• 430-100-641		Strowger Two-Motion Switches Repair and Replacement of Wipers	8	B C
430-100-642	2	Strowger Two-Motion Switches Adjustment of Wipers	16	B C
430-100-643	2	Strowger Two-Motion Switches Inspection and Adjustment	35	B C
430-100-644		Two-Motion Switches, Analysis of Failures & Correction of Faults—Pulsing Tests	3	B
• 430-100-648		Strowger Two-Motion Switches Replacing and Tying Wiper Cords	17	B C
		FUNCTIONAL TESTING		
430-100-704		Reverting Call Switch—Functional Test	4	B C
430-100-708		Two-Motion Finder Switch, Intercepting Equipment—Functional Test	2	B C
430-100-724	3	Linefinder Equipment Functional Tests	3	B C

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430-100-726		Primary Rotary Lineswitch—Continuity & Polarity Test	2	B
430-100-727		Primary Rotary Lineswitches—Functional Test	2	B
430-100-728		Master Switch for Plunger Lineswitch—Functional Test	2	B C
430-100-729		Plunger Lineswitch, Self-Aligning—Functional Test	5	B C
430-100-730		Fantail Plunger Lineswitch	7	B C
430-100-731		Selector Operation and Level Test	2	B C
430-100-733		Toll Selector or Toll Trunk—Operation Test	3	B
430-100-734		Battery Searching Selectors Rotary Test	2	B
430-100-735		Selector—Rotary Operation Test	2	B
430-100-736		Connector—Operation Test	8	B C
430-100-738	3	Local and Toll Level Hunting Connectors Functional Tests Using the Hand Test Telephone	2	B C
430-100-740	2	Local and Combination Connectors—Functional Test Ring and Talk	2	B C
430-100-745		Selector, Connector and Pulse Repeating Impulse—Operation Test	4	B C
430-100-746		Service Code Equipment—Operation Test	2	B C
430-100-750		Impulse Sender—Operation Test	3	B C
430-100-758		Paystation Equipment—Operation Test	5	B
430-100-760		Coin Box Line & Associated Equipment—Discriminating Tone Test	2	B
		INSPECTIONS		
430-100-829		Fantail & Self-Aligning Plunger Lineswitches Pivot Screws & B.C.O. Relays—Inspection	2	B
430-100-855		Off Normals, Permanents & Switches Made Busy Test—Maintenance	3	B C
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430-100-916	2	A.E. Co. Rotary Switches Bank Cleaning Procedures	2	B C
430-100-917	2	A.E. Co. Minor Switch Lubrication	2	B C
430-100-918	2	A.E. Co. Type 13 Rotary Switch Lubrication	2	B C
430-100-920		Rotary Switch, Type 26	2	B
430-100-922	2	A.E. Co. Types 40 and 44 Rotary Switches Lubrication	2	B C
430-100-923	3	A.E. Co. Type 45 Rotary Switch Lubrication	3	B C
430-100-928		Master Switch	2	B
430-100-929		Plunger Lineswitch	2	B
430-100-942	2	Strowger Two-Motion Switches Banks & Wipers Cleaning Requirements & Procedure	8	B C
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430-101-701		Inter-Office Trunk Equipment Tests	2	B
430-101-705		Toll Switching Trunks—General Functional Test	4	B
430-101-706		Outdial Trunks—General Functional Test	2	B C
430-101-707		Trunk Circuit, Type 62—Functional Test	2	B
430-101-709		SATT Sender, Type 62—Pulse Repeating Test	1	B
430-101-710		Trunks to Switchboards From Banks of Simplex Selectors	4	B
430-101-718		Rotary Switches, Out Trunk Rotary Secondary Equipment Type 13—Functional Test	6	B C
430-101-723		Rotary Switches, Out Trunk Rotary Secondary Equipment Type 45—Functional Test	2	B
430-101-750		Trunk & Signaling Circuits, Pulse Repeating Test (Percent Break)	8	B
430-101-752		CLR Trunks, Coin & Non-Coin, Functional Test	3	B
		AUTOMATIC ELECTRIC CO. SATT		
		ADJUSTMENT		
• 430-102-302		A.E. Co. Type 62 SATT Monitor Panel (Circuit H-850021) Description	9	B
430-102-602		62 SATT Monitor Panel, Calibration & Adjustments	3	B
430-102-640		Transender Shelf Pulsing Motor Adjustment	1	B
430-102-650		Tape Perforator, Model 122, Kleinschmidt	17	B
430-102-651		Tape Perforators, Teletype (BRPE-3)	4	B
		TESTING		
430-102-700		Ticketer Monitor Panel Pulse Generating Relays (PA1 and PA2) Pulsing (Percent Break & Pulses per Second) Tests	4	B
430-102-702	2	A.E. Co. Type 62 SATT Monitor Panel (Circuit H-850021) Test Procedures	7	B
430-102-705		SATT ONI Operator's Position Equipment, Functional Test	2	B
430-102-706		SATT ONI Operator's Trunk Circuit, Functional Test	2	B
430-102-709		Selector Level Adapter Functional Test	1	B
430-102-710		Single Digit Adapter Circuit H-75587 Functional Tests	2	B
430-102-711		Single Digit Adapter Circuit H-75588 Functional Tests	2	B
430-102-713		Dater-Timer, SATT System Time Setting & Operational Check	8	B
430-102-715		Tabulator PA Relay Pulse Repeating Test	2	B
430-102-722		SATT Ticketer—Pulsing Test	2	B
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430-102-741		Transender Codexer—Pulsing Test	3	B
430-102-742		Transender Bay Relay PS—Pulse Repeating Test	2	B
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430-102-744		Transender Codexer Unit—Functional Test	1	B
430-102-751		Tape Perforator, Teletype (BRPE-3)—Pulsing Test	3	B
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430-102-940		Transender Shelf Pulsing Motor	2	B
430-102-950		Perforator, Model 122, Kleinschmidt	7	B
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430-103-724		Type 102 Director, Preliminary Testing	11	B
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430-105-720		Impulse Sender, DC Key Pulsing Equipment—Functional Test	4	B
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• 430-108-648		Strowger Two-Motion Switches Replacing and Tying Wiper Cords	17	B C
		AUTOMATIC ELECTRIC CO. PULSING & TIMING TESTING		
430-110-700		Selectors—Timing Requirements	7	B C
430-110-702		Selectors, Non-Pulse Repeating & Loop Pulsed—Timing Test	5	B
430-110-703		Selectors, Non-Pulse Repeating Simplex—Pulsed—Timing Test	4	B
430-110-704		Selectors, Pulse Repeating Loop Pulsed—Timing Tests	4	B
430-110-705		Selectors, Pulse Repeating Simplex—Pulsed—Timing Test	5	B
430-110-710		Selectors, Non-Pulse Repeating Loop Pulsed—Pulsing Test	4	B
430-110-711		Selectors, Non-Pulse Repeating Simplex-Pulsed—Pulsing Test	3	B
430-110-713		Selectors, Pulse Repeating Simplex-Pulsed—Pulsing Test	2	B
430-110-715		Selectors, Loop Pulsed—Pulse Repeating Test	3	B
430-110-716		Selectors, Simplex-Pulsed—Pulse Repeating Test	1	B
430-110-725		Connectors—Timing Requirements	7	B
430-110-726	2	Regular, Rotary, Level Hunting and Test Connector Timing Test	4	B C
430-110-730		Repeaters, Coin Box—Pulse Repeating Test, Percent Break	2	B
• 430-110-734		Local and Combination Connectors Pulsing Tests Using the A.E. Co. Type 28 Semi-automatic Routiner	3	B C
430-110-735		Connectors, Regular—Pulsing Test	2	B
430-100-736		Connectors, Rotary & Level Hunting—Pulsing Test	3	B C
430-110-740		Long Line Equipment—Pulse Repeating Test (Percent Break)	3	B C
430-110-741		Repeaters, Loop or Battery and Ground—Pulsing Tests	2	B
430-110-742		Repeaters, Non-Pulse Correcting—Timing Test	2	B
430-110-746		Switch, Reverting Call—Pulsing Test	2	B
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430-200-634	2	Minor Switch, Direct Driven	4	B C
430-200-637	2	Rotary Switch, Spring Driven	6	B C
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430-200-640		Rotary Switch, Motor Driven	21	B C
430-200-643		Motion Switch, Rectangular	73	B C
430-200-646		Motor Switch	31	B C
430-200-647		Minor Switch, Type 47	8	B C
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		XY TESTING		
430-200-708	2	Selectors (First)—Operation Test	1	B C
430-200-709	2	Selectors (Intermediate)—Operation Test	1	B C
430-200-715		Linefinders—Operation Test	2	B C
430-200-716		Linefinders—Chain Circuit Test	1	B C
430-200-719	2	Connectors—Operation Test	2	B C
• 430-200-725		S-C Connector Routine Test Circuit Plate Maintenance Test Procedure	5	C
		INSPECTION		
430-200-875		Off Normals, Permanents & Switches Made Busy—Tests and Inspection	2	B C
		LUBRICATING & CLEANING STROMBERG-CARLSON—XY SYSTEMS		
430-200-901		XY Deca Switch Cleaning and Lubricating	2	B
430-200-903		XY Universal Switch—Cleaning and Lubricating	2	B
430-200-904		Addendum—Wirebanks & Wipers—Cleaning & Treating	1	B C D
430-200-904	2	Wirebanks & Wipers—Cleaning & Treating	3	B C D
		C.P.CLARE		
430-200-934		Minor Switch, Direct Driven	1	B C
430-200-937	2	Rotary Switch, Spring Driven	4	B C

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430-200-940		Rotary Switch, Motor Driven	2	B C
430-200-943		Motion Switch, Rectangular	9	B C
430-200-946		Motor Switch	4	B C
430-200-947		Minor Switch, Type 47	2	B C
430-200-948		Minor Switch, Type 41	1	B C
430-200-949		Minor Switch, Type 128	2	B C
430-200-950		Rotary Switch, Small Magnet	3	B C
430-200-951		Rotary Switch, Large Magnet	3	B C
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430-201-710		Trunk Operation & Special Service Test	3	B
		STROMBERG-CARLSON XY TOLL TICKETING DESCRIPTION, ADJUSTMENT, TESTING, CLEANING & LUBRICATION PROCEDURES		
430-202-300		LID System—Description & Use	14	B
430-202-350		S-C Automatic Message Accounting (SCAMA) Systems General Description	24	B
430-202-600		Type 40 LID—Maintenance Instructions	20	B
430-202-615		Recorder Adjustments	16	B
430-202-700		Type 40 LID—Testing & Troubleshooting	16	B
430-202-754		S-C Automatic Message Accounting (SCAMA) Systems Recording Office Access to Pre-selectors Test Procedures	9	B
430-202-756		S-C Automatic Message Accounting (SCAMA) Systems Outgoing Trunks from Tributary Office Equipment Test Procedures	12	B
430-202-758		S-C Automatic Message Accounting (SCAMA) Systems Tributary Office Trunk Access to Recording Office Preselectors Test Procedures	5	B
430-202-760		S-C Automatic Message Accounting (SCAMA) Systems Access to Recording Trunks, Data Registers, & MF Receivers Test Procedures	10	B
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490-050-400		Pressure Testing Fittings—Lead Cable—Installation	7	E
490-050-500		Material Recovery	2	E F
490-050-700		Cable Testing—Insulation Resistance Tests	4	E
490-055-701		Cable Testing—General Rules for Using Identification Tone	3	E
490-055-702		Cable Testing—Detecting Tone with an Amplifier	2	E
490-055-705		Cable Testing—Detecting Defective Pairs	2	E
490-055-706		Cable Testing—Detecting Defective Pairs, Battery & Receiver Method	5	E

Practice No.	Issue No.	Title	No. of Pages	Distribution
		DESCRIPTION, INSTALLATION, REMOVAL & TESTING (Continued)		
490-055-715		Locating Faults with Portable Wheatstone Bridge	20	E F
490-055-717		Cable Testing—Locating Faults in Long Or Loaded Cables by the Exploring Coil Method	4	E
490-055-718		Cable Testing—Locating Faults in Nonloaded Cables by the Exploring Coil Method	3	E
• 490-055-719		Cable Testing—Locating Faults Using Biddle CME-110A-1 Cable Test Set and CME-111-1 Pulse Amplifier	6	B E
490-055-725		Cable Testing—Flash Testing Procedures	3	D E F
490-055-740		Cable Testing—Section Replacement—General Rules	3	E
490-055-750		Cable Transfers	5	E
		CLEARANCES—OUTSIDE PLANT		
490-060-001		Measuring Clearances & Separations for Aerial Plant	2	F
490-060-002		Clearances for Aerial Plant	42	C D E F
490-060-010		Block and House Cables in or on Building—Separations	3	E F
		POLE LINES		
		GENERAL		
490-100-001		Guying	6	F
490-100-002		Guy Sizes & Use of Guy Rule	9	F
490-100-003		Hole Digging	4	F
490-100-004		Anchors & Rods—Description	3	F
490-100-005		Guying, Grounding or Insulating	18	F
490-100-100		Poles, Placing or Removing Near Electric Power Wires	7	F
		INSTALLATION		
490-100-401		Anchors & Rods	5	F
490-100-402		Rock Anchors	2	F
490-100-403		Guy Guards	4	F
490-100-404		Sidewalk Guys	4	F
490-100-405		Guys on Cable Lines	7	F
490-100-406		Guys on Open Wire Lines	13	F
490-100-407		Poles, Setting	6	F
490-100-408		Pole Facing	2	C D F
490-100-409		Pole Rake	1	F
490-100-410		Poles, Stepping	5	C D E F
490-100-411		Guying—Methods of Insulating	6	F
490-100-412		Guy Anchors, Blackburn & Chance—Description & Installation	3	E F
490-100-413		Guying, Extending Length of or Adding Additional Eye to Existing Guy Rods	3	F

Practice No.	Issue No.	Title	No. of Pages	Distribution
		REMOVAL		
490-100-500		Poles	11	F
490-100-501		Guys	4	F
490-100-502		Guy Anchors & Guy Rods	2	F
		INSTALLATION		
490-101-415		Pole Attachments, Placing Guard Arms	5	F
490-101-416	2	E and F Cable Crossarms Description and Application	2	F
		CONDUIT, MANHOLES & CABLE VAULTS		
490-150-001		Manhole Covers—Removing & Replacing	5	C D E F
490-150-100		Manholes—Safety Precautions	7	B C D E F
		OPEN WIRE		
490-200-001		Numbering of Pin Positions	1	C D F
490-200-021		Open Wire Transposition	14	F
		DESCRIPTION		
490-200-300		Insulators	2	C D F
490-200-301		R Type Transpositions	3	D F
		INSTALLATION		
490-200-400		Stringing Joint & Non-Joint Poles	11	F
490-200-401		Extension Arms	4	F
490-200-402		Brackets, Wooden Pole, Straight Section of Line	3	D F
490-200-403		Crossarm	7	D F
490-200-404		Deadends, Bracket Lines	1	D F
490-200-405		Positioning of Wire on Crossarms & Wood Brackets	2	D F
490-200-406		Brackets, Wooden Pole—Corners	1	D F
490-200-407		Deadend Crossarms	4	F
490-200-408		Brackets, Wooden Pole—Description	2	D F
490-200-409		Stringing Sags	4	C D F
490-200-410		Sag Tables	30	C D F
490-200-411		Stringing Sags, Open Wire Point Transposed	4	C D F
490-200-413		Open Wire Deadends	3	F
490-200-414		Bridling—Description & Installation	7	C D E F
490-200-415		Transpositions, R Type	4	F
490-200-416		Transpositions, R1-5—Installation	2	F
490-200-417		Transpositions, R1-6—Installation	5	F
490-200-418		Transpositions, R2-5—Installation	4	F
490-200-419		Tying Open Wire Lines	6	D F
490-200-420		Tree Wire—Open Wire Lines—Description & Installation	2	C D F
490-200-500		Open Wire & Attachments—Removal & Reuse	10	C D F
490-200-600		Repairing	3	F
490-200-800		Inspection	6	F

Practice No.	Issue No.	Title	No. of Pages	Distribution
		MULTIPLE LINE WIRE		
490-250-031		C Rural Wire Stringing Sags	4	F
490-250-432		C Rural Wire—Description, Precautions & Placing Operations	8	F
490-250-434		Splicing	4	E F
		COIL & COIL CASES		
490-300-301		Coil & Coil Cases Description	14	E
		AERIAL, BLOCK & HOUSE CABLE		
490-350-002		Aerial Cable, Lashed—General	3	E F
490-350-300		Lashing Cable with Cable Lashers	15	F
		INSTALLATION		
490-350-400		Ready Access Cable Stubs—CA 1906	2	E
490-350-401		Aerial Cable, Extension Arms	3	F
490-350-402		Locating Supports & Spacers	5	E F
490-350-403		Lashed Aerial Cable—Use of Corner Cable Jack	2	F
490-350-404		Lashed Aerial Cable—Direct Lashing Method	3	F
490-350-405		Lashed Aerial Cable—Block Method	4	F
490-350-408		Lashed Aerial Cable—Two Cables	10	F
490-350-409		Block & House Cable—Clamping Cables to Interior Walls	4	C D E F
490-350-410		Block & House Cable—Locating Cable Run	3	D E F
490-350-411		Block & House Cable—Placing Cable on Outside Building Walls	7	C D E F
490-350-412		Block & House Cable—Anchoring Devices for Attaching Cables to Walls—Non-Power Driven	8	C D E F
490-350-413		Aerial Cable Placing—General	2	F
490-350-414		Aerial Cable Placing—Setting up Cable Reels	2	F
490-350-415		Aerial Cable Placing—Preparations Along the Line	4	F
490-350-416		Aerial Cable Placing—Preparing Cable for Pulling	3	F
490-350-417		Aerial Cable Placing—Pulling Cable	3	F
490-350-418	2	Aerial Cable Supports	7	E F
490-350-419		Aerial Cable Spans without Strand	2	F
490-350-420		Aerial Cable Guard Protection From Squirrels	4	F
490-350-425		Aerial Cable Vibration Damper—Description & Installation	3	E F
490-350-450		Aerial Cable—Terminating Lashing Wire	8	E
490-351-600		Repairing Aerial Cable, Lead Sheath Cable—Slit Sheath Method	6	E
490-351-601		Repairing Aerial Cable Sheath—Torch Method	1	E
		AERIAL FIGURE 8 DISTRIBUTION WIRE & CABLE		
490-355-001		Sag & Tension Data—Figure 8 Distribution Wire	9	F
490-355-002	2	Sag & Tension Data—Figure 8 Cable	17	F

Practice No.	Issue No.	Title	No. of Pages	Distribution
		INSTALLATION		
490-355-400		Figure 8 Distribution Wire—Description & Installation	12	E F
490-355-401		Figure 8 Cable—Description & Installation	10	E F
		AERIAL STRAND (SUSPENSION)		
		GENERAL		
490-360-001		Sag & Tension Data—6M & 10M EHS Strand (Cable in Place)	30	F
490-360-002		Sag & Tension Data—6M, 10M & 16M Utilities Grade Suspension Strand with Telephone (Cable in Place)	9	F
490-360-003		EHS Tensions, Sags and Maximum Span Lengths	6	F
490-360-004		Utilities Grade, Selection, Tensioning & Maximum Span Lengths	4	F
		DESCRIPTION		
490-360-300		Strand Grips, Use	2	F
490-360-301		Attachments—Description & Use	10	F
		INSTALLATION		
490-360-400		Deadending—Installation General	12	F
490-360-401		False Deadending	13	F
490-360-402		Slack Span Construction	3	F
490-360-403		Pulling Up & Tensioning	5	F
490-360-410		Strand Dynamometer, Use	6	F
		TESTING		
490-360-700		Suspension Strand Testing	4	E F
		UNDERGROUND CABLE		
490-400-501		Removing Underground Cable	8	F
490-400-613		Underground Conduit Cable Creepage Prevention	1	E F
490-405-402		Sealing Ducts—Conditions Requiring Seals	3	E F
490-405-403		Sealing Ducts Caulking Materials	5	E F
		BURIED CABLE & BURIED WIRE		
490-500-002		Addendum—Buried Plant—Urban Telephone Installations Only	1	F
490-500-002		Buried Plant—Urban Telephone Installations Only	3	F
490-500-400		Pedestal Dam, Type DS—Single Sheath Cable	4	E
490-500-401	2	Drop and Block Wiring Armored Buried Service Wire	2	C D E F
490-500-420		Buried Plant—Trenching & Backfilling—Preparation	3	F
490-500-421		Buried Cable Placing	5	F
490-500-428		Buried Service Wire—Terminations with Aerial Plant	8	E F

Practice No.	Issue No.	Title	No. of Pages	Distribution
		BURIED CABLE & BURIED WIRE (Continued)		
490-500-430		Buried Wire Terminations at Junctions with Buried Plant	8	F
490-500-432		Addendum—Buried Plant—Buried Wire Description	1	E F
490-500-432	2	Buried Plant—Buried Wire—Description	2	E F
490-500-436	2	Protection of Buried Service Wire From Ground Level to Protector	7	C D E F
490-500-633		Buried Service Wire Repair	4	D E F
490-505-601		Buried Plant—Reclamation of Wet Buried PIC Cable—Selection of Cable	2	E
490-505-602		Buried Plant—Reclaiming Wet PIC Cable Using Reclamation Compound	14	E
		SPLICE CLOSURES		
490-550-314		K & B Splice Closures—Description	12	E F
490-550-400		Buried Splices—Corrosion Protection	5	E
490-550-404		Ready Access Closures—Fig. 8 & Lashed Alpeth 100MB Terminals	8	E F
490-550-405		Splice Cases, Types 20 & 21	8	E
490-550-406		Hanger Bracket Kit—Description & Installation	1	E F
490-550-407		Terminal Blocks, Loading Coils & Inductors in Ready Access Closures	8	C D E
490-550-412		Terminal Pedestal, Shield Termination for Double Shielded Double Jacketed APFSP Cables	5	E
490-550-413		Ready Access Closures, Types 50 & 58—Description & Installation	20	E F
490-550-414		K and B Splice Closures—Installation	10	E
490-550-415		Wrapped Joints, Auxiliary Sleeves PAP & PASP Sheath	5	E F
490-550-425		Splice Cases 9A, 10A, 11A, 12A	15	E F
490-550-427		Splice Cases—Types 30 and 31	14	E F
490-550-455		PIC Cable Closure—Description & Installation	10	F
490-551-401		Temporary Protection of Sheath Openings	3	E
490-551-402		Temporary Splice Closure Using CR Tape	13	E
• 490-551-410		Thermofit Wraparound Repair Sleeve (WRS) General Assembly Instructions	5	E
490-551-420		Insulating Joints	5	E
		SPLICE CLOSURES—LEAD		
490-552-410		Lead Discs, Casting & Preparing Lead End Plates	3	E
490-552-415		Lead Discs & Sleeves—Terminating Splices	2	E
490-552-420		Torch Soldered Joints	2	E
490-552-425		Wiping Lead Sleeves	6	E
490-552-428		Soldering Seams of Split Lead Sleeve	2	E
490-552-430		Removing Lead Sleeve	1	E
490-552-435	2	Wrapped Joint Auxiliary Sleeve, Lead Sleeve Closure	7	E
490-552-436		Wrapped Joint Closure, Lead Sleeve	2	E

Practice No.	Issue No.	Title	No. of Pages	Distribution
		CABLE SPLICING		
490-600-001	4	Cable Conductor Splicing Methods	1	D E F
490-600-300		Color Coding & Unit Arrangement Plastic Insulated Conductors	6	E
490-600-310		Cable Tags—Underground Cable	5	E
490-600-350		Layer Type Exchange Cable	4	E
490-600-352		Multiple Unit Cable	6	E
490-600-400		Sealing Cable Ends—Neoprene Cable Caps	2	E F
490-600-401		Paper Insulated Cable—Splicing Twisted Butt Joints	2	E
490-600-402		Paper Insulated Cable—Trimming Out Bridge Joints	1	E
490-600-403		Stalpeth & Alpeth Cables—Pressure Testing Fittings	2	E
490-600-404		Paper Insulated Cable—Arrangement of Cotton Sleeves	3	E
490-600-405		Paper Insulated Cable—Splicing Twisted Bridge Joints	4	E
490-600-406		Paper Insulated Cable—Splicing Twisted Straight Joints	7	E
490-600-414		Filled Plastic Sleeves General Use	2	E F
490-600-415		Soldering Twisted & Sleeved Joints	1	E
490-600-416		Twisted & Solder Dipped Joints Method Nonworking Cable	14	E
490-600-417		Use of Plastic Sleeves	4	E
490-600-418		Paraffin & Splicing Oil	3	E
490-600-423	2	Cable Splicing—AMP Picabond Wire Connectors	3	D E
490-600-424		Addendum—Cable Splicing—AMP Model MR-1 Hand Crimping Tool Operation	1	E
490-600-424		Cable Splicing—AMP Model MR-1 Hand Crimping Tool Operation	4	E
490-600-425	2	MA-6B Splice Connector—Description, Operation & Maintenance	11	E
490-600-426	2	Cable Splicing—Wire Joining Using the AMP MA-6B Applicator & Picabond Connection	11	E
490-600-428		B Wire Connector	15	E
490-600-430		Splicing Polyethylene Conductors Using UR, UG, & UY Connectors	4	E
490-600-450		Desiccant—Description & Use	3	E
490-600-520		Cutting Splice Closures from Plant, Cable Removal Precautions	1	E
490-601-401		Vicom T Carrier Splicing Repeater Cases, 1500 Series	24	E
490-602-010		Setting Up Underground Cable	7	E
490-602-405		Aerial Cable—Use of Slack Pullers	3	E
490-602-416		Removing Lead Sheath	4	E
490-602-418		Preparation of Alpeth & Stalpeth Sheath Ends	4	E
490-602-420		Preparation of PAP & PASP Sheath Ends	5	E
490-602-422		Preparation of Lepeth Sheath Ends	2	E

Practice No.	Issue No.	Title	No. of Pages	Distribution
		CABLE SPLICING (Continued)		
490-605-001		General Rules for Making Splices	4	E
490-605-350		Superior WT (Watertight) Filled Telephone Cable—Description	4	E
490-605-403		Aerial Preparation and Arrangement	1	E F
490-605-406		Random Splicing Exchange Cable—13-Gauge & 16-Gauge	2	E
490-605-420	2	Cable Splicing—Plastic Insulated Cable	3	E
490-605-430		Wrapping Completed Splices	7	E
490-605-450		Superior WT (Watertight) Filled Telephone Cable—Preparation, Splicing & Closure Installation Methods	13	E
490-610-410		Coil Cases, Stub Arrangements, Aerial	2	E
490-610-413		Cable Arrangements in Manholes	4	E
490-610-415		Support & Stub Arrangement in Manholes for Lead Sleeve Load Cases	2	E
490-610-416		Loading Coil Cases—Stub Arrangement in Manholes	3	E
490-610-425		Splicing Load Coils in Cases	6	E
490-610-426		Splice Type Coil Cases—Installation	4	E
490-620-401		Terminals, Pole Mounted	4	E
490-620-405		Strand Mounted Terminals	5	E
490-625-601		Repair of Underground Cable	4	E
		TERMINALS		
490-650-401		Types BF & BG—Installation	8	E
490-650-410		66B3-50 & B4-25 Connecting Blocks—Description & Use	7	C D
490-650-420		Pedestal Terminals F-2, F-3, F-4 & F-5—Description & Installation	17	E
490-660-415		29 Type Cabinets—Description & Installation	11	E
490-665-412		Type 503B Protected Terminals—Installation	12	C D
		MAIN FRAME TERMINATIONS & CONNECTORS		
490-700-401		Terminating Frame Quick Connect—Description & Installation	14	B C E
490-700-410		Connectors, Type 700—Description, Installation & Marking	10	E
		CABLE PRESSURE SYSTEMS		
490-750-002		Continuous Feed—Initial Procedures	3	E
490-750-004		Locating Pressure Contactors	4	E
490-750-100		Precautions	4	E
490-750-412		Soldering Molds—Use	2	E
490-750-413		Bypass Valves—Use	3	E
490-750-414		Arrangement of Valves	5	E
490-750-415		Locating Pressure Valves	2	E
490-750-416		Valves, Flanges & Ells for Polyethylene—Sheathed Cables—Installation	8	E
490-750-417		Air/Fluid Fitting—Installation	3	C D E F

Practice No.	Issue No.	Title	No. of Pages	Distribution
		CABLE PRESSURE SYSTEMS (Continued)		
490-750-418		Sheath Preparation for Fittings—Lead Sheath	3	E
490-750-430	2	Cable Pressure Systems Plugging Paper or Pulp Insulated Cable	6	E
490-750-433		Plugging Paper or Pulp Insulated Cable (Ren)	8	E
490-750-435	2	Cable Pressure System Plugging PIC Cable	6	E
490-750-437		Plugging PIC Cable (Ren)	5	E
490-750-440	2	Cable Pressure System Plugging DS (Double Sheath) PIC Cable	6	E
490-750-442		Plugging Double Sheath Plastic Insulated Cable (Ren)	9	E
490-750-600		Air Dryers, Models 750, 1500, 5000, Puregas—Maintenance Routine	3	B E
• 490-750-705		Cable Pressure Systems Cable Pressurization Computer	16	E
490-750-706		Plotting Pressure Gradients	5	E
490-750-707		Pressure Gradient Analysis	8	E
490-750-708		Computing Leak Location	3	E
490-750-709		Construction Test Procedures	4	E
490-750-710		Temperature Compensation	6	E
490-750-711		Pneumatic Resistance of Cables	5	E
• 490-755-601		Insulated Conductor Junction Splices Model 6000-D Moisture Separator PIC, Paper or Pulp Cable Installation and Maintenance	3	E
		ELECTRICAL PROTECTION & BONDING		
490-800-300	2	Grounding Harnesses—Description	3	C D E F
490-800-400		Protectors—Drainage Devices	3	C D F
490-800-401		Protectors—High Voltage, Joint Use	3	C D F
		BONDING & GROUNDING AERIAL & BURIED CABLE		
490-805-350		Fuse Cable Requirements	11	E
490-805-400		Suspension Strand—Bonding & Grounding Methods	6	E F
490-805-401		Guys—Grounding Method	7	F
• 490-805-402		Addendum—Bonding and Grounding Cable Sheath	9	E
490-805-402		Cable Sheath—Bonding & Grounding	9	E
490-805-403		Bonding Across Sheath Openings	3	E
490-805-404		Bonding Aerial Polyethylene Sheath Cables to Suspension Strand	3	E F
490-805-405		Bonding Armor, Buried Polyethylene Sheath Cables	3	E
490-805-406		Bonding Underground Lead Sheath Cables	3	E F
490-805-407		Bonding Underground Alpeth Sheath Cables	1	E
490-805-408		Bonding Armor to Sheath Buried Cable	1	E
490-805-415		Grounding—Block and House Cable—General	3	D E F
490-805-416		Grounding—Running Ground Wire—Block and House Cables	7	E F
490-805-417		Grounding—Use of Ground Clamps—Block and House Cable	6	D E F

Practice No.	Issue No.	Title	No. of Pages	Distribution
		SERVICE CENTER		
		GENERAL		
495-000-001		Numerical Index—Division 495—Service Center		
		CUSTOMER SERVICE		
495-230-001		Facilities and Station Apparatus Left-in Place Program		
		SERVICE TEST CENTER		
		GENERAL		
496-000-001		Numerical Index—Division 496—Service Test Center		

MONITORING OF WORKING LINES

1. GENERAL

1.01 This practice contains procedures to be followed by all employees when their work involves the monitoring of working telephone lines.

1.02 Working lines referred to in this practice are those lines other than special service lines. Special service lines require individual treatment.

2. TEST SETS

2.01 Use only a standard hand test telephone equipped with an approved monitoring device to monitor working lines.

3. MONITORING OPERATION

3.01 Work forces must monitor all working lines before opening, short circuiting, crossing, grounding, placing trouble clearing equipment or applying tone for identification. Circuits must test idle before such work is undertaken.

3.02 *Busy Circuit:* If circuit tests busy, employee shall immediately disconnect hand test telephone from circuit and continue with work assignment. After a reasonable period of time, remonitor circuit.

3.03 *Continued Busy Circuit:* If above mentioned circuit is still busy upon second or third test (provided a reasonable time has expired) and no other work has been prescribed at this location, or where it is otherwise necessary to interrupt conversation; employee should proceed as follows:

a. Politely excuse himself.

b. Identify himself as a telephone company employee.

c. Explain the necessity for service interruption.

d. Request permission to perform work on this line.

e. If permission is granted, thank the parties involved for their cooperation. If permission is not granted, excuse the interruption before connection with the talking party is broken.

f. Be sure the parties have hung up before proceeding with work, if permission is granted.

3.04 If either party should refuse to grant permission, employee shall disconnect hand test telephone from the line and, after a reasonable length of time, remonitor.

4. SECRECY OF COMMUNICATIONS

4.01 Employees monitoring working lines must be familiar with the Communications Act of 1934 which protects secrecy of communication.

4.02 *Notice of Secrecy of Communications*

a. Employees must not disclose the contents, or any part, of any telephone, radio (including television and facsimile), teletypewriter or telegraph message addressed to another person without the permission of the sender, or wilfully alter the purport or effect or meaning of any such message. Both parties to a telephone conversation are considered senders.

b. Employees must not use any information, derived from any private message passing through their hands and addressed to another person, or in any other manner acquired as an employee of the company.

c. Employees must not permit any unauthorized person to listen to any telephone conversation. Employees must not monitor any connection more than is needed for its proper supervision.

d. Employees must not tell anyone the fact or the nature of any message, except as required for handling it properly.

e. Employees must not discuss communication arrangements made between the company and its customers, except as required for handling them properly.

f. Employees must not give any unauthorized person any information whatever about the location of equipment, trunks, circuits, cables, etc., or about local or toll ticket records of calls, teletypewriter messages, etc.

The secrecy of communications is protected by laws imposing punishment by fine and imprisonment for its violation. Fines of as much as $10,000 and imprisonment for as long as two years and in some instances longer may be imposed for breaking these laws.

STATION INSTALLATION AND MAINTENANCE INSPECTION

1. GENERAL

1.01 This practice outlines the policy and procedure to be followed by outside plant foremen and their immediate supervisor in the inspection of station installation and maintenance work performed by outside installers and repairmen under their supervision.

1.02 The procedures stated in this practice will be most helpful in providing reliable and courteous service to the customer, and in assuring the craftsman that management has an interest in him and the quality of his work.

1.03 Evaluation of the work performance, thoroughness, and customer attitude of the craftsman must be performed, utilizing (as a check list) Form 2809 Station Installation & Maintenance Inspection. See Exhibit I.

1.04 For practical purposes, the individual assuming the duties of the plant foreman's immediate supervisor, shall be referred to as Plant Superintendent.

2. INSPECTING PROCEDURES

2.01 Each month the outside plant foreman shall:

a. Inspect two work locations for each craftsman under his supervision.

b. Review the results of each inspection with the responsible craftsman. If corrective action is required, it will be corrected as soon as practicable. *The foreman and craftsman will then sign Form 2809.*

c. Upon completion, the plant foreman will forward the Form 2809 to the Plant Superintendent.

2.02 The Plant Superintendent shall:

a. Inspect two or more work locations previously inspected by each plant foreman, within a three-month period. Should the inspection reveal that corrective action is required, appropriate measures will be taken to remedy the unsatisfactory conditions found at the work location.

3. FORM ORDERING INFORMATION

3.01 Form 2809 is available in pads of 100. Order from the Stationary Storeroom, 16071 Mojave Drive, Victorville, California 92392.

EXHIBIT I

STATION INSTALLATION & MAINTENANCE INSPECTION

FORM 2809
REV. 1/69

	EMPLOYEE NUMBER	EMPLOYEE NAME
DISTRICT		FOREMAN OR SUPERINTENDENT

SERVICE ORDER/REPAIR

NAME (Customer)		ADDRESS (Street)		(City)
TELEPHONE NUMBER	CLASS OF SERVICE	ZONE	SERVICE ORDER NUMBER	DATE COMPLETED

INSTALLATION	OTHER	ROUTINE	REPAIR
☐ NEW	☐ INSIDE MOVE	☐ PBX	☐ TROUBLE REPORTED WITHIN 30 DAYS
☐ RECONNECT	☐ TAKE OUT	☐ TELETYPE – DATA	☐ REPEATED COMPLAINT
☐ REINSTALL	☐ NO. CHANGE	☐ COIN TELEPHONES	☐ SPECIAL INSPECTION
OTHER _____ ☐			☐ VISIT

CUSTOMER ACCEPTANCE

ITEMS	SATISFACTORY	UNSATISFACTORY	REMARKS
TYPE OF TELEPHONE	☐	☐	
LOCATIONS	☐	☐	
CLEAN UP UPON COMPLETION	☐	☐	
DIRECTORY LEFT	☐ YES	☐ NO	
DIRECTORY EXPLAINED	☐ YES	☐ NO	
SALES ATTEMPT MADE	☐ YES	☐ NO	
EMPLOYEE APPEARANCE	☐	☐	
EMPLOYEE ATTITUDE	☐	☐	
REACTION TO THIS VISIT	☐	☐	

INSPECTION

ITEMS CHECKED	GOOD	REVISIT REQUIRED	REMARKS & ACTION REQUIRED
☐ DROP	☐	☐	
☐ PROTECTOR	☐	☐	
☐ GROUND	☐	☐	
☐ STATION WIRING	☐	☐	
☐ INSTRUMENTS	☐	☐	
☐ BOOTH	☐	☐	
☐ TERMINAL(S)	☐	☐	
☐ OTHER (KEY EQPT, ETC.)	☐	☐	
☐ EMPLOYEE ON JOB AT INSPECTION	☐ YES	☐ NO	
☐ SAFETY PRECAUTIONS OBSERVED	☐ YES	☐ NO	
FOLLOW-UP REQUIRED	☐ YES	☐ NO	

INSPECTION MADE BY	DATE OF INSPECTION	DATE CORRECTION COMPLETED
DATE DISCUSSED WITH EMPLOYEE	EMPLOYEE SIGNATURE	

FIRST AID

1. GENERAL

1.01 The purpose of this practice is to outline the latest first aid procedures as recommended in the American Red Cross First Aid Textbook.

1.02 It is essential that all Continental Telephone employees *know first aid.* Do not attempt to save time and effort by using second best first aid methods. It is just as important to know the "don'ts of first aid as it is to know the "do's".

1.03 Report all injuries to your supervisor as soon as possible.

2. THE WHY AND HOW OF FIRST AID

2.01 First aid is defined as the immediate and temporary care given to the victim of an accident or illness until the services of a physician can be obtained.

2.02 First aid training also shows how injuries occur and helps to reduce accidents by increasing the desire to prevent injuries.

2.03 In case of serious injury, act quickly as each second of delay is important. Take care not to make statements to the victim and to bystanders about the injuries. It is not the First Aider's duty to diagnose, evaluate, or predict.

2.04 Follow these general directions:

a. Keep the victim lying down. Do not transport a seriously injured person unless it is necessary to do so.

b. Treat injuries in this order:

(1) Severe bleeding.

(2) Stopped respiration.

(3) Poisoning by mouth.

(4) Shock.

c. Check for injuries and plan what to do.

d. Obtain the services of a physician.

3. GETTING THE DOCTOR OR AMBULANCE

3.01 If possible, stay with the victim and ask someone else to call a doctor. If necessary, call the police for this purpose. (Consult a list of physicians and hospitals, if available).

3.02 When the doctor is called, give him the following information:

a. Cause and probable extent of the injury.

b. Location of the victim.

c. What first aid is being given.

d. What first aid supplies are available.

e. Whether an ambulance is needed and if one has been called.

4. WOUNDS AND BLEEDING

4.01 A wound is a break in the skin. It is caused by force and usually extends into the underlying tissue. Control bleeding and protect wounds from contamination. The danger of tetanus (lockjaw) should be considered in all wounds. Guard against infection. (If it occurs, see paragraph 13.12.) Wounds with severe bleeding are treated as follows:

a. Severe bleeding must be stopped without delay. Apply direct pressure to the wound using a cloth pad or even a bare hand, if necessary. See Figure 1.

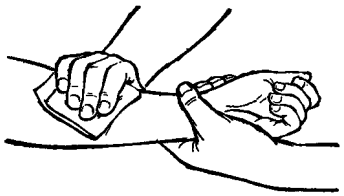


FIGURE 1. Direct Pressure on the Wound.

b. Elevate the bleeding part, if possible.

c. Pressure points are as follows:

(1) If an arm or leg is involved and direct pressure must be delayed or is not entirely effective, apply digital pressure at pressure points (Figures 2 and 3).

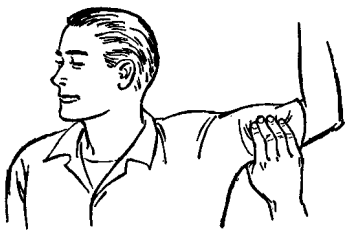


FIGURE 2. Finger Pressure on Brachial Artery.

(2) Pressure on the inner half of the arm (midway between the elbow and the armpit) compresses the brachial artery against the bone, causing bleeding in the arm, beyond the pressure point to be controlled.

(3) Pressure applied just below the groin on the front inner half of the thigh compresses the femoral artery against the underlying pelvic bone. If considerable force is applied, bleeding below the point of pressure will be controlled.

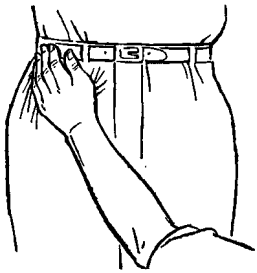


FIGURE 3. Hand Pressure on Femoral Artery.

d. Bandage the pad firmly into place on the wound. Do not remove it once it is in place. If blood saturates the dressing, place additional layers of cloth on top of the original dressing.

e. *The tourniquet should be used only in extreme cases, where it is necessary to risk losing the victim's limb in order to save his life.* If it is to be used:

(1) Place it above and near the wound, between the body and wound.

(2) Make sure that it is applied tightly enough to stop bleeding.

(3) Wrap the material tightly twice around the limb if possible and tie a half knot. (See Figure 4A.)

(4) Place a short stick on the half knot and tie a full knot. (See Figure 4B.)

(5) Twist the stick to tighten the tourniquet until the flow of blood ceases. (See Figure 4C.)

(6) Secure the stick in place with the loose ends of the tourniquet or another strip of cloth. (See Figure 4D.)

(7) A notation must always be made and attached to the victim, giving the time of application and location of the tourniquet. Be certain that the ambulance attendants are verbally notified also.

(8) *Do not release the tourniquet once it has been applied. It is urgent that such cases have medical attention as soon as possible.*

4:02 Neck Wounds–These are most frequently made by knives, razors and windshield glass. A large artery, vein, or both, may be cut. First aid for neck wounds is as follows:

a. Apply hand pressure both above and below the cut and continue to hold until a doctor directs that pressure be released. Do not worry about getting the hand in the wound in such severe cases.

b. A bulky compress of the cleanest immediately available material to maintain pressure may be a great help.

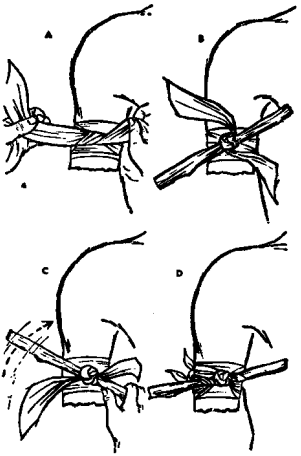


FIGURE 4. Application of Tourniquet.

4.03 Minor wounds in which bleeding is not severe. First aid for minor wounds is as follows:

a. Wash your hands thoroughly with clean water and soap.

b. Cleanse the injury thoroughly, using antiseptic soap and boiled water or if not available, use merthiolate on a sterile compress.

c. Apply merthiolate from first aid kit if available. If not, cover with sterile or clean dressing and bandage snugly.

d. See a doctor promptly if evidence of infection appears.

4.04 Wounds with internal bleeding are caused by head injury (see paragraph 9.02), or are caused by other than head injury and may be recognized by the appearance of blood at the uninjured mouth or nose. First aid for internal bleeding is as follows:

a. Keep the victim lying on his back. Turn the head to one side.

b. Raise the head and shoulders if breathing is difficult.

c. If the patient is in shock or is unconscious, turn him on his side with the head and chest lower than the hips to prevent blood from being drawn into the lungs.

d. *Do not* give stimulants.

4.05 First aid for gunshot wounds and other deep wounds is as follows:

a. Keep the victim as quiet as possible. Moving may aggravate fractures or the existing damage to internal organs.

b. *Do not* give stimulants. If the wound is abdominal, do not give any food or water.

c. If air passes through a chest wound as the victim breathes, cover the wound firmly with dressing material.

d. If intestines protrude, do not force them back into the abdomen; cover with wet cloths at body temperature. Water and dressings should be as sterile as possible under the circumstances.

5. BITES AND STINGS

5.01 First aid for animal bites is as follows:

a. Wash the wound thoroughly to remove all animal saliva. Use a gauze compress and a soap and water solution to scrub the wound; antiseptic soap is best, but any soap will do. Thorough washing of the bite wound should be continued for at least 10 to 15 minutes; then rinse with clean running water and apply a sterile dressing.

b. If possible, steps whould be taken to confine the animal so that it will be available for examination to determine whether or not its bite may have transferred rabies or tetanus.

c. Always consult a physician promptly.

5.02 Snake Bites (poisonous)–Most snake bites can be prevented when working in snake infested regions by wearing high topped boots or heavy leggings, and by being extremely careful about putting the hands in places where they may be bitten. Snake bite symptoms and first aid are as follows:

a. Symptoms of poisonous snake bite:

(1) The bite of a rattlesnake, copperhead or cotton-mouth moccasin leaves one or two small puncture wounds. Since the coral snake chews rather than bites, it leaves no fang marks. Severe pain, swelling and discoloration of the poisoned part occurs rapidly.

(2) General weakness, shortness of breath, nausea, vomiting, weak and rapid pulse, dimness of vision, and possible unconsciousness occurs.

b. First aid for poisonous snake bites:

(1) Begin at once. Have the victim lie down and keep quiet, as muscular activity increases circulation resulting in more rapid absorption of the venom.

(2) If the bite is on an extremity, tie a constricting band–*not* a tourniquet–firmly above the bite.

(3) Sterilize a knife or razor blade with a match flame, merthiolate, or alcohol and make incisions. Try with one incision to get into the venom deposit point. Crosscuts about 1/4" long may be made at each fang mark and over the suspected deposit point. Make shallow cuts through the skin in the crossways direction; longitudinal cuts may be deeper. Muscles and nerves run in a longitudinal direction and a deep crosscut may sever them. Beware of cutting muscles and nerves of the finger, hands, or wrist, for they lie immediately below the skin and their injury may cause disability. Apply suction, using the mouth or a suction cup. Continue suction for an hour or more.

NOTE: When a snake bite kit is available, the instructions inside the cover should be followed.

5.03 Snake Bites (nonpoinsonous)–This paragraph covers the symptoms of and first aid for nonpoisonous snake bites.

a. Symptoms of these bites are:

(1) Horseshoe-shaped row of teeth marks.

(2) Absence of symptoms other than those usually following a minor wound.

b. First aid for nonpoisonous bites is to:

(1) Cleanse the wound thoroughly with clean water.

(2) Apply sterile dressing.

5.04 Insect Bites and Stings–First aid procedures to be followed for bites and stings are:

a. Remove the "stinger" if it is still present.

b. If possible, apply ice or ice water to the wound.

c. Apply medicated ointment.

d. Avoid scratching the bite.

5.05 Tick Bites–Rocky Mountain Spotted Fever is transmitted by tick bites. Despite its name, the disease can occur in any part of the country. First aid for tick bites is as follows:

a. If a tick is present, grasp it with tweezers, remove it, and apply merthiolate to the wound.

b. If the hands come in contact with ticks, wash them thoroughly with antiseptic soap and water. Gently scrub the area of the tick bite thoroughly with antiseptic soap and water.

c. If any unusual symptoms develop, see a doctor.

5.06 Spider, Scorpion and Tarantula Bites–First aid for these bites is:

a. If the bite is on an extremity, apply a constricting band for *5 minutes only* just above the bite.

b. Keep the affected part lower than the rest of the body and apply ice, ice water, or any cold application locally for two hours.

c. Obtain medical attention.

6. SHOCK (DUE TO PHYSICAL INJURY)

6.01 *All seriously injured persons should be treated for shock.*

6.02 Shock is defined as a depressed condition of many bodily functions due to failure of sufficient blood to circulate through the body following serious injury. Shock causes low bodily resistance and possibly death. Shock factors, symptoms, and first aid are discussed in the following paragraphs:

a. Factors which make shock worse are:

(1) Pain.

(2) Rough handling.

(3) Improper transportation.

(4) Continued bleeding.

(5) Excessive cold or heat.

(6) Stopped respiration.

(7) Sight of blood.

b. Symptoms of shock are:

(1) Weakness of the victim.

(2) The skin is pale, cool, and moist. Perspiration appears on the forehead, lips, and palms.

(3) The pulse is rapid and sometimes weak or even absent.

(4) Breathing is fast, shallow, irregular, and sometimes comes in occasional deep breaths.

(5) The eyes appear vacant and lusterless.

c. More general and less severe shock symptoms are:

(1) Thirst.

(2) Nausea.

(3) Indifference.

(4) Restlessness.

d. First aid for shock is:

(1) Keep the victim lying down.

(2) Do not add heat. Simply prevent loss of body heat by covering (if necessary with a blanket, overcoat, or newspapers). *Do not* cause the victim to sweat.

(3) Fluids should be administered in small amounts if the victim is conscious.

7. ARTIFICIAL RESPIRATION

7.01 Rescue is usually the first step in aiding the victim. Electric shock, gas inhalation, and drowning are the most common causes of stopped respiration. Every plant man should be thoroughly familiar with rescue techniques where injury due to electricity or gas is involved, including rescue from manholes, poles, and power wires. Some of the important points to remember in effecting rescues are listed below:

a. For injury due to electricity:

(1) Break the contact by separating the victim from the electrical power source, making sure that in the process you do not expose yourself to contact with the victim or the source of electricity. Use rubber gloves, long dry sticks, dry rope, dry folded clothes, and stand on insulating material if possible.

(2) Cut off the current supply if possible.

b. Proceed as follows for gas inhalation:

(1) Recognize the danger of explosion.

(2) If in a building, shut off both gas and electricity supply.

(3) Ventilate the area thoroughly before attempting rescue.

c. Drowning–Unless you are an expert swimmer and trained in life saving, keep out of the water when rescuing a drowning person. Instead, "row or throw." (Learn American Red Cross life saving and water safety techniques.)

7.02 General Directions for artificial respiration are as follows:

a. *Start at once and do not give up.* There are many cases on record where a person apparently dead has been revived after several hours of continuous artificial respiration.

b. The purpose is to restore normal respiration by maintaining an alternating decrease and increase in the expansion of the chest and thereby an adequate air exchange.

c. The mouth to mouth rescue breathing method is the Continental Telephone standard for general use. However, in the rare case where it is impractical to use this method, another means of ventilating the lungs should be used.

d. The only equipment necessary to perform rescue breathing is carried with you at all times–your hands, your mouth, and your repetitive breathing.

7.03 Additional related directions for artificial respiration are:

a. Begin artificial respiration immediately.

b. A mechanical resuscitator operated by a trained person should be used when available.

c. If assistance is available, have blankets or other suitable material placed over and under the victim.

d. When breathing starts, keep the victim lying down and treat for shock.

7.04 Mouth-to-mouth (rescue breathing) Artificial Respiration—If there is foreign matter visible in the mouth, wipe it out quickly with your fingers or a cloth wrapped around your fingers. Proceed as follows:

a. Tilt the head back so that the chin is pointing upward (Figure 5). Pull or push the jaw into a jutting-out position (Figure 6 and 7).

FIGURE 5.

FIGURE 6.

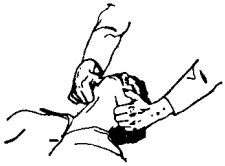


FIGURE 7.

These maneuvers should relieve airway obstruction by moving the base of the tongue away from the back of the throat.

b. Open your mouth wide and place it tightly over the victim's mouth. At the same time pinch the victim's nostrils closed (Figure 8) or close the nostrils with your cheek (Figure 9). An alternative is to close the victim's mouth and place your mouth over his nose (Figure 10). Blow into the victim's mouth or nose. (Air may be blown through the victim's teeth, even though they may be clenched.) The first blowing efforts should determine whether or not obstruction exists. This will be apparent if there is resistance to your blowing effort and if the victim's chest fails to rise.

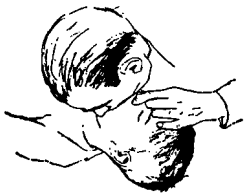


FIGURE 8.

FIGURE 9.

FIGURE 10.

c. Remove your mouth, turn your head to the side, and listen for the return rush of air that indicates air exchange. Repeat the blowing effort. For an adult, blow vigorously at the rate of about 12 breaths per minute. For a child, take relatively shallow breaths appropriate for the child's size, at the rate of about 20 per minute.

d. The rise and fall of the victim's chest wall is the best indication that you are correctly administering rescue breathing. Observe chest movement.

e. If you are not getting an air exchange, recheck the head and jaw position (Figures 5, 6, and 7). If you still do not get an air exchange, quickly turn the victim on his side and administer several sharp blows between the shoulder blades. This should dislodge any obstructing matter (Figure 11). Again sweep your fingers through the victim's mouth to remove any foreign matter.

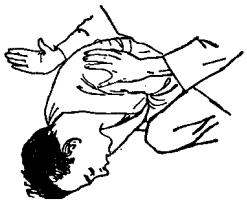


FIGURE 11.

f. Those who do not wish to come in contact with the person may place a cloth over the victim's mouth or nose and breathe through it. The cloth does not greatly affect the exchange of air.

7.05 Mouth-to-mouth (rescue breathing) Technique is possible for infants and small children. If foreign matter is visible in the mouth, clean it out quickly as described previously in paragraph 7.04. Proceed as follows:

a. Place the child on his back and use the fingers of both hands to lift the lower jaw from beneath and behind, so that it juts out (Figure 12).

b. Place your mouth over the child's mouth and nose (Figure 13), making a relatively leakproof seal. Breathe into the child, *using shallow puffs of air* in order to prevent damage to the child's lungs. The breathing rate should be about 20 per minute. Observe chest movement.

FIGURE 12.

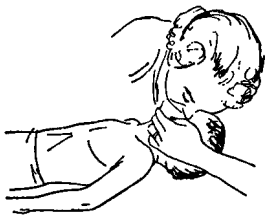


FIGURE 13.

If you meet resistance in your blowing efforts, recheck the position of the jaw. If the air passages are still blocked, the child should be suspended momentarily by the ankles (Figure 14) or inverted over the arm (Figure 15) and given two or three sharp pats between the shoulder blades to dislodge any obstructing matter. Check the mouth for obstructing matter and remove it quickly.

7.06 Back Pressure–Arm Lift Method of Artificial Respiration–It is possible that because of the nature of the injury or other circumstances, the manual method of artificial respiration should be used. It is re-emphasized that mouth-to-mouth (rescue breathing) is the preferred method because of its effectiveness, practicality, speed, and simplicity. Proceed as follows:

a. Place the victim in the facedown, prone position. Bend his elbows and place his hands one upon the other. Turn his face to one side, placing the cheek upon the hands (Figure 16).

FIGURE 14.

FIGURE 15.

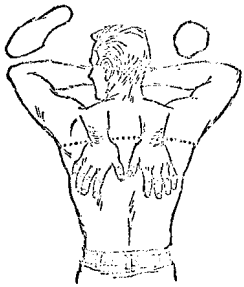


FIGURE 16. Position of Victim.

b. Position of the operator—kneel on either the right or left knee at the victim's head, facing him. Place your knee at the side of the victim's head close to his forearm. Place your other foot near his elbow. If it is more comfortable, kneel on both knees, one on either side of the victim's head. Place your hands on the flat of the victim's back so that the palms lie just below an imaginary line running between the armpits. With thumb tips just touching, spread your fingers downward and outward (Figure 17).

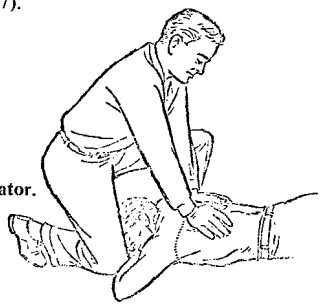


FIGURE 17. Position of Operator.

c. Rock forward until the arms are approximately vertical and allow the weight of the upper part of your body to exert slow, steady, even pressure downward on the hands. This forces air out of the lungs. Your elbows should be kept straight and the pressure should be exerted almost directly downward on the back. You do not need much pressure (Figure 18).

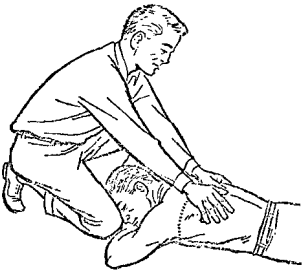


FIGURE 18. Compression Phase.

d. Release the pressure, avoiding a final thrust and commence to rock slowly backward. Place your hands upon the victim's arms just above his elbows (Figure 19).

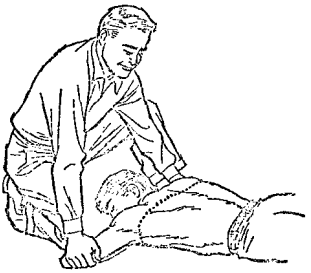


FIGURE 19. Position for Expansion Phase.

e. Draw his arms upward and toward you. Apply just enough lift to feel resistance and tension at the victim's shoulders. Do not bend your elbows, and as you rock backward the victim's arms will be drawn toward you. Then lower the arms to the ground. This completes the full cycle. The arm lift expands the chest by pulling on the chest muscles, arching the back, and relieving the weight on the chest. The cycle should be repeated 12 times per minute at a steady rate. The compression and expansion phases should occupy about equal time with the release periods being of minimum duration (Figure 20).

7.07 Pole Top Resuscitation—The conditions surrounding the victim and the exposure of the rescuer to danger would have a marked relationship as to what method should be used and how soon it could be started. Whenever conditions and safety of the rescuer will permit, the following basic principles should be applied:

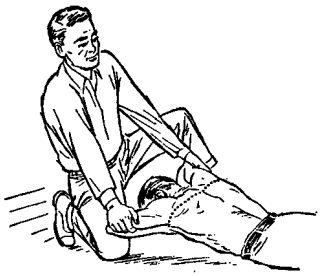


FIGURE 20. Expansion Phase.

a. *Get the first breath of air into the victim quickly.* This should be accomplished by simple compression of the chest by any means possible. The importance of early ventilation of the lungs is shown by the following:

% Chance for Survival	Minutes after Suspension of Breathing
98%	1 min.
90%	2 min.
55%	3 min.
30%	4 min.
15%	5 min.

b. If practicable, move the victim to a more desirable position described in step c.; however, this should be done without interrupting the exchange of air in the lungs.

c. The rescuer, after checking the conditions and assuring himself that artificial respiration can be safely administered, lets the victim hang from his safety strap, alongside the pole. He should then take a position from which he can secure his safety strap around the pole and between the legs of the victim, then proceed upwards until the victim is straddling the strap. By moving the safety strap as high as possible on the pole, much of the victim's weight is carried by the rescuer's strap as he places his weight against it (Figure 21).

d. Compression Phase–Pressure can best be applied by the rescuer locking his fingers over the lower abdomen, lifting up and back as he rocks back in his safety belt. This expels the air from the lungs as the rib cage is compressed and the intestines are forced up against the diaphragm. After firm resistance is met, release the pressure by rocking forward (Figure 22).

NOTE: Sometimes electric shock produces a muscle block which can be broken by additional finger pressure against the diaphragm.

FIGURE 21.

FIGURE 22.

Expansion Phase–Immediately after the completion of the compression phase, raise the arms beneath the victim's so that the rescuer's elbows hook beneath the victim's arm pits. The rescuer again rocks back in his safety belt lifting the victim's shoulders up and back, simulating the American Red Cross Arm-Lift Technique (Figure 23).

FIGURE 23.

f. The compression and expansion phases described should take approximately 2-1/2 seconds each.

8. POISONING BY MOUTH

8.01 *Hurry* is the word to associate with poisoning by mouth. Give first aid without delay. If possible have someone call a doctor, poison control center, or hospital while you give first aid.

8.02 Symptoms of poisoning vary greatly according to the kind and amount of poison taken and the time elapsed. Many poisons cause no symptoms until absorbed into the system. Others cause burns in the mouth or abdominal pain. There may be nausea, vomiting, visual disturbances, convulsions, headache, or deep sleep.

8.03 First aid for poisoning is as follows:

a. When the poison is not an acid, alkali, strychnine, or kerosene:

(1) Dilute the poison. Quickly administer fluid (milk and/or water) in large amounts.

(2) Induce vomiting–strong baking soda solution or milk of magnesia. Repeat the dilution and induction of vomiting until the fluid is returned clear. If fluid cannot be administered, use fingers or a spoon in the mouth to induce gagging and vomiting.

(3) If the antidote is given on the label, administer it as directed. If no specific antidote is known, administer a universal antidote of two parts by volume of crumbled burnt toast, one part strong tea, and one part milk of magnesia.

b. When the poison is an acid:

(1) Dilute the poison. Quickly administer fluid (milk and/or water).

(2) *Do not induce vomiting.* Neutralize with weak alkali (baking soda in water, or milk of magnesia); then give milk, olive oil, or egg white to protect the digestive tract lining.

(3) If the antidote is given on the label, administer it as directed.

c. When the poison is an alkali:

(1) Dilute the poison. Quickly administer fluid (milk and/or water).

(2) *Do not induce vomiting.* Neutralize the poison with weak acid (vinegar, lemon juice). Follow with milk, olive oil, or egg white.

(3) If the antidote is given on the label, administer it as directed.

d. When the poison is a petroleum product such as kerosene, solvents, or insecticides:

(1) Dilute the poison. Quickly administer fluid (milk and/or water).

(2) *Do not induce vomiting.*

9. INJURIES TO BONES, JOINTS, AND MUSCLES

9.01 Fractures are defined as a break in a bone. The various kinds of fractures, their symptoms and first aid are discussed in the following paragraphs.

a. The various kinds of bone fractures are:

(1) Simple fracture—a closed fracture not associated with an open wound.

(2) Compound fracture—an open fracture that has a wound extending from the skin to the fracture area.

(3) Comminuted fracture—The bone is broken into small pieces and it may be closed or open.

b. Symptoms of fractures are swelling, tenderness, deformity, pain on motion, discoloration, and possibly bleeding.

c. First aid for fractures is:

(1) Do not disturb or move broken ends.

(2) Do not disturb or move the joints on each side of the broken bone.

(3) Treat the victim for shock. See paragraph 6.05.

(4) When in doubt, handle the injury as a fracture.

(5) If possible, apply an ice bag over the painful area.

(6) Do not move the limb before immobilizing. Use splints, arm sling, newspapers, etc.

(7) Provide transportation.

(8) Call a doctor.

d. Additional measures for compound fractures are:

(1) Control the bleeding.

(2) Apply a clean dressing to the wound.

9.02 Head Injuries—These consist of concussion and skull fractures.

IMPORTANT: A concussion is is an injury to the brain caused by a blow to the head and may or may not involve a skull fracture. Concussion must be expected due to force in any accident. Whether or not the skull is fractured, it is not important compared to the possible injury to the brain. The primary treatment for both is the same and *in both cases it is essential to keep the victim as quiet as possible.* Symptoms of and first aid for head injuries are as follows:

a. Some or all of the following symptoms may be present:

(1) Evidence of a blow, head wound, or swelling.

(2) Unconsciousness—total or partial—even if only for a few seconds after an accident.

(3) Eye pupils are unequal in size.

(4) Headache and dizziness.

(5) Paralysis of extremities.

(6) Bleeding from the nose, an ear canal, or the mouth.

b. First aid for head injuries is as follows:

(1) **It is extremely important to keep the victim lying down and quiet.**

(2) *Do not give stimulants.*

(3) If the face is flushed, elevate the head slightly.

(4) If the victim is unconscious, turn the head to one side.

(5) Loosen clothing about the neck.

(6) Merely lay a dressing on the wound.

(7) Reassure the victim if he is conscious.

9.03 Fracture of the neck or spine is treated as follows:

a. If at all possible, do not move the victim; summon a physician to the scene.

b. Keep the victim flat on his back.

c. Do not allow the head to tilt forward or sideways.

d. If transportation is absolutely essential (even for a few feet), use a firm support such as a shutter, board, or door.

9.04 Dislocations–These injuries are defined as a displacement of the bone end from the joint. The surrounding ligaments and other soft tissue always suffer some injury. Symptoms and first aid for dislocations are:

a. Symptoms of dislocation are swelling, tenderness to the touch, deformity, pain on motion, and discoloration.

b. First aid for dislocation is as follows:

(1) Do not disturb the affected part.

(2) *Do not* attempt to reposition the dislocated bone.

(3) Obtain medical attention.

(4) Treat for shock as in paragraph 6.05.

9.05 Strains and Sprains–A strain is defined as an injury to a tendon or muscle. A sprain is a stretching or tearing of the ligaments around a joint. The symptoms of and first aid for these injuries are as follows:

a. Symptoms of these injuries are:

(1) Strain–pain and stiffness.

(2) Sprain–pain, swelling, lack of use, and discoloration.

b. First aid for a strain is:

(1) Rest and apply heat.

(2) Rubbing may help.

(3) In severe cases, call a doctor.

c. First aid for a sprain is:

(1) Elevate the injured member and apply cold.

(2) If the ankle is sprained, apply a bandage over the shoe to immobilize the ankle.

(3) If lower extremities are involved, avoid placing weight on the limb.

(4) In severe cases, see a doctor.

(5) Always have suspected sprains x-rayed.

10. BURNS

10.01 Most burns are caused by the following:

a. Dry heat.

b. Flame.

c. Hot metal.

d. Hot liquid.

e. Steam.

f. Electricity.

g. Sun.

h. Chemicals.

10.02 Possible effects of burns on the body are:

a. Shock

b. Infection.

c. Permanent tissue damage.

d. Death.

10.03 There are three degrees of burns which are:

a. Skin merely reddened–first degree burn.

b. Skin blistered–second degree burn.

c. Deeper tissue is destroyed–third degree burn.

10.04 First aid for burns is as follows:

a. Thermal burns are extensively burned areas, such as those covering the back or chest area or a large portion of one or more extremities. First aid methods to be followed are:

(1) Treatment for shock.

(2) Keep air from the burn by application of a thick dressing; if the dressing is sterile, it will help prevent further contamination. Use a lint-free material.

(3) The dressing should be kept dry.

(4) Do not break blisters.

(5) Transport the victim at once to a doctor or hospital.

b. Small area burns should be treated by applying vaseline and a sterile dressing.

c. Thermal burns of the eye should be treated thusly:

(1) If pain can be tolerated, irrigate the eye gently to remove the foreign material.

(2) Cover the eye with a dry sterile dressing or clean cloth.

(3) Obtain medical aid immediately.

(4) *Do not* apply oil or ointments.

d. Chemical burns should be treated by:

(1) Washing away the chemical with large amounts of water.

(2) If specific chemicals for treatment are indicated on the label and they are available, apply them after washing with water.

e. Creosote burns should be treated by washing with hot soap and water and applying vaseline to the burned area.

f. Acid or alkali burns of the eye should be treated thusly:

(1) *Quickly* irrigate the eye thoroughly with plain tap water for several minutes.

(2) Remove any particles of the chemical.

(3) Have the victim close his eye.

(4) Place a dressing over the lid and bandage snugly.

(5) Obtain immediate medical attention.

g. Sunburn—The two types of sunburn should be treated. They are:

(1) Mild sunburn—Treat with medicated ointment, cold cream, salad oil, or shortening.

(2) For severe sunburn, obtain medical advice.

11. ILL EFFECTS OF EXCESSIVE HEAT

11.01 Exposure to excessive heat may result in heat exhaustion, heat stroke, or heat cramps. Symptoms of and first aid for heat are as follows:

a. Symptoms of heat exhaustion are:

(1) Temperature is normal.

(2) Fatigue.

(3) Headache.

(4) Vomiting or nausea.

b. Symptoms in severe cases of heat exhaustion are:

(1) Profuse perspiration.

(2) Extreme weakness.

(3) Pale and clammy skin.

(4) Heat cramps may be present.

c. First aid for heat exhaustion is to:

(1) Provide bed rest.

(2) Every 15 or 20 minuets give a half glass of water in which a half teaspoon of salt has been dissolved.

d. Symptoms of heat stroke are:

(1) Usually begins with a sharp pain in the head and dizziness.

(2) Almost immediate unconsciousness.

(3) Skin is dry and very hot.

(4) The face is flushed.

(5) Breathing is difficult.

(6) Very high temperature.

(7) Pulse is rapid.

e. First aid for heat stroke is as follows:

(1) Arrange for medical care immediately.

(2) Move the victim to a cool place; indoors if possible.

(3) Provide bed rest.

(4) Remove clothing.

(5) Sponge the body with alcohol or lukewarm water to reduce the body temperature. Pulse rate should be 110 per minute or less. Resume the sponging if the temperature rises again.

(6) When the victim is fully conscious, give a half glass of water with half a teaspoon ful of salt dissolved in it.

(7) Provide covering according to the victim's comfort.

f. Symptoms of heat cramps are pain in the abdominal muscles or limbs with profuse perspiration.

g. First aid for heat cramps is to:

(1) Apply firm, steady pressure to the painful area.

(2) Apply warm wet towels to the painful area.

(3) Give a half glass of salt water. Repeat this several times at 15 minute intervals.

12. ILL EFFECTS OF EXCESSIVE COLD

12.01 Frostbite is defined as the freezing of a body part, usually the nose, ears, cheeks, fingers, or toes. Symptoms of frostbite vary and the condition may not be evident to the victim. Symptoms and first aid for this condition are as follows:

a. Frostbite symptoms are:

(1) Feeling of intense cold or numbness.

(2) Pain in the early stages, later subsiding.

(3) Dead white, glossy skin, later changing to yellow.

(4) Blisters may appear.

b. First aid for frostbite is:

(1) Handle a frozen or frostbitten area with the greatest care.

(2) Firm pressure applied against the area with a warm hand is helpful but *rubbing with the hand or snow is definitely harmful.*

(3) If outside, cover the frozen area with woolen material.

(4) Make the victim warm and remove him to a warm room as soon as possible.

(5) If the frozen area is still cold or numb, rewarm it by immersing it in *lukewarm* water, or by wrapping it in blankets. **Do not rub or expose to extreme heat,** such as a hot stove, hot water bottle, or heat lamp, etc. **Excessive heat may increase the damage.**

(6) Once the fingers or toes are rewarmed, encourage the victim to exercise them.

(7) Do not disturb blisters.

12.02 Prolonged Exposure to Cold–Symptoms of and first aid for this type of exposure are:

a. Symptoms of exposure:

(1) General numbness.

(2) Difficulty in moving with staggering.

(3) Drowsiness or failing eye sight.

(4) Unconsciousness in advanced cases.

b. First aid for this exposure is:

(1) Start artificial respiration if breathing has stopped.

(2) Move the victim to a warm room as soon as possible.

(3) Rewarm the victim as rapidly as possible by wrapping him in warm blankets or by immersing him in warm *but not hot* water.

(4) When the victim responds, give him a hot drink and dry his body thoroughly if wet.

13. OTHER EMERGENCIES (LISTED ALPHABETICALLY)

13.01 Apoplexy—is defined as a sudden loss of consciousness, sensation, and motion. Symptoms of and first aid for apoplexy are as follows:

a. Symptoms of apoplexy are:

(1) Unconsciousness usually occurs.

(2) Loud, heavy breathing.

(3) Slow, strong pulse rate.

(4) Partial paralysis. This is seen in an unconscious person by lack of muscular tension if one of the extremities is moved.

b. First aid for apoplexy is as follows:

(1) Obtain medical care immediately.

(2) Place the victim on his back. If breathing is difficult, place him on his side to allow saliva to drool from his mouth.

(3) Cover the victim sufficiently to prevent chilling.

13.02 Appendicitis—is defined as inflammation of the appendix.

a. Symptoms of appendicitis are as follows:

(1) Abdominal pain usually generalized in the beginning, later localizes especially in the lower right abdomen.

(2) Nausea or vomiting.

(3) Mild fever.

(4) Constipation or diarrhea may be present.

b. First aid for appendicitis is as follows:

(1) Obtain medical attention without delay.

(2) *Do not* administer laxatives, food, or water.

(3) An ice bag placed over the painful area may help relieve discomfort but it should be understood that this merely removes a symptom and does not correct the condition.

13.03 Blisters—are defined as an elevation of the skin containing watery liquid. This paragraph applies only to blood blisters and water blisters caused by pinching and chafing. See paragraphs 10.04 and 12.01 for blisters due to burns and frostbite. First aid for blisters is as follows:

a. Wash the blister thoroughly with antiseptic soap and warm water. Dry, and apply a small amount of merthiolate to the edge of the blister. Puncture the blister at this point with a sterilized needle, or other sharp sterile object. Press out the fluid.

b. Apply a sterile dressing held in place with a bandage.

c. If the blister has already burst, wash with antiseptic soap and water and apply a dressing.

d. Consult a doctor if the blister is very extensive or if there is evidence of infection.

13.04 Boils and Sties—A boil is defined as a localized swelling and inflammation of the skin due to infection in a skin gland and containing pus. A sty is an inflammed, swollen sebaceous gland at the edge of the eyelid. First aid for these ailments is as follows:

a. Boils and sties in the facial region should be kept free from pressure.

b. Boils in other regions may be covered lightly with compresses saturated with a solution of 1 tablespoonful of epsom salts dissolved in 1 pint of warm water.

c. NEVER squeeze a boil. If it breaks, wipe away the pus with a sterile pad soaked in rubbing alcohol.

13.05 Bruises and Contusions—A bruise or contusion is an injury that does not break the skin but causes rupture of small underlying blood vessels with discoloration of the tissues. First aid for these injuries is:

a. Apply cold packs, use ice when available.

b. Elevate the injured area to reduce swelling and relieve pain.

13.06 Convulsions in Young Children—These are abnormal, violent, and involuntary contractions of the muscles. Symptoms of and first aid for convulsions are as follows:

a. Symptoms of convulsions are:

(1) Muscle spasms and twitching of various degrees.

(2) Stupor or sleep may follow the spasms.

b. First aid for this condition is:

(1) Remain calm in the child's presence.

(2) Provide bed rest and quiet.

(3) Call a doctor.

(4) *Do not* give an enema, bath, or warm packs unless so directed by a doctor.

13.07 Epileptic Fits–are any of the various disorders marked by disturbed electric rhythms of the central nervous system. Symptoms of and first aid for epileptic fits are as follows:

a. Symptoms of epilpsey are:

(1) An attack of epilepsy is generally preceded by a loud cry and the victim generally falls.

(2) The victim becomes unconscious and has convulsive, jerking movements of the muscles.

b. First aid for this condition is as follows:

(1) Prevent the victim from harming himself by placing a pillow, coat, or blanket under his head.

(2) Place folded compress, clean handkerchief, or piece of wood, etc., between his teeth at one side of his mouth to prevent him from biting his tongue. *Do not* obstruct breathing.

(3) *Do not* restrain convulsive movements.

(4) *Do not* give stimulants.

(5) When jerking has ceased, loosen clothing about the neck and keep the victim quiet.

13.08 Eye Injuries–are classified according to the following types:

a. Group 1 cases–injury to the eyelids and soft tissue around the eye.

b. Group 2 cases–injury to the surface of the eyeball.

c. Group 3 cases–injury that extends through the surface of the eye into the deeper tissues.

d. First aid for Group 1 injuries is as follows:

(1) Open wound should be covered with a sterile dressing and bandage.

(2) Bruises or "black eyes" may be given cold compresses immediately after injury.

(3) Use warm compresses after swelling has been controlled.

e. First aid for Group 2 injuries is as follows:

(1) If the injury is due to entry of a chemical, flush the eye thoroughly and repeatedly with clean water.

(2) Obtain medical attention immediately.

(3) If the injury is due to entry of a foreign body, pull down the lower lid and see if the foreign body lies on the surface of the lid lining. If so, it can be lifted off gently with the corner of a clean handkerchief or a piece of moist cotton. *Never* use dry cotton around the eye.

(4) Grasp the lashes of the upper lid gently between the thumb and forefinger while the victim looks upward. Pull the upper lid forward and down over the lower eyelid. A foreign body on the upper lid lining can be dislodged and swept away with tears. Flush the eye with a cool solution. This can be done with an eye dropper or small bulb syringe if available.

f. First aid for Group 3 cases is as follows:

(1) Lay a sterile compress or clean cloth over the eye.

(2) *Make no attempt at further first aid.*

(3) Obtain medical care as quickly as possible.

(4) If necessary to transport the victim, keep him FLAT, using a stretcher.

13.09 Fainting–is defined as losing consciousness due to a temporary decrease in the blood supply to the brain. First aid for fainting is as follows:

a. Often a person feeling faint can prevent fainting by lowering his head as though to tie a shoe.

b. If further care is necessary, treat for shock as in paragraph 6.05.

13.10 Heart Attack–is an interruption of normal heart functions. Symptoms of and first aid for heart attack are as follows:

a. Symptoms of heart attack are:

(1) Chest pain.

(2) Shortness of breath.

(3) Bluish color of the lips and fingernails.

b. First aid for heart attack victims is as follows:

(1) Keep the victim quiet and as comfortable as possible.

(2) **Obtain medical care at once.**

13.11 Hernia–is the protrusion of an organ or part through connective tissue or through the cavity wall in which it is enclosed. Symptoms of a hernia are protrusion or bulging in any region of the abdomen from the navel to the crotch. First aid for a hernia is as follows:

a. Have the victim lie down and refrain from physical activity.

b. If the bulge does not subside, apply cloths saturated with cold water to the area.

c. If the above measures fail, have the victim lie on his abdomen and bring his knees up under the chest.

d. *Do not* attempt to reduce the bulge by pressure.

e. Send for a doctor.

13.12 Infection—is defined as a condition caused by contaminating disease-producing germs.

a. Symptoms of infection are:

(1) Pain and swelling.

(2) Redness and heat.

(3) Pus and red streaks.

(4) Tenderness.

b. First aid for infection is as follows:

(1) Apply hot compresses—2 teaspoonfuls of salt per quart of boiled water.

(2) Be sure that the hot compresses do not burn the victim.

(3) Keep the victim at rest.

(4) **Obtain medical attention as soon as possible.**

13.13 Insulin Reaction—is caused by excessive insulin in the system and is characterized by the progressive development of a coma. The symptoms of and first aid for insulin shock are:

a. Symptoms of insulin reaction are:

(1) Confusion.

(2) Stupor.

(3) Mental disturbance.

(4) Unconsciousness.

NOTE: Diabetics should and generally do wear a tag or carry a readily accessible card to identify them. **Search for such identification only in the presence of a witness.**

b. First aid for insulin shock is:

(1) Administer any food or drink containing sugar.

(2) Send for a doctor.

13.14 Nosebleed—First aid for a nosebleed is as follows:

a. Have the victim sit up with his head thrown slightly back.

b. Have the victim breath through his mouth.

c. Loosen clothing around the neck.

d. Apply cold packs of the nose.

e. Pressing the nostrils together firmly for 4-5 minutes often stops the bleeding and gives opportunity for a clot to form.

f. Have the victim avoid blowing his nose for a few hours.

g. If these measures do not stop the bleeding, **obtain medical attention immediately.**

13.15 Plant Poisoning–There are three types of poisonous plants:

a. Poison Ivy–see Figure 24.

b. Poison Oak–see Figure 25.

c. Poison Sumac–see Figure 26.

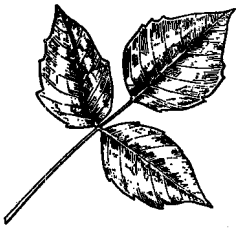


FIGURE 24. Poison Ivy.

Grows as a climbing plant and is found on fences, poles, and trees. Also, grows as a crawling plant and a low shrub. Leaves are green in spring and summer but turn to brown in fall. All of the plant, including the roots, is poisonous. The berries, when present, are white.

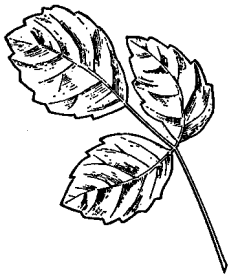


FIGURE 25. Poison Oak.

Closely related to the ivy plant, similar in appearance and habits of growth, but with the edges of the leaves more deeply notched. It is not a tree and is in no way related to the oak family.

13.16 Preventive measures are as follows:

When exposure to poison oak is expected, it is advisable for employees to immunize themselves by taking oral immunizing Broemmel. Immunizing extracts and injections administered by physicians should be continued in lieu of or in addition to the use of ointment by those employees who have found the treatment to be helpful.

13.17 Employees who are known to be susceptible to oak or ivy poisoning should not be assigned to work in known infested areas unless they have been immunized against the infection by the doctor or as covered in the preceding paragraph.

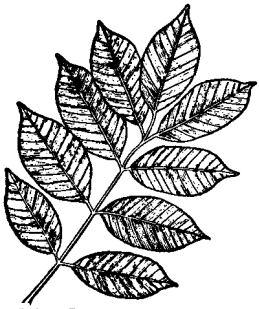


FIGURE 26. Poison Sumac

A shrub or small tree which may grow 20 feet high. Distinguished from the nonpoisonous sumac by its loose, drooping clusters of berries, which are always white. Leaves are orange colored in spring, green in summer and orange or russet in the fall.

13.18 Before entering poison oak areas rub in B-Y's Medicated Ointment thoroughly to all exposed areas. Continue rubbing until greasiness or stickiness disappears. Repeat application after washing or bathing.

13.19 Use of immunizing mixture–This extract may be ordered as a first aid supply. The following precautions and instructions should be observed:

a. It should be taken only by persons known to be susceptible to the poisoning.

b. *No more* than the contents of one bottle should be taken each season and it should be taken in doses only as directed on the bottle.

c. For best results, the mixture should be taken up to one month in advance of exposure, but it may safely be used and generally proves helpful if taken after known exposure or after reaction has started. When used for treatment after reaction has started it should *not* replace the use of calamine lotion or other approved first aid measures.

d. In cases where the reaction has become serious and widespread, or when it involves the eyes, medical care should always be secured in addition to the use of the mixture and other approved first aid measures.

e. Preventive measures outlined in the foregoing should not be discontinued after taking the mixture.

13.20 First aid for plant poisoning is as follows:

a. As soon as possible, wash the exposed part with soap and water.

b. Apply B-Y's medicated ointment liberally. Repeat as often as necessary and continue treatment until the rash disappears.

NOTE: The use of calamine solution or other preparations for first aid treatment *should be discontinued when using B-Y's medicated ointment.*

c. If calamine lotion is used rather than B-Y's medicated ointment, the following instructions should be followed:

(1) The lotion should *not* be rubbed into the skin, but should be painted on or daubed over the areas involved by means of a small wad of cotton, cloth, or sponge, or it may be daubed with the fingers.

(2) Repeated applications of the lotion should be made at intervals necessary to keep the infected parts covered until the rash heals or disappears.

d. *In severe cases and cases involving the eyes, a physician should be consulted.*

13.21 Splinters are thin pieces of an object which become imbedded in the skin. First aid for splinters is as follows:

a. If the splinter is near the surface, it may be picked out.

b. Apply merthiolate to the skin.

c. Remove the splinter with a knife point, needle, or tweezers that have been sterilized.

d. Induce bleeding.

e. Apply merthiolate to the wound.

f. Cover the wound with a clean compress.

g. If the foreign body is buried deeply or if the wound is of considerable size, apply merthiolate and a proper dressing. See a doctor.

13.22 Unconsciousness (cause unknown) is defined as not possessing mind, sensation, or feeling.

a. Possible causes of unconsciousness are:

(1) Asphyxia (see paragraph 7).

(2) Shock (see paragraph 6).

(3) Poisoning, including sleeping pills (see paragraph 8).

(4) Head injury (see paragraph 9.02).

(5) Heat stroke (see paragraph 11.03).

(6) Heart attack (see paragraph 13.10).

(7) Apoplexy (stroke) (see paragraph 13.01).

(8) Epilepsy (see paragraph 13.07).

(9) Insulin reaction (see paragraph 13.13).

b. First aid for an unconscious victim is:

(1) Give artificial respiration if the victim is not breathing.

(2) Move the victim as little as possible until the cause of unconsciousness can be determined.

(3) If necessary to prevent the victim from choking on vomitus, blood, etc., place him on his abdomen, with his head turned to one side.

(4) Send for a doctor without delay.

14. TRANSPORTATION

14.01 In rendering emergency assistance in serious accident or illness, there is no greater need for calmness than in the procedures associated with transportation.

14.02 The objective is to avoid subjecting the patient to unnecessary disturbance during planning, preparation, and transfer, to prevent injured body parts from twisting, bending, and shaking. **Take the necessary time and effort to provide good transportation.** (More harm is done through improper transportation than through any other measure associated with emergency assistance.)

14.03 If a person must be lifted to safety before a check for injuries can be made, the body should not be jackknifed. An attempt should be made to give adequate support to each extremity, the head and the back, keeping the entire body in a straight line and maintaining it immobile. One method for accomplishing this is the 3-man hammock carry–victim lying face up–supine. Steps for this method of carry are:

a. Step 1–All carriers kneel on the knee towards the victim's feet (see Figures 27 and 28).

b. Step 2–No. 1 cradles the victim's head and shoulders with his top arm. His other arm is placed under the victim's lower back.

c. Step 3–No. 2 slides his top arm under the victim's back above No. 1's bottom arm, and his other arm just below the buttocks.

d. Step 4–No. 3 slides his top arm under the victim's thighs above No. 2's bottom arm. His other arm is placed under the victim's legs below the knees.

NOTE: The hands of carriers No. 1 and No. 2 should be placed about halfway under the victim's body at this stage (see Figure 29).

e. Step 5–At a signal, the victim is lifted to the carriers' knees and rested there while the hands are slid far enough under the victim to allow rotation of the hands inward to secure an interlocking grip. (See Figure 30.)

f. Step 6–At the next signal, all carriers stand erect with the victim. (See Figure 31.)

g. Step 7–To lower the victim to the ground, merely reverse the procedure.

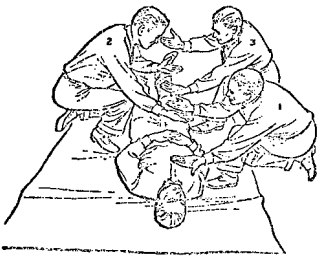


FIGURE 27. Hammock Carry Step 1–Position of Bearers.

FIGURE 28. Hammock Carry–Showing Interlocking Grip.

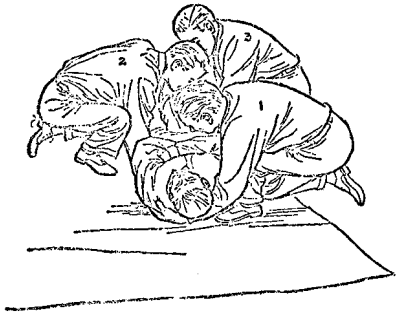


FIGURE 29. Position of Bearers–Ready to Lift.

FIGURE 30. Position of Bearers–Lifting Victim to Knees.

FIGURE 31. Ready to Carry.

14.04 If the victim must be pulled to safety, he should be pulled in the direction of the long axis of his body, not sideways. If available, a blanket or similar object placed beneath the victim will serve as a drag and lessen the danger of aggravating any injuries. Blanket drag is performed as follows:

a. Place the blanket diagonally beneath the victim.

b. Cross the arms of the victim over his chest, then fold the lower end and sides of the blanket over the victim.

c. Drag the victim by grasping the end of the blanket near the victim's head. (See Figure 32.)

FIGURE 32. The Blanket Drag.

14.05 Persons who may have head injuries, fractures of the thigh, leg, arm, and pelvis bones, or possible back injuries should not be transported in a sitting position.

14.06 Methods of transportation are:

a. Litter (stretcher). If no litter is available, one may be improvised. Use a cot or door, or use two poles with a blanket as shown in Figure 33; a strong sheet, rugs, or coats may be substituted for the blanket.

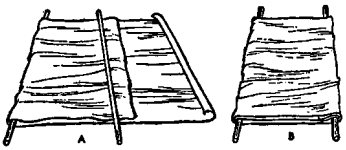


FIGURE 33. Improvised Litter.

b. Traction Blanket Lift (5 men and victim)—position of victim—supine. Proceed as follows:

(1) Step 1—Pleat a standard army blanket in folds about 1' long and place on the floor just above the victim's head so that the pleated blanket will "feed out" from the bottom.

(2) Step 2—Fold back the top pleat so that the man at the head and the two men at the shoulders can kneel on the fold.

(3) Step 3—No. 1 takes the position on one or both of his knees and grasps the victim's head in the standard manner for applying traction. (See Figure 34.)

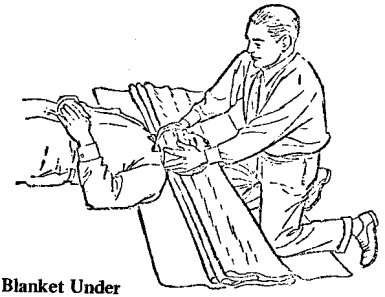


FIGURE 34. Placing the Blanket Under the Victim.

(4) Step 4—Nos. 2 and 3 kneel on one or both knees at the victim's shoulders, placing one hand flat under his shoulder blade and the other in his armpit. (See Figure 35.)

FIGURE 35. Holding Victim Against the Pull of the Blanket.

(5) Step 5--Nos. 4 and 5 grasp the bottom pleat of the blanket and pull the blanket under the victim while Nos. 1, 2, and 3 hold the upper portion of the victim's body in place. (See Figure 36.)

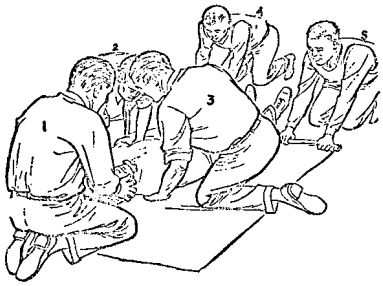


FIGURE 36. Pulling the Blanket Through

(6) Step 6--Roll the blanket tightly at the sides until it fits the contour of the victim's body. (See Figure 37.)

FIGURE 37. Rolling Edges Tightly for Firm Grip.

(7) Step 7--Nos. 2 and 3 (on opposite sides) grasp the blanket with the top hands at the victim's shoulder and the bottom hands at his lower back. Nos. 4 and 5 grasp blanket with top hands at his hips and lower hands at his legs (below knees). No. 1 remains at his head, holding slight traction. (See Figure 38.)

FIGURE 38. Blanket Fits Contour of Body.

(8) Step 8--At a signal, Nos. 2, 3, 4, and 5 lean back in opposite directions, using the back muscles and body weight. This will lift the victim 6" to 8" from the floor so that a litter can be slid underneath him. Use same procedure for victim in prone position. (See Figure 39.)

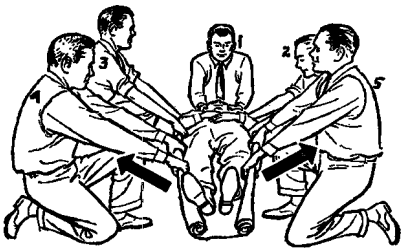


FIGURE 39. Bearers Lean Backward and Litter is Placed under Victim.

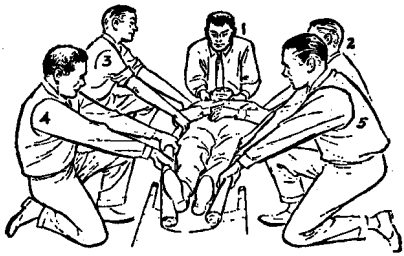


FIGURE 40. Lowering Victim to Litter.

c. The suspension lift is performed as follows:

(1) Step 1--The victim lies in a prone position with his hands under his chin, similar to the position assumed in applying artificial respiration. (See Figure 41.)

FIGURE 41. Position of Victim.

(2) Step 2--Carrier 1 kneels on one or both knees at the victim's head. He carefully slides his hands under the mid-forearms of the victim until the upturned palms of his hands rest under the victim's armpits. (See Figure 42.)

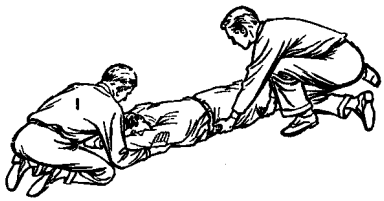


FIGURE 42. Position of Carrier No. 1.

(3) Step 3--Carriers 2 and 3 grasp the victim's hipbone with their top hands and his knee cap with their lower hands. (See Figure 43.)

FIGURE 43. Position of Carriers.

(4) Step 4--On signal, all lift together so that the victim is raised 5" or 6" from the floor (just high enough to slide a litter underneath). (See Figure 44.)

NOTE: Care should be taken so that the body is lifted as a unit. Also, carriers Nos. 2 and 3 should shift the weight toward carrier No. 1 when raising the victim.

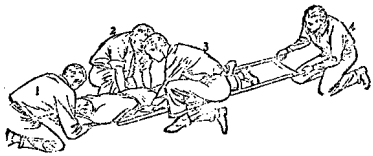


FIGURE 44. Lifting and Placing of Litter.

d. **Many other methods of transportation are useful. Learn first aid and know them all.**

14.07 Methods of Transfer—These include special methods for short-distance transfers, the walking assist, manual carries, transfer by supporting devices such as stretchers and cots, and transfer by vehicles. It is difficult for inexperienced people to lift and carry a person gently. Their efforts may not be well coordinated. They need careful explanations.

14.08 The best device for short-distance transfers is the stretcher or cot. It is important to remember that the short-distance transfer is harmful unless the injured parts are immobilized. "Splint them where they lie" unless there is urgent danger in delay. Unless there is unusual urgency, it is best to wait until an ambulance is available.

14.09 Aside from rare exceptions, the drive should be at moderate speeds, with gentle stops and starts, and with observance of all safety rules.

PREVENTION OF AND FIRST AID FOR SKIN IRRITATION FROM CREOSOTE

1. GENERAL

1.01 The purpose of this practice is to provide the procedure to be used for prevention of and first aid for skin irritation from creosote.

1.02 It is desirable that all employees who have occasion to handle creosote treated poles and other creosote treated wood products know and follow simple precautions to prevent skin irritations which may result from contact with creosote.

1.03 All employees should follow the first aid practices as outlined in this practice if creosote irritation does ocur.

2. PREVENTIVE MEASURES

2.01 Employees climbing, handling, or working on creosoted poles or crossarms where some of the creosote may be transferred to the skin (for example, while the poles or arms are new or during hot weather) should observe the following precautions:

a. *Do not* roll up the shirt sleeves.

b. Wear gloves.

c. Keep the neck well covered with a collar or handkerchief.

d. Keep the pant legs well down over the ankles.

e. When direct skin contact with creosote is likely, rub the arms, face and other possible exposed skin areas with vaseline or with medicated ointment before starting the work.

f. As soon as practicable after completing the work, remove the protective coating with a clean, dry cloth. Then wash thoroughly with soap and hot water.

g. *Never* rub the eyes or wipe perspiration off with the hands or shirt sleeve if they have been exposed to creosote.

h. When there has been direct skin contact with creosote:

(1) Wash the skin with plenty of hot water and soap.

(2) Coat the affected area with medicated ointment.

i. When creosote exposure has occurred, wash the hands, arms, face, and neck with plenty of hot water and soap before lunch and after the day's work.

NOTE: In washing the face, thoroughly wash the hands before attempting to wash around the eyes.

j. Clothing that has been in contact with creosote should be soaked in soapy hot water and washed as soon as possible.

3. FIRST AID

3.01 The following first aid procedures are to be followed for exposure to creosote:

a. Skin Irritations:

(1) Wash the affected area with plenty of hot water and soap.

(2) If the irritation continues for 24 hours or if a large area is affected, see a doctor for treatment.

b. Eye Burns:

(1) Flush the eye with water by submerging the face in a basin of water and opening and closing the eyelids.

(2) Drop two or three drops of castor oil into the eye.

(3) Apply an eye bandage.

(4) Obtain medical attention.

RESCUE OF PERSON FROM LIVE WIRE ON GROUND

1. GENERAL

1.01 This practice outlines methods of rescuing a person who is in contact with a live wire that is on the ground or at any location other than on a pole.

1.02 In an electric shock accident, quick rescue and prompt artificial respiration (if normal breathing has stopped) are extremely important. In some cases the injured person may remain in contact with the wire because of his inability to let go of the live conductor, or due to his being unconscious.

1.03 An attempt to rescue a person from contact with a live wire is dangerous for anyone who does not understand how to proceed, because of the fact that the electric current may be carried through the victim's body to the rescuer, or the live wire may come in contact with the rescuer or other person and shock him unless proper precautions are taken.

1.04 If an unconscious person is in contact with a wire and it is not definitely known that the wire has been de-energized, assume that it is a live circuit in proceeding to clear him from contact with the wire.

1.05 In all cases where the victim is unconscious, call a physician to the location as soon as possible without delaying the rescue. After the victim has been removed from the contact, begin first aid as is necessary.

1.06 All employees should review this practice and other applicable first aid practices as well as the Red Cross First Aid Textbook at frequent intervals so that if it should become necessary to rescue a person in contact with a live wire on the ground, the rescue work will be handled promptly and safely.

2. PLANNING THE RESCUE

2.01 Before starting the rescue, consider quickly but carefully how the operation can best be carried out. The most important details to be considered are as follows:

a. Position of the injured person with respect to the conductor. His position will influence the method to be employed in clearing the contact; that is, whether to:

(1) Cut the wire, or

(2) Pull the wire clear of the victim, or

(3) Roll him off the wire, or

(4) Lift him clear of the wire.

b. Presence of a nearby switch so that the wire may be de-energized.

c. Rescue equipment available that could be used for cutting or moving the wire or moving the victim, such as:

(1) Rubber gloves.

(2) Rubber footwear.

(3) Pliers.

(4) Dry rope.

(5) Tree pruner.

(6) Long handled shovel.

(7) Dry board.

(8) Dry ladder.

(9) Triangular bandage.

(10) Other non-conducting material.

d. Dependable assistants.

e. Probable voltage of circuit.

f. Presence of bystanders. It may be necessary to modify the rescue methods so that bystanders will not be injured by the energized wire while it is being handled.

2.02 Men conducting the rescue must remain calm, think clearly, and avoid impulsive and unsafe operations. Keep in mind the fact that wet ropes, wet wood and wet clothing are not good insulators and severe shocks can be transmitted by them. Avoid standing on wet ground and in water.

2.03 Employees should become generally familiar with the types of construction used by the electric companies that operate in the areas where rescue work may be necessary so that they may be able to recognize the different types of circuit voltages to be encountered.

3. FREEING A PERSON FROM CONTACT WITH LIVE WIRE OF LESS THAN 10,000 VOLTS

3.01 In rescuing a person who is in contact with a live wire, wear rubber gloves and rubber footwear. While putting on the protective equipment, take the precaution to look for holes or cuts and signs of wear.

3.02 If rubber gloves are available, with or without rubber footwear, proceed in accordance with one of the following methods. They are listed in order of preference:

a. Pull the wire clear of the victim by means of a rope, or push it clear with a tree pruner, board, or ladder.

b. Cut the live wire on both sides of the victim or on the remaining side if the wire is broken.

(1) Use pliers or a tree pruner.

(2) In cutting the wire, close the eyes or turn the head away so that the eyes will not be exposed to the electrical flash.

(3) Warn bystanders to keep clear so that they will not be injured by the ends of the wire after it has been cut.

(4) In many kinds of electric circuits, voltage may remain on the wires after they have been cut at one place. If possible and if it will not delay the rescue operations, hold the wire down by means of a board or tool handle before it is cut so that the wire ends will stay under control.

c. Roll the victim off the wire. Observe the wire closely to avoid accidental contact with it and prevent the ends from hitting bystanders.

d. Lift the victim off the wire.

3.03 If rubber gloves are not available, extreme care must be exercised to avoid direct contact with the body of the person or the live circuit. Use one of the following methods which are listed in order of preference:

a. Pull the wire clear of the victim by means of a dry rope, provided that it appears that the wire can easily be freed. A dry tree pruner may also be used in pulling the wire or cutting it clear.

NOTE: *Do not* under any circumstances use a wet rope or other wet materials that may come in contact with the live wire or the body of the victim.

b. If the live wire cannot be freed readily by pulling it clear, slip a dry rope or other dry material under the shoulder or other part of the victim's body and roll him or lift him off the wire. A dry board, ladder, or dry stick may be used to assist in pushing the rope under his body.

c. If the victim's clothing is wet, *do not* touch him under any circumstances unless rubber gloves are being worn. If his clothing is dry, it may be touched only if other dry insulating material is not available.

d. Before grasping any portion of the victim's clothing, touch it lightly to make sure that there is no voltage in it.

(1) Preferably stand on a dry board or other insulating material while in contact with the clothing.

(2) Remember that under wet weather conditions extreme care must be used to avoid shocks even though rubber gloves and rubber footwear or the equivalent are used.

4. FREEING A PERSON FROM CONTACT WITH LIVE WIRE OF MORE THAN 10,000 VOLTS

4.01 If the victim is in contact with a live wire and in the best judgement of the rescuer the voltage exceeds 10,000 volts, the rescuer should for his own protection secure the assistance of a qualified employee of the power company to break the contact before proceeding with the rescue. This precaution is necessary since the rubber gloves are not designed to withstand higher voltages and the rescuer cannot be sure that ropes, tree pruner handles, ladders and such equipment that might be used with rubber gloves are always dry enough to provide the degree of protection required.

5. ARTIFICIAL RESPIRATION AND OTHER FIRST AID

5.01 If normal breathing has stopped, start artificial respiration immediately after the rescue. Follow the methods as outlined in the American Red Cross First Aid Book. In CTSP 400-405-001, refer to:

a. Artificial Respiration, paragraph 7.

b. Burns, paragraph 10.

c. Shock, paragraph 6.

FIRST AID
RESCUE OF EMPLOYEE FROM POLE

1. GENERAL

1.01 This practice specifies methods of rescuing an employee working aloft when (on account of electric shock or for any other reason) help is required to lower him to the ground.

1.02 In an electric shock accident, quick rescue and prompt artificial respiration if normal breathing has stopped are extremely important. In some cases, the injured person may remain in contact with the wire because of his inability to let go of the live conductor or due to his being unconscious.

1.03 Unless it is definitely known that the cause of the disability is not electric shock or that the contact with the electric supply conductors has been broken, it should be assumed that all of the wires on the pole are energized with dangerous voltages. In this event, the rescuer should take precautions as specified in this practice to protect himself and his assistants from injury due to electric shock.

1.04 In all cases where the employee has received a severe electric shock or is unconscious, have someone call a physician to the location as soon as possible without delaying the rescue. (If the victim is conscious and can safely be moved after receiving first aid, he should be taken where he may receive the services of a physician.) In administering first aid and transporting the victim, follow the recommendations covered in the American Red Cross First Aid Text Book and outlined in CTSP 400-405-001.

1.05 Send someone to get the truck as soon as possible if it is not near the scene of the accident, as it may contain useful equipment or it may be needed as an insulated platform to effect the rescue and to transport the injured employee.

1.06 In electric shock cases, notify the serving power company which operates the equipment involved in the accident as soon as possible.

1.07 If the cause of the disability is not electric shock, the rescue work may be conducted more deliberately and without the necessary speed which is essential in electric shock cases.

1.08 Review this practice and also the Red Cross First Aid Text Book at intervals so that if an accident on a pole should occur, the rescue work would be handled effectively.

2. PLANNING THE RESCUE

2.01 Before starting the rescue, plan quickly but carefully how the operation can best be carried out. The most important details to be considered are the following:

a. Probable cause of the disability (electric shock, sickness, fainting, etc.). In an electric shock case, determine if possible the source of the shock and whether or not the contact has been cleared. If the source is not apparent or if the nature of the disability cannot be determined from the ground, assume that the injured person has been shocked and that the contact still exists, and use the protective measures applicable to such cases.

b. Rescue materials should be available for use such as rope, rubber gloves, pliers, tree pruner, climbers, body belt, safety strap, ladder. (An extension ladder may be used, under some conditions, to facilitate the removal of the victim.)

c. Assistants to help handle the rope in lowering him from the pole.

d. Position of the victim in respect to wires and other attachments on the pole.

e. Method to be used in clearing contact between the victim and the source of shock. (Lifting him clear, opening switch, cutting wires, etc. If wires are to be cut, consider the possibility of unsound pole falling due to an unbalanced load effect on the pole.)

f. Side of the pole to be climbed and the position from which rescue work will be done.

g. Point of attachment for the rope to be used in lowering the employee.

h. Need for cutting wires below the victim which might interfere with rescue work and the lowering operations.

i. Protection of the rescuer from electric shock (if pole, rope or other equipment is wet).

j. Availability of the truck to be used (with necessary precautions) as an insulated platform, particularly under wet conditions.

2.02 Employees should become generally familiar with the types of construction used by the electric companies that operate in the areas where rescue work may be necessary so that they are able to recognize the different types of circuit voltages to be encountered.

3. REMOVING AN EMPLOYEE FROM CONTACT WITH LIVE CIRCUIT OF LESS THAN 15000 VOLTS

3.01 In electric shock cases, the rescuer should wear rubber gloves throughout operations when he will be exposed to possible shock. If rubber gloves are not available, rescue work may be undertaken *only* if the contact can first be cleared by available safe means, such as the use of a dry rope, dry board, dry tree pruner, dry ladder, or opening a switch. Men conducting the rescue must remain calm, think clearly, and avoid impulsive and unsafe operations. Keep in mind the fact that wet ropes, wet wood and wet clothing are not safe insulators, and severe shock can be transmitted by them.

3.02 When handling wires that may be "hot", use only one hand if practicable and keep the other hand and other parts of the body clear of wires, guys, suspension strand, cable terminals, or other grounded structures.

3.03 If the reason for the high voltage being on the plant is evident, the contact should be removed (where practicable to do so) without handling the supply conductors. In some cases it may be possible to clear the contact by throwing a dry hand line over the telephone or supply wires and pulling them apart or by pushing them apart with a ladder or long dry stick, such as a tree pruner handle or pike pole. Do not use green wood or damp sticks in attempting to separate the wires and avoid standing on wet ground and in water.

3.04 If methods mentioned above cannot be employed and if rubber gloves are worn, the contact between the supply wires and telephone conductors may be opened by cutting the telephone wires with pliers. For this purpose a tree pruner with a dry pull rope may also be used, preferably with rubber gloves.

3.05 Under extreme conditions, secondary electric circuits may be cut, provided that rubber gloves are worn while the wires are being cut. Do not attempt to cut a primary wire.

3.06 In cutting supply wires or telephone wires that are crossed with electric supply wires, take a position so that the cut wires will not fly back or fall and injure the rescuer or other person. Turn the face away or close your eyes while cutting the wire to protect the eyes from the electric flash that may follow.

4. REMOVING AN EMPLOYEE FROM CONTACT WITH LIVE CIRCUIT OF MORE THAN 15000 VOLTS

4.01 In electric shock cases, if the injured employee remains in contact with either charged telephone or power wires and, in the best judgment of the rescuer, the voltage involved is greater than 15000 volts, the rescuer should, for his own protection, secure the assistance of a qualified employee of the power company to break the contact or open the switch before proceeding with the rescue. This precaution is necessary since rubber gloves are not designed to withstand higher voltages and the rescuer cannot be sure that ropes, tree pruner handles, ladders and such equipment that might be used with rubber gloves are always dry enough to provide the degree of protection required.

5. ASCENDING THE POLE

5.01 Keeping in mind the rescue plan as developed in accordance with paragraph 2, proceed with the rescue.

5.02 The rescue rope should be a rope in good condition, not less than 3/8" in size, and long enough to permit any available assistants on the ground to lower the victim. (A larger rope is preferable.)

5.03 Push a loop formed near the end of the rescue rope under the body belt at the back so that it can be conveniently carried up the pole and removed when needed.

5.04 Climb the pole on the selected side and get into proper position for rescue.

5.05 While aloft, exercise every precaution to avoid contact with telephone wires, suspension strand, cable guys and other equipment, as well as contact with the victim unless it is clearly evident that the contact with the "hot" wire has been broken.

5.06 If necessary, in order to facilitate lowering the victim, cut those telephone wires which would interfere. (It is assumed that no wires will be cut which, in the planning of the rescue, it was concluded would be likely to cause the pole to fall.) In cutting the telephone wires, exercise care to avoid dropping them on persons below. Be careful also that no projecting ends are left which might injure the victim while he is being lowered.

6. REMOVING EMPLOYEE FROM CONTACT WITH WIRES AND LOWERING HIM

6.01 Pass the rescue rope over a crossarm or other suitable strong attachment located above the employee. If working alone, take one complete turn of the rope around the crossarm or other fixture so as to provide some snubbing action to assist in holding the victim's weight.

6.02 Avoid direct contact with the victim until he is clear of the wires or other equipment that may be charged. When practicable, double back the end of the rope on itself and place the double rope end around the victim's body under the arms, and tie it either at the front or back with a bowline knot. However, time should not be taken to double the end of the rope if it delays the rescue.

6.03 If it will facilitate the rescue, pass the rope through the D rings of the victim's body belt and tie the rope securely, preferably in front. If the rope is attached to his belt, take care in handling him so that the belt will not slip over his shoulders or down over his hips and cause him to fall. If necessary to move the employee to facilitate attaching the rope, this may be done by pulling on his safety strap.

6.04 After the rope has been secured to the victim by either of the methods described in paragraphs 6.02 and 6.03, pull the victim toward the pole by means of the rope or both the rope and the safety strap. If help is available on the ground, these assistants should be guided by the rescuer on the pole.

6.05 When the preparations for lowering have been completed, unsnap or cut the employee's safety strap and lower him to the ground, guiding him when necessary so that he will clear attachments on the way down.

7. ARTIFICIAL RESPIRATION AND OTHER FIRST AID

7.01 When the victim reaches the ground, immediately remove the rope or body belt from his chest so that it will not interfere with his breathing.

7.02 If normal breathing has stopped, start artificial respiration immediately and other first aid procedures that may be necessary in accordance with the recommendations of the American Red Cross First Aid Text Book and CTSP 400-405-001, paragraphs 7.02 and 7.07.

SAFEGUARDING SPECIAL SERVICE CIRCUITS CLIP TYPE CONNECTING BLOCKS

1. GENERAL

1.01 This practice is issued to describe the device used to identify the terminations of wiring for special services on clip-type connecting blocks.

2. 10,000Ω TERMINATING RESISTOR (RADIO LOOPS)

2.01 The 10,000Ω resistor is applied to provide a termination for the line at all times, including lengthy periods when no customer's equipment is connected to it. At such times, it may be necessary to test the circuit for continuity, balance and noise in preparation for a new lease period. Maintaining a permanent termination in a manner not susceptible to casual disconnection eliminates the need to dispatch an installer/repairman to the broadcast location to apply a termination when such tests are to be made.

3. CIRCUIT IDENTIFICATION FOR CLIP TYPE CONNECTING BLOCKS

3.01 The device used to identify the terminations of wiring for special services is made of red plastic material folded so that it can be placed over the terminals of a clip type connecting block (i.e., 66-Type). Three sizes are available: one which covers two terminals, one which covers three terminals, and one which covers six terminals. The 2-terminal clips are shown in place on terminals of a 66E block in Figure 1.

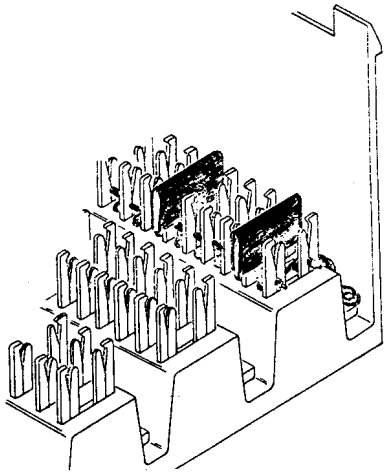


FIGURE 1. Red Signal Device Used to Identify Special Service Wire Terminations on Clip-Type Connecting Block.

4. ORDERING INFORMATION

ITEM	COLOR	SIZE	NUMBER	SUPPLIER
Clip Insulator	Red	Two Terminals	P11800	Stromberg-Carlson
Clip Insulator	Red	Three Terminals	P11799	Stromberg-Carlson
Clip Insulator	Red	Six Terminals	P11798	Stromberg-Carlson

NOTE: It is not the purpose of the Plant Practice Section to indicate where a product should be purchased. The above simply mentions one known supplier.

VEHICLES
GENERAL OPERATING INSTRUCTIONS

1. GENERAL

1.01 This practice covers operating instructions that are common to all vehicles. It is necessary that every operator and potential operator of a company vehicle be familiar with the contents of this practice. If the instructions covered herein are followed, extended vehicle life, improved safety, and lower maintenance costs will result.

2. BEFORE MOVING THE VEHICLE

2.01 The method in which the operator handles the vehicle is the greatest factor in obtaining maximum economy and performance. The operator should be throughly instructed in the operation of the vehicle before it is placed in his care.

2.02 The following procedures should be followed before moving the vehicle:

a. Before starting, check engine oil and coolant levels. *Place transmission in neutral* and depress clutch pedal (if provided), this lessens the load on the starter and decreases the drain on the battery. Automatic transmissions must also be placed in neutral or park.

b. *Avoid racing the engine when first starting* as it is harmful to the engine, especially in cold weather. Even though light oils are used, the flow of oil is retarded until engine is properly warmed.

c. Allow the engine to idle for a short period (2 to 5 minutes), and push manual choke in on vehicles so equipped before attempting to move the vehicle. *Drive vehicle conservatively until heat gauge reads normal.*

d. *Check the oil pressure gauge*; it should rise immediately upon starting and should not drop until engine is thoroughly warmed and then only slightly. Oil pressure light indicators will go out when the pressure is up, however, a moment should be allowed for the oil to circulate.

e. Many repair bills can be avoided by keeping the clutch in proper adjustment so that it will release properly and a smooth shift achieved. *Always check the clutch action before moving vehicle.* Clutch adjustment varies (3/4" - 2-1/2") depending upon type of vehicle.

f. Check brakes

(1) *Air Equipped System*

The *audible warning device* should be on at pressures below 60 pounds.

Allow engine to run until pressure reaches 100 to 120 pounds.

Apply brakes several times with engine running. Pressure should drop to approximately 85 pounds then recover to maximum pressure.

Turn ignition off. Apply brakes and hold. The pressure should not drop over 5 pounds initially. With the brakes held on, the pressure should not decrease at a rate over 1 pound for each 2 minutes. *(This test is basic, and should be performed at the start of each shift.)*

(2) *Vacuum Brakes - Trucks*

Start engine and *allow sufficient time for vacuum to build up* in system (approximately 1 minute).

Apply brakes and check pedal travel. This should not be over 30% of the available travel distance.

Release brakes and allow engine to idle for 1 minute.

Turn off engine and apply brakes 3 times. ADEQUATE VACUUM SHOULD BE IN RESERVE TO ASSIST ON THE THIRD APPLICATION.

If the vehicle is equipped with a gauge, start engine and BUILD A VACUUM RESERVE OF 18" TO 23". Turn off engine. The vacuum should not drop over 2 inches during a 5 minute period. *This test should be performed at the start of each day.*

If the vehicle is towing a trailer equipped with vacuum brakes, check connections and hoses for leaks and damage.

Vehicles equipped with vacuum booster brakes should not be towed when there has been an engine failure, make use of a tow bar for this condition.

(3) *Light Trucks and Passenger Cars*

Depress brake pedal to a full stop position. THE PEDAL SHOULD BE FIRM.

(4) *All Systems - Operational*

Check tires for proper inflation and visible defects.

Check all lights including stop and turn signals.

After making the above initial tests, place the vehicle in gear and increase speed to 10 mph. Apply brakes. The vehicle should stop promptly without any side directional pull.

3. MOVING INSTRUCTIONS

3.01 Occasionally drivers acquire habits in driving which shorten the life of the vehicle and its component parts. Some points to observe to avoid this are listed below.

a. *Keep the tires properly inflated*, not only to reduce the tire wear and save fuel, but also as a safety measure to insure proper braking and steering. Tire pressures will vary with size, type and usage.

b. *Good brakes are essential* so that the vehicle will be under control at all times. A good driver rarely needs to use the brakes to their full capacity and is aware of the fact that excessive strains are placed on the entire chassis if emergency applications are made.

c. *Avoid allowing engine to idle for long periods*; this will result in dilution of the oil on the cylinder walls. This means that the cylinder walls, bearing, and pistons will not be properly lubricated. At idling speeds, engines will draw in more fuel than is actually consumed, and unburned fuel has a tendency to form harmful carbon deposits, dilute oil and foul spark plugs.

d. Stopping on hills–When it is necessary to stop on a hill, *be sure that the hand brake is set before leaving the vehicle*. If grade is particularly steep, IT IS ADVISABLE TO BLOCK WHEELS WITH CHOCK BLOCKS ON HEAVY DUTY VEHICLES. When parking parallel to curbs, be sure to turn wheels *toward curb* if vehicle is *facing downhill*, and turn wheels *away from curb* if vehicle is *facing uphill*.

e. Be sure to watch dashboard gauges for indications of overheating of engine. excessive discharging or charging of generator/alternator, and low oil pressures. It is important that these gauges be checked intermittently during all operations of the vehicle. Check for excessive oil and water leaks under vehicle when backing or driving from a parking location.

f. Vehicle speed limits: No person shall drive a vehicle faster than is reasonable or prudent having due regard for the traffic on, and the surface and width of, the highway and in no event at a speed which endangers the safety of persons or property. THIS IS IN ADDITION TO POSTED SPEED LIMITS WHICH SHALL NOT BE EXCEEDED.

3.02 *Manual Shift Transmissions* -

a. When shifting gears, move the gear shift lever as far as it will go, to assure that they gears are fully engaged. When gears are not fully engaged, they will wear rapidly or chip.

b. Avoid driving with foot resting on the clutch pedal (referred to as "riding the clutch"), as this may cause the clutch to slip; it may also cause premature wear of the clutch facing, release bearing and engine thrust bearing. *Gradually* release the clutch when starting or changing gears. Avoid jackrabbit starts.

c. INCORRECT USE OF THE ENGINE AS A BRAKE MAY CAUSE A GREAT DEAL OF UNNECCESSARY MOTOR TROUBLE. If the engine is forced to run faster than the rated speed or the speed permitted by a governor setting, internal engine parts will not react fast enough and can completely destroy the engine. For example, if the engine is governed at 4,000 RPM, permitting the vehicle to travel 40 miles per hour in high gear, and the unit is driven downhill at a speed of 50 miles per hour, momentum of the vehicle will force the engine to run 800 RPM over the governed speed. This increase is enough to destroy the engine.

d. When traveling downgrade, it is advisable to change to the same gear as required to go up the grade, or one gear lower. This will normally provide adequate engine braking action. *Always* keep the motor running. *In all cases* brakes *must* be reserved as the main factor in retarding the descent. Do not rely on brakes alone on long grades as they will become hot and "Fade." Over prolonged use, brake fade will result in complete temporary (until cooled off) loss of braking. *Do not* allow engine to operate in excess of governed speed.

e. Lugging the engine on uphill grades at low engine speeds promotes overheating and is harmful to all working parts of the engine. Although it is desirable to have an engine that will pull exceptionally well, proper engine speed should be maintained by selecting a lower gear when traveling uphill. (Lugging is defined as being unable to increase speed by depressing the accelerator.)

f. There are certain types of field conditions where it is practically impossible to shift to a lower gear without stopping the vehicle. For example, operating in loose sand where the momentum of the vehicle is rapidly decreasing, the gears on the main shaft of the transmission will lose their momentum faster than those of the driveshafts. In this type of soil, it is desirable to bring the vehicle to a complete stop before attempting to shift. When vehicle is at a standstill, select the proper gear before resuming operations.

3.03 *Four-Wheel Drive* – DRIVERS MUST BE FAMILIAR WITH THE FUNCTIONS OF THE FOUR-WHEEL-DRIVE TRANSFER ASSEMBLY TO OBTAIN SAFETY AND EFFICIENCY. Refer to manufacturer's instructions for specific vehicles.

3.04 *Automatic Transmissions* – In present use are various automatic transmissions each of which operate somewhat differently. Avoid driving with left foot on brake pedal as this will wear brakes and place a strain on the transmission and engine.

4. CARE OF VEHICLE CAB

4.01 Tools and work equipment are NOT to be carried in the cab of the vehicle. Under no condition will an employee drive or ride in the cab of a vehicle while wearing tool belts, climbers, lineman's safety belt or tool pouch.

4.02 Cabs must be kept in a clean orderly condition at all times.

5. PRECAUTIONS FOR VEHICLES AT JOB LOCATIONS

5.01 When locating vehicle at job site, safety is a most important consideration; therefore, the workmen or crew should complete the necessary precautions listed below, as applicable:

a. Direct vehicle operator when backing vehicle to job site location.

b. Place traffic cones, "Men Working" signs and high level warning devices as applicable.

c. Place flasher lights.

d. Check aerial clearances before derrick is raised into place.

e. Inspect site to prevent property damage.

f. Secure dolly or poles.

g. Make sure that vehicle is in gear or "park" and EMERGENCY BRAKE AND MICO-BRAKE LOCK are applied when left unattended.

h. Place chock blocks when parking vehicle on hills and grades. Do not rely on brake lock devices such as mico-lock, or hand vacuum and air controls for unattended parking on grades.

5.02 Warning devices or flagmen are required when traffic may be hindered by the job-site parked vehicle near hills, curves or other obstructions to other drivers' vision are encountered.

5.03 Before raising, swinging or otherwise operating the lift, boom or derrick *make sure there will be no interference from traffic, nearby objects* OR POWER FACILITIES. All operations shall be done with the vehicle facing with the direction of traffic, when practicable.

5.04 Before entering or leaving the vehicle, the driver should always assure himself that boom, basket, derrick, ladder, or any other part of the vehicle is not in contact with any object that might energize the truck. *If there is any doubt, it must be assumed that the truck is energized.*

SAFETY PRECAUTIONS: Plan and conduct work in the vicinity of power structures as though any metallic part of the power structure is alive with a dangerous voltage. Avoid all contacts, directly or indirectly, with any metallic part of the power system.

If shocks are experienced, due to other than normal telephone voltages and currents, work involving contact with wires should be stopped immediately.

When an accidental contact with power wires is made, *NO ONE SHALL APPROACH AND MAKE CONTACT WITH VEHICLE OR WIRES.* Vehicle driver, operator or any other person who may be on the vehicle, shall remain on the vehicle until the contact can be cleared.

5.05 *Moving vehicles with a man in the operator basket -*

a. When a workman/operator is in the basket of a lift, boom or ladder the driver shall not leave the cab of the truck unless the engine is turned off, hand brake set, and the vehicle is either in low or reverse gear "park" position. If the vehicle is on a grade, in addition to the above, chock blocks must be placed against the wheels.

b. Any movement of the truck, while a workman/operator is in the basket, is to be made only at the direction of that workman.

c. When operating on inclines or terrain where the vehicle is not level, exercise caution as stability of the vehicle is reduced. While traveling over uneven ground, speeds must be reduced and the boom or ladder must be retracted, lowered and aligned with the vehicle.

When moving the vehicle with the boom or ladder elevated, the speed should not exceed 2 miles per hour. The driver should be alert for instructions from the workman/operator in the basket. No wires, lines, strand, or cable should be attached to the boom or ladder, except as permitted in detailed instructions for specific vehicles. Under all conditions when a man is in the basket, the vehicle must be operated in the lowest possible gear.

5.06 No person driving, or in control of, or in charge of, a motor vehicle shall permit it to stand on any highway unattended without first effectively setting brakes therein and stopping the motor thereof as stated in paragraph 5. (A Vehicle Code effective in many states.)

This means, in effect, that a workman/operator SHALL NOT BE IN THE BASKET OF ANY AERIAL PERSONNEL CARRIER WITH NO ONE IN CONTROL OR ATTENDANCE AT THE VEHICLE CAB WITH THE ENGINE RUNNING. The only exception is a vehicle that is specifically designed for security during one-man operation.

6. INTERCOMMUNICATION SPEAKERS

6.01 Intercommunication speakers are provided in most areas for all aerial lift, boom basket and ladder vehicles. These speakers are located in the basket area and in the cab of the vehicle. They are to provide two-way communications between the workman/operator and the driver.

CAUTION: An intercom should be used whenever there are two men on the vehicle; one man in the basket and the other in the vehicle.

7. FLASHER WARNING SIGNALS

7.01 Certain vehicles have been equipped with special amber warning lights. The conditions under which these lamps may be used are limited. Their use is confined to periods when utility crews are actually engaged in construction, removal, maintenance or inspection of telephone plant during such times that our vehicles shall be either moving at a rate of speed less than the normal flow of traffic, thereby creating a hazard, or parked *other* than adjacent to a curb.

7.02 *Warning lamps are intended to augment and not to take the place of* traffic safety warning devices such as, cones, signs, flags, flasher lights, and high level warning standards, presently required by safety practices.

8. VEHICLE SECURITY

8.01 To prevent losses of tools, materials or other property, the following measures shall be taken:

a. All tools and materials not in use shall be placed in the proper compartments on the vehicle, not on the bed of the truck or the ground nearby.

b. When leaving the vehicle unattended at a work location or when stopping for lunch, all bins and compartments containing tools and materials and cab shall be *locked* and the *keys shall be removed from the truck*. Other items should be removed and placed in protective tool areas, chained and locked to the vehicle.

9. REPORTING VEHICLE TROUBLE

9.01 All vehicle defects which create unsafe conditions or potential mechanical failures to the driver or workman/operator, shall be reported as directed by local procedure.

PARKING COMPANY VEHICLES AND CIRCLE OBSERVATION CHECK

CONTENTS

1. GENERAL

1.01 This practice is reissued to duplicate procedures contained in the Safety Series CTSP 610-600-010, PARKING COMPANY VEHICLES AND CIRCLE OBSERVATION CHECK. Due to major revisions in format and content, brackets indicating changes and/or additions are omitted. **Remove from the file and destroy all copies of CTSP 400-800-012, Issue 1, 1971.**

1.02 This practice provides procedures for parking Company vehicles and for making the circle observation check when leaving a parked position.

1.03 The procedures in this practice must be followed by all Continental Telephone employees when driving Company vehicles.

1.04 The purpose of this practice is to help eliminate backing-up accidents involving Company vehicles.

2. PARKING COMPANY VEHICLES

2.01 When parking a Company vehicle on the street or other public thoroughfare, park in a parallel position if at all possible.

2.02 If it will be necessary to back up the vehicle, do so when parking and not when leaving the parked position. Any other Company employee present should act as a guide outside and to the rear of the vehicle.

2.03 When the vehicle is in the desired parked position:

a. Put it in the proper gear.

b. Engage the hand brake.

c. Turn the wheels into the curb and/or use wheel chocks (if available).

d. Shut off the engine before leaving the vehicle.

2.04 With the exception of passenger cars, all Company vehicles are equipped with traffic cones. When these vehicles are parked, a traffic cone will be placed at the left front and another traffic cone at the left rear of the vehicle.

2.05 Unless specifically prohibited or otherwise not feasible, **all Company vehicles shall be backed into parking lot spaces.** (Accidents occur frequently when two or more vehicles are being backed out of parking spaces at the same time.)

3. CIRCLE OBSERVATION CHECK

3.01 When preparing to leave a parked position, all operators of Company vehicles shall check for hazardous conditions around, behind and under the vehicle. It is important to check for the presence of children or animals, or hazards such as posts, other parked vehicles, etc.

3.02 In addition to making the circle observation check, operators of Company vehicles that require the placing of traffic cones (paragraph 2.04), will proceed in the following manner:

a. Pick up the traffic cone at the left front of the vehicle.

b. Cross in front of the vehicle from the left to the right; then along the right side to the right rear of the vehicle.

c. Go from the right rear to the left rear of the vehicle and pick up the second traffic cone.

d. Place the traffic cones in their proper storage place in the vehicle.

e. Get into the vehicle and leave the parked position immediately.

CAUTION: If there should be a delay in leaving the parked position for any reason, the operator shall get out of the vehicle and make the circle observation check again; the situation may have changed.

DISTRIBUTING FRAME PROCEDURES

1. GENERAL

1.01 This addendum is issued to correctly identify the standard color coding for four wire cross connect jumpers used on distributing frames.

1.02 The color code referenced in paragraph 5.02 of CTSP 400-975-001 is not a standard, and should be crossed out. With red pencil or ink, write, "See addendum, paragraph 2.02," and file this addendum in front of the practice.

2. STANDARD FOUR WIRE JUMPER COLOR CODING AND IDENTIFICATION

2.01 Continental System Supply provides a standard color coding of white, red, blue, and black wires.

2.02 Paragraph 5.02 c. of CTSP 400-975-001 should read:

> Four conductor jumpers have white, red, blue and black wires. The white wire is the **tip** (+), the red is the **ring** (-), the blue is the control (C, S or B_1) lead and the black is the extra control (EC, HS or B_2) lead. The fourth (EC, HS or B_2) wire is used in making connections to equipment such as the distributing terminal assembly (DTA) frame and the trunk intermediate distributing frame (TIDF).

3. IDENTIFICATION OF FOUR WIRE COLOR CODES

3.01 Other color codes have been used in the field in the past and this has created problems in identification. The following paragraphs identify the various four wire jumper color codes.

3.02 Four conductor jumpers color coded white, red, blue and black (standard):

- **a.** White is the tip (+) lead.
- **b.** Red is the ring (-) lead.
- **c.** Blue is the control or sleeve (C, S, B_1) lead.
- **d.** Black is the EC, HS or B_2 lead.

3.03 Four conductor jumpers color coded white, red, blue and green:

- **a.** White is the tip (+) lead.
- **b.** Red is the ring (-) lead.
- **c.** Blue is the control or sleeve (C, S, B) lead.
- **d.** Green is the EC, HS or B_2 lead.

3.04 Four conductor jumpers color coded white, red, green and black:

- **a.** White is the tip (+) lead.
- **b.** Red is the ring (-) lead.
- **c.** Green is the control or sleeve (C, S, B) lead.
- **d.** Black is the EC, HS or B_2 lead.

DISTRIBUTING FRAME PROCEDURES

1. GENERAL

1.01 This practice explains and illustrates approved distributing frame procedures (jumper work) required to provide customer service, and replaces CTSP 400-300-400.

1.02 In a Central Office, the automatic switching and other equipment is maintained by craftsmen. In most instances, central office distributing frames are the initial training grounds for these craftsmen. In all cases, a contact memo is issued to authorize every installation, move, change, and discontinuance of service. These orders are submitted to the frame forces as work assignments in several different forms, such as contact memo, rack sheet, read order, read-out install order, etc. This practice provides a method of handling these orders, symbols to be used to denote work progress or completion, and special conditions sometimes involved in frame procedures.

1.03 *Every precaution shall be taken not to impair or disrupt existing service* and all employees should be familiar with Continental Telephone System Practices regarding special circuit protection. Other CTSP's used for reference and training purposes are:

CTSP 400-300-019 -- Monitoring of Working Lines
CTSP 400-405-001 -- First Aid
CTSP 400-450-110 -- Central and PABX Office Safety Precautions
CTSP 400-700-100 -- Special Safeguarding Measures (SSM) for Leased Circuits
CTSP 400-700-101 -- Safeguarding Special Service Circuits-Clip Type Connecting Blocks
CTSP 400-905-070 -- Contact Memo Order--Form CM 1066
CTS 405-700-xxx -- Soldering Irons and Wire Wrap Tools (series)
CTSP 410-650-410 -- Soldering Methods
CTSP 430-905-804 -- Rolling Ladders - Inspection
CTSP 430-906-303 -- Intercept Strapping -- Description and Methods
CTS 490-700-xxx -- Main Frame Terminations (series)

2. TOOLS AND MATERIALS

2.01 The following tools and materials are required when running jumpers:

a. Iron, soldering.

b. Holder, soldering iron.

c. Stick, probing (orange stick).

d. Pliers, longnose.

e. Pliers, oblique cutting.

f. Stripper.

g. Brush, rubberset.

h. Pouch, tool.

i. Rubber gloves and canvas bag holder.

j. Frame Bag (for wire clippings and jumper scraps).

k. Wiping cloth (for copper tip).

2.02 The following tools are required when making solderless wrapped connections:

a. Electric wrapping tool.

b. Hand wrapping tool.

c. Combination 22-24 gauge bit.

d. Combination 22-24 gauge sleeve.

e. Unwrapping tool.

f. Holder for wrapping tool.

3. SAFETY PRECAUTIONS

3.01 Employees are expected to make use of all safeguards provided for their protection and that of their fellow employees and to observe the following precautions:

a. When using a rolling ladder, make sure the brake is set.

b. When pulling or passing jumper wire, take care to avoid injury to hands and arms.

c. Double back the end of the jumper wire before unreeling. This will reduce the risk of puncture wounds and aid in preventing the free ends from sagging.

d. Do not stand or climb on the transverse arms of distributing frames.

e. While working on or near distributing frames, eye protection must be worn at all times.

f. Use rubber gloves when working near breakdown voltage tests.

4. FRAMES AND ASSOCIATED EQUIPMENT

4.01 Distributing frames are open metal frameworks which provide neat, accessible terminating facilities for outside cable pairs, central office line circuits, and other central office equipment. Connections can be made by simply changing jumpers, which allows the central office cabling to be largely a permanent installation.

4.02 Main distributing frames (MDF) are frames on which the outside telephone lines terminate on one side; the multiple cabling of the lines and trunks of the office terminate on the other side. The central office protective equipment is usually mounted on the MDF, which serves as a test point between the individual telephone lines and the central office. There are two types of MDF:

a. *Type A* has all outside lines and cables terminated on the horizontal side; the vertical side has all connections to central office equipment and protective devices for the lines or cable pairs.

b. *Type B* has all outside lines for cables and their protective devices terminated on the vertical side; the central office equipment terminates on the horizontal side. *Type B* is the more commonly used.

4.03 Line intermediate distributing frames (LIDF) are used to provide neat and flexible facilities for terminations and cross-connections that are intermediate in the switching sequence. The frames are similar to the MDF in construction and cross-sectional dimensions, but do not have protectors. On one side, wiring is terminated to terminal blocks mounted horizontally. Jumpers between terminal blocks permit the adjustment of trunking arrangements.

4.04 Combined distributing frames (CDF) are usually located close to the cable vault. The CDF is designed for type B protection, with the outside cable pairs terminated on protectors mounted vertically on one side of the frame, and central office equipment on terminal blocks mounted horizontally on the other side. A CDF combines the functions of an MDF and LIDF; therefore, no separate LIDF is required.

4.05 The trunk intermediate distributing frame (TIDF) is similar to the CDF in construction and cross-sectional dimensions, but terminal blocks are mounted vertically on one side and horizontally on the other. Many of the central office trunk circuits are terminated on these blocks and are crossconnected by means of jumpers. The TIDF is designed to be lined up with and connected to the CDF to form a single assembly. This permits the running of jumpers from either side of the TIDF to either side of the CDF, and vice versa.

4.06 The major components of the frame are:

a. *Jumper rings* serve to guide jumpers where they make sharp changes in direction and have an insulated cover to protect the jumper wire insulation from chafing against the framework.

b. *Guard rails* and end guard rails are lengths of angle iron used to protect the terminal blocks from damage by rolling ladders and other floor equipment. End guards are similarly mounted to protect the ends of the frame. These guards form a continuous protection, extending slightly beyond the fronts of the terminal blocks and protectors.

c. A *ground bus bar* of flat, hard, drawn copper is furnished with each vertical assembly. When connected, the entire frame is equipped with a continuous ground connection that is both electrically and mechanically strong. A ground lead connects the ground bus bar to the central office ground.

d. The *central office protector* (spring and terminal assembly) provides cable termination and protects central office equipment and personnel from excessive, high foreign voltages and/or *sneak* currents. There are several different types in general use but their function is the same.

(1) One type of protector, the Cook 3800 central office protector, is shown in Figure 1. In operation, the protector opens the switchboard circuit, grounds the outside line, and operates an alarm circuit. It provides for temporary disconnect, and the self-soldering heat coils can be reset easily without changing the coil. Line connections are on one side of the protector and switchboard connections are on the other side. The protector is reset after operation simply by relatching the operating spring over the heat coil.

(2) The *test plug* (shoe) shown in Figure 2 is designed to fit the type 3800 protector. Test plugs are used to test line circuits through or around the heat coils. The test plug divides the circuit so that tests can be made looking either to the outside plant or to the central office equipment.

(3) *Carbon protector blocks* (also known as carbon blocks, protector blocks, open space cutouts, or carbons) are essentially lightning arresters. They serve to protect the central office equipment from excessive voltages which might result from power contacts and protect the outside plant from the effects of lightning.

(4) The plain carbon block fits into a groove of the protector mounting base which is grounded. If the line becomes crossed with a power circuit or is hit by lightning, the high voltage impressed on the line causes an arc to form across the air gap to the grounded block, effectively shunting the line to ground and dissipating the voltage. Frequently the protector blocks show marks of arcing after a foreign voltage has been discharged through the blocks to ground. Whenever heat coils are replaced, remove and inspect the protector blocks and inner surfaces for discoloration or pitting. Discolored, pitted or broken blocks should be replaced.

e. *Heat Coils:*

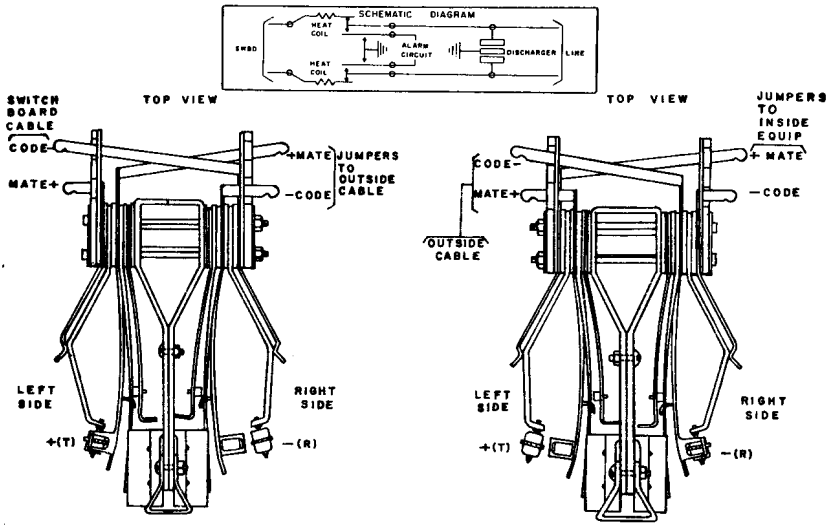
(1) Heat coils are used in conjunction with carbon protector blocks to protect the central office equipment from small values of continuous current called *sneak* currents. The heat coils, which are directly in each side of the line, will operate whenever a faulty condition occurs which permits a small value of current to flow in the circuit for any length of time. These heat coils are rated to ensure operation at a current of .35 A for three hours at 68° F. or .5 A for 210 seconds at 68° F.

(2) When operated, the Cook type 3800 heat coil opens and grounds the line. The heat coil is self-soldering and contains two small triggers. The circuit normally passes through the springs, through the heat coils, and then through the heavily tensioned spring which rests against the triggers when the coils are normal. When too much current flows through the coil, solder in the coil is melted, which in turn causes a trigger to rotate. The rotating alarm spring is pressed against the grounded protector mounting plate, while the heavily tensioned spring rests against the carbon protector blocks. After a heat coil has become hot enough to melt the solder and then cool, the solder hardens and holds the trigger so that the trigger cannot rotate. A heat coil of this type can be used repeatedly by removing it and reinserting it so that the trigger engages the heavily tensioned spring. An alarm lamp (called the *telltale* alarm lamp), is associated with each vertical. One side of this lamp is connected through a switch to battery. The other side is connected through the alarm spring of the protector to ground. Any heat coil operating will cause the lamp to light.

f. *Fanning strips* are mounted on each vertical. The left-hand fanning strip has staggered holes, one for each of the cable pairs terminated on the left side of the protectors. The right-hand side also has staggered holes, one for each jumper that can be terminated on that side. The holes are positioned so that each is opposite a pair of terminals on the protector assembly.

g. *Terminal boards (or blocks)* are generally defined as T-bar sections of wood and other insulation such as molded, hard black rubber. The stem of the T carries double ended terminals held transversely in rows. The base of the T (called the mounting base) has holes opposite both ends of the terminals which serve as a fanning strip for cables or jumpers. Terminal boards provide terminating facilities on the horizontal side of the CDF, and both the vertical and horizontal sides of the VIDF.

h. *Distributing blocks* are similar in construction to terminal boards. One side is permanently wired, while the wiring on the other side can be changed.



When Used on Type A Frame.

When Used on Type B Frame.

NOTE: Cable wires connected to left side of protector block.
Jumper wires connected to right side of protector block.

FIGURE 1. Cook 3800 Central Office Protector

5. DISTRIBUTING FRAME CROSS-CONNECTIONS

5.01 The terms *cross-connection or jumper* are applied to twisted insulated conductors used to provide flexible assignment of inside plant equipment. Generally, all fixed plant is permanently cabled to a distributing frame. Connections between various equipment are then made with jumpers. *Cross-connection work is one of the most important operations performed in the central office.* Before running any jumpers, verify all terminal locations to avoid errors and save time. Refer to paragraph 6.01.

5.02 Twenty-two gauge distributing frame wire should be used on all frames, except for single conductor jumpers. Because of its increased mechanical strength, 20-gauge wire should be used for single conductor jumpers.

a. Two-conductor jumpers have white and red insulated wire. The white wire, called the *tip*, is used to connect to the positive ground (+) side of the line. The red wire, called the *ring*, is used to connect to the negative battery (-) side of the line.

b. Three-conductor jumpers have white, red, and blue wires. The third (blue) wire is called the *sleeve*; it is the control (C) lead wire and controls the guarding, holding, and releasing of switches, and holds switches operated to guard them against seizure by other calls.

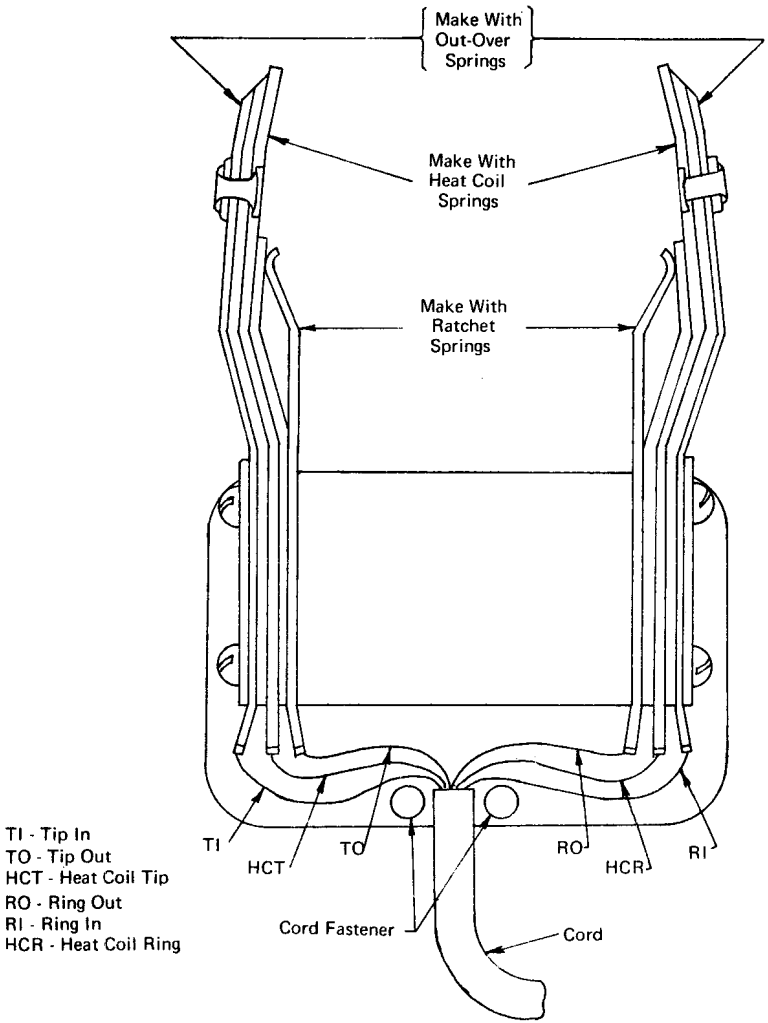


FIGURE 2. Cook 3800 Test Plugs (Shoes)

The test plugs (shoes) are used to test line circuits through or around the heat coils dividing the circuit into its compound parts, thereby simplifying the testing operation. The test plug (shoe) is designed to fit the Central Office Protector (3800).

c. Four-conductor jumpers have white, red, blue, and black wires. The white wire is the *tip* (+), the red is the *ring* (-), the blue is the control (C, S, or B_1) lead and the black is the extra control (EC, HS, or B_2) lead. The fourth (EC, HS, or B_2) wire is used in making connections to equipment such as the distributing terminal assembly (DTA) frame and the trunk intermediate distribution frame (TIDF).

5.03 Jumpers are usually run from the horizontal side of a frame to the vertical side. When running in or handling jumpers, do not allow the wires to become kinked. At the point where a jumper enters a jumper ring, place it in such a way that it will neither bind against nor cross over other jumpers or jumper ring bars.

5.04 Figure 3 is a line drawing of jumpers entering and leaving a ring and is being used *only* to illustrate the distribution of jumpers to different sections of the ring, depending on the direction of origin and termination. Figures 4, 5, and 6 illustrate the correct use of rings when running jumpers, i.e., with the wire slack and *resting lightly* against the rings.

NOTE: Continuous jumper activity may loosen jumper rings. Loose rings should be tightened as soon as possible to prevent complications in jumper running.

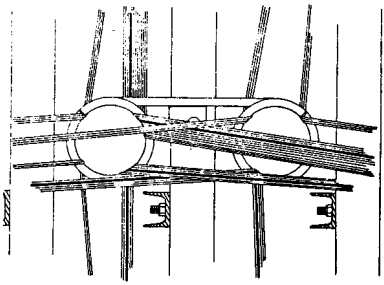


FIGURE 3. Line Drawing Designed to Illustrate How Jumpers, Ideally, Should Enter and Leave Rings.

5.05 The majority of unacceptable (crossed and poorly placed) jumpers are those run from right to left on the horizontal side. These jumpers are run through rings on their particular horizontal levels, then to connecting blocks on the vertical side. Proper procedures are:

a. Run the jumper into a ring on the same horizontal level with the jumper wire entering near the top inside edge. See Figure 4.

b. If the jumper is to go to a connecting block three or more levels below its horizontal level, use the right hand to bring it around inside and to the bottom of the ring. Place the left hand under and behind the ring to receive the jumper (see Figure 5) and place it in a downward position (see Figure 6). This type of jumper may be run in front of existing jumpers on the vertical side. Run as directly as possible into the proper connecting block hole.

c. If the jumper is to go to a connecting block three or more levels *above* its horizontal level, proceed as in paragraph 5.05 a. Then bring the jumper out *in front* of existing jumpers on the vertical side and run it as directly as possible into the proper connecting block hole.

d. If the jumper is to go from its horizontal level *straight across* (or less than three levels up or down), proceed as in paragraph 5.05 a. Then bring the jumper around the inside edge of the ring to a point where it can run as directly as possible into the proper connecting block hole. Run it *behind* the existing jumper on the vertical side.

5.06 Run jumpers from *left to right* as described in paragraph 5.05. Jumpers should be placed *in front* of existing jumpers on the vertical side. As stated in paragraph 4.04, the jumpers should lie against the jumper rings when they have been run and tied down.

5.07 Run short horizontal jumpers (within three verticals of straight across) *underneath* all other jumpers but *on top of* the ironwork of their respective levels (see Figure 7). In most instances, they will then cause the least possible interference with other jumpers in the rings through which they are run. Run these jumpers through the rings so that they pull on the inside edge of the rings and go as directly as possible to the proper connecting block holes.

5.08 A contact memo (or rack sheet) may require that a jumper be run from one block on a horizontal level to another block on the same level. This type of jumper should be run through a ring at least one vertical to the *right* of the *right-hand* block of the two on which it is to terminate. The jumper will then lie against the ring when it is tied down to the connecting block.

5.09 An order may require that a jumper be run from one block on a vertical to another block on the same vertical. This type of jumper should be run through a ring at least one level *above* the *higher* of the two blocks on which it is to terminate. The jumper will then lie against the ring when it is tied down to the connecting block.

5.10 Avoid weaving jumpers through existing jumpers or between the individual conductors of an existing jumper. Be sure to keep jumpers above the horizontal ironwork and inside the vertical ironwork of the frames (see Figure 7).

5.11 Run lineswitch-to-X-block jumpers as directed by the central office foreman. Allow approximately 5 inches of slack (measured from the point of tying down), so that jumpers can be pulled.

5.12 To prevent a congestion of jumpers on one level and one ring, run cable ties on different levels.

5.13 When running used jumpers, remove all kinks and knots. Inspect the wire and discard any with damaged insulation.

5.14 Be sure to run the jumpers through the correct holes in the fanning strips of connection blocks (see Figure 8). Avoid crossing jumpers at the holes of blocks on the vertical side of the LIDF. If a jumper comes to a block (vertical) from a higher (horizontal) level, do *not* run it around existing jumpers in the outer row of holes (see Figure 8) to get to the inner row. Pull existing jumpers in the outer row toward the outer edge of the block. This will clear a *straight run* to the hole in the inner row. Make every effort to avoid running a jumper in such a way that it will interfere with another jumper.

6. TYING DOWN JUMPERS

6.01 If a jumper is working on a location assigned for a new jumper to be run, verify the assignment. If the assignment is correct, pull the old jumper and give the complete information to Line Assignment forces. This ensures that if the assignment is incorrect, corrections will be made before work is called for by outside plant forces.

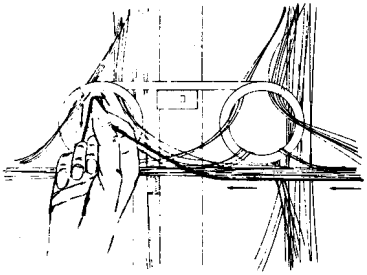


FIGURE 4. Right Hand Receiving a Right-to-Left Jumper (HLIDF) and Placing It Into Ring at the Top Inside Edge.

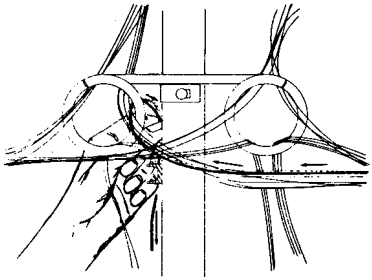


FIGURE 5. Left Hand Placed Under and Back of a Ring to Receive a Right-to-Left Jumper (HLIDF).

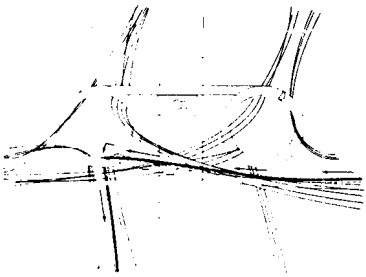


FIGURE 6. Tied-Down Jumper Correctly Placed Against the Bottom Inside Edge of a Ring.

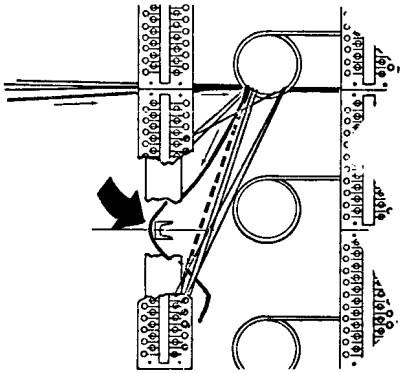


FIGURE 7. Large Arrow Points to Jumper Run Outside Vertical Ironwork. Broken Line Represents Correct Run.

6.02 Before stripping insulation from jumper wire, place the distributing frame bag on the shelf below the shelf where the work is to be done. Make sure there will be approximately 4 inches of slack in the jumper when it is tied down. Measure the slack by making sure the jumper length will extend the width of a hand beyond the front edge of the block. (An exception to the 4-inch slack requirement applies to jumpers run directly across the horizontal side; in this case, allow only enough slack for pulling and to prevent binding.)

6.03 Untwist the jumper back far enough so the wires will come through the fanning strip parallel to each other. Wrap the wires so that insulation comes just to the notch of the pin as shown in Figure 9. Allow for stretch in the case of plastic insulation. Figures 9 through 17 show typical terminations.

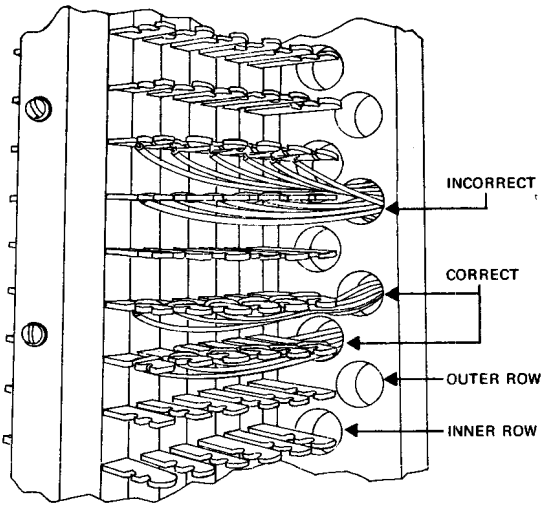


FIGURE 8.

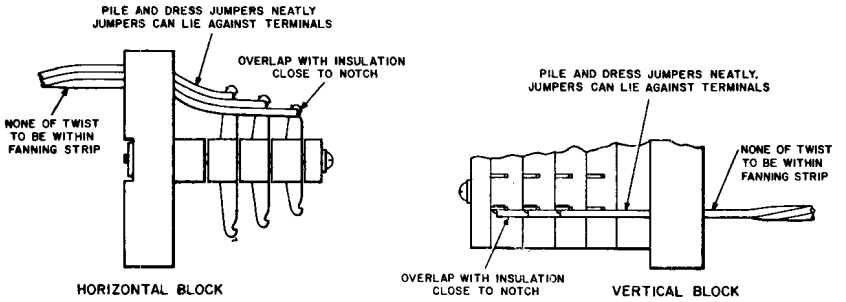


FIGURE 9. Termination of Wire on Terminal Strip

6.04 With the jumper supported against the fanning strip, break off the wire on the terminal by a series of up and down motions for *horizontal* terminal strips, or left and right motions for *vertical* terminal strips. The motions should be in a direction parallel to the flat surface of the terminal to avoid strain on the terminal. This method avoids crossing the wires with other terminals of the terminal strip, or crossing the pliers with terminals when cutting the wire.

NOTE: Twenty-gauge wire may be cut instead of broken. Excess cut or broken wire should not be allowed to fall on terminal strips, protectors, floor, etc.

6.05 To terminate a wire on the terminal of a protector where the notch appears on the *underside* of the terminal (as shown in Figure 10), bring the wire under the terminal, up through the notch, along the front of the terminal, over the top edge (or through the back notch, where provided), and down the rear side, making one complete turn of bare wire around the terminal. Cut or break the excess wire at point *X*.

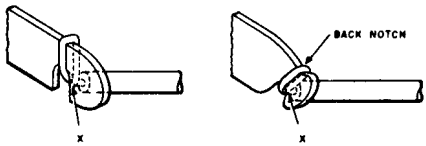


FIGURE 10. Termination of Wire on Protector with Notch on Underside of Terminal

6.06 To terminate a wire on the terminal of a protector where the notch appears on the *upper side* of the terminal (as shown in Figure 11) bring the wire through the notch, down the front side, and up the rear side, making one complete turn of bare wire around the terminal. Cut or break the excess wire at point *X*.

NOTE: If a protector is broken, replace the defective terminal (or spring), using a spring bender or appropriate size wrench. Do not terminate the jumper wire on the spring on the cable side of the protector as this will remove the protection on the side of the line affected and create a fire hazard.

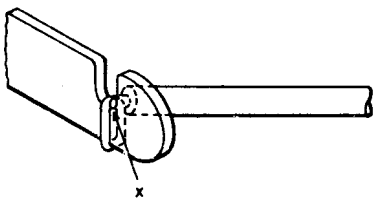


FIGURE 11. Termination of Wire on Protector with Notch on Upper side of Terminal

6.07 To terminate a wire on a type 444 jack, pass the wire through the proper hole in the fanning strip (as shown in Figure 12), bring the wire under the terminal, up through the notch, across the top of the terminal, and down through the back notch (as shown in Figure 13). Cut or break the excess wire at point *X*.

6.08 To terminate a wire on a terminal of a type 65 (or similar) terminal strip, bring the wire along the left side of the terminal, through the notch, back along the right side of the terminal, and across the top (as shown in Figure 14). Cut or break the excess wire at point *X*.

6.09 When terminating jumpers on terminal strips of the type shown in Figure 10, first connect the wire on the terminal nearest the front and then work toward the rear of the block.

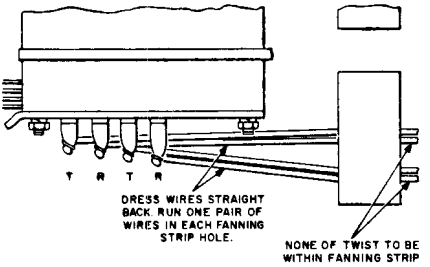


FIGURE 12. Termination of Wire on Type 444 Jack at MDF

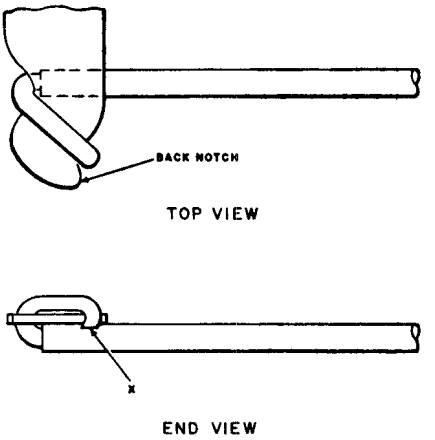


FIGURE 13. Termination of Wire on Terminal with a Back Notch

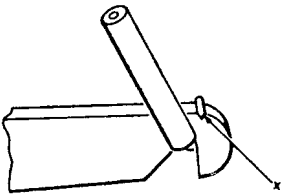


FIGURE 14. Termination of Wire on Terminal of Type 65 (or Similar) Terminal Strip

6.10 To terminate a wire on a terminal which is in a *vertical* position (horizontal IDF), with a single notch (either with or without a back notch), bring the wire along the left side of the terminal, through the notch, along the right side of the terminal, and across the back (or through the back notch, where provided). See Figure 15. Cut or break the excess wire at point *X*.

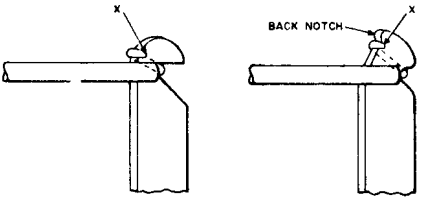


FIGURE 15. Termination of Wire on Vertical Terminal with a Single Notch

6.11 To terminate a wire on a terminal which is in a *horizontal* position (vertical IDF), with a single notch (either with or without a back notch), bring the wire along the bottom of the terminal, through the notch, back along the top of the terminal, and terminate at the back (or back notch, where provided). See Figure 16. Cut or break the excess wire at point *X*.

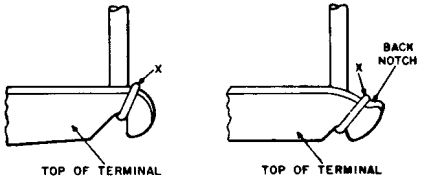


FIGURE 16. Termination of Wire on Horizontal Terminal with a Single Notch (Top View)

6.12 To terminate wires on a terminal strip where the terminals have twin notches or double twin notches and only one set of leads is required, connect them in the outer notches unless it is necessary to reserve these notches for strapping, subject to change in service. The jumpers should be terminated as described in paragraphs 6.10 and 6.11 and as shown in Figure 17.

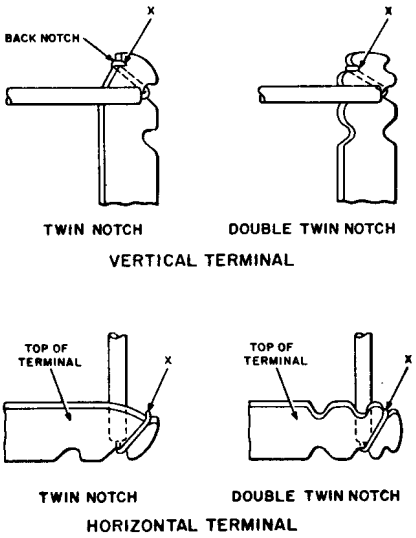


FIGURE 17. Termination of Wire on Terminal with a Twin Notch or Double Twin Notch

6.13 Where a second jumper is to be terminated on the same terminal with another jumper, the first jumper should be unsoldered and removed and both the terminal and the notch in the terminal freed from all excess solder. The two jumpers should then be terminated in the same notch.

6.14 Immediately after wire is connected to the terminal, it should be soldered.

6.15 Tie down as many jumpers as possible called for on rack sheets, but do not connect normals until called for by the installer.

6.16 The frameman on the vertical side should tie down all jumpers as he receives them. If jumpers cannot be tied down at the time they are caught, tie them in the wood. Pull out the loose ends for easy visibility, except when jumpers are *hold sheet* items. In such cases, tie the jumpers in the wood and tuck the loose ends back into existing jumpers. (The frameman should be able to look down the frame and easily detect the jumpers to be tied down and the tails of kills to be cleaned off.)

6.17 When a jumper is to be terminated on the back pins, tie a knot in the loose end.

7. WRAPPED CONNECTIONS

7.01 *Solderless Wrapped Connections:* The *minimum* number of turns around the terminal shall be 6 complete turns for 24-gauge wire, and 5 complete turns for 22-gauge wire. A skinned length of 1-5/8 inches should be sufficient for 22- and 24-gauge wire to permit the required number of turns around the terminal. See Figure 18. More than the required number of turns is permissible. To be sure satisfactory connections are being made, check them periodically.

7.02 *Soldered Wrapped Connections:* A *minimum* of three complete turns around the terminal shall be made for soldered wrapped connections. A skinned length of 3/4 inch should be sufficient to permit the required number of turns around the terminal. See Figure 19. More than the required number of turns is permissible.

7.03 *Skinning Leads:* Care must be taken when skinning leads for wrapped connections. It is important that the leads are not *nicked* or *flattened*. Do not bend the wires as this makes it difficult to insert the wire ends into the wire feed slot of the bit.

NOTE: Before skinning cable conductors on the equipment side of terminal strips, the wires shall be in their final position.

7.04 *Wrapping Leads:* Wrap leads as follows:

a. Insert the skinned portion of the lead into the feed slot of the wrapping bit; ensure that no bare wire is showing. Bond the insulated portion of the lead into the anchoring notch as illustrated in Figure 20. Hold the wire taut in the anchoring notch and push the tool onto the terminal. Use of the left or right anchoring notch is determined by the direction of approach:

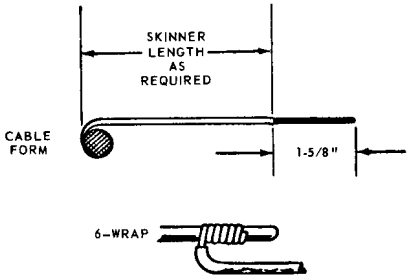


FIGURE 18. Skinned Wire Required for a Solderless Connection

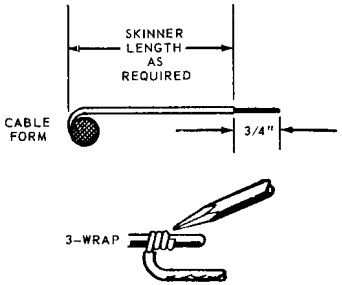


FIGURE 19. Skinned Wire Required for a Soldered Connection

(1) A lead dressed to the left of the terminal is placed in the left anchoring notch.

(2) A lead dressed to the right of the terminal is placed in the right anchoring notch.

NOTE: If the wire is not inserted up to the insulation, a shiner may result. A shiner shall not be longer than 1/8 inch. A longer length shiner is potential trouble.

b. The tool shall be inserted over the terminal as far as it will go without touching the terminal molding.

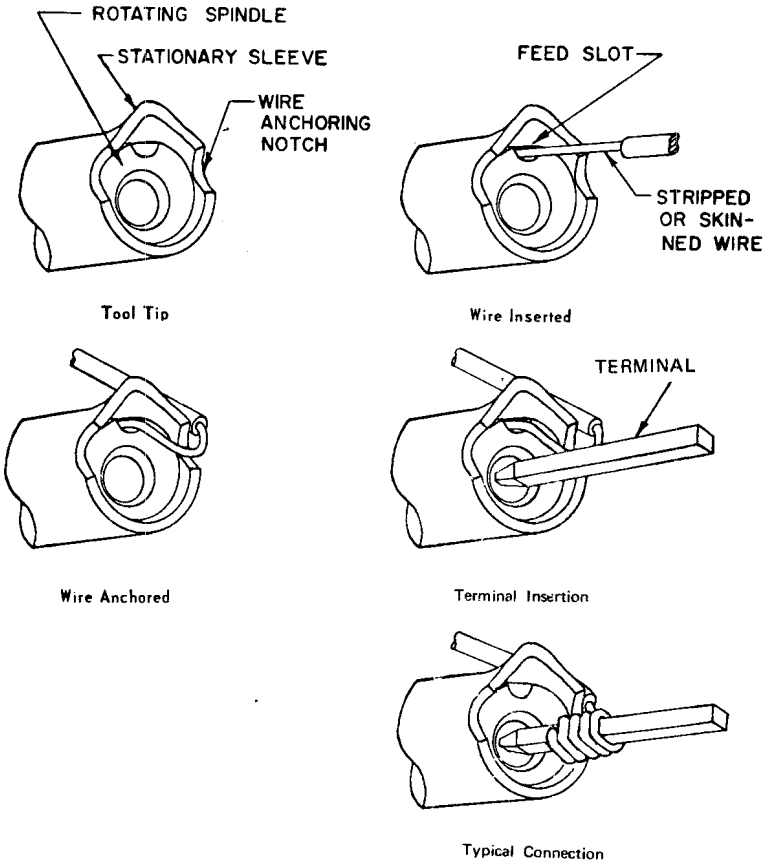


FIGURE 20. Solderless Wrapped Connection Process.

c. The tool shall be in a direct line with the terminal before being operated.

d. Operation of the trigger will wrap the wire on the terminal. The tool w automatically move backward as the wire coils on the terminal, producing a finish connection.

e. Insufficient pressure on the tool when wrapping may cause separation as shown Figure 21.

FIGURE 21. Separated Turns Resulting from Insufficient Pressure

f. Excessive pressure on the tool when wrapping can cause overriding (overlapping) turns as shown in Figure 22.

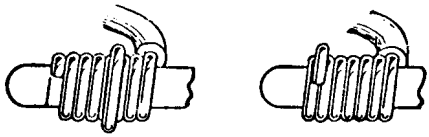


FIGURE 22. Overriding (Overlapping) Turns Resulting from Excessive Pressure

g. While it is not necessary for the wire end to be flat against the terminal, in no case should it project to the extent that the required 1/64-inch clearance between the wire and an adjacent terminal cannot be maintained. In addition, the wire end must not extend over 1/8 inch.

h. Where the clearance between the wire end and the adjacent terminal is not the required 1/64 inch (or the wire end extends 1/8 inch), the wire end can be wrapped down using the wire wrapping tool, pliers, spudger or similar tool. This connection shall be soldered.

7.05 *More than one wire per terminal:*

a. Where more than one connection per terminal is necessary, the method of wrapping the second or third connection is determined by the remaining terminal length after the first connection has been made. Each 6-turn connection takes approximately 1/4 inch of the terminal. In order to make a second or third connection, at least 1/4 or 1/2 inch of the terminal must be available. See Figure 23.

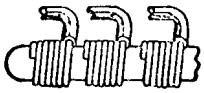


FIGURE 23.

b. If there is not sufficient terminal length available for solderless connecting,a 1-1/4 to 3-turn connection may be made, but must be soldered. See Figures 24A and 24B.

c. If there is not sufficient terminal length for a 1-1/4 inch turn connection, wrap the lead over the previous connection and solder. See Figure 25.

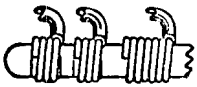


FIGURE 24A.

FIGURE 24B.

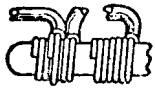


FIGURE 25.

d. Where it is not practical to apply solderless wire wrapped connections on terminal strips, the soldering operation can be facilitated if the wrapping tool is not placed on the terminal as far as it will go. A depth guide (as shown in Figure 26 and used as illustrated in Figure 27) will position the wrapping tool to leave sufficient space for three connections of three turns each. After the first horizontal row of connections has been made on a group of terminal strips, the remaining terminals can be gauged by eye rather than repositioning the guide on each succeeding row of terminals.

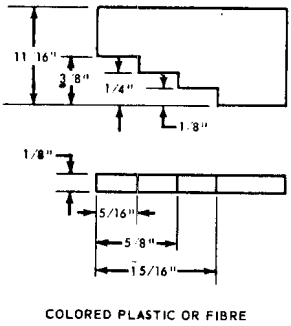


FIGURE 26. Depth Guide for Soldered Connections on Terminal Strips

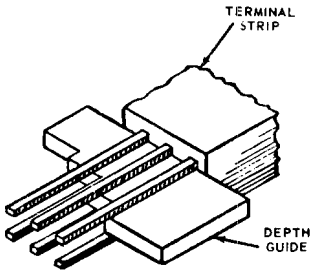


FIGURE 27. Method of Using Depth Guide for Soldered Connections on Terminal Strips

7.06 *Soldering Wrapped Connections:*

a. When a terminal contains solder, either on an existing connection or resulting from a previously soldered connection, all connections added to this terminal shall be soldered.

b. When soldering a wrapped connection, a minimum of two adjacent turns of the connection shall be soldered.

c. Where a connection requiring solder is added to a terminal, all connections on that terminal shall be soldered.

7.07 *Removing Wrapped Connections:*

a. The spiral may be unwound with an unwrapping tool or pliers (see Figure 28), or by hand if there is sufficient slack.

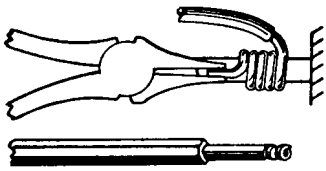


FIGURE 28. Removing Wrapped Connection

b. Where a connection has been soldered, a soldering iron should be applied to the connection and the spiral unwound with pliers or by hand. *Do not use the unwrapping tool.*

c. No attempt shall be made to pull the wrap from the terminal by pulling on the lead. This may break the wire and make the wrap difficult to remove.

d. If a wrap must be removed and then reconnected, proceed as follows:

(1) When there is sufficient slack in the lead to obtain the proper skinned length, cut the previously connected lead back, skin and reconnect. Do not rewrap a previously wrapped skinned length; the tensile strength of the lead has been reduced by the first wrapping operation.

(2) Where there is insufficient slack to make a normal connection, skin 1/4 inch of insulation from the lead and wrap at least 1-1/4 turns of wire, using the wrapping tool or pliers. This wrap shall be soldered.

NOTE: This does not apply to jumpers. If there is not enough slack, replace the jumper.

(3) Rewrapped connections made on a terminal that was not previously soldered do not require soldering.

8. SOLDERING REMINDERS

8.01 Soldering methods are covered in CTSP 410-650-410.

8.02 The soldering iron should be hot before an attempt is made to solder a connection. Test for heat by touching a piece of solder to the copper tip, *never by holding the iron near the hand or face.*

8.03 Take care not to melt the plastic insulation with the soldering iron. Place the iron tip against the pin and wire. Hold the tip against the pin until solder flows freely on the pin. Use as little solder as possible to cover the wire and weld it to the pin. The use of excessive heat and solder causes solder runs on pins.

8.04 Excess solder should be removed from the hot tip *only* by wiping on the wiping pad. *Never flip solder from the iron; solder splashes can be very dangerous.*

8.05 Examine the pins and blocks around the work for excess solder and splashes. Remove excess solder with a spudger and correct any potential trouble. A short-bristled, nonmetallic brush is useful for cleaning between the pins after excess solder has been loosened. Hold the free hand under the block (or use a wiping cloth) and make sure the distributing frame bag is properly placed to catch the excess solder.

8.06 All loose solder, loose wire, bits of insulation, etc., *must* be placed in the distributing frame bag as work is being performed. This is most important to reduce the chances of accidents caused by slipping on bits of material and to maintain a neat appearance.

9. ORDERS

9.01 *Removing Jumpers:*

a. When removing jumpers, make sure that the jumper to be cut is clear of other jumpers.

b. Before cutting a jumper, monitor the line to make sure it is not busy. Do not cut a jumper if the line is in use.

c. Immediately place all disconnected normals on intercepting service (operator or mechanical, depending on the order being worked). This action is important as it reduces no-ring complaints. When cutting other jumpers, leave a *tail* at least 3 inches long attached to those pins which are not to be cleaned immediately. Pull such tails out from the block so that they can be easily seen. Remove tails each day (with a hot iron) and clean the pins.

9.02 *Out (O) Orders:*

a. After cutting long jumpers, remove (pull) them from the horizontal rather than the vertical side. If a long jumper is removed from the vertical side, it may rub on and melt the plastic coating on the conductors of a working circut.

b. If two men work together on O orders, any error is likely to be found and can be corrected, which will reduce the possibility of a customer complaint. If a frameman is working alone, he can pull up the slack on one side to mark the jumpers to be cut, or he can go up on the test turret and short the pins at the X-block or lineswitch before cutting the jumpers.

c. Any orders, whether connect, remove, F&T, or C, may or may not be designated HOLD (to be completed at a specified time). Do the preparatory work (running jumpers, etc.) on HOLD orders as soon as possible. However, do not complete a HOLD order until the installer calls in and requests it.

d. Immediately correct any errors found when working or trying to work HOLD orders. Call Line Assignment and get a correction as soon as possible.

e. Complete *all* work on disconnect orders designated as HOLD at the time specified to prevent disconnecting in error.

9.03 *Testing:* Test all orders (whether hold or nonhold) immediately after the normal is connected. Test by dialing the connector normal on the test turret and shorting the cable pair on the cable side of the VMDF (the test will then include a check of the protector springs).

9.04 *Intercept Service:*

a. Orders requiring intercept service will state the method to be used in intercepting disconnected normals (mechanical or operator). Do not solder intercept straps; make a good mechanical connection.

b. When disconnected, rotary or level hunting connector groups should have the strapping removed at the connector board terminal block. Connect the first number of a group to be intercepted to the intercept pins of the block involved. If intercept of additional numbers is required, jumper the second number to another convenient connector board intercept block. This will ensure access to the intercept operator if a second call is being answered. On dial PBX equipment, restore ground to the disconnected line equipment.

9.05 *Completion Symbols:* To indicate the progress of work on an order, the following symbols can be used to mark the order:

a.	Jumper run.	O
b.	Jumper run and tied in the wood.	Ow
c.	Jumper tied vertical.	⊕
d.	Jumper tied horizontal.	⊖
e.	Completed.	⊛
f.	Disconnected.	+

10. SPECIAL CONDITIONS

10.01 Write up on the job order special cuts or trouble cuts received from the testboard. Show the date, time, and name of testboardman; also show the name of the person who is to do the work.

10.02 If the testboard requests a jumper to be reversed at a protector to compensate for a reversed pair, inform the foreman and place a tag on the pair. Write on the tag the date, the reason for reversal, and the name of the testboardman.

10.03 Place dummy carbons and dummy heat coils in special lines *only* when an order specified them. Make sure the carbons are marked and the cable is tagged. Cover the protector with a protector guard. When the line is disconnected, remove the dummy carbons, heat coils, and the tag; replace with standard protection.

10.04 Run a jumper tied to the cable side of the protector (bypassing the protection) as follows:

a. Run the jumper as usual in the fanning strip and then run it behind the fanning strip and through the hole for the cable pair.

b. Tag the jumper on the right-hand side to avoid any assumption that the pair is vacant.

PART II

TOOLS, GAUGES, TEST EQUIPMENT, MISCELLANECUS METHODS AND EQUIPMENT

DIAL HAND TEST SET
QSE4A AND QSE4B TYPE HANDSETS
DESCRIPTION, OPERATION AND MAINTENANCE

1. GENERAL

1.01 This practice covers the description, operation and maintenance of the QSE4A (CTS #74-54-070-0) and QSE4B (CTS #74-54-071-8) handsets (dial hand test set).

1.02 The primary application of these handsets is to originate test calls in dial system equipment to test switching, continuity, and talking features of the circuit. In the maintenance of equipment they may also be used to locate trouble in the various portions of the circuit. The types of equipment with which these handsets are used are shown in Table A.

1.03 These handsets are intended for indoor use, and are available in the standard green (-51) color.

1.04 Each type of handset is provided with a "Monitor-Talk" switch to provide a means of monitoring the line under test to determine if it is in use.

1.05 The QSE4A and QSE4B type handsets are equipped with a pushbutton switch which, when depressed, will facilitate dialing over very long loops.

NOTE: QSE4A2 and QSE4B2 handsets provide an arrangement whereby a basic coded handset can be adapted, by means of plug-in cords, to all central office tests requiring the use of a handset.

1.06 If these handsets are accidentally connected directly across 48 volts with the "Monitor-Talk" switch in the talk position, the circuit design is such that minimum damage results.

NOTE: When this condition occurs, the QHP99A inductor located on PC2 (P0500416 or P0500417) is subjected to excessive power dissipation for approximately 10 seconds, at which time the thermistor limits the current to a safe level.

1.07 Conversion Parts: Parts are available to modify QSE4A type handsets in service to QSE4B types, in order to provide the additional features shown in Table B. For installation of these conversion kits, refer to paragraph 4.10.

2. DESCRIPTION

2.01 The QSE4A1 and QSE4B1 type handsets consist of a plastic handset equipped with a

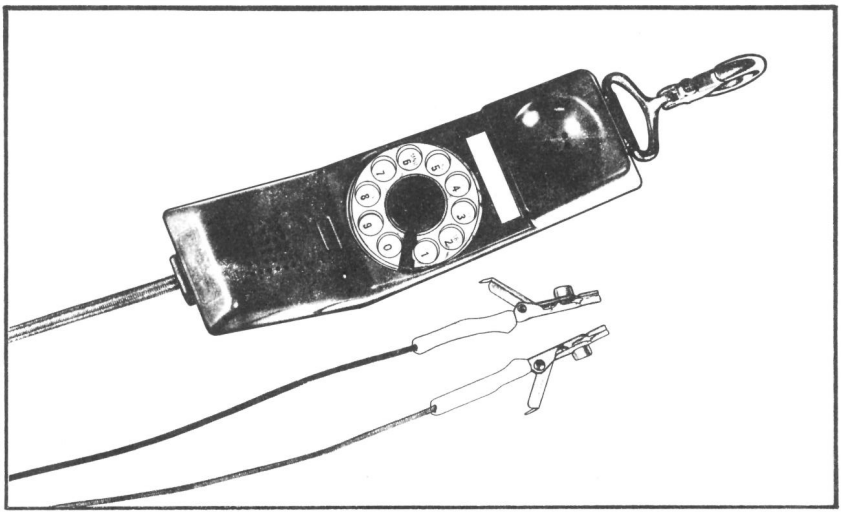


FIGURE 1. QSE4A1 Handset

TABLE A

Handset Code	Identification Dial Center Insert	Features	Primary Application	Cord Code	Cord Termination	See Note
QSE4A1	Red	Medium Impedance Monitor	Outside Plant	W2QK	Test Clips Q4100- L1	
QSE4B1	Yellow	High Impedance Data—Manual Return-to-Monitor				
QSE4A2	Red	Medium Impedance Monitor	General Use	H2QB	346A Plug	1
QSE4B2	Yellow	High Impedance Data—Manual Return-to-Monitor				

10QA type dial in the center of the housing, a T1 Transmitter Unit, a U1 Receiver Unit, and a cord provided with test clips. See Figure 1.

2.02 The QSE4A1 and QSE4B1 handsets differ in their operational features and circuitry, as shown in Table A and Figures 2 and 3 (foldouts).

2.03 The QSE4A2 and QSE4B2 handsets are the same as the QSE4A1 and QSE4B1 types respectively, except that they use a cord equipped with a 346A plug. This plug-ended cord provides an arrangement whereby a basic coded handset can be adapted, by means of plug-in cords, to all central office tests requiring the use of a handset. See Figure 4.

2.04 The QSE4A type handsets are for use where data transmission facilities are not provided, and it is only necessary to bridge the line under test with a medium impedance of 1000Ω in the "Monitor" position, as indicated on the rocker switch when the red face is hidden. In the "Talk" position the red face on the switch is visible and the DC resistance is approximately 130Ω . The use of the pushbutton is described in paragraph 3.01, d.

2.05 The QSE4B handsets are designed for use in areas where local plant involves data circuits, and it is essential to monitor lines before test with a high impedance bridging the line. This high impedance is approximately 100,000Ω in the "Monitor" position and will not disrupt data transmission which may be under way. The change from "Monitor" to "Talk" is accomplished by a rocker switch, after ensuring that the line is not in use. This switch must be in the "Monitor" position before using the handset to test the line. The use of the pushbutton switch is described in paragraph 3.02, d.

2.06 Equipment features of the different types of handsets are shown in Table A.

2.07 Schematic and wiring diagrams of the handsets are shown in Figures 2 and 3.

2.08 Figure 5 (foldout) shows the schematic diagrams of the accessory cords available for use with the QSE4A2 and QSE4B2 handsets.

2.09 All handsets are equipped with a snap hook to allow the handset to be carried on a tool belt. The hook is positioned in such a manner as to allow the handset to hang and follow the contour of the body, thus affording protection to the face of the handset as shown in Figure 6.

2.10 When the handset is not in use, the cord should be wrapped as shown in Figure 7.

TABLE B

CONVERT FROM	CONVERT TO	PART NUMBER
QSE4A- Medium Impedance Monitor (Non-Data)	QSE4B- High Impedance Monitor Manual (Data-Manual)	P0500416

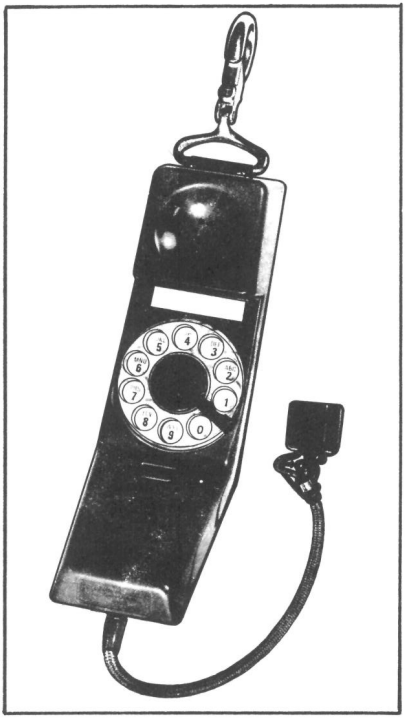


FIGURE 4. QSE4B2 Handset

3. OPERATIONAL PROCEDURE

3.01 QSE4A Type Handsets:

a. Make certain that the test clips make electrical contact with only one circuit at a time.

b. To bridge the line under test, the rocker switch should be in the "Monitor" position, which is indicated by the red face of the switch being hidden. In this mode, the handset has an impedance of approximately 1000 Ω.

c. Dialing can be accomplished in the normal manner; however, since the handset resistance is slightly higher than the resistance of a 500 type telephone set, difficulty could be encountered when dialing over a very long line.

d. If dialing difficulty is experienced, it can be overcome by keeping the pushbutton depressed while dialing. This procedure allows the handset to operate on any line which permits operation of a 500 type telephone set.

e. If talking is necessary, the rocker switch must be placed in the "Talk" position, which is indicated by the red face of the switch being visible, to establish the talking circuit.

f. Checking for the presence of 48 volts on the line should be done with the rocker switch in the "Talk" position (red face showing). Clicks will be produced in the receiver each time 48 volts is present on the test clips.

3.02 QSE4B Type Handsets:

a. Make certain that the test clips make electrical contact with only one circuit at a time.

b. To bridge the line under test, the rocker switch should be in the "Monitor" position, which is indicated by the red face of the switch being hidden. In this mode, the handset presents a very high impedance to the line, which ensures minimum loading of the line under test and thus can be used on circuits where data is present.

c. If talking is necessary, the rocker switch must be placed in the "Talk" position, which is indicated by the red face of the switch being visible, to establish the talking circuit.

d. Dialing can be accomplished in the normal manner; however, since the handset resistance is slightly higher than the resistance of a 500 type telephone set, difficulty could be encountered when dialing over very long lines. This dialing difficulty can be overcome by keeping the pushbutton depressed while dialing.

e. Checking for the presence of 48 volts on the line should be done with the rocker switch in the "Talk" position (red face showing). Clicks will be produced in the receiver each time 48 volts is present on the test clips.

4. MAINTENANCE

4.01 Normal maintenance may involve replacement of the dial, transmitter unit, receiver unit, or the cord.

NOTE: Dial maintenance consists only of determining if the dial is defective. Do not attempt adjustments of the dial in the field.

4.02 Disassembly of handset (see Figures 8 and 9 foldouts) (circled numbers refer to Figure 9 foldout):

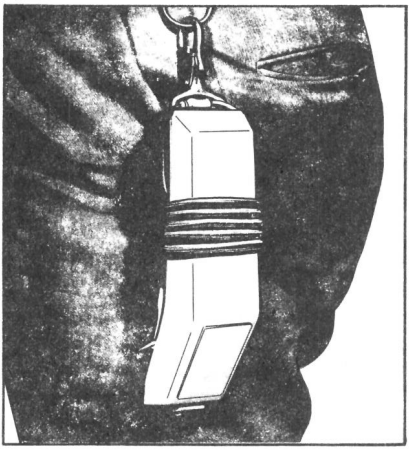


FIGURE 6. Wearing of Handset on Tool Belts

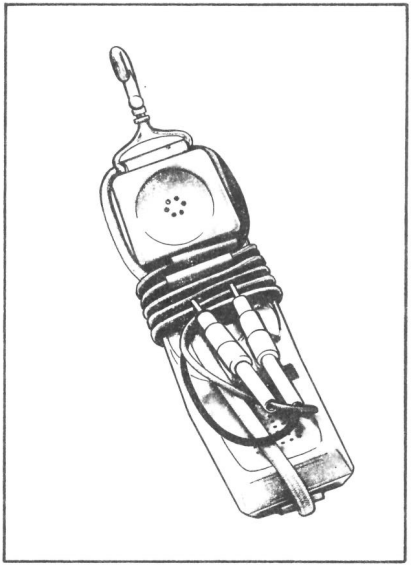


FIGURE 7. Method of Wrapping Cord When Handset is Not in Use

a. To remove the card retainer window (13), insert the tip of a 16750 L3 releaser (a paper clip may be used) into the small slotted hole at the edge of the window. Ensure that the tip does not enter the hole by more than one-eighth of an inch, as an underlying screw may hinder the lateral motion of the releaser. Apply a slight lateral pressure to the handle of the releaser. The housing projection provides a fulcrum and this will bow the window upward so that its edges may be grasped with the fingertips of the other hand to spring it out.

b. Remove the handset line cord grommet (27) and (28), by turning the handset face down and pushing the cord into the grommet to release the pressure on the inside of the grommet, then exerting a lateral pressure toward the rocker switch and an upward pressure (while retaining the lateral pressure) until the grommet comes out of the housing (see Figure 8). This grommet is in two pieces.

c. Once the grommet has been withdrawn, two screws (3) are exposed. Loosen these two screws by about three-sixteenths of an inch only, as it is not desirable or necessary to remove them.

d. Free (do not remove) the two captive screws (2) in the card retainer well. Loosen the receiver end, then slide the smooth (back) half of the handset housing back to release this section from the slotted screw holes.

4.03 To Replace Dial:

a. See paragraph 4.02 for instructions on opening the handset.

b. Remove the dial leads from the terminals.

c. Remove the four mounting screws (1) and loosen rocker switch.

d. Replace dial.

e. See paragraph 4.09 for instructions on reassembly of handset.

4.04 To Replace Transmitter:

a. See paragraph 4.02 for instructions on opening the handset.

b. Remove the two screws (3) holding the transmitter cup (TB2) and loosen the rocker switch retainer bracket (11).

c. Lift out transmitter cup and replace transmitter (MK1).

d. See paragraph 4.09 for instructions on

reassembly of handset.

4.05 To Replace Receiver:

a. See paragraph 4.02 for instructions on opening the handset.

b. Remove the three screws (1) holding the receiver cup (TB1).

c. Slide the cup along the leads.

d. Disconnect and replace the receiver units.

e. See paragraph 4.09 for instructions on reassembly of handset.

4.06 Fingerwheel: Should the fingerwheel require replacement, replace the complete dial as fingerwheel replacement in the field may result in permanent damage to the dial.

4.07 To Replace Line Cord:

a. See paragraph 4.02 for instructions on opening the handset.

b. Disconnect and replace the line cord, ensuring that the cord is properly dressed in the housing (see Figure 10 foldout).

4.08 To Replace Hook:

a. See paragraph 4.02 for instructions on opening the handset.

b. Remove the four screws (5) and remove the two hook plate retainers (15) and the hookstop (14).

c. Replace the hook, ensuring that the four mounting screws are properly positioned in the two hook plate retainers and that the hookstop is properly positioned between the hook and the cover.

d. See paragraph 4.09 for instructions on a reassembly of handset.

4.09 Reassembly of Handset:

a. Align the jacketed portion of the handset line cord (29) or (30) into the handset so that it will fit into the channel in the transmitter cup (TB2).

b. Slide the two handset sections together so that the two slots at the grommet end slide over the two screws (3) in the instrument section (22B).

c. Carefully align the two sections so that the two screws (2) in the card holder well will engage the tapped post holes in the back cover (23B).

d. Tighten the two screws (3) in the grommet cut-out and the two screws (2) in the card holder well.

CAUTION: Do not use undue force when tightening these screws.

e. Slide the grommet (27) and (28) into the rectangular hole in the end of the handset housing, with the side ribs of the grommet sliding into place on the inside face of the cover. Then pull the line cord to ensure that the grommet is securely in place.

f. Insert the card and retainer window into the well in the handset.

4.10 To convert QSE4A Type to QSE4B Type (see Figures 9 and 10 Foldouts):

a. Open handset as described in paragraph 4.02.

b. Remove the two screws (6) which fasten the line cord leads and the red and orange leads to the transmitter cup terminals. Fold the red and orange leads to the sides of the handset.

c. Remove slate-red lead from under dial plate screw (1), the white lead connected to terminal C of PC2, the yellow-slate lead from under terminal R on the transmitter cup (TB2) and the red and blue leads from (TB2) to (S3).

d. Remove original PC2 (P0500417).

e. Insert slate-red lead into terminal B and white lead into terminal C on the new PC2 (P0500416).

f. Carefully place new PC2 (P0500416) into position and ensure that the yellow-slate lead is dressed between the transformer on PC2 and the transmitter cup (TB2) and that the transformer bobbin rests on the raised portion of the instrument section housing between the dial and pushbutton (S1). The bracket of the transformer should now be located over the pushbutton.

g. Connect the yellow-slate lead from PC2 to terminal "R" of the transmitter cup with the existing yellow-slate lead on that terminal.

h. Insert the two screws (6) through the mounting holes in PC2 and into the terminal screw holes in the transmitter cup.

i. Ensure that the line cord is passed through the cord hole in the handset back cover (23B).

j. Connect the red lead, which was moved to one side of the handset in paragraph b. above, and the red lead of the line cord, to the terminal immediately above terminal "R" on the transmitter cup (see Figure 10). Tighten this connection.

k. Connect the orange lead which was moved to one side of the handset in paragraph b. above, and the black line cord lead to the other PC2 mounting terminal (rocker switch side) and tighten the mounting screw (see Figure 10).

l. Dress leads and line cord as shown in Figure 10.

m. Replace handset back cover, line cord grommet and card retainer window as instructed in paragraph 4.09.

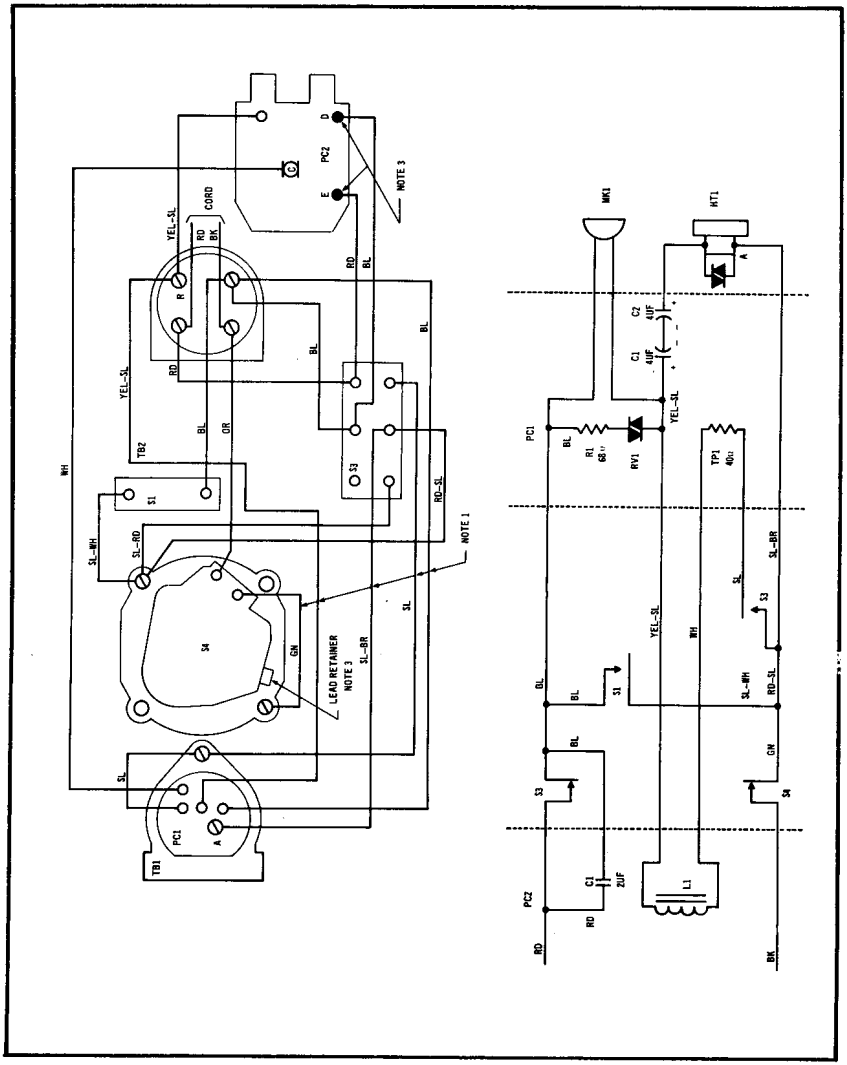


FIGURE 2. QSE4A Handset Schematic and Wiring

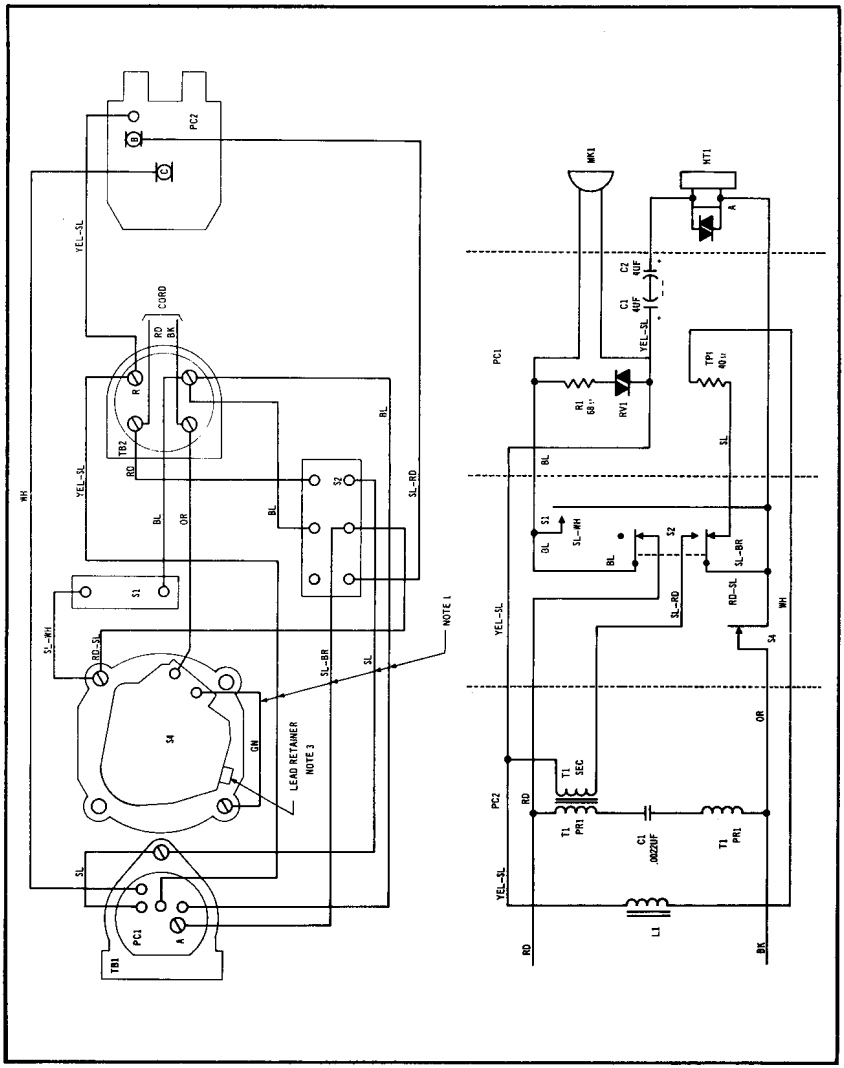


FIGURE 3. QSE4B Handset Schematic and Wiring

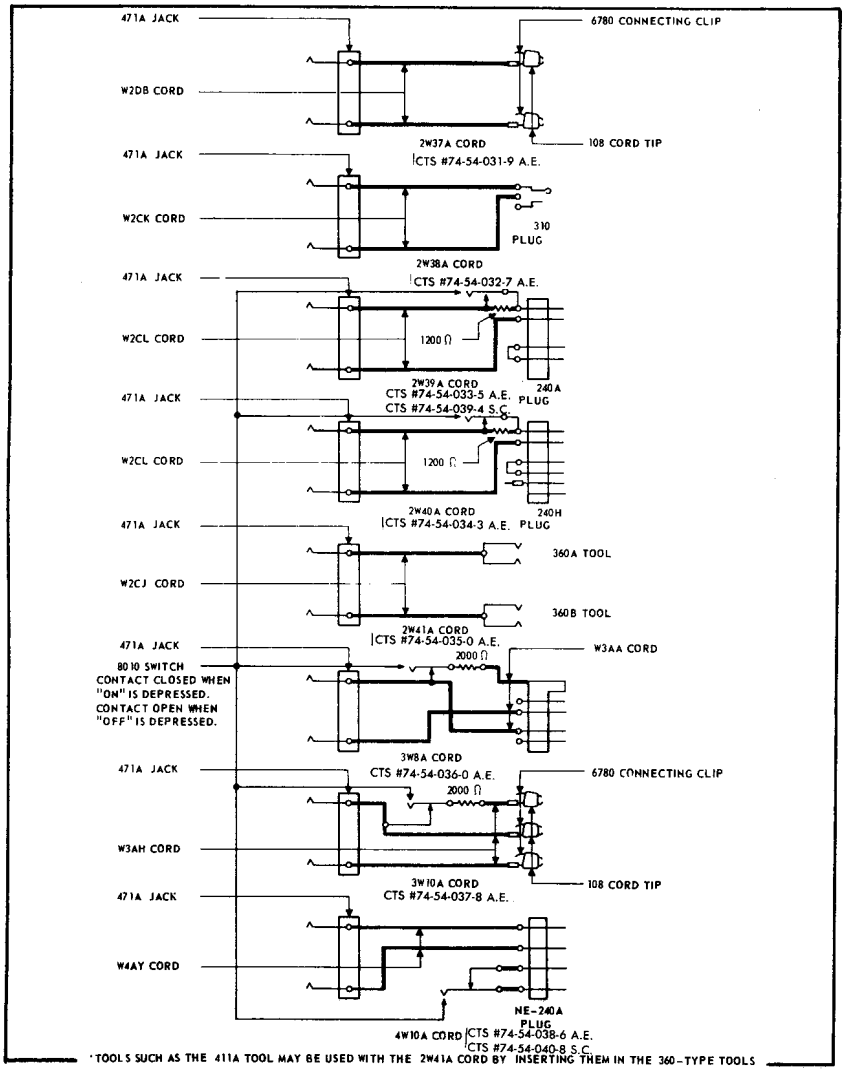


FIGURE 5. Schematics of Accessory Cords for QSE4A2 and QSE4B2 Handsets

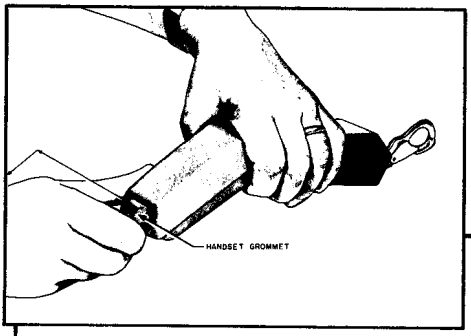


FIGURE 8. Removal of Handset Grommet

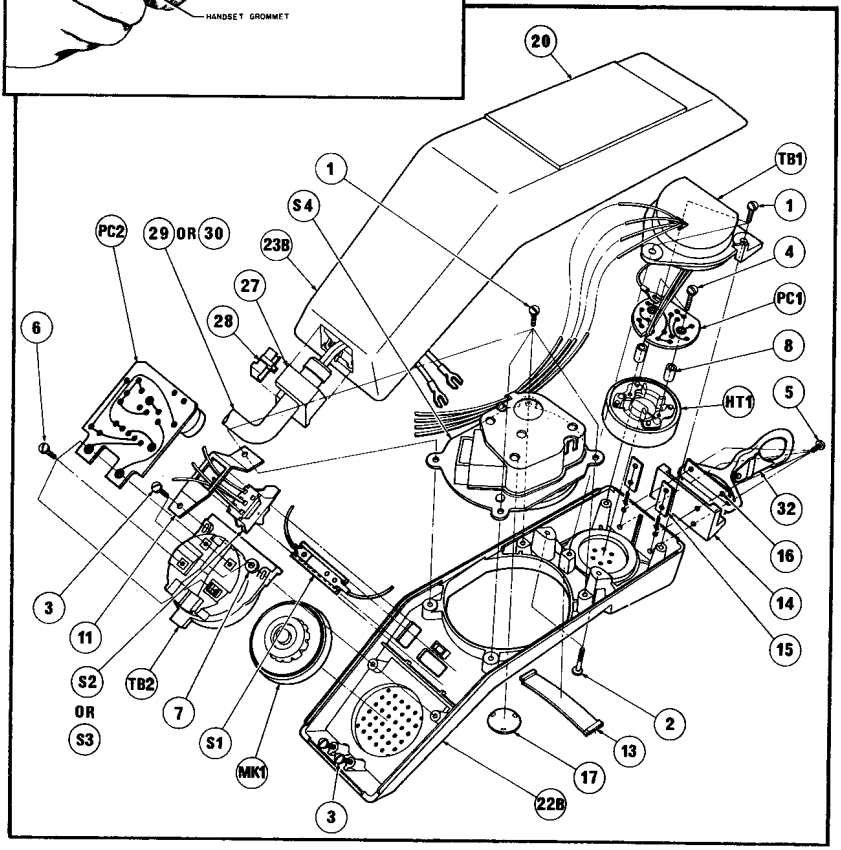


FIGURE 9. QSE4 Type Handsets—Assembly of Parts

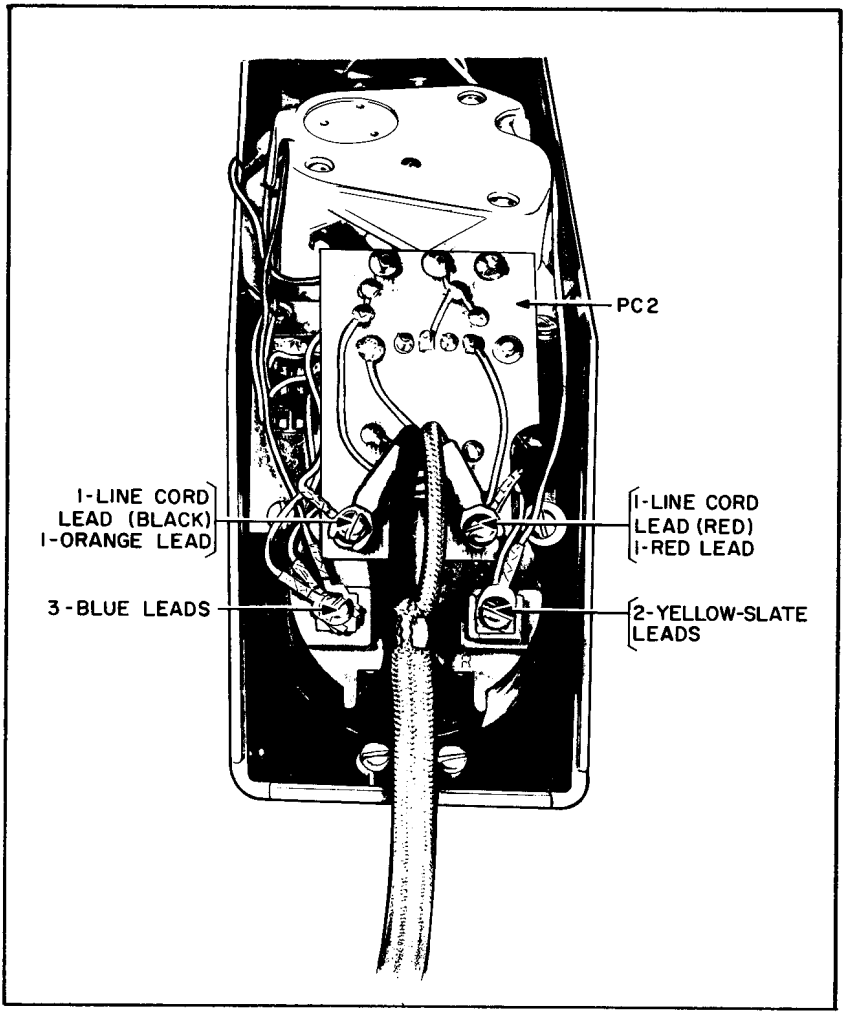


FIGURE 10. QSE4 Type handset—Cover Removed—Showing Connection of Line Cord and Assembly of PC2 (P0500416) For Conversion Purposes

TRIPLETT MODEL 310C VOLT-OHM-MILLIAMMETER

1. GENERAL

1.01 This addendum is issued to correct meter range information in paragraph 3.02, c.

1.02 With red pencil or ink, make the changes specified in paragraph 2 of this addendum, and file the addendum in front of CTSP 405-110-301.

2. CORRECTION

2.01 Change paragraph 3.02, c, to read as follows:

c. The 0-600 range is read on the 0-60 scale by adding one zero to the reading; e.g., a meter reading of 40 would equal 400 volts.

TRIPLETT MODEL 310C VOLT-OHM-MILLIAMMETER

1. GENERAL

1.01 This practice provides the description and operation of the Triplett Model 310C Volt-Ohm-Milliammeter (V.O.M.). Maintenance instructions are also included in this practice.

2. DESCRIPTION

2.01 Figure 1 shows the operational features on the Triplett 310C V.O.M.

2.02 The DC voltage ranges have sensitivities of 20,000Ω per volt. The AC voltage ranges have sensitivities of 15,000Ω per volt.

2.03 Directly under the zero adjust control located on the side of the meter case, in the upper left-hand corner, is a polarity reversing switch for the DC voltage and current ranges. This switch has no effect on the AC volts or ohms ranges. The positive battery of the ohmmeter circuit is connected to the positive V.O.M. terminal.

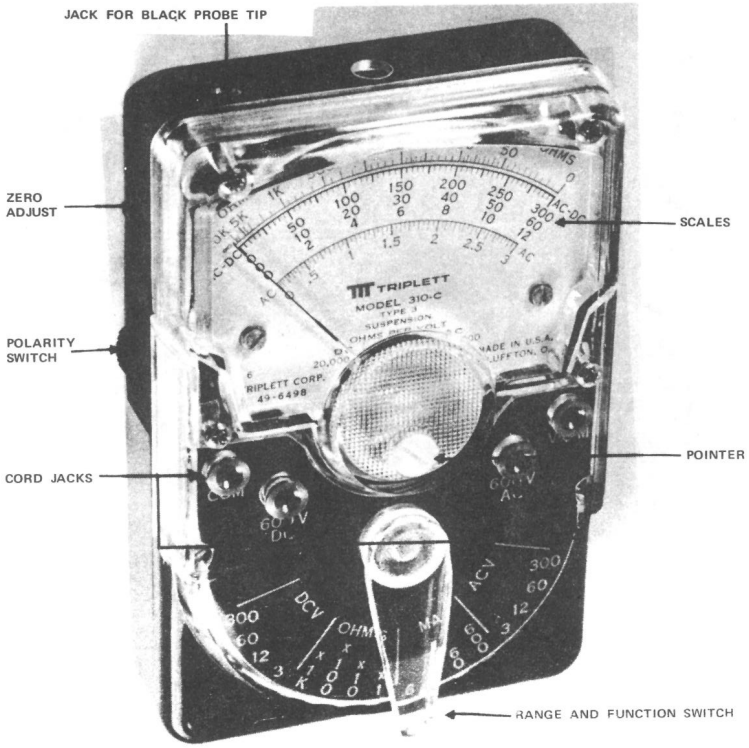


FIGURE 1. Triplett Model 310C V.O.M.

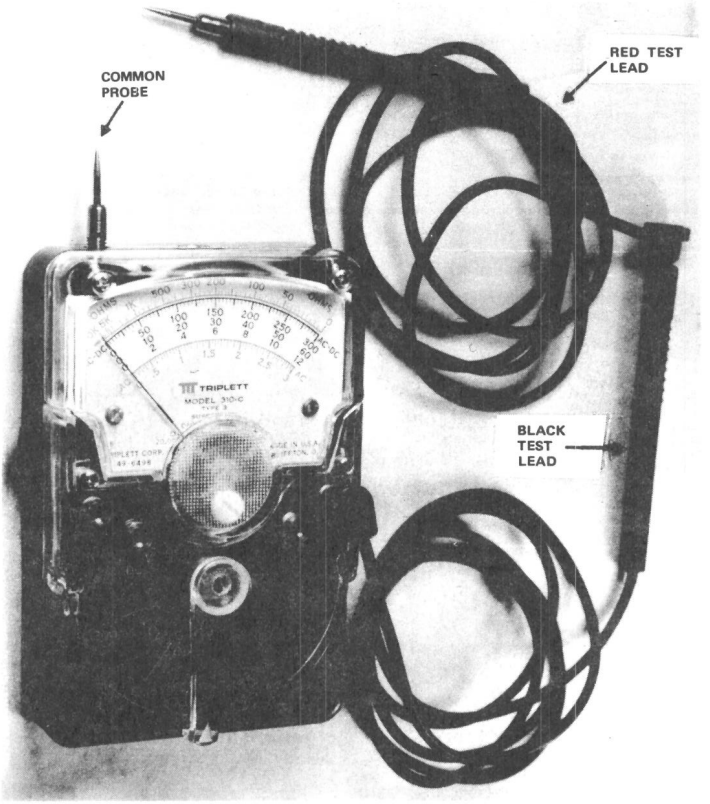


FIGURE 2

2.04 To avoid the necessity of handling the meter and two test cords with probes, unscrew the tip from the black test lead probe and insert it in the jack on the top of the meter. By doing this, the meter can be held in one hand and used as the common probe. With the red test lead connected to the V.O.M. jack, the other hand is free to operate the red test lead. The two leads can be connected together if a long lead is necessary. This can be accomplished by removing the black probe tip and inserting the red lead plug end into the cavity of the black probe. See Figure 2.

3. OPERATING PROCEDURES

3.01 The volt-ohmmeter is designed to measure resistance, AC and DC voltage and DC current. The resistance is in four ranges, i.e., 0-20,000 Ω, 0-200,000 Ω, 0-2 MΩ, and 0-20 MΩ. All four ranges may be used without changing the positions of the test leads. This is done as follows:

a. To measure **resistance from 0 to 20,000Ω,** move the range switch lever to position X1.

b. To measure **resistance from 0 to 200,000Ω,** move the range switch lever to position X10.

c. To measure **from 0 to 2 MΩ**, move the range switch lever to X100.

d. To measure **from 0 to 20 MΩ**, move the range switch lever to X1K.

e. To make all the above measurements, connect the black test lead to the COM jack and the red test lead to V.O.M. jack. See Figure 3.

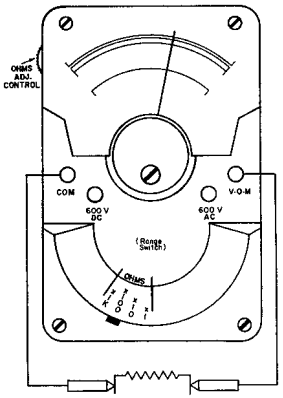


FIGURE 3. Resistance

CAUTION: Before making Ω readings, place the range switch lever in the proper position. With the black test cord in the COM jack and the red test cord in the V.O.M. jack, short the test cord together and adjust the OHMS Adjust control so the pointer will rest on 0 of the Ω scale, which is the top scale.

3.02 The DC voltage ranges are 0-3, 12, 60, 300 and 600 volts and are read as follows (see Figure 4):

a. Read all DC volts on the black scales. The 0-3 volt range is read on the 0-300 scale. Divide the reading by 100; therefore, if the meter reads 250, this would be 2.50 volts.

b. The 0-12, 0-60, and 0-300 ranges are read directly on the corresponding scales.

c. The 0-1200 range is read on the 0-12 scale by adding two zeros to the reading. A meter reading of 8 would be 800 volts.

d. To make readings on 3, 12, 60 and 300 ranges, connect the black test lead to the COM jack and the red test lead to the V.O.M. jack, with the range switch lever at the position of the scale to be used.

e. To make a reading on the 600 volt range, move the red test lead to the 600 VDC jack and set the range switch lever to the 300 DCV position.

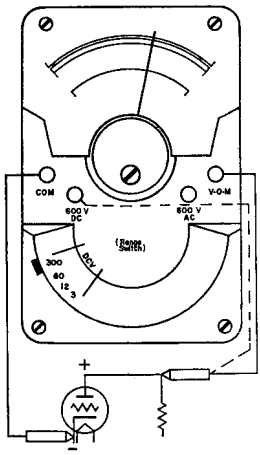


FIGURE 4. DC Voltage

CAUTION: Always place the range switch in the position you intend to use before making contact with the test leads to any equipment. If approximate voltage is unknown, place the range switch in the highest DC position.

3.03 The AC voltage ranges are 0-3, 12, 60, 300 and 600 and are read as follows (see Figure 5):

a. Read all AC volts on the red scale. For greater accuracy, a separate scale is provided for 0-3 volts.

b. The 0-12, 0-60, and 0-300 ranges are read on the corresponding scales.

c. The 0-600 range is read on the 0-60 scale by adding one zero to the reading. A meter reading of 40 would be 400 volts.

d. To make readings on 3, 12, 60 and 300 ranges, connect the black test lead to the COM jack and the red test lead to the V.O.M. jack, with the range switch lever on the position of the scale to be used.

e. To make a reading on the 600 volt range, move the red test lead to the 600 VAC jack and set the range switch lever to the 300 ACV position.

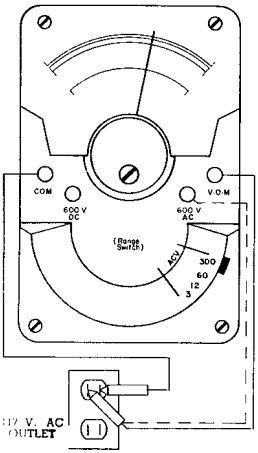


FIGURE 5. AC Voltage

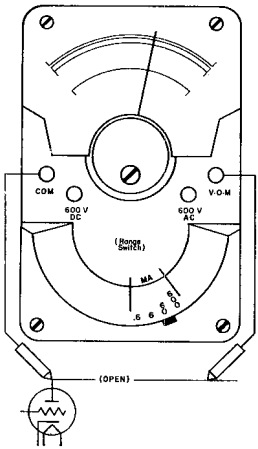


FIGURE 6. DC Current

TABLE A

OPERATION CHART

To Measure	Set Range Switch	Leads Connections Black Lead "COM" Red Lead Listed Below	Read on Scale	Each Scale Div. Equals
DC Volts				
0-3	DCV 3	V-O-M	300÷100	.05 Volt
0-12	DCV 12	V-O-M	12	.20 Volt
0-60	DCV 60	V-O-M	60	1 Volt
0-300	DCV 300	V-O-M	300	5 Volt
0-600	DCV 300	600 V DC	60x10	10 Volt
AC Volts				
0-3	ACV 3	V-O-M	3 AC	.05 Volt
0-12	ACV 12	V-O-M	12	.20 Volt
0-60	ACV 60	V-O-M	60	1 Volt
0-300	ACV 300	V-O-M	300	5 Volt
0-600	ACV 300	600 V AC	60x10	10 Volt
OHMS				
0-20,000	Ω X1	V-O-M	0-20K	
0-200,000	Ω X10	V-O-M	0-20Kx10	
0-2 Meg.	Ω X100	V-O-M	0-20Kx100	
0-20 Meg.	Ω X1K	V-O-M	0-20Kx1000	
DC Mil.				
0-.6	MA .6	V-O-M	60÷100	.01 Mil.
0-6	MA 6	V-O-M	60÷10	.1 Mil.
0-60	MA 60	V-O-M	60	1 Mil.
0-600	MA 600	V-O-M	60x10	10 Mil.
				* Polarity switch at + position

CAUTION: Always place the range switch in the position you intend to use before making contact with the test leads to any equipment. If approximate voltage is unknown, place the range switch in the highest AC position.

3.04 The four DC current ranges are 0-.6, 0-6, 0-60, and 0-600 milliamperes. All four ranges are read on the 0-60 DC scale as follows (see Figure 6):

a. On the 0-.6 range, divide the reading by 100; on the 0-6 range, divide by 10; on the 0-60 range, read the scale directly; on the 0-600 range, multiply the reading by 100 or add one zero to the reading.

b. All current readings are made with the black test cord in the COM jack, the red cord in the V.O.M. jack, and the range switch lever in the range position to be used.

c. Connect the meter in series with the circuit to be measured. Do not test directly across any potential circuit as this may harm the meter. Where polarity is difficult to determine and the meter reads reversed, exchange the probe end of the test leads.

3.05 Table A is a reference chart for lead hookup, range switch setting, scale readings and what each division on the scale equals.

4. MAINTENANCE

4.01 To adjust the pointer so that it will rest on "0", use a small screwdriver placed in the adjusting screw located on the front of the meter.

4.02 When the ohms ranges X1, X10 and X100 will not zero with the ohms adjust control, the 1.5V battery should be replaced. If the X1K range will not zero, then replace the 15 volt battery. To replace either battery, remove the small panel on the back of the meter.

CAUTION: Watch polarity when replacing batteries.

4.03 The plastic window has been treated to dissipate static charges. If cleaning is necessary, use cotton dipped in a solution of common household detergent and water. After cleaning, allow the solution to dry without rubbing; the resultant detergent film will effectively dissipate static charges.

CAUTION: Solvents may crack or scar the plastic window if applied to it.

STROMBERG-CARLSON WIRE CHIEF'S TEST SET—TYPE B 419086-018 AND 419086-028 DESCRIPTION

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1. GENERAL

1.01 This practice provides the description of the S-C Wire Chief's Test Set, Type B, which is used to assist in the testing and troubleshooting of inside and outside plant equipment associated with a dial office. See Figure 1.

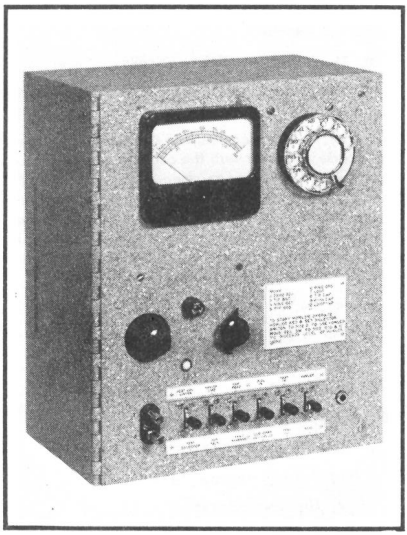


FIGURE 1. Wire Chief's Test Set, Type B

1.02 Also included in this practice are procedures for the installation, maintenance, and calibration of the Type B test set.

1.03 There are two models of the Type B test set:

a. S-C Part No. 419086-018 is supplied for use with a CDO (community dial office) test selector and is wired in accordance with Figures 1, 3, and 7 of circuit diagram S-419086 (see Figure 2, Sheets 1 and 2, foldouts).

b. S-C Part No. 419086-028 is used with an MDO (main dial office) test selector and is wired as shown in Figures 1, 2, and 3 of circuit diagram S-419086 (see Figure 2, Sheets 1 and 2, foldouts).

NOTE: Other FIG. numbers shown on the circuit diagram are for optional equipment wiring. All options are not included in any particular test set but options are selected to suit the requirements of the office in which the test set is to be installed.

1.04 An Equipment Specification may accompany the equipment. If instructions in the Equipment Specification differ from those in this practice, follow the Equipment Specification.

1.05 Refer to CTSP 405-110-728 (S-C switching series) for test procedures using the Type B test set.

2. DESCRIPTION

2.01 System Application: A block diagram of the application of the test set in a typical dial central office is shown in Figure 3 and described as follows:

a. Test Telephone Switching Equipment: When an external telephone set is connected to the test set, the telephone is assigned a station number and functions as a station telephone. The test set uses this number and the dial equipment associated with it to receive and originate calls through the central office equipment.

b. Test Train Switching Equipment: The test switchtrain consists of a test selector and a test connector. The test switchtrain is seized directly from the test set. Normally, there is only one test switchtrain in an office, but a local demand or future expansion may require an additional switchtrain.

c. Test Shoe: The test set is provided with a test shoe circuit. The test shoe permits the testing

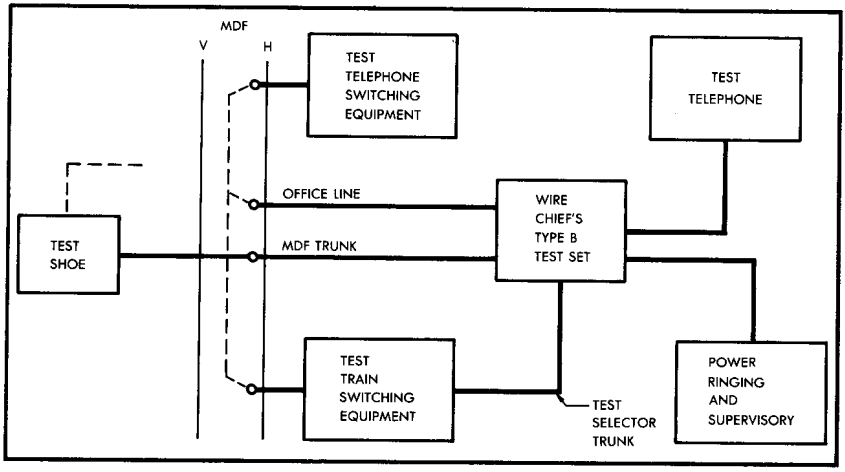


FIGURE 3. Typical Application for Type B Test Set

(without going through the dial equipment) of all lines and trunks that terminate on the protector blocks of the MDF (main distributing frame). The test shoe must be inserted manually into the protector of the line or trunk to be tested.

2.02 Capabilities: The individual requirements and specifications of the office in which the test set is to be used determine the functional circuits incorporated into the unit. Testing facilities for the following principal functions are available:

a. Tip, ring, and loop capacitance.

b. Tip, ring, and loop ground.

c. Loop resistance.

d. Tip and ring battery.

e. Positive booster voltage (+60 volt) on tip.

f. Single frequency, five-frequency, code, or superimposed ringing.

g. Howler with automatic cut-off and restoration of service.

h. Access to inside and outside plant by way of MDF protectors.

i. Reversal of test leads.

j. Dial pulsing.

k. Talking path.

l. Access to inside and outside plant by way of the test selector.

m. Monitoring at MDF heat coils.

n. Permanently held line condition (MDO type test set only).

2.03 Physical Characteristics: The test set is housed in a wooden cabinet with the controls mounted on a hinged metal front panel (see Figure 1), and the assembly is finished with a stone gray multicolored lacquer. Mounting holes drilled in the cabinet rear panel allow for mounting on the end of a main distributing frame, in an equipment bay, or on a wall. Dimensions of the test set are:

a. Height: 14-1/2 inches.

b. Width: 12 inches.

c. Depth: 8-1/2 inches.

d. Weight: 20 pounds (approximately).

2.04 Technical Characteristics:

a. Operating requirements:

(1) Battery voltage: 44 to 54 VDC.

(2) Dial characteristics:

(a) Percent make: 38.5 ±2%.

(b) Speed: 8 to 12 pps.

(c) Ringing voltage: As required.

b. Volt-ohmmeter:

(1) Full scale deflection current: 0.00075 ampere.

(2) Internal resistance: 200Ω maximum.

(3) Scales:

(a) DC voltage (lower scale): 0 to 150.

(b) Ω (upper scale): 0 to infinity.

3. CIRCUIT DESCRIPTION

3.01 This circuit description applies to the Type B test set used in MDO's or CDO's. Operation of the circuit is the same for both models except for the test selector train (see paragraphs 3.09 and 3.10). Each test set provides a means of applying various test circuits and potentials to the tip and ring conductors of a line under test.

3.02 Line Connection: This circuit provides three separate means of accessing a line under test:

a. Binding Post: The T and R binding posts are provided to connect external test equipment to the test set circuit.

b. MDF Test Shoe: The MDF test shoe can be inserted into the protector strip to provide three separate points of access:

(1) The T-IN and R-IN leads are the T and R leads to the line equipment.

(2) The heat coil tip (HCT) and heat coil ring (HCR) leads provide access through the heat coils to the customer's line.

(3) The T-OUT and R-OUT leads provide direct access to the customer's line, bypassing the heat coils.

c. Test Selector: The test selector trunk provides access to a customer's line by way of the test selector and test connector. A metallic path may be established to the line for ringing or meter measurements.

3.03 Receiving and Transmitting: Use a hand test telephone or a regular telephone with this circuit to provide a means of listening and talking.

a. Where a hand test telephone is plugged into the TEST TEL jack mounted in the face of the unit or when the handset of the station test telephone is lifted, a circuit is closed to relay CB.

b. Relay CB operating switches the test pair away from the meter, ringing, and howler circuits and couples the test pair to the test telephone.

c. Operation of the HEAT COIL LISTEN-TEST SELECTOR switch to the HEAT COIL LISTEN position will extend the transmission path from the line through the heat coils to the test pair. If the line is accessed by way of the test selector trunk, operation of this switch to the TEST SELECTOR position extends the transmission path to the test pair.

d. To talk with someone on the line, transmission battery is furnished to the line by operating the OFFICE LINE-OUT TALK switch to the OUT TALK position. This switch short circuits the transmission capacitors, so that relay CB furnishes transmission battery to both the testman and the person on the line under test.

3.04 Office Line Connection: Provision is made in this test unit to connect to a regular exchange line circuit. An external extension ringer may be connected to provide a means of signaling on incoming calls. Operation of the OFFICE LINE-OUT TALK switch to the OUT TALK position connects the test telephone to the exchange line circuit to permit origination or termination of a call in the usual manner.

3.05 Ringing: There are various ways of applying ringing to a line as shown in the following paragraphs a. through g. (see schematic diagram, Figure 2.). One of the methods shown applies to a particular office and other methods may be ignored once the proper method has been determined. Ringing is applied to a line by way of the test shoe or the test train by positioning the selector switch to the proper position and then operating the HOWLER-RING switch to the RING position. If the test shoe is used, the TEST IN-TEST OUT switch must also be placed in the TEST OUT position. Ringing is coded by the appropriate operation of the HOWLER-RING switch since this unit supplies noninterrupted ringing. In all cases, the selector switch position number corresponds to the number of the party on the line.

a. Five Frequency Harmonic Ringing (see FIG. B on Figure 2, sheet 3):

GENERATOR	SIDE OF LINE	SELECTOR SWITCH POSITION
1	R	1
2	R	2
3	R	3
4	R	4
5	R	5
1	T	6
2	T	7
3	T	8
4	T	9
5	T	10

b. Five Frequency Harmonic Ringing Odd and Even (see FIG. E on Figure 2, sheet 3):

GENERATOR	SIDE OF LINE	SELECTOR SWITCH POSITION
1	T	1
1	R	2
2	T	3
2	R	4
3	T	5
3	R	6
4	T	7
4	R	8
5	T	9
5	R	10

c. Five Frequency Ringing Odd and Even (see FIG. L on Figure 2, sheet 3):

GENERATOR	SIDE OF LINE	SELECTOR SWITCH POSITION
1	R	1
2	T	2
3	R	3
4	T	4
5	R	5
1	T	6
2	R	7
3	T	8
4	R	9
5	T	10

d. Five Frequency Harmonic Ringing On Ring Lead (see FIG. G or K on Figure 2, sheet 3):

GENERATOR	SIDE OF LINE	SELECTOR SWITCH POSITION
1	R	5
2	R	4
3	R	3
4	R	2
5	R	1
1	R	10
2	R	9
3	R	8
4	R	7
5	R	6

e. Four Frequency Ringing (see FIG. J on Figure 2, sheet 3):

GENERATOR	SIDE OF LINE	SELECTOR SWITCH POSITION
1	R	1
2	R	2
3	R	3
4	R	4
1	T	5
2	T	6
3	T	7
4	T	8

f. Single Frequency Code Ringing (see FIG. C on Figure 2, sheet 3):

SIDE OF LINE	SELECTOR SWITCH POSITION
R	1
T	2
R	3
T	4
R	5
T	6
R	7
T	8
R	9
T	10

g. Superimposed Ringing (see FIG. D on Figure 2, sheet 3):

POLARITY OF SUPERIMPOSED BATTERY	SIDE OF LINE	SELECTOR SWITCH POSITION
Neg.	R	1
Neg.	T	2
Pos.	R	3
Pos.	T	4
Neg.	R	5
Neg.	T	6
Pos.	R	7
Pos.	T	8

3.06 Howler: With the HOWLER-RING switch in the normal position, the tip and ring conductors under test are extended into the testboard for connection to the test telephone.

a. To apply the HOWLER, the test telephone must be on-hook.

b. When a connection to the line is made by way of the test shoe, the TEST IN-TEST OUT switch must be operated to the TEST OUT position. See FIG. 3 on Figure 2, sheet 2, and FIG. H on Figure 2, sheet 3.

c. Operation of the TEST IN-TEST OUT switch to the TEST OUT position disconnects the customer's line T-OUT and R-OUT leads from the exchange line circuit T-IN and R-IN leads. This opens the loop to allow the held line circuit to restore to normal and extends the customer's line T-OUT and R-OUT leads through normal contacts of the TEST REVERSE switch and normal contacts of relay CB to control of relay HL contacts.

d. After operation of the TEST IN-TEST OUT switch to the TEST OUT position with the selector switch positioned to 8 (TIP CAP), operation of the HOWLER-RING switch to the HOWLER position closes a circuit to the B-D winding of relay HL from ground through normal contacts of relay HL and prepares an alternate holding loop for relay HL.

e. Operation of relay HL grounds the HST lead, causing activation of the external howler circuit. This disconnects the T-OUT and R-OUT leads from control of the HOWLER-RING switch and closes a holding loop circuit to itself by way of operated contacts of the HOWLER switch section, its own operated contacts, normal relay CB contacts, normal TEST REVERSE-CAP READ switch contacts, operated TEST OUT section of the TEST IN-TEST OUT switch contacts, the T-OUT and R-OUT leads, and the customer's telephone hookswitch.

f. The selector switch is now set to the OFF position. This opens the operating loop circuit for relay HL and places it under control of the customer's telephone on the T-OUT and R-OUT leads.

g. External howler tone, capacitor coupled in parallel with the windings of relay HL by way of the HT and HR leads, is applied through the holding path for relay HL (as described above) to the customer's telephone receiver. This provides an audible indication that the telephone is off-hook.

h. If a graduated howler is used, the tone is increased automatically, in steps, to its maximum.

i. When the telephone handset has been properly restored on the hookswitch, the T and R loop is opened to the windings of relay H.

j. Release of relay HL removes ground from the HST lead, deactivates the external howler circuit, disconnects the T-OUT and R-OUT leads from the output of the external howler circuit, and connects the customer's exchange line circuit T-IN and R-IN leads to the customer's line T-OUT and R-OUT leads by way of operated contacts of the HOWLER-RING and TEST IN-TEST OUT switches.

k. With the exchange line circuit reconnected, the customer's telephone is available for normal service.

l. After applying the howler tone for a desired time, the TEST IN-TEST OUT switch must be restored to normal before operating the HEAT COIL LISTEN-TEST SELECTOR switch to the HEAT COIL LISTEN position; then remove the telephone from the hookswitch to monitor the line.

m. Restoration of the TEST IN-TEST OUT switch reconnects the T-OUT and R-OUT leads through normal contacts of the TEST IN switch section to maintain the connection with the exchange line circuit by way of the T-IN and R-IN leads. It also disconnects the test out leads from control of the HOWLER section of the HOWLER-RING switch and relay HL.

n. The line can be monitored as described in paragraph 3.03 and resistance measurements made of the line loop (paragraph 3.07 f.) to determine if the condition has been corrected.

3.07 Meter Connections: Connection to the line is established by way of the test selector switchtrain or the MDF test shoe. When the test shoe is used, the TEST IN-TEST OUT switch must be placed in the TEST OUT position. If the test train is used, the HEAT COIL LISTEN-TEST SELECTOR switch must be placed in the TEST SELECTOR position, and the TEST IN-TEST OUT switch must be left in the normal position. Before making each resistance measurement test, the meter should be calibrated as instructed in paragraph 3.07 b. (4).

NOTE: When making meter measurements, the test telephone must be on-hook.

a. The Selector Switch: The selector switch is a twelve terminal point switch with terminal 1 not wired and referred to as the OFF position. On FIG. 1 of the schematic diagram (Figure 2, sheet 1), terminal 12 is shown as brush wiper connections on each bank A, B, C, D, E, F, and G. The test function of each terminal position of the selector switch is shown in Table A of the schematic diagram (Figure 2, sheet 1).

b. Zero Adjust: Turn the selector switch to position 1.

(1) The ground present on the C brush wiper (relay HL normal) is conducted by way of the strap to terminal 1 (C and F gang), F brush wiper to the positive (+) side of the meter.

(2) Negative battery potential is conducted by way of the resistance network composed of resistors RH1, R2 center tapped, RH2, normal

DIAL IN-LOW OHMS switch, terminal 1, G brush wiper through the winding of relay MS to the negative side of the meter.

(3) Excessive current will operate relay MS which shunts the meter, thereby protecting the meter.

(4) To set the meter needle to 0 Ω, operate the ZERO ADJUST rheostat to RH1.

c. Negative Potential Measurement: Turn the selector switch to position 2.

(1) Tip battery voltage—TEST REVERSE-CAP READ switch normal.

(a) The meter circuit is returned to ground by way of the F wiper and the tip side of the line is connected to the other side of the meter circuit.

(b) Ground is applied by way of the diode and F wiper through the meter and relay MS in series with the G wiper position 2, resistors RH3 and R3, D wiper, normal contacts of the HOWLER-RING switch, normal contacts of relays HL and CB, and normal contacts of the TEST REVERSE-CAP READ switch to the tip side of the line under test.

(c) Operation of the TEST IN-TEST OUT switch to the TEST OUT position connects the meter circuit by way of the T-OUT lead of the MDF test protector shoe to the tip of the line under test.

(2) Ring battery voltage—TEST REVERSE-CAP READ switch in the TEST REVERSE position.

(a) The meter circuit is returned to ground by way of the F wiper. The ring side of the line is connected to the other side of the meter through operated contacts of the TEST REVERSE section of the TEST REVERSE-CAP READ switch.

(b) Ground is applied by way of the diode and F wiper position 2, through the meter and relay MS in series with the G wiper position 2, resistors RH3 and R3, D wiper, normal contacts of the HOWLER-RING switch, normal contacts of relays HL and CB, and operated contacts of the TEST REVERSE section of the TEST REVERSE-CAP READ switch to the ring side of the line under test (test telephone on-hook).

(c) Operation of the TEST IN-TEST OUT switch to the TEST OUT position connects the meter circuit by way of the R-OUT lead of the MDF test protector shoe to the ring side of the line under test.

(d) The meter is connected as a voltmeter and will indicate the reading of negative battery voltage of the ring conductor under test.

d. Positive Booster Voltage Measurement: Turn the selector switch to position 3.

(1) The meter circuit is returned to ground by way of the G wiper; the tip side of the line is connected to the other side of the meter circuit.

(2) Ground is applied by way of the G wiper position 3, relay MS and meter in series, the F wiper position 3, resistors RH3 and R3, D wiper, normal contacts of the HOWLER-RING switch, normal contacts of relays HL and CB, and normal contacts of the TEST REVERSE-CAP READ switch to the tip side of the line under test (test telephone on-hook).

(3) Operation of the TEST IN-TEST OUT switch to the TEST IN position connects the meter circuit by way of the T-IN lead to the tip conductor of either line adapter circuit.

(4) The meter is connected as a voltmeter and will indicate a reading of positive booster voltage (+60) on the tip conductor under test.

e. Line Battery Measurement: Turn the selector switch to position 4.

CAUTION: During this test, if the meter needle moves to the left (negative on tip) or moves very quickly to the right (voltage more than 150 volts), release the TEST IN-TEST OUT switch immediately.

(1) The positive side of the meter is connected to the tip side of the line under test by way of the F wiper and F gang terminal 4, normal contacts of the HOWLER-RING switch, normal contacts of relays HL and CB, and normal contacts of the TEST REVERSE switch.

(2) With the selector switch in position 4, the negative side of the meter is connected to the ring side of the line under test by way of relay MS, the G wiper and G gang terminal 4, strap to G gang terminal 2, resistors RH3 and R3, strap from D gang terminal 2, E gang terminal 4, the E wiper, normal contacts of the HOWLER-RING switch, normal contacts of

relays HL and CB, and normal contacts of the TEST REVERSE switch.

(3) Operation of the TEST IN-TEST OUT switch to the TEST OUT position connects the meter circuit across the T-OUT and R-OUT leads of the MDF test protector shoe to the tip and ring conductors of the line under test.

(4) The meter is connected as a voltmeter and will indicate any extraneous or foreign DC voltage that may be connected across the line.

(5) Operation of the TEST IN-TEST OUT switch to the TEST IN position connects the meter circuit across the T-IN and R-IN leads of the MDF test protector shoe to the tip and ring leads of the line equipment under test. This provides a meter indication of the exchange battery voltage, unless + booster voltage is used on that line. Subtract the + booster voltage (see paragraph d.) to determine the exchange battery voltage.

f. Resistance Measurements: The meter center scale deflection indicates 50,000 Ω . When the DIAL IN-LOW OHMS switch is operated to the LOW OHMS position, the meter scale indication is one hundredth of the high Ω indication (center scale deflection is 500 Ω).

(1) Tip Resistance to Ground Meter Scale Reading—Selector switch in position 5.

(a) With the resistance ground on tip, ground is applied on wiper C, conducted by the straps on terminals 1 and 5 of gang C; then strap to terminal 1 of gang F, furnishing ground to the resistor network composed of R4, R11, R2, and RH1.

(b) The negative battery potential is conducted by way of resistor RH1 to the center tap of resistor R2, to rheostat RH2, normal contacts of the LOW OHMS switch, terminal 5 of gang C, wiper G of the selector switch through relay MS and meter in series, through F gang terminal 5, strap to gang D terminal 5, wiper D, normal contacts of the HOWLER-RING switch, relays HL and CB and normal contacts of the TEST REVERSE switch, to the tip side of the line under test.

(c) Operation of the TEST IN-TEST OUT switch to the TEST OUT position connects the meter circuit by way of the T-OUT lead of the MDF test protector shoe to the tip of the line under test (test telephone on-hook).

(d) The meter connected to battery through high resistance of resistor RH2, in series with the line, indicates the resistance in Ω of the tip conductor.

(2) Tip Resistance to Ground (Low Meter Scale Reading)—Selector switch in position 5.

(a) With the resistance ground on tip and the DIAL IN-LOW OHMS switch operated to the LOW OHMS position, the battery feed of the meter is transferred from high resistance to a low resistance network formed by resistors RH1, R2, R11 center tapped and R5.

(b) The meter reading multiplied by 0.01 will indicate the resistance in Ω of the tip conductor under test.

(3) Ring Resistance to Ground (Normal Meter Scale Reading)—Selector switch in position 6.

(a) With the selector switch in position 6 and the DIAL IN-LOW OHMS switch in normal position, the negative battery is fed by way of resistors RH1 to the center tap R2, RH2, normal contacts of the LOW OHMS switch, G gang terminal 6, G wiper, relay MS and meter in series, the F wiper, F gang terminal 6, strap to F gang terminal 5, D gang terminal 5, E gang terminal 6, E wiper, normal contacts of the HOWLER-RING switch, normal contacts of relays HL and CB and the TEST REVERSE switch, to the ring side of the line under test.

(b) Operation of the TEST IN-TEST OUT switch to the TEST OUT position connects the meter circuit by way of the R-OUT lead of the MDF test shoe to the ring of the line under test (test telephone on-hook).

(c) The meter connected to battery through high resistance RH2 in series with the line indicates the resistance in Ω of the ring conductor.

(4) Ring Resistance to Ground (Low Meter Scale Reading)—Selector switch in position 6.

(a) With the selector in position 6 and the DIAL IN-LOW OHMS switch operated to the LOW OHMS position, the battery feed of the meter is transferred to low resistance formed by resistor network RH1, R2, center tap R11 and R5.

(b) The meter reading multiplied by 0.01 will indicate the resistance in Ω of the ring conductor under test.

(5) **Loop Leakage Resistance**—Selector switch in position 7.

(a) With the selector switch in position 7 and the DIAL IN-LOW OHMS switch normal, the ring side of the line under test is connected to battery by way of the TEST REVERSE switch, relays CB and HL, the HOWLER-RING switch, E wiper, E gang terminal 7, strap to E gang terminal 6, strap to D gang terminal 5, strap to F gang terminals 5, 6, and 7, wiper F to the meter and relay MS in series, wiper G, G gang terminal 7 to the normal LOW OHMS switch, resistor RH2 center tap resistor R2, and resistor RH1. The tip conductor of the line under test is grounded at D gang terminal 7 by way of the normal contacts of the TEST REVERSE switch, relays CB and HL, the HOWLER-RING switch, and the D wiper.

(b) **Normal Meter Scale Deflection**—Operation of the TEST IN-TEST OUT switch to the TEST OUT position connects the meter circuit by way of the R-OUT lead onto the ring side of the line under test. Also, ground is placed on the tip of the line by way of the T-OUT lead for testing leakage resistance between the tip and ring conductors. With a customer's telephone handset on-hook, the leakage resistance is measured between tip and ring. The meter will indicate the high scale leakage resistance in Ω of the line under test. The center scale deflection indicates 50,000 Ω.

(c) **Low Scale Deflection**—Operation of the DIAL IN-LOW OHMS position transfers the meter circuit to low resistance. The meter will indicate in Ω the low scale leakage resistance of the line under test. The center scale deflection is 500 Ω.

(6) **Line Loop Resistance**—The circuit description is the same as that described for the loop leakage resistance in paragraph (5) above.

(a) **Normal Meter Scale Deflection**—With the customer's telephone handset off-hook and the DIAL IN-LOW OHMS switch normal, the line loop resistance measured includes the telephone resistance.

(b) **Low Meter Scale Deflection**—With the customer's telephone handset off-hook and the DIAL IN-LOW OHMS switch operated to the LOW OHMS position, a low scale line loop resistance is measured which includes the telephone resistance.

g. Capacitance Measurement: The tip, ring, or loop capacitance of a line under test can be determined by operating the TEST REVERSE-CAP READ switch to the CAP READ position, with the selector switch placed in the appropriate position. The observed meter deflections are interpreted by using Table A.

NOTE: The TEST REVERSE-CAP READ switch should be operated repeatedly to the CAP READ position to obtain an average reading.

(1) **Tip Capacitance**—With the selector switch in position 8, high resistance battery is extended to the relay side of the meter by way of resistor R1 and the G wiper. The other side of the meter is connected through the F wiper and the normal contacts of the TEST REVERSE switch to D gang terminal 10 wiper D, normal contacts of the HOWLER-RING switch, relays HL and CB normal contacts of the TEST REVERSE switch to the tip side of the line under test. Operating the TEST IN-TEST

TABLE A. Conversion of Meter Deflection to Capacity Value

DEFLECTION (in volts)	CAPACITY (in μf)	DEFLECTION (in volts)	CAPACITY (in μf)	DEFLECTION (in volts)	CAPACITY (in μf)
19	0.5	36	1.0	110	6.0
22	0.6	62	2.0	116	7.0
26	0.7	78	3.0	122	8.0
30	0.8	94	4.0	128	9.0
32	0.9	102	5.0	132	10.0

OUT switch to the TEST OUT position connects the meter circuit by way of the T-OUT lead to the tip of the line under test. When the TEST REVERSE-CAP READ switch is operated to the CAP READ position, the tip conductor is grounded. On release of the switch, the tip conductor is connected to the meter and the meter is returned to battery, so that the capacitance is charged in series with the meter. This results in a meter deflection which is proportionate to the capacitance. Refer to Table A for approximate values.

(2) Ring Capacitance—Turn the selector switch to position 9. The ring capacitance is determined in a manner similar to that used to determine tip capacitance except for the position of the selector switch. This measurement is made with the selector switch in position 9. The ring lead of the line under test is connected to the meter by way of the E wiper and E gang terminal 9.

(3) Loop Capacitance—The loop capacitance is determined in a manner similar to that used to determine tip capacitance except for the position of the selector switch. This measurement is made with the selector switch in position 10. The meter circuit is connected to the tip lead of the line under test by way of the D wiper, D gang terminal 10; the ring lead of the line under test is grounded by way of the E wiper and the E gang terminal 10. With the TEST IN-TEST OUT switch in the TEST OUT position, operation of the TEST REVERSE-CAP READ switch to the CAP READ position connects the tip and ring conductors to ground, which provides a metallic shunt, discharging the total line capacitance. When the TEST REVERSE-CAP READ switch is returned to normal position, the tip lead is connected to the meter and the meter is returned to battery potential so that the total line capacitance is charged in series with the meter. This results in a meter deflection which is proportionate to the loop capacitance. Refer to Table A for approximate values.

3.08 Testing Office Equipment (Using the Test Shoe): Connect the test shoe to the line to be tested at the MDF. To perform tests on the customer's line equipment inside the office, place the selector switch in the OFF position and proceed as follows:

a. To check the customer's office equipment, the Wire Chief's test telephone must be off-hook. If the line is free and the associated line circuit furnishes ground on the tip side (T-IN) lead, operate the DIAL IN-LOW OHMS switch to the DIAL IN position. A loop is placed across the T-IN and R-IN leads, seizing the line circuit; dial tone will be returned to the Wire Chief's test telephone.

b. Use the dial on the test telephone to dial any connection served by the exchange to check the functional operation of the exchange equipment for the line circuit under test.

c. If the line is free, but the associated line circuit does not furnish ground on the tip side (T-IN) of the line (which is common on circuits associated with PABX combination trunks), connect a ground to the R binding post and operate the DIAL IN-LOW OHMS switch to the DIAL IN position. This connects a loop across the T-IN and R-IN leads but will not operate the line relay in that circuit.

d. The line circuit is seized when the TEST IN-TEST OUT switch is placed to the TEST IN position. This places the R binding post ground on the R-IN lead which seizes the line circuit, initiating a linefinder action. When the exchange equipment finds the line, dial tone will be returned to the wire chief's test telephone.

e. When dial tone is heard, operate the TEST IN-TEST OUT switch to the TEST OUT position. Ground is removed from the test telephone dial impulse springs.

f. The testman may now use the test set dial to dial any connection served by the exchange to check the functional operation of the inside equipment for the office line.

3.09 Testing Line Equipment, Using the CDO Test Train: The CDO test train control circuits are described in the following paragraphs. See FIG. 7 of the schematic diagram (sheet 2 of Figure 2) for wiring details.

a. Supervisory Lamp: The supervisory (SR) lamp, mounted on the front panel of the test set, serves as a combined busy and supervisory lamp for the test selector. When the HEAT COIL LISTEN-TEST SELECTOR switch is in the normal position and the SR lamp is illuminated, it indicates that the test selector is busy. The HEAT COIL LISTEN-TEST SELECTOR switch should not be operated to the TEST SELECTOR position unless the SR lamp is extinguished.

b. Test Selector Seizure: To reach a line by way of the switchtrain, place the HEAT COIL LISTEN-TEST SELECTOR switch to the TEST SELECTOR position and dial the last four digits of the line number, using the position dial shown in FIG. 7 (sheet 2 of Figure 2). If the line is busy, the SR

lamp will be illuminated and conversation may be heard on the Wire Chief's telephone. If the line is idle, the testman can make meter measurements or other tests on that line.

c. Meter Measurements, Ringing or Placing Howler on Line Under Test: Placing the HEAT COIL LISTEN-TEST SELECTOR switch to the TEST SELECTOR position connects the test T and R leads of the test position (see FIG. 1 on sheet 1 of Figure 2) to the TTS and TRS leads of the test selector circuit (see FIG. 7 on sheet 2 of Figure 2). The TTS and TRS leads are extended on a metallic basis through to the test selector and test connector circuits as the line number is dialed. Upon connection to an idle circuit, the test selector causes operation of the cut-off relay CO in that line circuit which frees the associated line of attachments, allowing meter measurements (see paragraph 3.07), application of ringing (see paragraph 3.05), or connection of the howler to the line (see paragraph 3.06).

d. Testing Lines In Same Test Connector Bank Level: To test the next consecutive line in the same connector bank level, dial the digit 1 using the test set dial (see FIG. 7 on sheet 2 of Figure 2). The test selector then steps the associated test connector to the next wire bank position.

e. Release of Test Switchtrain: To seize a line in a different level or to seize a different test connector, the HEAT COIL LISTEN-TEST SELECTOR switch (see FIG. 7 on sheet 2 of Figure 2) must be returned to the neutral position, releasing the test selector and test connector circuit.

3.10 Testing Line Equipment, Using the MDO Test Train: The MDO test train control circuits are described in the following paragraphs. (Refer to FIG. 2 on sheet 1 of Figure 2) for wiring details.

a. Supervisory Lamp: The supervisory lamp (SR), mounted on the front panel of the test set, serves as a combined busy and supervisory lamp for the test selector. When the HEAT COIL LISTEN-TEST SELECTOR switch (see FIG. 2 on sheet 1 of Figure 2) is in the normal position and the SR lamp is illuminated, it indicates that the test selector is busy. The HEAT COIL LISTEN-TEST SELECTOR switch should not be operated to the TEST SELECTOR position unless the SR lamp is extinguished.

b. Test Selector: Placing the HEAT COIL LISTEN-TEST SELECTOR switch (see FIG. 2 on sheet 1 of Figure 2) to the TEST SELECTOR position causes the following functions:

(1) Connects the A-C winding of relay BY across the T and R leads to the test selector.

(2) This loop across the T and R leads seizes the test selector.

(3) The test selector returns ground on the S lead to operate relay BY through the B-D winding.

(4) Operation of relay BY connects ground to light the supervisory lamp, indicating that the selector is available for dialing.

c. Dialing: Operation of the test set dial causes the following functions:

(1) When the dial is moved off normal, ground is forwarded from the operated off-normal springs to operate relay DA through the A-C winding.

(2) Operation of relay DA connects ground to operate relay DB.

(3) Operation of relay DB connects the dial impulse springs across the T and R leads to the test selector, disconnects the A-C winding of relay BY from the dialing loop (to prevent impulse distortion), and disconnects resistance ground from the HS lead to the test selector.

(4) While the dial is returning to normal, the impulse springs open and close the loop on the T and R leads to the test selector, causing the test selector to step in accordance with the digit dialed.

(5) When the dial has returned to normal, the following functions occur:

(a) The impulse springs remain closed, holding the loop to the seized test selector.

(b) The off-normal spring open, causing relay DA to release.

(c) Release of relay DA reconnects ground on the HS lead and opens the circuit to slow release relay DB.

(d) Release of relay DB transfers the T and R leads from the dial to the loop provided by the A-C winding of relay BY.

(6) The dialing sequence is repeated until sufficient digits have been dialed to reach the line to be tested.

d. Idle Line Connection: When the test selector trunk connects to an idle line, battery is returned on the HS lead to operate relay SA. Operation of relay SA connects ground (from the CONN RLS switch) to operate relay SB. Operation of relay SB causes the following functions:

(1) Removes ground from the supervisory lamp, causing the lamp to extinguish.

(2) Disconnects the A-C winding of relay BY from across the T and R leads.

(3) Extends the T and R leads from the test selector to the testing circuits in the test set.

(4) Provides a locking path for relay SB to ground at the CONN RLS switch.

(5) Ground pulses received on the HS lead from the test connector cause relays SA and SB to operate and light the supervisory lamp in accordance with the line conditions detected by the test connector as follows:

LAMP INDICATION	LINE CONDITION
120 IPM flashing	Line busy
1 flash	Battery on line
2 flashes	Ground on line
3 flashes	Low loop leakage resistance
4 flashes	No fault on line

e. Additional Digit Dialing: After a line has been seized through the test selector trunk, dialing an additional digit 1 at the test set dial causes the test connector wipers to step to the next consecutive line on the test connector bank. This function is performed by the regular operation of the dialing circuit, with the test connector operating under control of the loop provided by the dial impulse springs.

f. Busy Conditions: When the test train from the test selector trunk detects a busy condition, the supervisory lamp on the test set gives a busy indication as follows:

(1) **Test Connector Busy**—When a busy test connector is detected, ground is applied to the S lead of the test selector and the HS lead becomes open (instead of having battery applied). Relay BY remains operated but relays SA and SB will not operate, causing any further dial pulses to be ineffective. On completion of dialing, the supervisory lamp remains lighted (from the ground on the BY relay contacts) to give a visual indication of the busy condition.

(2) **Line Busy**—When the test connector is stepped to a busy line, 120 IPM battery pulses are forwarded on the HS lead to pulse the SA and SB relays, causing the supervisory lamp to flash at 120 IPM.

(3) **Monitoring a Busy Line**—Placing the DIAL IN-LOW OHMS switch to the DIAL IN position, and the TEST OUT-TEST IN switch to the TEST IN position removes transmission battery from the T and R leads of the TEST TEL jack on the test set and connects these leads to the test selector. The line can then be monitored through capacitors in the test selector circuit from a hand test telephone plugged into the TEST TEL jack.

g. Releasing a Permanently Held Line Circuit: Placing the IN TEST-RELS PERM switch to the RELS PERM position releases any battery feed relay held by a faulty condition (loop more than 50 Ω) on the line circuit. The RELS PERM switch connects low resistance battery on the test selector S lead, in place of the high resistance battery from the B-D winding of the BY relay. This low resistance battery causes the test selector to apply ground on the tip conductor and low potential battery on the ring conductor of the line. These conditions cause the battery feed relay to release.

h. Releasing CO Relay on Regular Line Circuit: Operation of the IN TEST-RELS PERM switch to the IN TEST position and the CO CONTROL-CONN RELEASE switch to the CO CONTROL position causes release of the CO relay of the line circuit selected by the test selector test train. It is necessary to release the CO relay so that tests may be performed on the line equipment inside the office. The release sequence is:

(1) Place the IN TEST-RELS PERM switch to the IN TEST position which applies ground to operate relay DB.

(2) Operation of relay DB connects the T and R leads from the test selector to the dial impulse springs.

(3) Place the CO CONTROL-CONN RELEASE switch to the CO CONTROL position to shunt the B-D winding of relay SB which applies low resistance ground to the HS lead of the test selector.

(4) The test selector removes ground from the sleeve lead of the line circuit, causing release of relay CO in the line circuit.

(5) Release of relay CO transfers the line circuit LR relay to control of the loop provided by the test set dial impulse springs.

(6) The line circuit can now be pulsed from the test set dial.

i. Connecting the Hand Test Telephone to the Test Train: When the hand test telephone (in the off-hook condition) is connected to the TEST TEL jack on the test set, the telephone may be

connected to the line accessed by the test connector in the following manner:

(1) Place the DIAL IN-LOW OHMS switch to the DIAL IN position and the TEST IN-TEST OUT switch to the TEST IN position to connect the T and R leads of the telephone to the test selector trunk circuit. The T and R leads are then extended through the operated contacts of the TEST SELECTOR switch and relay SB to the open contacts on relay DB.

(2) Restore the IN TEST-RELS PERM switch to its normal position which removes ground from relay DB. Relay DB releases, connecting the T and R leads of the test selector train to the leads of the test telephone.

(3) Place the OFFICE LINE-OUT TALK switch to the OUT TALK position which connects battery and ground from the CB relay to the T and R leads of the line. This energizes the transmitters of the telephones on the line so that conversation is possible between the test set operator and the called party.

j. **Disconnecting the Hand Test Telephone from the Line Being Tested:** The hand test telephone is restored on-hook before the operated CO CONTROL switch is restored to normal.

(1) When the hand test telephone is restored on-hook, the T and R loop is opened which releases the line circuit under test.

(2) When the CO CONTROL switch is restored to normal, the shunt is removed from the B-D winding of relay SB. This causes high resistance ground to be applied to the HS lead of the test selector. The test selector then applies ground on the S lead of the line circuit, reoperating the CO relay. Operation of the CO relay causes the test selector train T and R leads to be connected to the outside line equipment (and disconnected from the office equipment) of the line under test.

k. **Releasing the Test Selector Trunk:** The testing train from the test selector trunk can be released by releasing the test connector only, or by releasing both the test selector and the test connector.

l. **Releasing the Test Connector:** The test connector is released in the following manner:

(1) Operate the CO CONTROL-CONN RELEASE switch to the CONN RELEASE position to perform the following:

(a) Remove ground from the A-C winding of relay SB.

(b) Disconnect the T lead from FIG. 1.

(c) Connect a holding battery through R12 to the T lead of the test selector.

(d) Disconnect high resistance ground from the HS lead, causing release of the line relay of the test selector.

(e) Open the loop for A-C winding of relay BY to prevent connection across the T and R leads of the test selector after release of relay SB.

(2) Release of relay SB performs the following:

(a) Connects ground from operated BY relay contacts to light the supervisory lamp.

(b) Opens the path to the A-C winding of relay BY.

(c) Opens the R lead to the test selector, releasing the pulse control relay in the test selector which releases the associated test connector.

(3) Restoring the CO CONTROL-CONN RELEASE switch to normal performs the following:

(a) Reinstates high resistance ground through relays SA and SB to the HS lead.

(b) Reconnects ground to operate relay SB.

(c) Reconnects the A-C winding of relay BY across the test selector T and R leads and removes resistance battery from the tip lead, causing reseizure of the test connector.

m. **Test Selector and Test Connector Release:** The entire test selector train is released by restoring the HEAT COIL LISTEN-TEST SELECTOR switch to normal. Restoring the switch to normal performs the following:

(1) Disconnects the holding ground from relay SB.

(2) Opens the HS lead.

(3) Opens the loop across the T and R leads, causing release of the test selector and test connector.

(4) Release of the test selector removes ground from the S lead to the B-D winding of relay BY.

(5) Release of relay BY emoves ground from

the supervisory lamp, causing the lamp to extinguish.

3.11 Heat Coil Test: To test the protectors, go off-hook with the test telephone and turn the selector switch to the OFF position. Operating the HEAT COIL LISTEN-TEST SELECTOR switch to the HEAT COIL LISTEN position will capacitor couple the line under test to the test telephone. If the line is free, operation of the TEST IN-TEST OUT switch to the TEST OUT position will capacitor couple the customer's line T-OUT and R-OUT leads to the test telephone. This disconnects the associated line circuit T-IN and R-IN leads, transferring seizure of the line circuit under test to the control of a loop circuit composed of the test telephone, the OUT TALK section of the OFFICE LINE-OUT TALK switch, and the test shoe connected to the coils. Operation of the OFFICE LINE-OUT TALK switch to the OUT TALK position shunts the transmission capacitors, closing a T and R loop, seizing the line circuit under test by way of the HC-TIP and HC-RING conductors through the heat coils. Seizure of the line circuit initiates an allotter linefinder action, returning dial tone if the coils are not open.

3.12 Test Lead Reversal: To reverse the conductors under test into the test set, operate the TEST REVERSE-CAP READ switch to the TEST REVERSE position. The T and R leads are transposed from the test set access through the springs of the TEST REVERSE switch. The TEST REVERSE switch is used in conjunction with position 2 of the selector switch to test for battery on the ring lead of a line or trunk.

3.13 Use of External Test Equipment: With the TEST IN-TEST OUT switch in the TEST OUT position, the selector switch in the OFF position and the test telephone on-hook, the T-OUT and R-OUT pair from the test shoe are connected to the T and R binding posts on the front panel of the test set. Equipment such as a Wheatstone bridge or a dial speed and percent make test set may be connected to the binding posts for making tests from the customer's line. If the test selector circuit is used, the external test equipment connected to the binding posts is connected to the line under test when the HEAT COIL LISTEN-TEST SELECTOR switch is placed in the TEST SELECTOR position.

3.14 Generator Ground Cut-Off:

a. When the selector switch is placed to the position for the desired frequency selection, and the DIAL IN-LOW OHMS switch is placed to the LOW OHMS position, ground is removed from the GEN GRD leads of FIGS. B, C, D, E, G, J, K, or L (sheet 3 of Figure 2). This function is called **generator ground cut-off** and is used on lines with subsets that do not remove ringers from the line when the telephone is off-hook; or on lines having telephones equipped with varistors connected across the receiver.

b. The **howler** would not be effective for signaling a customer who had left the handset off-hook on these lines. When the testman places the DIAL IN-LOW OHMS switch to the LOW OHMS position, ground is removed from the line, removing the shunt from the ringers on both the tip and ring (due to the off-hook subset). When applied, ringing current will not short circuit or damage the receiver of the off-hook telephone.

c. Operation of the HOWLER-RING switch to the RING position applies the desired ringing current to the line and rings the parties on both the tip and ring, with ringers connected from one side of the line to ground when both parties are rung normally with the same frequency on separate sides of the line (divided circuit ringing). This is due to the off-hook telephone bridging both the tip and ring of the line.

4. INSTALLATION PROCEDURES

4.01 Mounting Instructions: The test set can be mounted in a relay rack, on a wall, or on the end of the MDF. Figure 4 shows the typical methods of mounting the test set and the location of the required mounting holes to be drilled. When mounting on a wall, all four mounting holes in the corners of the base should be used. For MDF mounting, the installer must drill the cross channel for the two top mounting holes and use suitable screws for securing the test set. When the test set is to be mounted in a relay rack, the installer should drill the base as shown in FIG. B (sheet 3 of Figure 2), and the unit mounted on the brackets supplied as shown in FIG. A of Figure 4.

4.02 Wiring Instructions: A cable entry hole should be drilled in the test set base or top to permit the cabling to be run to the MDF, local telephone, supervisory terminal block, etc. (refer to the equipment specification for details of cable runs required). These cables are terminated on the terminal block inside the test set. Remove the terminal block mounting nuts and turn the block on its side to facilitate wiring. Wire as shown in FIG. A of Figure 2 (sheet 3), then replace the terminal block after all connections have been completed.

5. MAINTENANCE PROCEDURES

5.01 Performance Routine: The performance routine checks in the following paragraphs should be

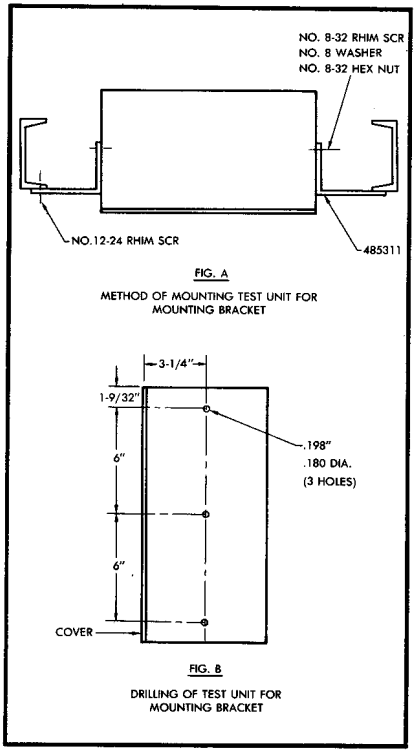


FIGURE 4. Wire Chief's Test Set, Type B, Mounting Details

periodically applied to the Type B Wire Chief's test set. Refer to paragraph 6 for ordering information for any replacement parts required.

a. Material Required: The following materials are required to perform routine checks on the Type B Wire Chief's test set:

(1) Single conductor test cords with an alligator clip at each end of the cord (two cords are required).

(2) 510 Ω resistor (1-watt, carbon, ±5%), Stromberg-Carlson No. 554003-511, or equivalent.

(3) 5100Ω resistor (1 watt, carbon, ±5%), Stromberg-Carlson No. 554003-512, or equivalent.

(4) 2 μf capacitor (+38%, -0%, 200-watt VDC), Stromberg-Carlson No. 202886-865, or equivalent.

b. Preliminary Procedures:

(1) Restore all switches to normal on the test set.

(2) Assign a convenient local telephone as a test telephone.

c. ZERO ADJ Check:

(1) Rotate the selector switch to position 1 (ZERO ADJ).

(2) Rotate the ZERO ADJ control in each direction in turn. Check that the meter needle moves freely in each direction as the control is rotated.

(3) Use the ZERO ADJ control to set the meter indication at 0 on the upper meter scale.

d. Resistance Check:

(1) Connect the 510Ω resistor to the test set T and R binding posts.

(2) Operate the DIAL IN-LOW OHMS key to the LOW OHMS position.

(3) Rotate the test selector switch to position 7 (LOOP).

(4) The meter should indicate 51 K.

(5) Disconnect the 510Ω resistor from the binding posts.

(6) Connect the 5100Ω resistor across the binding posts.

(7) The meter needle should indicate approximately 500 K.

(8) Restore the DIAL IN-LOW OHMS key to normal.

(9) The meter should indicate 5.1 K.

(10) Disconnect the 5100Ω resistor from the T and R binding posts.

e. TIP GRD, RING GRD, TEST REVERSE Check:

(1) Rotate the test set selector switch to position 5 (TIP GRD).

(2) Connect one end of the 5100Ω resistor to the T binding post and the other end to ground.

(3) Check that the meter indicates 5.1 K.

(4) Rotate the test set selector switch to position 6 (RING GRD). The meter should indicate infinity on the upper scale.

(5) Operate the TEST REVERSE-CAP READ key to the TEST REVERSE position. The meter should indicate 5.1 K.

(6) Disconnect both test leads and restore the TEST REVERSE-CAP READ key to normal.

f. Voltmeter, TIP BAT, RING BAT Check:

(1) Rotate the selector switch to position 2 (BAT ON TIP).

(2) Connect the test lead from the battery to the T binding post on the test set. The test set meter should indicate the same voltage as the meter on the powerboard.

(3) Operate the TEST REVERSE key. The test meter should indicate zero.

(4) Disconnect test lead T from the binding post and connect to the R binding post on the test set. The test set meter should indicate the same voltage as in (2) above.

(5) Restore the TEST REVERSE key. The test set meter should indicate zero.

(6) Disconnect the test lead from the R binding post and battery.

g. Capacitance Check:

(1) Rotate the selector switch to position 8 (TIP CAP).

(2) Connect the test lead from the T binding post to one lug of a 2 μf capacitor.

(3) Connect the test lead from ground to the other lug of a 2 μf capacitor.

(4) Rapidly operate and restore the CAP READ-TEST REVERSE key from CAP READ to the normal position several times.

(5) The maximum reading on the meter should be approximately 62.

(6) Disconnect the test lead from the T binding post and connect it to the R binding post.

(7) Rotate the selector switch to position 9 (RING CAP).

(8) Repeat steps (4) and (5) above.

(9) Disconnect the test lead from ground and connect it to the T binding post.

(10) Rotate the selector switch to position 10 (LOOP CAP).

(11) Repeat steps (4) and (5) above.

(12) Disconnect the test leads.

h. OFFICE LINE Key and Test Set Dial Check:

(1) Insert a hand test telephone (with the switch in the center position) into the TEST TEL jack on the test set.

(2) Operate the OFFICE LINE-OUT TALK key to the OFFICE LINE position.

(3) Use the test set dial to dial the test telephone number assigned in paragraph 5.01 c. (2).

(4) The circuit is operating correctly if conversation can take place when the called party answers.

(5) Restore the OFFICE LINE-OUT TALK key to normal and remove the hand test telephone from the TEST TEL jack on the test set.

i. TEST SELECTOR and RING Keys Check (CDO Model Test Set):

(1) From a convenient local telephone, dial the test telephone number assigned in paragraph 5.01 c. (2).

(2) When the called party answers, instruct him to monitor the line while a test is performed from the Wire Chief's test set.

(3) Leave the handset off-hook on the telephone used to dial the test number.

(4) At the Wire Chief's turret, operate the HEAT COIL LISTEN-TEST SELECTOR key to the TEST SELECTOR position.

(5) The SR supervisory lamp lights.

(6) Use the test set dial to dial the last four digits used in step (1).

(7) Insert the hand test telephone (with the switch in the center position) into the TEST TEL jack on the test set.

(8) Operate the OFFICE LINE-OUT TALK key to the OUT TALK position.

(9) Check that conversation is possible with the party at the telephone in step (2) above; then instruct that party to replace the receiver of the handset.

(10) Replace the receiver of the handset of the local telephone used in step (1) above.

(11) Restore the OFFICE LINE-OUT TALK key to normal; remove the test telephone from the TEST TEL jack on the test set.

(12) Restore the HEAT COIL LISTEN-TEST SELECTOR key to normal.

(13) Repeat steps (4), (5), and (6) above.

(14) Position the test set selector switch on the position corresponding to the ringing digit for the telephone used in step (6) above.

(15) Operate the HOWLER-RING key to the RING position for 2 or 3 seconds.

(16) Insert the hand test telephone (with the switch in the center position) into the TEST TEL jack on the test set.

(17) Operate the OFFICE LINE-OUT TALK key to the OUT TALK position.

(18) Check that conversation is possible with the party at the telephone extension dialed in step (6) above; then instruct the party to replace the receiver of the handset.

(19) Restore the OFFICE LINE-OUT TALK and HEAT COIL LISTEN-TEST SELECTOR keys to normal.

(20) Remove the hand test telephone from the TEST TEL jack.

(21) Restore the test set selector switch to the OFF position.

j. TEST SELECTOR, CONN RLS, and RING Key Check:

(1) From a convenient local telephone, dial the test telephone number assigned in paragraph 5.01 c. (2).

(2) When the called party answers, instruct him to monitor the line while a test is performed from the Wire Chief's test set.

(3) Leave the handset off-hook on the telephone used to dial the test number.

(4) At the Wire Chief's turret, operate the HEAT COIL LISTEN-TEST SELECTOR key to the TEST SELECTOR position.

(5) The SR supervisory lamp lights.

(6) Use the test set dial to dial the same digits as in step (1) above.

(7) The supervisory lamp flashes at 120 IPM.

(8) Insert the hand test telephone (with the switch in the center position) into the TEST TEL jack on the test set.

(9) Operate the OFFICE LINE-OUT TALK key to the OUT TALK position.

(10) Check that conversation is possible with the party at the telephone used in step (2) above; then instruct the party to replace the receiver on the handset.

(11) Replace the receiver of the handset of the local telephone used in step (1) above.

(12) Restore the OFFICE LINE-OUT TALK key to normal; remove the hand test telephone from the TEST TEL jack on the test set.

NOTE: Perform the following steps (13) through (19) only when testing the MDO model test set.

(13) Operate the CO CONTROL-CONN RLS key to the CONN RLS position for 2 or 3 seconds; then restore the key to normal.

(14) Use the test set dial to dial the last two digits of the number used in step (1) above.

(15) Position the test set selector switch on the position corresponding to the ringing digit for the phone used in paragraph 5.01 c. (2).

(16) Operate the HOWLER-RING key to the RING position for 2 or 3 seconds.

(17) Insert the hand test telephone (with the switch in the center position) into the TEST TEL jack on the test set.

(18) Operate the OFFICE LINE-OUT TALK key to the OUT TALK position.

(19) Check that conversation can take place with the called party.

(20) Restore all keys on the test set to normal and remove the hand test telephone from the test set jack.

k. Test Shoe Check:

(1) Restore all keys on the test set to normal and rotate the selector switch to the OFF position.

(2) Insert the test shoe into the MDF protector block of the local telephone line assigned as the test number in paragraph 5.01 c. (2).

(3) Insert the plug of the hand test telephone (with the switch in the center position) into the TEST TEL jack on the test set.

(4) Operate the HEAT COIL LISTEN-TEST SELECTOR key to the HEAT COIL LISTEN position. Monitor the line to see if it is in use.

(5) If the line is not in use, restore the HEAT COIL LISTEN-TEST SELECTOR key to normal.

(6) Remove the hand test telephone from the test set jack.

(7) **TEST IN-TEST OUT Key Check—**

(a) Operate the TEST IN-TEST OUT key to the TEST IN position.

(b) Rotate the selector switch on the test set to position 2 (RING BAT). Operate the TEST REVERSE-CAP READ key to the TEST REVERSE position. The test set meter should indicate approximately 48 volts.

(c) Restore the TEST REVERSE-CAP READ key to normal.

(d) Rotate the selector switch to position 5 (TIP GRD). The meter should give full scale deflection to the right.

(e) Operate the TEST IN-TEST OUT key to the TEST OUT position.

(f) Rotate the selector switch to position 10 (LOOP CAP).

(g) Operate and restore the CAP READ-TEST REVERSE key from CAP READ to normal two or three times. The meter should indicate above 10 on the lower scale.

(h) Restore the selector switch to the OFF position.

(8) **DIAL IN Key Check—**

(a) Insert the hand test telephone (with the switch in the center position) into the test jack.

(b) Operate the DIAL IN-LOW OHMS key to the DIAL IN position. Dial tone is heard.

(c) Dial the digits of the number assigned as the test number in paragraph 5.01 c. (2). Busy tone (60 IPM) is heard in the hand test telephone receiver.

(d) Restore the DIAL IN-LOW OHMS key to normal; remove the hand test telephone plug from the test set jack.

(9) **HOWLER-RING and OUT TALK Keys Check—**

(a) Operate the TEST IN-TEST OUT key to the TEST OUT position.

(b) Rotate the selector switch to position 8 (HOWLER START).

(c) Operate the HOWLER-RING key to the RING position for 2 or 3 seconds.

(d) The local test telephone ringer sounds.

(e) Insert the hand test telephone (with the switch in the center position) into the test set jack.

(f) Operate the OFFICE LINE-OUT TALK key to the OUT TALK position.

(g) Instruct the party answering the test telephone to leave the handset off-hook for a few seconds for the howler test, and to replace the handset on-hook after the howler tone reaches maximum volume.

(h) Restore the OFFICE LINE-OUT TALK key to normal and operate the C switch of the hand test telephone.

(i) Operate the HOWLER-RING key to the HOWLER position.

(j) Rotate the selector switch on the test set from position 7 (HOWLER START) to positions 8, 9, and 10. At position 8, howler tone is heard in the test telephone receiver used in step (g) above. In positions 9 and 10, the level of the howler tone is increased progressively.

(k) When the test telephone is placed on-hook, the howler tone is cut off.

(l) Restore the HOWLER-RING and TEST IN-TEST OUT switches to normal and rotate the selector switch to the OFF position.

(m) Remove the hand test telephone from the test set jack.

(10) Remove the test shoe from the MDF protector block.

l. Positive (+) Booster Battery on Tip:

(1) Rotate the selector switch to position 3 (+BOOSTER VOLTAGE ON TIP).

(2) Connect a +60V battery supply to the T binding post. The test set meter should indicate 60 volts.

(3) Remove the +60V battery connection.

(4) Restore the selector switch to the OFF position.

5.02 Repair and Replacement:

a. Access is gained to the components in the test set by loosening the captive screws in the right-hand upper and lower corners of the front panel and swinging the panel open.

b. The test set components consist of standard relays, capacitors, resistors, and switches. Repair and replacement procedures should be performed in accordance with good basic maintenance practices. Refer to paragraph 6 for identification and part numbers of components and for method of mounting replacement components.

c. When required, relay adjustments should be made to conform with the specifications in Table B. The column headings in Table B indicate the following:

(1) The **RELAY** column lists the relays in each circuit by their functional designations. For example, the designation HL means **howler**; BY means **busy**, etc.

(2) The **BLOCK OR INSULATE** column provides necessary instructions for preparing the relay for testing. For example, when checking the electrical operation, it may be necessary to block another relay (hold it nonoperated) or to insulate between a pair of contacts.

(a) Where the notation (NO) appears in this column, block relay DB (hold it nonoperated) by inserting a toothpick between the core and the armature. Be sure to remove toothpicks when testing is completed.

(b) Where the notation SA (1,2) appears in this column, insulate contact 1 from contact 2 on the SA relay by inserting a piece of bond paper between them. Be sure to remove the paper after testing is completed.

(3) The **TEST WITH** column provides reference to one or more of the following notes:

(a) Positive battery through the test set to the point indicated.

(b) Test set across the points indicated.

(4) The **TEST SET POINT** column lists the relay terminals to which alligator clips of the test cords are connected.

TABLE B. Relay Adjustment for Wire Chief's Type B Test Set Circuit (S-419086)

RELAY	BLOCK OR INSULATE	TEST WITH	TEST SET POINT	RESID (Inch)	TEST WDG	TEST FOR	READJ MA	TEST MA	REMARKS
CB		1	CB (B)	0.006	B-D	O NO	36.0 30.0	40.0 27.0	FIG. 1
HL		1	HL (B)	0.004	B-D	O H R	13.0 8.0 6.8	14.0 8.8 6.4	
MS		2	MS (A+, C-)	0.004	A-C	O NO	9.0 6.5	10.0 6.0	Disconnect wires from terminal MS (A)
DA	DB (NO)	1	DA (A)	0.004	A-C	O NO	11.0 9.0	12.0 8.0	FIG. 2 Disconnect wires from terminal DA (A)
DB		1	DB (A)	0.004	A-C	O NO	37.0 30.0	41.0 27.0	
BY		1	BY (B)	0.004	A-C	O NO	9.5 6.5	10.5 6.0	Disconnect wires from terminal BY (B)
SA		2	SA (A+, C-)	0.006	A-C	O NO R	24.0 20.0 9.5	26.0 18.0 8.5	
SB	SA (1,2)	1	SB (A)	0.004	A-C	O NO	13.0 10.0	14.0 9.0	

(a) If one point is specified, the alligator clip is attached to that terminal only. For example, if the notation CB (B) appears, this means that the alligator clip is attached to terminal B of relay CB.

(b) If two points are specified, one alligator clip is attached to each of the two terminals noted. For example, if the notations MS (A,C) appears, one alligator clip is attached to terminal A and the other to terminal C on relay MS.

(5) The **RESID** (Inch) column lists the minimum operated air gap for each relay. The air gap is determined by the projection of the residual screw.

(6) The **TEST WDG** column designates the winding through which current flows during the test.

(7) The **TEST FOR** column lists relay response for a particular test. Designations appearing in this column are: O (operate); NO (nonoperate); H (hold); R (release). Each designation is associated with current values in the **READJ MA** (milliamperes) and **TEST MA** columns. The designations relate to the current values in the **TEST MA** column as follows:

(a) When the indicated value of current for NO (nonoperate) is flowing through the winding (before operation), the relay should not operate.

(b) When the indicated value of current for O (operate) is flowing through the winding, the relay should operate.

(c) When the indicated value of current for H (hold) is flowing through the winding (after current has been reduced from operate value), the relay should remain operated.

(d) When the indicated value of current for R (release) is flowing through the winding (after the current value has been reduced from the operate value), the relay should release.

(8) The **READJ MA** column indicates the value of current to which the relay must be adjusted if the relay does not meet the requirements in the **TEST MA** column.

(9) The **REMARKS** column lists any pertinent information not listed in the other columns.

d. A relay current flow test set is used to check the relays with respect to the requirements specified in Table B. The procedures for making these tests are:

NOTE: It is not necessary to remove the relay from the test set for the electrical test.

(1) Ensure that battery and ground are connected to the test set.

(2) Ensure that all switches on the test set are in the normal position.

(3) Test the relay with the test current specified.

(4) Check the electrical requirements in the relay adjustment tables. If the mechanical adjustment is correct, the relay should function properly in the circuit.

(5) If the relay does not operate properly on the **TEST MA** column values, readjust the relay to meet the **READJ MA** column values specified.

(6) If the relay does not meet readjust values, check the mechanical adjustments.

e. If required, make mechanical adjustments in the following manner:

(1) If the relay operates on the nonoperated value, increase the tension on the force springs.

(2) If the relay fails to operate on the operate value, decrease the tension on the force springs.

(3) If adjustments cannot be made by adjusting the tension of the force springs, carefully adjust the tension of the movable springs.

(4) If hold or release adjustments cannot be made by adjusting the springs, the setting of the residual screw may be changed; however, residual projection must be perceptible at all times.

5.03 Calibration Routines:

a. Meter Calibration Operation Check: Although the meter is calibrated before leaving the factory, an operational check is recommended prior to initial use and thereafter as often as it appears necessary. When making resistance measurements, the meter should be set to zero before each measurement to ensure accuracy of the check. See (1), (a), (b), and (c) for zero setting procedures. Office battery and

ground must be connected to the test set by way of the terminal block terminals 54 and 58, respectively. The telephone assigned to the test set office must be on-hook and the hand test telephone plug removed from the jack on the front panel of the test set.

NOTE: A resistance decade box is recommended for use in steps (1), (a), and (b) below. If proper indications for resistance checks are not obtained, calibrate the meter according to instructions in paragraph 5.03 b.

(1) Low Resistance Check—

(a) Place the selector switch to position 1 (ZERO ADJ).

(b) Operate the DIAL IN-LOW OHMS key to the LOW OHMS position.

(c) Adjust the ZERO ADJ control of the 0 indication on the meter.

(d) Connect a 500 Ω resistor (that is known to be accurate) across the T and R binding posts.

(e) Rotate the selector switch to position 7 (LOOP).

(f) A midscale deflection of 50 K should be indicated on the resistance scale of the meter. With the LOW OHMS key operated, the scale indication is divided by 100 to obtain the resistance value (50,000 ÷ 100 = 500 Ω).

(g) Remove the 500 Ω resistor from the T and R binding posts and return the LOW OHMS key to normal. Rotate the selector switch to the OFF position.

(2) High Resistance Check—

(a) Place the selector switch to position 1 (ZERO ADJ).

(b) Check that all test keys are in the normal position.

(c) Adjust the ZERO ADJ control for 0 indication on the meter.

(d) Connect a 50,000 Ω resistor (that is known to be accurate) across the T and R binding posts.

(e) Rotate the selector switch to position 7 (LOOP).

(f) A midscale deflection of 50 K should be indicated on the resistance scale of the meter.

(g) Remove the 50,000 Ω resistor from the T and R binding posts. Rotate the selector switch to the OFF position.

(3) Voltage Check and Calibration—

(a) Check that all test keys are in the normal position.

(b) Connect a vacuum tube voltmeter (VTVM), set to the proper DC scale, across terminal 54 (-48 volts) and terminal 58 (+ ground) of the test set terminal block.

(c) Rotate the selector switch to position 2 (TIP BAT).

(d) Connect a wire between terminal 54 (-48 volts) on the terminal block and the T binding post on the front panel of the test set.

(e) The indications on the test set meter and on the VTVM should be identical. If not, adjust RH3 on the back of the test set panel until the test set meter indication matches that of the VTVM.

(f) Lock the RH3 adjustment with a light touch of Glyptal cement, or equivalent.

NOTE: The above procedures can be modified to use any source of DC voltage up to 150 volts, provided the DC voltage value is known accurately. For example, the VTVM could be deleted in favor of the voltage reading on the powerboard meter. It is recommended that the DC voltage source be in the office battery range, i.e., approximately 50 volts.

b. Calibration of Meter for Resistance Readings: Calibration of the meter should not be necessary unless the operational check requirements in paragraph 5.03 a. cannot be met.

(1) Low Resistance (LOW OHMS) Calibration—

(a) Perform steps (1), (a) through (f) above, except in step (1), (c), adjust the ZERO ADJ control to approximately midposition of its range, regardless of the meter indication.

(b) Check that R11 on the back of the panel is adjusted to midposition of its range. If the factory seal is not disturbed, no adjustment is necessary; if the seal is broken, adjust R11 to midposition.

(c) On the back of the panel, alternately adjust R4 and R5 for 50,000 Ω and 0 Ω

indication, respectively. The selector switch must be in position 7 (LOOP) when adjusting R4, and switched to position 1 (ZERO ADJ) when adjusting R5 for 0 Ω indication on the meter. Repeat the adjustments until both indications are accurate. Lock R4 and R11 with a light touch of Glyptal cement, or equivalent.

(d) Remove the 50,000 Ω resistor from the T and R binding posts. Rotate the selector switch to the OFF position.

(2) High Resistance Calibration—

(a) Perform steps (1), (a) through (g) in paragraph 5.03 a. except in step (1), (c), adjust the ZERO ADJ control to approximately midposition of its range.

(b) On the back of the panel, alternately adjust R2 for 50,000 Ω indication on the meter and RH2 for 0 indication. The selector switch must be in position 7 (LOOP) while adjusting R2, and in position 1 (ZERO ADJ) when adjusting RH2. Repeat the adjustments until both indications are accurate. Lock R2 and RH2 with a light touch of Glyptal cement, or equivalent.

(c) Remove the 50,000 Ω resistor from the T and R binding posts. Rotate the selector switch to the OFF position.

6. PARTS IDENTIFICATION AND PARTS LIST

6.01 Parts Identification: Individual components for the Wire Chief's Type B test set can be identified by locating the part on Figure 5 (foldout) and obtaining the associated part identification item number.

6.02 Parts List: Table C lists the part numbers opposite the item numbers referred to in paragraph 6.01 and gives a brief description of the item. Be certain to include all the information provided on Table C to ensure that you will receive the correct replacement part in the fastest possible time.

TABLE C. Replacement Parts List

ITEM	DESCRIPTION	STOCK NO.
1	Cabinet Assembly	303700-499
3	Bracket Assembly	481936-000
4	Binding Post (Red Top)	209572-000
5	Binding Post (Black Top)	209571-000
6	Mounting Plate (Resistor)	302850-362
7	Spacer	481903-000
8	Insulation Strip	481908-000
9	Insulator (Binding Post)	205794-000
10	Relay (MS)	352258-000
12	Relay (HL)	206267-401
13	Relay (CB)	352262-000
14*	Relay (DA)	352263-000
15*	Relay (DB)	352264-000
16*	Relay (BY)	352265-000
17*	Relay (SA)	352266-000
18*	Relay (SB)	352267-000
19	Key Assembly (172-C)	204964-000
20	Key Assembly (173-N)	802621-000
21*	Key Assembly (172-D)	204965-000
22	Key Assembly (172-E)	802619-000
24	Key Assembly,	211367-000
25	Handle	6541-000
26	Capacitor, 2 x 2 μf (C-1, C-2; C-6, C-7)	42375-000
27	R/C Network, 0.5 μf /150 ohms	202895-213
29	Capacitor Bracket	480793-000
30	Resistor, 200 Ω , 25 W (R-9, R-10)	203618-000
31	Resistor, 68K Ω , 1/2 W (R-1)	554001-683
32	Resistor, 1500 Ω , 25 W, (variable (R-2)	203657-000
33	Resistor, 150K Ω , 1/2 W (R-3)	554001-154
34	Resistor, 25 Ω , 25 W, variable (R-4)	205961-000
35	Resistor, 250 Ω , 25 W, variable (R-5)	149224-000
36	Resistor, 510 Ω , 5 W (R-20)	554554-511
37	Diode, SC827 (CR1)	202852-138
39	Bracket, Standoff	302859-101
40**	Key Blank	204279-000
41	Resistor, 2 Ω , 25 W, variable (R-11)	206789-000
42	Resistor, 300 Ω , 10 W (R-13)	554580-301
43	Rheostat, 350 Ω , 25 W (RH-1)	203675-000
44	Rheostat, 70 K Ω , 4 W (RH-2, RH-3)	204916-000
45	Knob	203955-000
46	Meter	202812-499
47	Selector Switch	208249-000
48	Dial (DE 209)	213084-000
49	Dial Plate	208250-000
50	Terminal Block (6 x 10)	211695-000
51	Lamp Socket (No. 13)	801421-000
52	Lamp (48 C)	42201-000
53	Lamp Cap No. 31-A	801412-000
54	Fuse Holder	128008-000
55	Fuse (1-1/2 amp)	21566-000

*Used on MDO Test Set (419086-028) only. **Used on CDO Test Set (419086-018) only.

TABLE C. Replacement Parts List (cont'd)

ITEM	DESCRIPTION	STOCK NO.
56	Spacer	36787-000
57	Jack Assembly (No. 140)	49907-000
58	Designation Holder	205960-000
59	Designation Card	E-73304-63
60	No. Card Package Assembly	204785-012
61**	Impedance Coil (RE)	36299-000
62	Dial Adapter Ring	16321-000
64	Terminal	540570-021
65	Protector (8-5/8 Inches Long)	E-35275-1
66	Paper Strip (8-5/8 Inches Long)	E-73304-22
67	Paper Strip (8-5/8 Inches Long)	E-73304-23
69*	Resistor, 100 Ω , 25 W (R-16, R-19)	149240-000
70*	Resistor, 1000 Ω , 5 W (R-12), (R-14)	554554-102
72	Cable	202017-094
73	Board, Component	202136-061
74	Terminal	202135-335
75	Clamp	540202-006
77	No. 8-32 x 2-1/2 Inches RHIM Screw	506752-000
78	No. 8-32 x 2-1/4 Inches FHIM Screw	506682-000
80	No. 8-32 x 3/4 Inch BHIM Screw	505872-000
82	No. 8-32 x 5/16 Inch SEMS Fastener	207353-000
83	No. 8-32 x 1/4 Inch RHIMS (SEMS)	35746-000
84	No. 6 x 3/8 Inch RHIW Screw	521012-000
85	No. 4-40 x 1-1/4 Inches BHIM Screw	503273-000
86	No. 4-36 x 3/8 Inch SSBH Screw	515423-000
87	No. 4-36 x 3/16 Inch BHIM Screw	515172-000
88	No. 0 x 1/4 Inch PK Drive Screw	205900-000
89	No. 3-48 x 3/8 Inch PHIM Screw	501472-000
90**	No. 4-48 x 1/4 Inch RHIM Screw	513252-000
91	No. 8 Washer (Insulated)	34987-000
92	Lockwasher, (Shakeproof)	526210-000
95	No. 4 Washer, (Shakeproof)	526281-000
96	No. 3 Washer, flat	525502-000
97	No. 8-32 Hex Nut	525152-000
98	No. 4-40 Hex Nut	525122-000
99	3/8-32 Hex Nut	540417-119
100	Bushing	9927-000
101**	No. 4-48 Hex Nut	525232-000
103	3-48 ESNA Nut	540334-115
105	Instruction Manual	SCP 76-001-10
106	No. 6 Washer, flat	525532-000
107	No. 6-32 Hex Nut	525132-000
108	No. 8-32 Speed Nut	302850-412
109	No. 6-32 Speed Nut	540463-006
110	No. 6-32 x 3/8 Inch RHIMS Screw	503852-000

*Used on MDO Test Set (419086-028) only. **Used on CDO Test Set (419086-018) only.

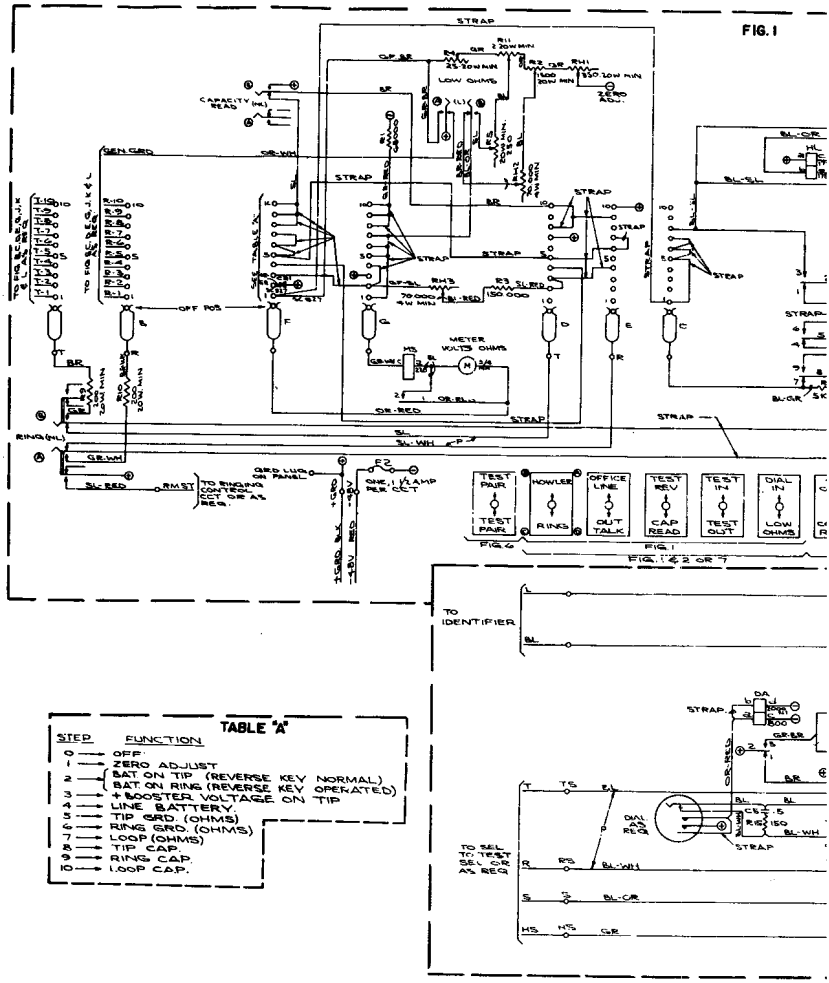


TABLE 'A'

STEP	FUNCTION
0	OFF
1	ZERO ADJUST
2	BAT. ON TIP (REVERSE KEY NORMAL)
	BAT. ON RING (REVERSE KEY OPERATED)
3	+ BOOSTER VOLTAGE ON TIP
4	LINE BATTERY
5	TIP GRD. (OHMS)
6	RING GRD. (OHMS)
7	LOOP (OHMS)
8	TIP CAP.
9	RING CAP.
10	LOOP CAP.

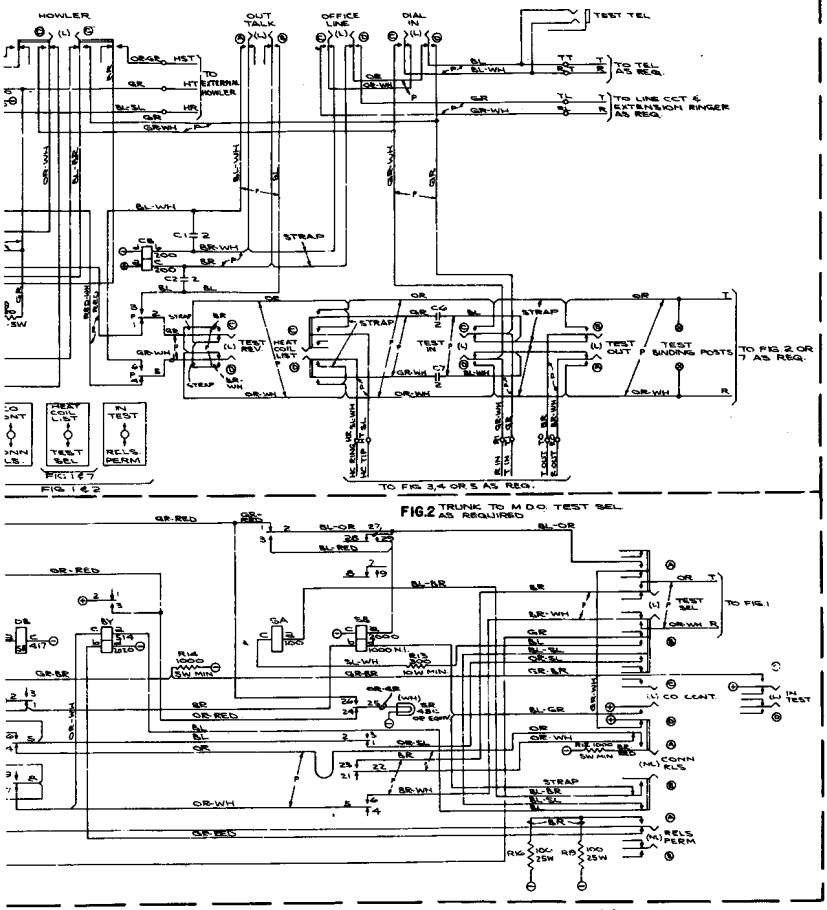


FIGURE 2. Wire Chief's Test Set, Type B, Schematic Diagram (S-419086) (Sheet 1 of 3)

FIG. 3
MDF CORD
AS REQ.

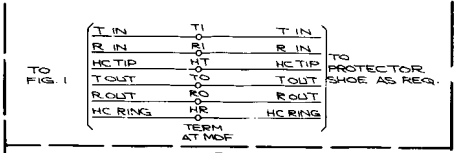


FIG. 4
JACK FIELD TERMINATION
TWIN JACKS

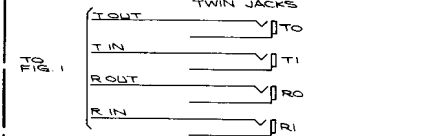


FIG. 5
JACK FIELD TERMINATION
SINGLE JACKS

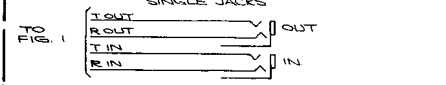


FIG. 6

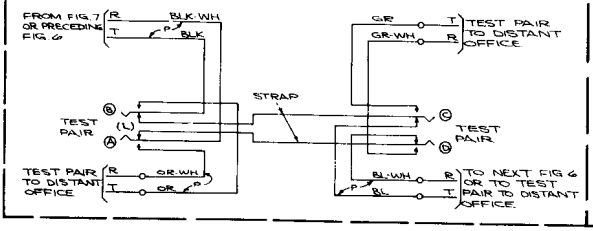
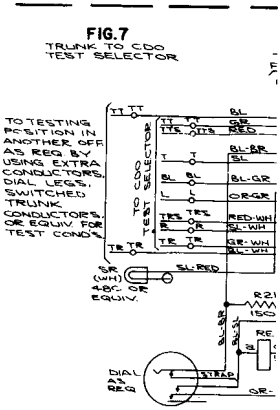
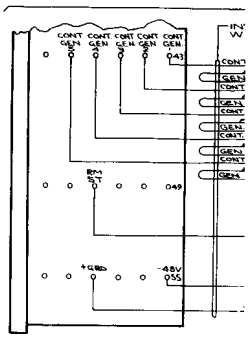


FIG. 7
TRUNK TO CDO
TEST SELECTOR





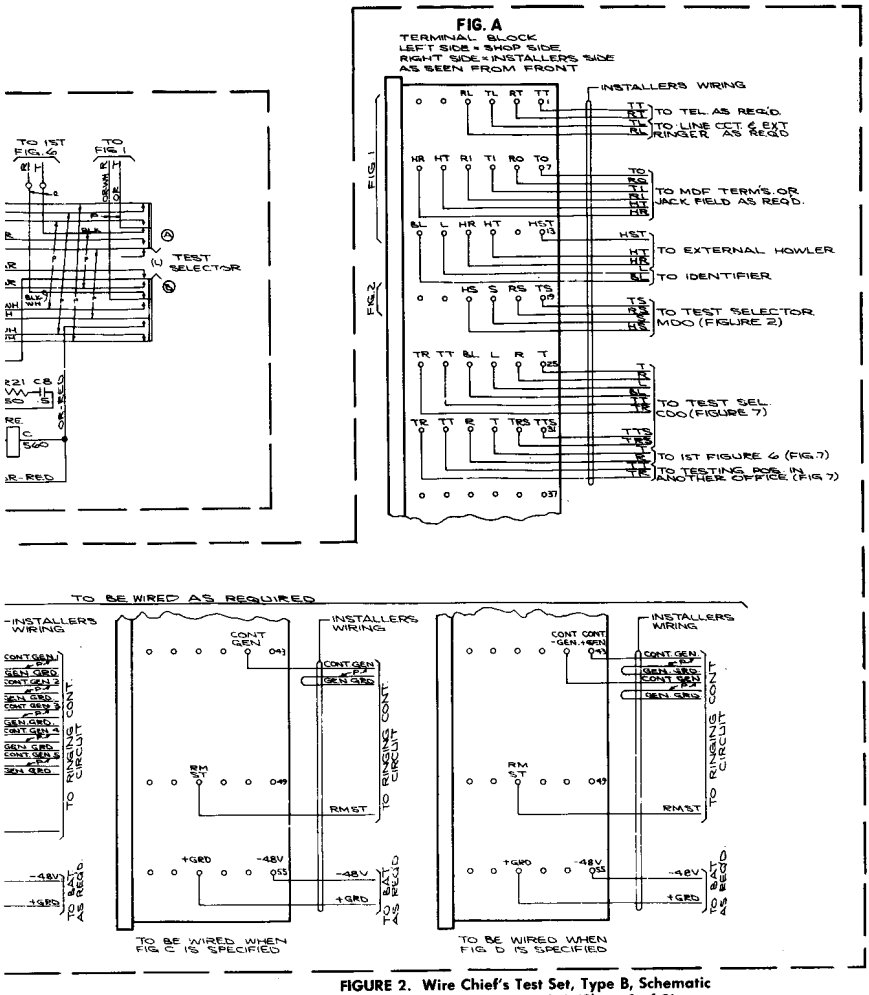


FIGURE 2. Wire Chief's Test Set, Type B, Schematic Diagram (S-419086) (Sheet 2 of 3)

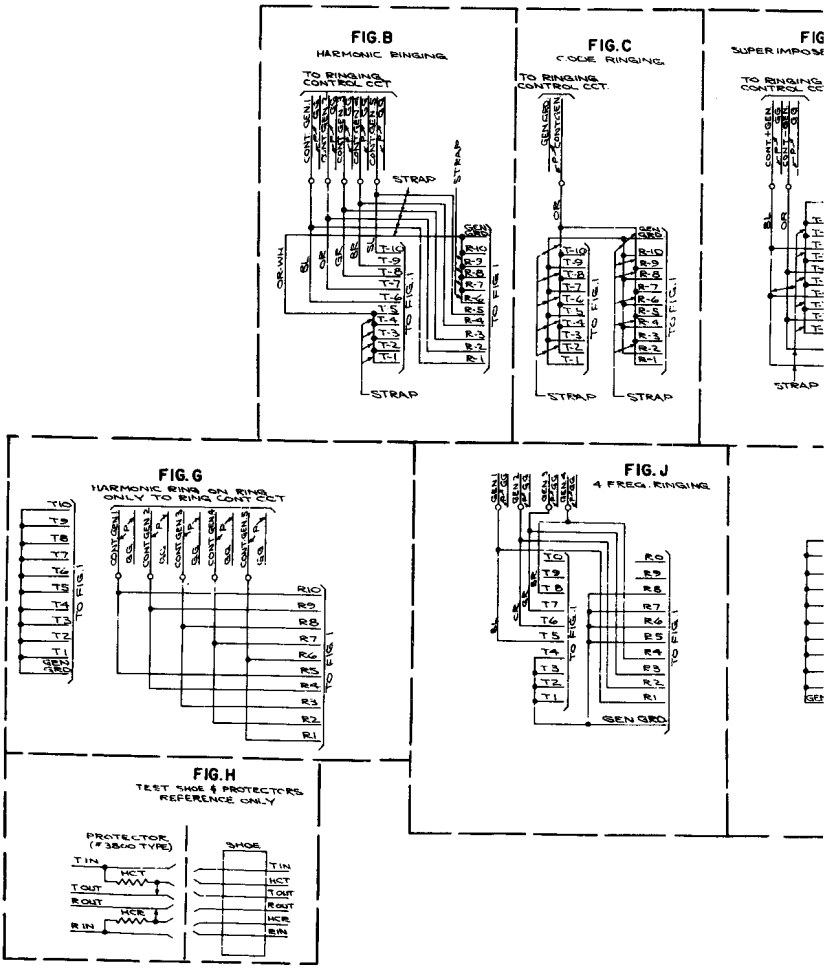


FIG.B
HARMONIC RINGING
TO RINGING CONTROL CCT
STRAP
TO FIG.1
FIG.C
CODE RINGING
TO RINGING CONTROL CCT
STRAP
TO FIG.1
FIG
SUPERIMPOSE
TO RINGING CONTROL CCT
STRAP
FIG.G
HARMONIC RING ON RING ONLY TO RING CONT CCT
TO FIG.1
FIG.J
4 FREQ. RINGING
TO FIG.1
GEN GRD
FIG.H
TEST SHOE & PROTECTORS REFERENCE ONLY
PROTECTOR (#3800 TYPE)
SHOE
T IN
HCT
T OUT
R OUT
HCR
R IN

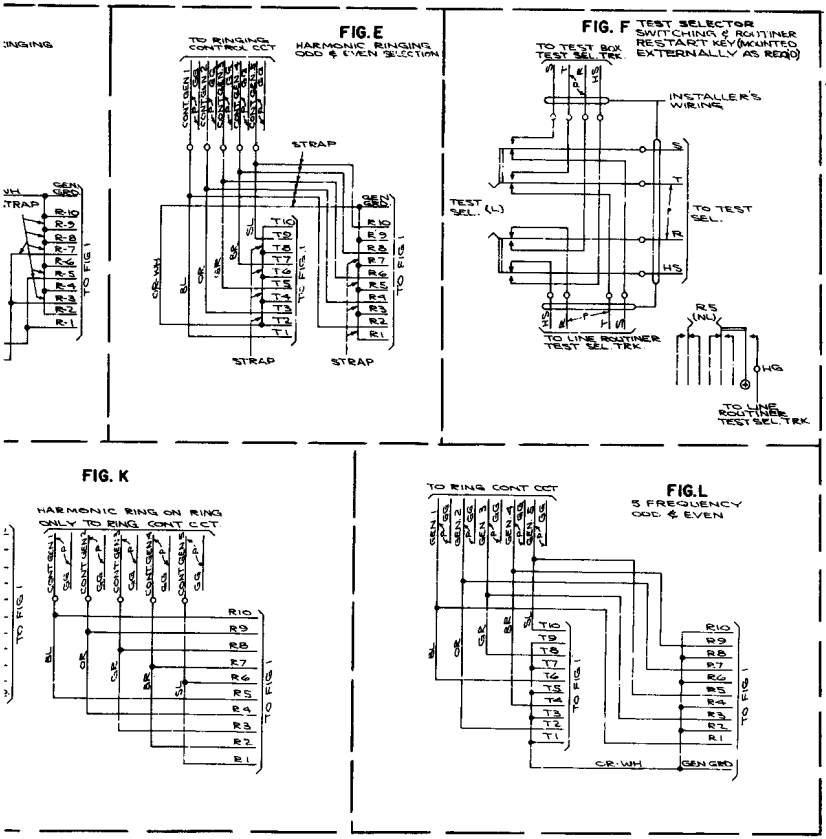
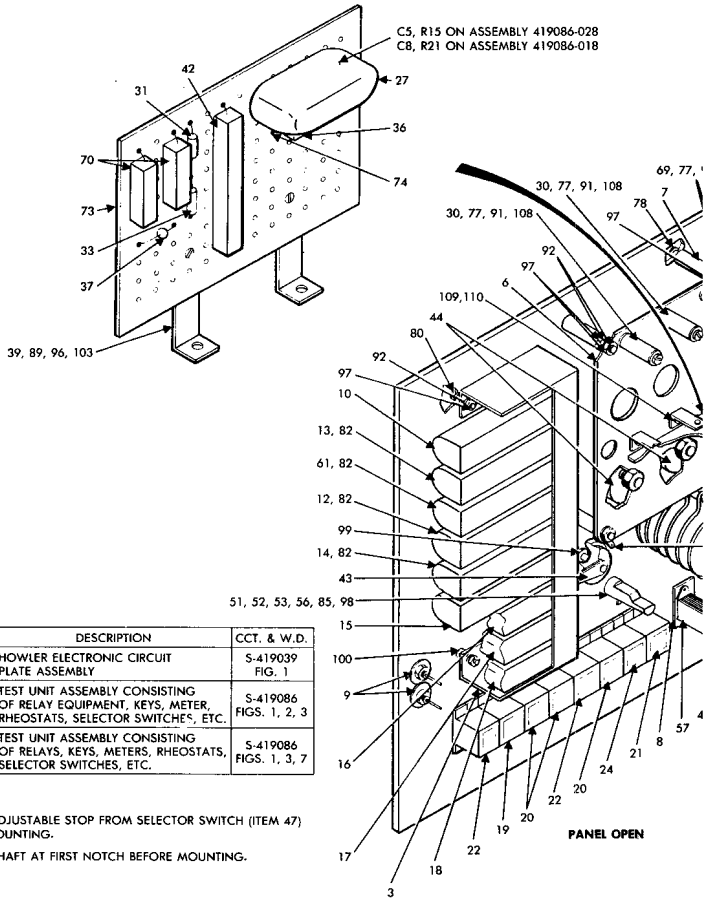


FIGURE 2. Wire Chief's Test Set, Type B, Schematic Diagram (S-419086) (Sheet 3 of 3)



ASSEMBLY	DESCRIPTION	CCT. & W.D.
419039-032	HOWLER ELECTRONIC CIRCUIT PLATE ASSEMBLY	S-419039 FIG. 1
419086-028	TEST UNIT ASSEMBLY CONSISTING OF RELAY EQUIPMENT, KEYS, METER, RHEOSTATS, SELECTOR SWITCHES, ETC.	S-419086 FIGS. 1, 2, 3
419086-018	TEST UNIT ASSEMBLY CONSISTING OF RELAYS, KEYS, METERS, RHEOSTATS, SELECTOR SWITCHES, ETC.	S-419086 FIGS. 1, 3, 7

NOTES:

1 REMOVE ADJUSTABLE STOP FROM SELECTOR SWITCH (ITEM 47) BEFORE MOUNTING.

2 CUT OFF SHAFT AT FIRST NOTCH BEFORE MOUNTING.

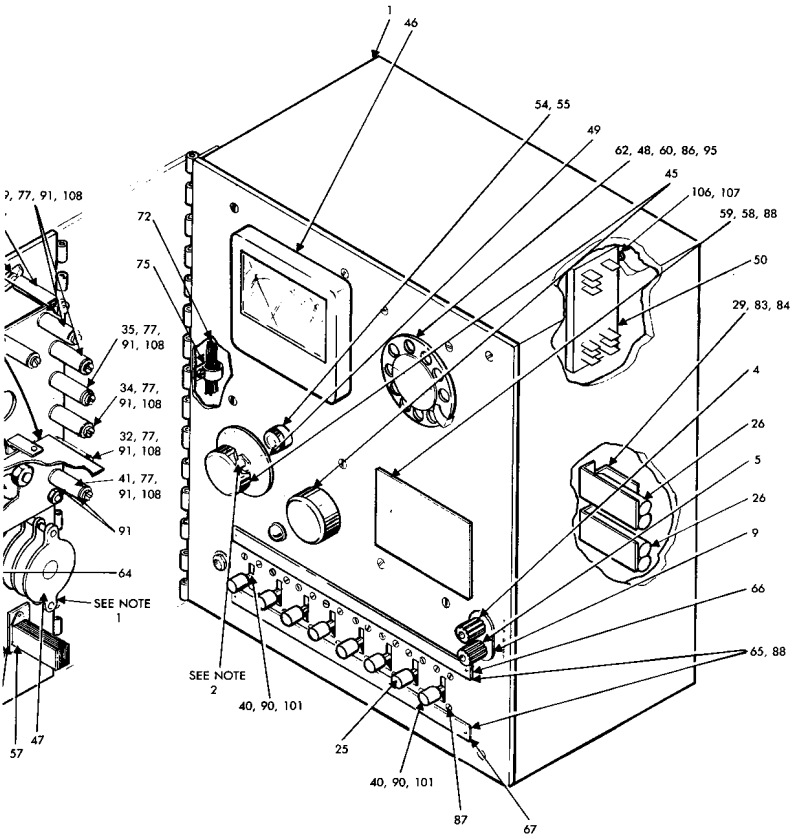


FIGURE 5. Wire Chief's Test Set, Type B, Parts Identification and Modification Details

STROMBERG-CARLSON WIRE CHIEF'S TEST SET—TYPE B 419086-018 AND 419086-028 OPERATION AND TEST PROCEDURES

1. GENERAL

1.01 This practice provides instructions on the operation of and test procedures for the S-C Wire Chief's Test Set, Type B. See Figure 1.

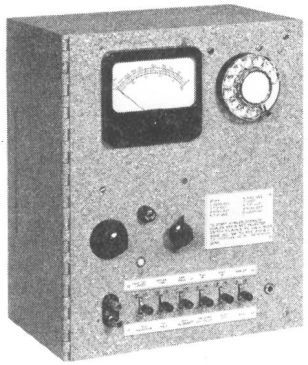


FIGURE 1. Wire Chief's Test Set, Type B

1.02 The test set is used to assist in the testing and troubleshooting of inside and outside plant equipment associated with a dial office.

1.03 An equipment specification may accompany the equipment. If instructions in the equipment specification differ from those in this practice, follow the equipment specification.

1.04 Refer to CTSP 405-110-328 for the description and other information regarding the Type B Wire Chief's test set.

2. TOOLS AND TEST EQUIPMENT

2.01 The following tools and test equipment are required to perform the test procedures in this practice:

a. Hand test telephone, Stromberg-Carlson No. 203685-000, or equivalent.

b. 510Ω resistor (±5%, 1 watt, carbon), Stromberg-Carlson No. 554003-511, or equivalent.

c. 5100Ω resistor (±5%, 1 watt, carbon) Stromberg-Carlson No. 554003-512, or equivalent.

d. 2μf capacitor (+30%, –0%, 200 WVDC), Stromberg-Carlson No. 202886-865, or equivalent.

e. Two test leads, single conductor, terminated in test clips.

3. OPERATING INSTRUCTIONS

3.01 The test set can be connected to the equipment to be tested by one of the following methods:

a. Through a test shoe at the MDF (main distributing frame) protector blocks.

b. By connecting to the binding posts of the test set.

c. By accessing the equipment through a test selector train.

3.02 When using the test set, the selector switch should be in the OFF position unless the operating instructions state otherwise.

3.03 In the test procedures in paragraph 6, the test set is in the **on-hook** condition when the hand test telephone is removed from the TEST TEL jack (or the test telephone C switch is operated) and the test set station telephone handset is resting on the cradle.

CAUTION: If the meter needle deflects to the left when connected to a line to be tested, immediately disconnect from the line (by restoring the last key operated) to prevent damage to the meter.

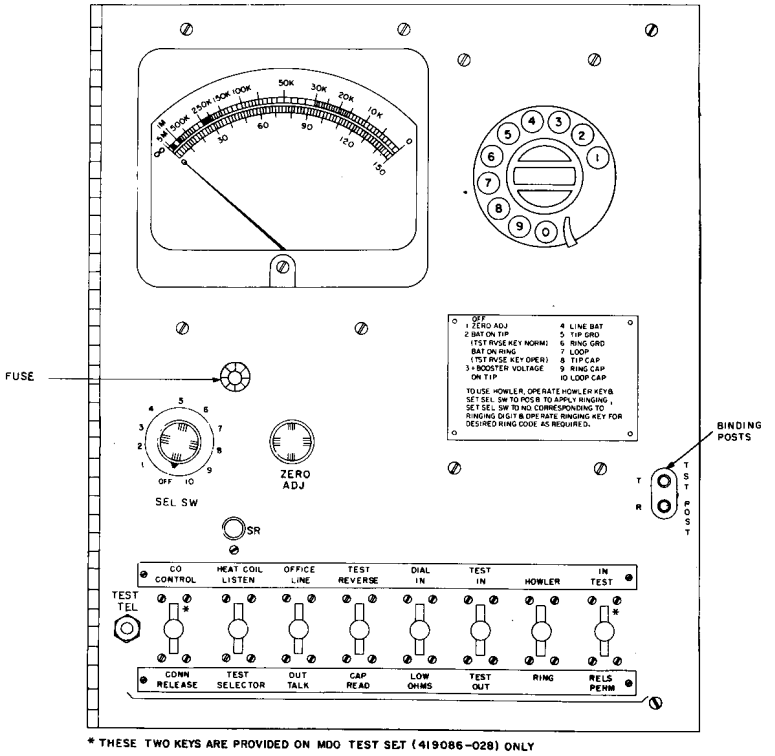
3.04 Controls and Indicators: Tables A through E list the test set controls, indicators, and terminals that are shown in Figure 2 and describe the function of each.

a. Test Keys: Three-position, lever type key switches are used to provide the desired operating condition. The midposition (normal) is off. The operating position is either nonlocking (spring loaded return to midposition upon release), or locking as indicated in Table A.

NOTE: Some positions may not be equipped depending on the model number, options, and whether application is for CDO (community dial office) or MDO (main dial office).

b. Selector Switch: The selector switch is a ganged, seven section, wafer type assembly which can be rotated to any one of eleven positions. The

twelfth terminal of the assembly is for the wiper connection of each section. The first position (extreme counterclockwise) is the OFF position. The other positions of the selector switch are labeled 1 through 10, and the function of each position is listed on the designation card on the front of the test set. When performing the operating procedures in this practice, make certain that the selector switch is in the proper functional position. See Table B.



* THESE TWO KEYS ARE PROVIDED ON MDO TEST SET (419086-028) ONLY

FIGURE 7 Wire Chief's Test Set, Type B, Controls and Indicators

TABLE A. Key Functions

KEY	*FUNCTION*
HEAT COIL LISTEN–TEST SELECTOR	HEAT COIL LISTEN (locking) position–used to test heat coils and to monitor on the MDF trunk circuit. TEST SELECTOR (locking) position–seizes test selector.
OFFICE LINE–OUT TALK	OFFICE LINE (locking) position–connects test telephone jack to line circuit allocated to test set. OUT TALK (locking) position–connects transmission battery to line being tested.
TEST REVERSE–CAP READ	TEST REVERSE (locking) position–reverses tip and ring test set connections to line being tested. CAP READ (nonlocking) position–permits capacitance tests to be made on line being tested.
DIAL IN–LOW OHMS	DIAL IN (locking) position–permits test telephone dial to step XY® dial equipment through test shoe. LOW OHMS (locking) position–permits meter to make low resistance measurements. Also removes generator ground from ringing circuit to permit ringing of some types of station phones when off-hook.
TEST IN–TEST OUT	TEST IN (locking) position–permits testing of inside plant equipment through test shoe. TEST OUT (locking) position–permits testing of outside plant equipment through test shoe.
HOWLER–RING	HOWLER (locking) position–extends howler tone to line being tested. RING (nonlocking) position–applies ringing current to line being tested.
CO CONTROL–CONN RELEASE (MDO ONLY)	CO CONTROL (locking) position–releases CO relay and connects LR relay of line being tested through the test switch train. CONN RELEASE (nonlocking) position–permits release of test connector without releasing test selector.
IN TEST–RLS PERM (MDO ONLY)	IN TEST (locking) position–connects dial to test selector. RELS PERM (locking) position–permits release of a permanently held CO line relay.

c. Indicators: Indicators and their functions are described in Table C.

d. Calibration Controls: The controls described in Table D are used to calibrate the meter. Except for the ZERO ADJ control on the hinged front panel, all others are located on the back of the panel. For more detailed calibration instructions, refer to CTSP 405-110-328, paragraph 5.03.

TABLE B. Selector Switch Functions

CARD DESIGNATION	*SWITCH POSITION*	*FUNCTION*
OFF	OFF	Disconnects meter circuit from testing circuit. [1]
ZERO ADJ	1	Provides circuit for zero set of meter before each resistance measurement.
BAT ON TIP (TST RVSE KEY NORM)	2	Permits testing for battery on tip side of line when TEST REVERSE–CAP READ key is in normal (center) position.
BAT ON RING (TST RVSE KEY OPER)	2	Permits testing for battery on tip side of line when TEST REVERSE–CAP READ key is operated to TEST REVERSE position.
+BOOSTER VOLTAGE ON TIP	3	Permits testing for high voltage (+60 V) on tip side of line.
LINE BAT	4	Permits measurement of potential on line loop.
TIP GRD	5	Permits testing for ground on tip side of line.
RING GRD	6	Permits testing for ground on ring side of line.
LOOP	7	Permits measurement of line loop resistance.
TIP CAP	8	Permits capacitance measurement between tip side of line and ground. Starts operation of howler circuit when HOWLER-RING key is operated to HOWLER position.
RING CAP	9	Permits capacitance measurements between ring side of line and ground.
LOOP CAP	10	Permits measurements of line loop capacitance.
Text	1 thru 10	Connects correct ringing condition for party lines when HOWLER-RING key is operated to RING position.

TABLE C. Indicator Functions

INDICATOR	*FUNCTION*
Volt-Ohmmeter	Upper scale indicates resistance from 0 to infinity. Lower scale indicates DC volts from 0 to 150.
Lamp SR	When lighted, with TEST SELECTOR switch not operated, indicates that test selector is busy and switch should not be operated to TEST SELECTOR position. With switch operated to TEST SELECTOR and last four digits of line number dialed, the condition of the supervisory lamp indicates the following: Lighted steady—line busy (CDO only) 120 IPM flashing—line busy (MDO only) *Note: The following flashing indications are for automatic line test which is a special application. The condition of the supervisory lamp indicates the following:* Lighted steady—line busy. 1 Flash—Battery on line. 2 Flashes—Ground on line. 3 Flashes—Low loop leakage resistance. 4 Flashes—No fault on line.

TABLE D. Calibration Control Functions

CONTROL	*FUNCTION*
ZERO ADJ (RH1)	Used to calibrate meter for 0 ohms before each resistance measurement.
RH2	Used in overall calibrations with RH1 to obtain correct relationship between 0 ohms indication and midscale (50,000 ohms) deflection.
RH3	Used to calibrate meter for 150 volts full scale deflection.
R4, R5, R11	With R11 at midpoint, R4 and R5 are adjusted alternately to obtain 0 ohms (full-scale deflection) and 500 ohms (midscale deflection) when DIAL IN-LOW OHMS key is operated to LOW OHMS position.

e. Terminals, Fuse, and Dial: Table E describes the function of the components listed.

4. OFFICE LINE TEST PROCEDURES

4.01 To place or receive a call on the office line allocated to the test set, the operator can use either a hand test telephone jacked into the test set or the regular station test telephone wired externally to the test set.

TABLE E. Miscellaneous Components

COMPONENT	*FUNCTION*
TST POST, T and R	Test binding posts—permits connection of components to test set for testing purposes. Also permits connection of test equipment (Wheatstone bridge, dial speed test set, etc.) to expand capabilities of test set.
TEST TEL Jack	Switchboard—type jack—permits connection of hand test telephone to test set for answering, monitoring, or placing calls over office line.
Fuse	Protects test set against current overload.
Dial	Permits stepping of test train through test selector trunk.

4.02 Placing a Call with the Hand Test Telephone:

a. Operate the OFFICE LINE key.

b. Insert the plug of the hand test telephone into the TEST TEL jack.

c. Listen to the receiver of the hand test telephone.

d. When dial tone is heard, dial the desired number, using the dial on the hand test telephone.

e. When the call is completed:

(1) To place another call immediately, operate the C button on the hand test telephone; then release the button, listen for dial tone, and dial the desired number.

(2) If further calls are not desired, remove the hand test telephone plug from the TEST TEL jack and restore the OFFICE LINE key to normal.

4.03 Placing a Call Using the Station Test Telephone:

a. Operate the OFFICE LINE key.

b. Remove the handset of the station test telephone and listen to the receiver.

c. When dial tone is heard, dial the desired number, using the dial on the test telephone.

d. When the call is completed:

(1) To place another call immediately, depress the hookswitch on the test telephone. Release the hookswitch, listen for dial tone, and dial the desired number.

(2) If further calls are not desired, restore the handset of the test telephone and restore the OFFICE LINE key to normal.

4.04 Answering An Incoming Call: When the extension ringer sounds, it indicates an incoming call. To answer the call:

a. Operate the OFFICE LINE key.

b. Insert the plug of the hand test telephone into the TEST TEL jack, or remove the handset of the station test telephone and talk to the calling party.

c. When the call is completed:

(1) Restore the OFFICE LINE key.

(2) Remove the plug of the hand test telephone from the TEST TEL jack, or restore the handset of the station test telephone.

5. TEST SHOE TEST PROCEDURES

5.01 Test Connection: Tests can be made from the test set on all lines and trunks that are connected at the protector blocks of the main distributing frame (MDF) by using the test shoe. To connect the test set to a line or trunk, first ensure that all keys on the test set are normal; then insert the test shoe into the protector block of the line or trunk. If the test set MDF trunk is terminated in a jack field instead of a test shoe, the line to be tested must be patched to the jack field.

5.02 Preliminary (Monitoring) Test: Before making any test on a line or trunk, monitor from the test set to determine if the line or trunk is in use, as follows:

a. Go off-hook with the test telephone by inserting the plug of the hand test telephone (with the R switch operated) into the TEST TEL jack; or removing the handset from the station test telephone.

b. Operate the HEAT COIL LISTEN key and listen to the receiver.

c. If the line or trunk is busy, restore the HEAT COIL LISTEN key and go on-hook with the test telephone by removing the hand test telephone from the TEST TEL jack (or operating the C switch); or, if the station telephone was used in this test, replacing the handset on the cradle.

d. If the line or trunk is idle, proceed as instructed in paragraphs 5.03 through 5.10 for the type of test required.

5.03 Testing Outside Plant:

a. Monitor the line as instructed in paragraph 5.02; then go on-hook.

b. Restore the HEAT COIL LISTEN key.

c. Operate the TEST OUT key.

d. Refer to paragraphs 8 through 17 and perform the required tests as instructed.

e. When testing is completed, restore all keys to normal and remove the test shoe.

5.04 Testing Inside Plant Bypassing Heat Coils:

a. Monitor the line as instructed in paragraph 5.02; then go on-hook.

b. Operate the TEST IN key.

c. Refer to paragraphs 8 through 17 and perform the required tests as instructed.

d. When testing is completed, restore all keys to normal and remove the test shoe.

5.05 Testing Inside Plant Through Heat Coils:

a. Monitor the line as instructed in paragraph 5.02; then go on-hook.

b. Refer to paragraphs 8 through 17 and perform the required tests as instructed.

c. When testing is completed, restore all keys to normal and remove the test shoe.

5.06 Outgoing Call Through Outside Plant:

a. Monitor the line as instructed in paragraph 5.02; then go on-hook.

b. Restore the HEAT COIL LISTEN key.

c. Operate the TEST OUT key.

d. Set the selector switch to the number corresponding to the ringing digit of the party to be called.

e. Operate the RING key. (Operate the key momentarily, or operate the key intermittently to produce the desired ringing code.)

f. After about 3 seconds, momentarily reoperate the RING key; or repeat the ringing code.

g. Go off-hook with the test telephone.

h. Operate the HEAT COIL LISTEN key and monitor the line to determine if the called party has answered.

i. When the called party answers, restore the HEAT COIL LISTEN key to normal.

j. On lines that require transmission battery, operate the OUT TALK key.

k. Proceed with the conversation.

l. When the conversation is finished, restore all keys to normal.

m. Go on-hook with the test telephone.

n. Remove the test shoe.

5.07 Originating Calls Through Dial Equipment—Regular Lines or Trunks:

a. Monitor the line as instructed in paragraph 5.02 and stay off-hook.

b. Restore the HEAT COIL LISTEN key.

c. Operate the DIAL IN key.

d. Dial the desired number using the dial on the test telephone.

e. When dialing is completed, the dial equipment rings the called party.

f. When the called party answers, the dial equipment supplies transmission battery to the test set telephone and to the called telephone.

g. Proceed with the conversation.

h. When the conversation is finished, restore all keys to normal.

i. Go on-hook with the test telephone.

j. Remove the test shoe.

5.08 Originating Calls to PBX Lines or Special Lines: When testing a PBX line circuit (or any other circuit that does not furnish ground on the tip side of the line), proceed as follows:

a. Connect ground to the R terminal of the TST POST.

b. Go off-hook with the test telephone.

c. Operate the DIAL IN key.

d. Operate the TEST IN key.

e. When dial tone is heard, restore the TEST IN key to normal.

f. Operate the TEST OUT key.

g. Proceed as instructed in paragraph 5.07, steps d. through j.

h. Remove ground from the R terminal.

5.09 Originating Calls Through Incoming Ringdown Trunks:

a. Monitor the trunk as instructed in paragraph 5.02; then go on-hook.

b. Restore the HEAT COIL LISTEN key.

c. Operate the TEST IN key.

d. Momentarily operate the RING key.

e. Go off-hook with the test telephone.

f. When the switchboard operator answers, proceed with the conversation.

g. When the conversation is finished, restore all keys to normal.

h. Go on-hook with the test telephone.

i. Remove the test shoe.

5.10 Originating Calls Through Incoming Common Battery Trunks:

a. Restore the HEAT COIL LISTEN key.

b. Operate the TEST IN key.

c. Operate the DIAL IN key.

d. When the switchboard operator answers, proceed with the conversation.

e. When the conversation is finished, restore all keys to normal.

f. Go on-hook with the test telephone.

g. Remove the test shoe.

6. TEST SELECTOR—MDO TEST PROCEDURES

6.01 Tests can be made on any line or trunk terminated on selector or connector banks in the MDO by using the test selector trunk from the MDO test set. The supervisory lamp (SR) on the front panel lights when the test selector is seized from the test set or the operator's switchboard. Testing should not be attempted when the test selector is already seized from the operator's switchboard.

6.02 Connecting to the Line:

a. Turn the selector switch to the OFF position.

b. Operate the TEST SELECTOR key. The supervisory lamp lights, indicating that the test selector is ready to receive dial pulses.

c. Use the test set to dial the last four digits of the desired number. If the supervisory lamp flashes at 120 IPM, the line is busy; if the lamp remains lighted, the test connector is busy; if the lamp extinguishes, the line is free for testing.

d. If the line is busy (120 IPM flashes), monitor the line to determine whether conversation is in progress or whether a fault condition is holding the line circuit. Monitor as follows:

(1) Operate the DIAL IN and TEST IN keys.

(2) Go off-hook with the test telephone and listen to the receiver.

e. If the test connector is busy (lamp remains lighted), restore the TEST SELECTOR key and try again later.

f. If the line is idle (supervisory lamp extinguishes), apply tests by operating the appropriate keys on the test set.

6.03 Stepping to the Next Line or Level: After completing the tests on a line, the connector can be stepped to the next line by dialing the digit 1 with the test set dial while the DIAL IN and TEST IN keys are operated.

6.04 Releasing the Test Connector: The test set can be connected for testing on a line within a different level (tens group) by releasing the test connector without releasing the test selector. To do this, operate the CONN RLS key, then dial the last two digits of the desired number. The supervisory lamp indications and test functions are as described in paragraph 6.02. To access lines within a different hundreds connector group, both the test selector and test connector must be released. To do this, restore the TEST SELECTOR key to normal and repeat the procedures described in paragraph 6.02.

6.05 Release Permanent: If the supervisory lamp on the test set is lighted after a line has been restored to normal, momentarily operate the RLS PERM key. This releases the battery feed relay so that tests can be made on the T and R leads.

6.06 Inward Test—Regular Lines and Trunks:

a. Operate the TEST SELECTOR key and use the test set dial to dial the desired number.

b. After the supervisory lamp extinguishes (indicating that the test selector has stepped to the desired line):

(1) Operate the IN TEST key and then the CO CONT key.

(2) Go off-hook with the test telephone.

(3) Operate the DIAL IN and TEST IN keys.

(4) Restore the IN TEST key to normal.

(5) Dial the desired line number, using the test telephone dial.

c. Operate the appropriate keys for the desired test.

d. To release from the inward test, the following sequence of operation must be observed to prevent locking up the switchtrain connection:

(1) Go on-hook with the test telephone.

(2) Restore the TEST IN key to normal.

(3) Restore the CO CONT key to normal.

6.07 Inward Test—PBX and Special Lines: When testing PBX lines (or any other circuit that does not furnish ground on tip), use the following procedure:

a. Connect ground to the R binding post of the test set.

b. Go off-hook with the test telephone.

c. Operate the DIAL IN and TEST IN keys.

d. Operate the CO CONT key.

e. When dial tone is heard, remove the ground connection from the R binding post.

f. Use the dial on the test telephone to dial the digits of the desired line number.

g. Operate the appropriate keys for the desired test.

h. To release from the test connection, go on-hook with the test telephone; then restore the CO CONT key to the normal position.

7. TEST SELECTOR—CDO TEST PROCEDURES

7.01 Tests can be made on any line or trunk terminated on the selector or connector banks in the CDO by using the test selector trunk from the CDO test set. The supervisory lamp (SR) on the front panel lights when the test selector is seized from the test set or the operator's switchboard. Testing procedures should not be attempted when the test selector is already seized from the operator's switchboard.

7.02 Connection to a Line:

a. Turn the selector switch to the OFF position.

b. Operate the TEST SELECTOR key. The supervisory lamp lights, indicating that the test selector is ready to receive dial pulses.

NOTE: The dial on the test set controls the test train only and should not be used in an attempt to control the regular central office dial equipment for inward tests.

c. Use the test set dial to dial the last four digits of the desired line number. If the supervisory lamp remains lighted, the line is busy; if the supervisory lamp extinguishes, the line is free for testing.

d. If the line is busy, monitor to determine whether conversation is in progress or whether a fault condition is holding the line circuit. Monitor the line as follows:

(1) Operate the DIAL IN and TEST IN keys.

(2) Go off-hook with the test telephone and listen to the receiver.

e. If the line is free, go on-hook with the test telephone and make tests by operating the appropriate keys on the test set.

8. BINDING POSTS TEST PROCEDURES

8.01 The binding posts, designated TST POST T and R (see Figure 2), can be used for two different purposes:

a. Components or equipment to be tested can be connected to the binding posts so that tests may be applied from the test set.

b. External test equipment (e.g., Wheatstone bridge, dial speed test set, etc.) can be connected to the binding posts to increase the capability of the test for testing lines and equipment through the test shoe or test selector train.

8.02 When the test set is used for testing components connected to the binding posts, the following particular type of test condition is applied:

a. Potential Tests:

(1) Connect the equipment to be tested to the binding posts.

(2) Refer to paragraphs 11 through 16 and select the test to be performed.

(3) Disconnect the equipment from the binding posts when testing is completed.

b. Ringing:

(1) Turn the selector switch to the required ringing digit (see paragraph 5.06).

(2) Connect the equipment to be tested to the binding posts.

(3) Operate the RING key to apply the required ringing frequency to the equipment connected to the binding posts.

(4) Restore the RING key to remove the ringing.

(5) Disconnect the equipment from the binding posts when testing is completed.

c. Transmission Battery:

(1) Connect the equipment to be tested to the binding posts.

(2) Go off-hook with the test telephone.

(3) Operate the OUT TALK key to connect battery and ground to the component by way of the R and T binding posts, respectively.

(4) Restore the OUT TALK key to disconnect the transmission battery supply.

(5) When testing is completed, go on-hook with the test telephone.

(6) Disconnect the equipment from the binding posts.

d. Dialing:

(1) Connect the equipment to be dial pulsed to the binding posts.

(2) Go off-hook with the test telephone.

(3) Operate the DIAL IN key.

(4) Operate the TEST IN key.

(5) Dial the desired number on the test telephone dial to apply dial pulses to the equipment connected to the binding posts.

(6) When the pulsing test is completed, go on-hook with the test telephone.

(7) Restore all keys to normal.

(8) Disconnect the equipment from the binding posts.

8.03 Auxiliary test equipment is connected to the binding posts after the preliminary test path has been set up through the test shoe (see paragraph 5) or through the test selector train (see paragraph 6 or 7). When using the test selector train, the TEST OUT key must be operated to connect the auxiliary test equipment to the test train.

9. HEAT COIL TEST PROCEDURES

9.01 To check the condition of the heat coils, proceed as follows:

a. Position the selector switch to the OFF position.

b. Go off-hook with the test telephone.

c. Operate the HEAT COIL LISTEN key and listen to the receiver. If the line is busy, try again later.

d. If there is no conversation on the line, operate the TEST OUT and OUT TALK keys.

e. If dial tone is heard in the receiver, the heat coils are not open.

10. METER CALIBRATION

10.01 Before making a resistance test, zero set the meter in accordance with the following steps to ensure accuracy of the readings. (If the proper indications are not obtained, refer to CTSP 405-110-328, paragraph 5.03 for more detailed calibrating procedures.)

a. Rotate the selector switch to position 1 (ZERO ADJ).

b. If a resistance below 5000Ω is to be measured, operate the LOW OHMS key.

c. Adjust the ZERO ADJ control so that the meter needle indicates 0 on the resistance scale.

11. TESTING FOR NEGATIVE BATTERY ON THE TIP OR RING LEAD

CAUTION: If the meter needle moves off-scale (left) during the following procedures, disconnect immediately from the line being tested.

11.01 Proceed as follows:

a. For testing on the tip lead, rotate the selector switch to position 2. For testing on the ring lead, rotate the selector switch to position 2 and operate the TEST REVERSE key.

b. Connect to the line or trunk by using the test shoe or test selector train. Refer to paragraph 5, 6, or 7.

c. If there is a negative battery potential on the lead, the meter needle will indicate the voltage value on the lower scale of the meter.

d. If the meter needle does not move, the lead is either open or free of battery potential.

e. Upon completion of the test, restore all keys to normal and disconnect the test shoe or test selector train.

12. TESTING FOR + BOOSTER VOLTAGE ON THE TIP

CAUTION: If the meter needle moves off-scale (left) during the following procedures, disconnect immediately from the line being tested.

12.01 Proceed as follows:

a. Rotate the selector switch to position 3.

b. Connect to the line or trunk by using the test shoe or test selector train. Refer to paragraph 5, 6, or 7.

c. If there is a positive battery potential on the tip lead, the meter needle will indicate the voltage value on the lower scale of the meter.

d. If the meter needle does not move, the lead is either open or free of battery potential.

e. Upon completion of the test, restore all keys to normal and disconnect the test shoe or test selector train.

13. MEASURING LINE BATTERY VOLTAGE

13.01 To measure the battery voltage around the T and R loop of a line, rotate the selector switch to position 4 and follow the same testing procedures described in paragraph 12. With the selector switch in position 4, the meter reading shows the battery voltage on the line loop.

14. TESTING FOR GROUND ON TIP OR RING

14.01 Proceed as follows:

a. Zero set the meter as described in paragraph 10.

b. Rotate the selector switch to position 5 for measuring ground on the tip lead, or to position 6 for measuring ground on the ring lead.

c. Connect to the line or trunk by using the test show or test selector train. Refer to paragraph 5, 6, or 7.

d. If there is a ground on the line, the resistance to ground will be indicated on the upper scale of the meter.

e. If the meter needle does not move, it indicates that the lead is either open or not grounded.

f. Upon completion of the test, restore all keys to normal and disconnect the test shoe or test selector train.

15. MEASURING LINE LOOP RESISTANCE AND LEAKAGE

15.01 Proceed as follows:

a. Rotate the selector switch to position 7.

b. Connect to the line or trunk by using the test shoe or test selector train. Refer to paragraph 5, 6, or 7.

c. With the telephone at the far end **on-hook**, the meter reading indicates the leakage resistance of the line.

d. Compare this reading with the resistance shown on the line record card to determine if the line is faulty.

e. With the telephone at the far end **off-hook**, the meter reading indicates the loop resistance of the line. If the meter needle indicates 5000Ω or less, operate the LOW OHMS key and divide the meter indication by 100 to obtain the actual loop resistance.

f. Compare this reading with the resistance shown on the line record card to determine if the line is faulty.

g. Upon completion of the test, restore all keys to normal and disconnect the test shoe or test selector train.

16. MEASURING LINE CAPACITY

16.01 When testing the capacity of a line, the telephone at the far end should be **on-hook**. Proceed as follows:

a. Tip to Ground Capacitance:

(1) Rotate the selector switch to position 8.

(2) Connect to the line or trunk by using the test shoe or test selector train. Refer to paragraph 5, 6, or 7.

(3) Rapidly operate and restore the CAP READ key several times.

(4) While performing step (3), observe the meter needle and record the maximum reading observed on the lower scale of the meter.

(5) Restore the CAP READ key.

(6) Compare the recorded reading with the DEFLECTION column in Table F to obtain the capacitance reading (CAPACITY column).

(7) Upon completion of this test, either proceed with other tests or restore all keys to normal.

b. Ring to Ground Capacitance: The procedures for measuring ring capacitance are identical to those for measuring tip capacitance (a. above), except that the selector switch is turned to position 9 on the test set.

c. Loop Capacitance:

(1) Rotate the selector switch to position 10.

(2) Rapidly operate and restore the CAP READ key several times.

(3) While performing step (2), observe the meter needle and record the maximum reading observed on the lower scale of the meter.

(4) Restore the CAP READ key.

(5) Subtract the tip capacity reading (obtained in paragraph 16.01, a.) from the loop capacitance reading obtained in step (3) above. The result is the loop capacity.

(6) Compare the recorded reading with the DEFLECTION column in Table F to obtain the capacitance reading (CAPACITY column).

(7) Upon completion of this test, either proceed with other tests or restore all keys to normal.

d. Converting Meter Deflections to Capacitance: Table F lists typical readings

TABLE F. Conversion of Meter Deflection to Capacity Value

DEFLECTION (in volts)	*CAPACITY (in μf)*	*DEFLECTION (in volts)*	*CAPACITY (in μf)*	*DEFLECTION (in volts)*	*CAPACITY (in μf)*
19	0.5	36	1.0	110	6.0
22	0.6	62	2.0	116	7.0
26	0.7	78	3.0	122	8.0
30	0.8	94	4.0	128	9.0
32	0.9	102	5.0	132	10.0

obtained on the lower scale of the meter and the approximate capacitance in microfarads to which they are equal.

17. GENERATOR GROUND CUT-OFF

17.01 The test key which controls generator ground cut-off is the same key that controls application of the circuits to obtain LOW OHMS. However, the circuits for each function are different and separate. Generator ground cut-off is used on lines having subsets which do not remove ringers from the line when the phone is off-hook, or on lines having telephones equipped with varistors connected across the receiver.

17.02 To signal a customer who has left his telephone off-hook, the usual howler method would be ineffective. To signal such a customer, the LOW OHMS key is operated and ringing is applied to the line by operation of the RING key. Operation of the LOW OHMS key removes the shunt across the ringer of the off-hook telephone so that the telephone can be rung without ringing current damaging the receiver.

18. HOWLER

18.01 Except as noted in paragraph 17, the howler is used to try to alert a customer whose telephone is off-hook. Either an internal howler or an external howler is supplied. Generally, the internal howler is adequate for smaller offices, and the external howler is used when many lines must be covered. Both howlers are automatic to the extent that the rising and falling tone will continue until the telephone is placed on-hook; then howler operation will cease automatically.

18.02 If the telephone is not placed on-hook, the testman should stop howler operation by restoring the HOWLER key and recheck at a later time.

WILCOM T-136B CIRCUIT TEST SET
DESCRIPTION AND OPERATION

1. GENERAL

1.01 This practice provides the description of and operating procedures for the Wilcom T-136B Circuit Test Set.

1.02 The T-136B circuit test set measures circuit loss (dbm), transmitter current (ma), power influence (dbrnC) [equivalent to **noise to ground**] and circuit noise (dbrnC) [equivalent to **noise metallic**]. This compact, portable test set is capable of measuring the significant transmission characteristics of a subscriber loop.

1.03 The test set has a color coded scale which facilitates **go, no-go** testing and decision making.

1.04 The input impedance (terminating) is 735 Ω, which is the geometric mean between 600 and 900 Ω. The set indicates correctly on either 600 or 900 Ω circuits.

2. DESCRIPTION

2.01 The operation of the test set is controlled by a single function switch located in the center of the front panel. See Figure 1.

a. A dialing and hold arrangement makes it possible to dial a remote test line when the function switch is in the DIAL & LINE MA position, and to hold the connection in all measurement positions of the function switch. Square posts are provided for connecting a dial telephone handset to the test set. The hold coil provides a DC resistance of about 225 Ω with an AC impedance high enough to have no significant effect on the measurements.

b. The type of measurement is selected by the function switch. The DC line current may be measured when the function switch is in the DIAL & LINE MA position. The meter includes a scale calibrated from 0 to 100 ma in 5 ma increments.

c. The next position is CKT LOSS which provides a means for measuring (on a terminated basis) the level of a tone received from a 1 mw reference tone source over a level range of -15 dbm to +3 dbm on a color segmented meter scale. Measurements may be made at frequencies other than 1 kHz as the CKT LOSS response characteristic is flat from 300 Hz to 15 kHz; 60 Hz is attenuated more than 30 db.

d. The next position of the function switch is designated CKT NOISE which provides additional sensitivity for measuring noise metallic on a C-message weighted basis. The color segmented meter scale for this measurement extends from 33 dbrnC to 15 dbrnC.

e. The third position of the function switch is designated PWR INFL (power influence) which provides a means for measuring noise voltages between a circuit and ground on a C-message weighted basis. The input circuit in this position has an impedance of about 200,000 Ω between the input terminals and over 100,000 Ω between either input terminal and ground. The noise to ground level is measured on the same color segmented scale as CKT NOISE, but the range of measured noise is now arranged for the normal range of power influence measurements. The scale extends from 93 dbrnC to 75 dbrnC.

f. In most conventional noise measuring sets, 40 db is added to the noise to ground measurements to take into account the difference between noise metallic and noise to ground measurement circuits. The PWR INFL scale on the meter is calibrated to provide the absolute value; therefore, it is not necessary to add 40 db to the measurement.

g. A nonlocking pushbutton switch is provided to add 20 db attenuation to the input signal, if the signal level is sufficient to cause the meter to read off scale. In most cases, operation of the switch will bring the meter pointer back on scale; consequently, the T-136B test set has a range of measurement of about 35 db.

h. A phone jack is provided to enable the tester to listen to the signals being measured without interfering with the measurements. The jack accepts the standard 310 type plug, the normal termination of the 723A receiver, and W2FS cord.

i. Three 4-foot leads, equipped with clips and colored green for tip, red for ring, and yellow for ground, are permanently attached to the set.

j. A nonlocking pushbutton switch is used to supply power to the measuring circuits from two small 9-volt batteries. No current is supplied by the batteries until the switch is depressed to take a

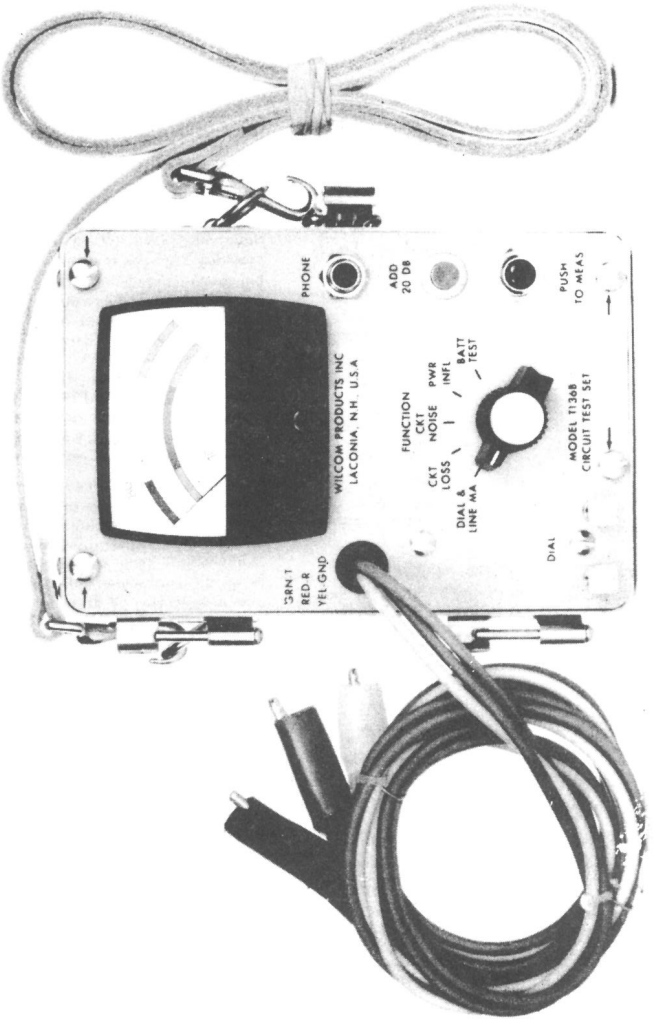

PHONE
ADD
20 DB
PUSH
TO MEAS
WILCOM PRODUCTS INC
LACONIA N.H. U.S.A.
FUNCTION
CKT
NOISE
PWR
INFL
BATT
TEST
CKT
LOSS
DIAL &
LINE MA
MODEL T1368
CIRCUIT TEST SET
DIAL
GRN-T
RED-R
YEL-GND

FIGURE 1.

reading. Therefore, the useful life of the batteries approaches shelf life as the ON period is usually very short. The set cannot be left ON inadvertently.

k. The physical dimensions of the test set are 4-3/8 inches wide by 6-3/8 inches long by 4-7/8 inches high. The weight is 3 pounds.

3. CHARACTERISTICS

3.01 The response of the T-136B test set in the CKT LOSS function is flat from 300 Hz to 15,000 Hz; 60 Hz is attenuated more than 30 db.

3.02 When measuring PWR INFL or CKT NOISE, the test set exhibits the C-message weighting characteristic.

3.03 Figure 2 shows a block diagram of the T-136B test set.

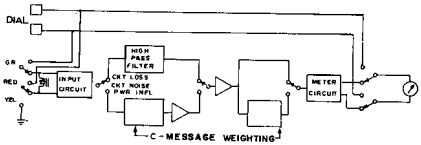


FIGURE 2. Block Diagram

3.04 A schematic of the input circuit for the three modes of the test set are shown in Figures 3, 4, and 5.

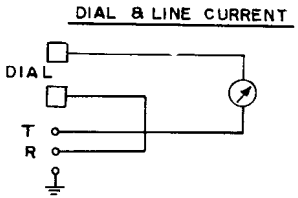


FIGURE 3. Input Circuit

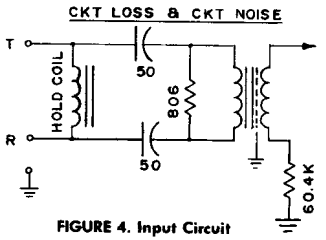


FIGURE 4. Input Circuit

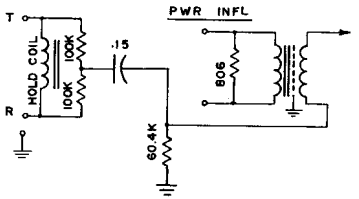


FIGURE 5.

3.05 A schematic of the T-136B test set is shown in Figure 6 (fold-out).

4. TEST SET OPERATION

4.01 The measurement ranges of the T-136B test set are designed to be within the normally acceptable limits of circuit loss, noise metallic, and noise to ground. The colored segments of the meter scale indicate the degree of performance acceptability when direct readings are made on the meter, i.e., when it is not necessary to press the ADD 20 DB pushbutton switch. The significance of each color is:

a. Green: Acceptable performance.[1]

b. Yellow: Marginal performance: investigation should be made.

c. Red: Unacceptable performance; corrective action required.

4.02 The T-136B test set terminates the circuit in the proper impedance when it is across the line during a measurement. The **green, red,** and **yellow** leads of the set are connected to the **tip, ring** and **ground,** respectively. A low resistance ground is not required. When available, an earth ground is preferred.

4.03 After connecting the test set to the circuit to be tested, proceed as follows:

a. Place the function switch in the DIAL & LINE MA position. Line current may be measured on the MA scale before dialing.

b. Dial the number of the milliwatt generator in the central office. When connection is established, the line current may be checked again. Turn the function switch to the CKT LOSS position and press the PUSH TO MEAS button. This turns on the set and must be held in place until the measurement has been made. Readings are made on the CKT LOSS scale of the meter which is calibrated from 0 to -10 dbm in divisions of 1 db. The -15 dbm point is the last marking on the scale.

NOTE: Release the central office connection.

c. Noise measurements are made by dialing the number of the quiet (or balance) termination in the central office. The function switch must be in the DIAL & LINE MA position. When a connection is made, turn the function switch to the CKT NOISE position and press the PUSH TO MEAS button. The reading on the CKT NOISE scale on the meter is the noise metallic on the line. If the meter should read off scale, press the ADD 20 DB pushbutton switch; this should bring the meter pointer within the measuring scale of the meter unless the noise is excessively high. If it is necessary to push the ADD 20 DB button, add 20 db to the meter reading to get the exact value of circuit noise (or noise metallic).

d. PWR INFL (or noise to ground measurements) are made while connected to the quiet termination at the central office by turning the function switch to the PWR INFL position and reading the top scale on the meter. The PWR INFL scale is calibrated to read the noise to ground directly; it takes into account the 40 db addition usually required for the attenuation in the input circuit in noise measuring sets. If the meter should read off scale, press the ADD 20 DB pushbutton switch; this should bring the meter pointer within the measuring scale of the meter unless the noise is excessively high. If it is necessary to push the ADD 20 DB button, add 20 db to the meter reading to get the exact value of power influence (or noise to ground).

e. Circuit balance can be determined from the CKT NOISE and PWR INFL measurements made with the T-136B test set.

Balance (db) = PWR INFL—CKT NOISE

The balance of a circuit will determine how susceptible it is to induced noise. The following values provide a guide for evaluating balance:

BALANCE	CONDITION
Over 70	Excellent
60—70	Good
50—60	Fair
Under 50 db	Poor

NOTE: Refer to Figure 7 for a graphic solution of the balance equation.

5. MAINTENANCE

5.01 The T-136B test set requires very little maintenance except for replacement of the battery. The battery is replaced by removing the screws identified by an arrow on the faceplate of the set. If maintenance is necessary, the unit should be sent to the local storeroom for return to the manufacturer: Wilcom Products Inc., Box 508, 109 Court St., Laconia, New Hampshire 03246.

6. CALIBRATION

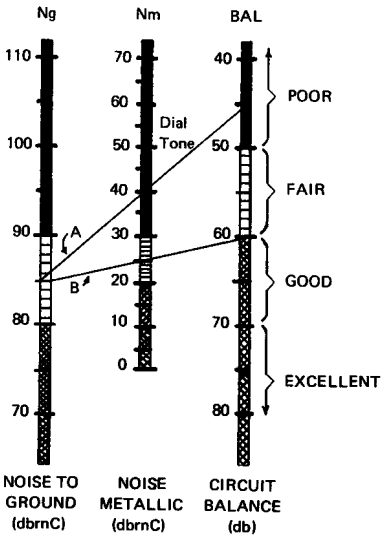
6.01 The calibration of the T-136B test set is checked by the manufacturer. However, a test line equipped with an attenuator and potentiometer will facilitate periodic checks of the test set at the -10 dbm CKT LOSS point and 20 ma transmitter current point. As these are the decision points for these parameters, the test set should be checked there. Test sets which do not indicate accurately at these points should have a calibration chart attached (inside the cover) to indicate the correction (+ or -). If the deviation is more than 5 ma or 1 db, the set should be returned to the manufacturer for maintenance. The PWR INFL and CKT NOISE scales are accurate (+ or -1/4 db).

NOMOGRAPH FOR SOLVING CIRCUIT BALANCE EQUATION

(CIRCUIT BALANCE = NOISE TO GROUND–NOISE METALLIC)

EXAMPLE

	VERY NOISY CIRCUIT (A)	SAME CIRCUIT AFTER BALANCE IMPROVEMENT (B)
Ng	85	85
Nm	40	25
BAL	45	60



SUBSCRIBER LOOP ACCEPTABILITY CRITERIA:

- ACCEPTABLE PERFORMANCE
- MARGINAL PERFORMANCE; INVESTIGATION OF POTENTIAL TROUBLES SHOULD BE INITIATED
- UNACCEPTABLE PERFORMANCE; CORRECTIVE ACTION REQUIRED

FIGURE 7.

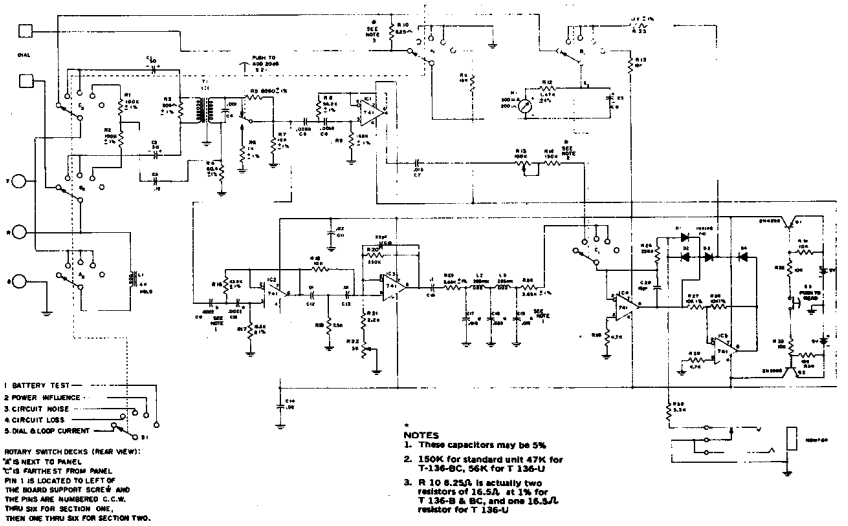

1 BATTERY TEST
2 POWER INFLUENCE
3 CIRCUIT NOISE
4 CIRCUIT LOSS
5 DIAL & LOOP CURRENT
S1
ROTARY SWITCH DECKS (REAR VIEW):
"A" IS NEXT TO PANEL
"C" IS FARTHEST FROM PANEL
PIN 1 IS LOCATED TO LEFT OF THE BOARD SUPPORT SCREW AND THE PINS ARE NUMBERED C.C.W. THRU SIX FOR SECTION ONE, THEN ONE THRU SIX FOR SECTION TWO.
NOTES
1. These capacitors may be 5%
2. 150K for standard unit 47K for T-136-BC, 56K for T 136-U
3. R 10 8.25Ω is actually two resistors of 16.5Ω at 1% for T 136-B & BC, and one 16.5/L resistor for T 136-U

FIGURE 6.

B VOLTAGE TESTER
DESCRIPTION

CONTENTS

1. GENERAL

1.01 This practice provides the description of the B Voltage Tester, CTS #74-94-310-3, (Figure 1) and accessories:

a. B Temporary Bond, CTS #74-88-011-0, (Figure 2).

b. B Shunting Capacitor, CTS #74-88-012-8, (Figure 3).

c. B Voltage Tester Carrying Case, CTS #74-94-327-8, (Figure 4).

d. B Voltage Plug, CTS #74-94-295-4.

1.02 This practice also includes information on field repairs that may be required on the tester.

2. DESCRIPTION OF B VOLTAGE TESTER

2.01 The B Voltage Tester is designed to detect the presence of voltages from 60 to 7600 volts. It consists of an indicator assembly which contains a small neon glow unit and reflector, and a plastic insulated probe equipped with a toothed metal disc on one end for making contact with the conductor, conduit, or street light fixture to be tested. The probe is designed to limit the amount of current which can pass through the device. The probe, indicator assembly, and an insulated clip are connected by insulated cord. See Figure 1.

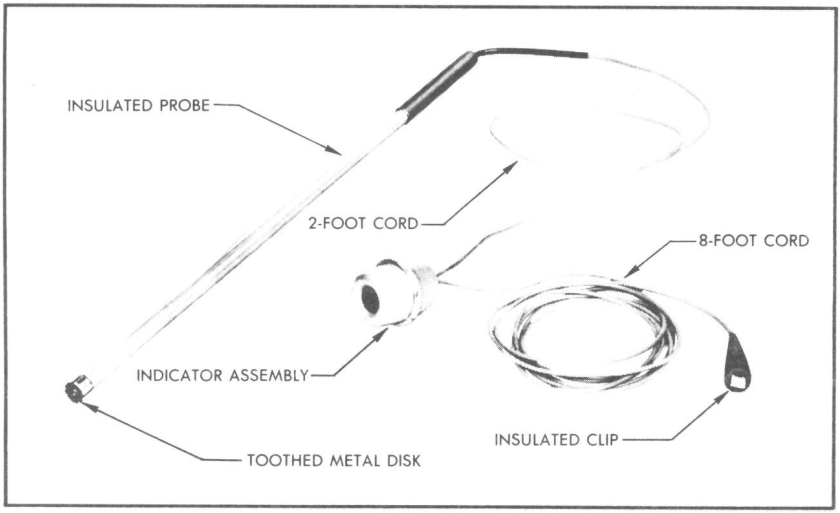


FIGURE 1. B Voltage Tester CTS #74-94-310-3

2.02 At 60 to 70 volts the indicator of the B voltage tester glows dimly. Higher voltages will produce a brighter glow. Higher voltages can damage the tester (7200 volts will burn it out in approximately one minute), it should be touched to the facility being tested **only long enough to determine whether or not the indicator glows.**

3. VOLTAGE PLUG

3.01 A voltage plug, to be made up locally (Figure 5), is designed to provide a safe and convenient means for checking the operation of the B voltage tester. When plugged into any standard 110 to 120 volt convenience outlet, it provides a source of voltage in series with a current limiting resistor. As shown in Figure 5, the resistor is connected to only one prong of the plug and this prong must be plugged into the **hot** side of the outlet. Generally, the **hot** side is the smaller of the two parallel slots in the outlet.

a. Voltage plug, CTS #74-94-295-4, designed for checking the B voltage tester can be ordered from the Test Equipment catalog. When the voltage plug is inserted into a standard 110-120 AC outlet, an electrical source will be provided that is controlled by a current limiting resistor.

b. The insulated clip of the B voltage tester is attached to a ground (as recommended in paragraph 6.02, c.) and the probe of the tester is inserted into the exposed end of the voltage plug so that the toothed metallic disc makes contact with the metal spiral in the plug.

c. If the indicator on the B voltage tester glows dim when contact is made, the tester is operating properly. If not, reverse the plug in the outlet. If there is still no glow, the B voltage tester is defective and should not be used.

4. B TEMPORARY BOND

4.01 The B Temporary Bond is a 5-foot length of stranded copper, rubber covered cord with battery clips at each end. The B Temporary Bond is used to prevent electrical shock to craftsmen by temporarily grounding to cable strand and can be used with the B Voltage Tester and the B Shunting Capacitor to prevent false indication on the B Voltage Tester.

5. SHUNTING CAPACITOR

5.01 The B Shunting Capacitor (Figure 3) is used to distinguish dangerously energized street light fixtures from weakly energized fixtures which are not dangerous. For further information, refer to CTSP 490-050-106.

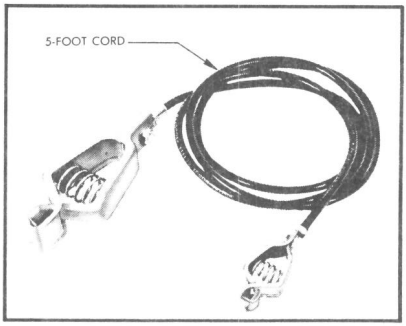


FIGURE 2. B Temporary Bond CTS #74-88-011-0

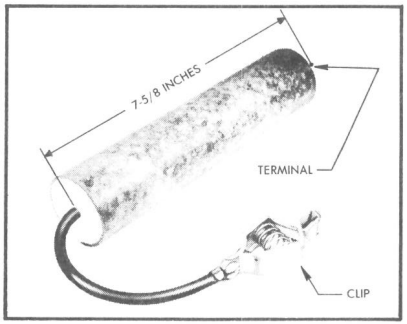


FIGURE 3. B Shunting Capacitor CTS #74-88-012-8

5.02 Because the B Voltage Tester is extremely sensitive and operates with very small currents, street light fixtures may cause the indicator to glow even though they are energized only by leakage across damp cobwebs or induction between the fixture and its wiring.

5.03 The B Shunting Capacitor will drain off harmless voltages such as those described in paragraph 5.02. It will not interfere with the operation of the B Voltage Tester if the fixture is dangerously energized (as it would be if the wiring insulation in the fixture broke down).

5.04 The B Shunting Capacitor should not be used in making other tests except as specifically authorized by local instructions.

5.05 The B Shunting Capacitor should not be dropped and should be kept reasonably clean and dry. It does not require testing or any special maintenance.

6. TESTING THE B VOLTAGE TESTER

6.01 The B Voltage Tester should be tested weekly to ensure that it is operating satisfactorily.

6.02 The method of testing the B Voltage Tester is:

a. Locate a standard 110 to 120 volt convenience outlet which is energized. This may be checked with an extension cord and lamp.

b. Insert the voltage plug into the outlet; first choose the smaller of the two slots in the outlet to insert the prong connected to the resistor.

c. Attach the insulated clip of the voltage tester to a ground such as a water pipe, radiator, metallic power conduit, etc. If none of these are available, lay the B temporary bond, uncoiled, on concrete floor and attach to one of its clips.

d. Touch the toothed metal disc of the probe to the metal spiral of the voltage plug. The indicator should glow faintly. If the indicator does not glow, release the tension in the wire, but keep the probe in contact with the voltage plug. If the indicator glows after the tension has been released, the wire is broken under the insulation and the tester should be disposed of.

e. If the indicator does not glow, reverse the voltage plug in the outlet by removing it, turning a half turn and inserting again into the outlet. Repeat the test.

f. If the indicator still does not glow and it is known that the convenience outlet is not defective, then the voltage tester must be defective and should be disposed of.

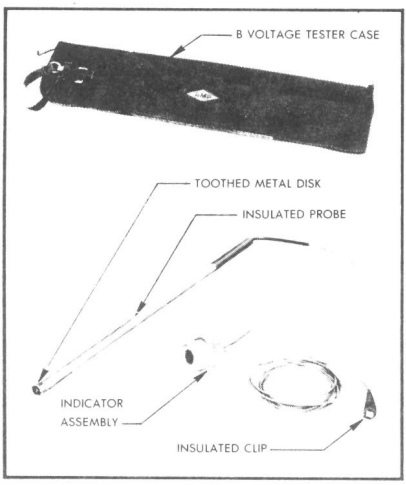


FIGURE 4. B Voltage Tester and Case CTS #74-94-327-8

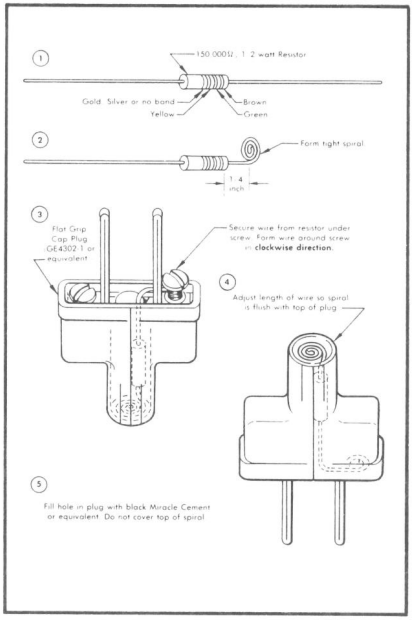


FIGURE 5

7. FIELD REPAIR OF B VOLTAGE TESTER

7.01 Certain limited field repairs to the B Voltage Tester will be required. Testers which cannot be repaired by using the methods described in this practice should be disposed of in accordance with local instructions.

7.02 The wire or cord of the B Voltage Tester may be spliced under the following conditions:

a. Between the probe and the indicator assembly, a maximum of two splices are permitted. Do not attempt to splice wire if the break is within 4 inches of either the indicator assembly or the grip of the probe.

b. Between the indicator assembly and the grounding clip, a maximum of three splices is permitted. No attempt should be made to splice wire breaks within 4 inches of the indicator assembly. No attempt should be made to splice wire breaks if the overall length of the cord between the clip and the indicator assembly will be less than 7 feet 6 inches. Each splice will reduce the length of the cord about 2 inches.

7.03 To splice broken cords (Figure 6):

a. Strip 2 inches of insulation from the wire on each side of the break using the wire stripping hole of the standard 6-inch diagonal pliers.

b. Clean the insulation of the wire adjacent to the break for a distance of at least 1 inch to remove mud, grease, etc.

c. Tie a square knot in the middle of the exposed wire so the ends will lie parallel and extend approximately to the beginning of the insulation.

d. Tape the joint with 3/4-inch vinyl tape or friction tape. Start the tape at about a 45-degree angle beginning at the knot and continue until about 1/2-inch of the rubber insulation has been covered. Continue taping until the splice has two layers. End the tape in the middle of the splice.

8. CARE AND STORAGE

8.01 In placing the tester in the case, place the toothed metal disc first. The capacitor and bond should be carried in the lower pocket of the case.

8.02 The B Voltage Tester should be handled and stored with reasonable care. Remove any dampness or dirt with a clean cloth before using or storing. Keep the instrument free of grease or oil to prevent deterioration of insulation.

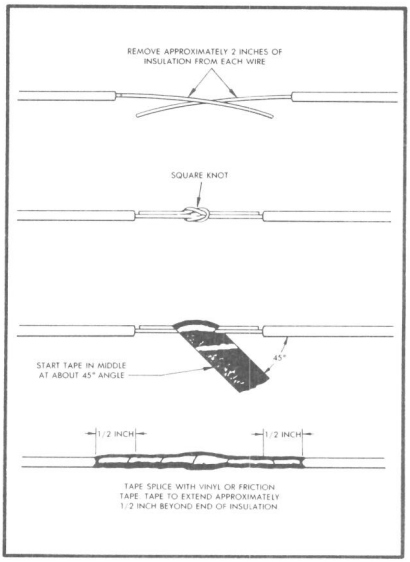


FIGURE 6. Repairing Broken Cord

8.03 Avoid exposing the instrument to excessive heat as the plastic rod may become deformed under high temperatures.

8.04 The instrument should be **carried down and lowered** from poles, **not dropped,** as the impact may short-circuit the elements in the neon glow unit of the indicator.

FABRIC BODY BELTS AND SAFETY STRAPS DESCRIPTION, USE AND MAINTENANCE

1. GENERAL

1.01 This addendum is to add safety precautions in connection with fabric body belts and safety straps.

1.02 With red pencil or ink, make the changes and additions specified in paragraph 2 of this addendum and file in front of CTSP 405-601-303. In the margin of subject paragraphs write the words "See Addendum".

2. CHANGES AND ADDITIONS

2.01 Change paragraph 3.06 to read:

3.06 Body belts should not be worn while working on the ground. For example, do not use body belt to assist in piking poles. If the pike pole should slip down between the belt and the craftsman's body, serious injury could result.

2.02 Add paragraph 3.11 k. which reads:

k. Do not place any metal such as rivets on the body side of a belt.

2.03 Change paragraph 5.02 to read:

5.02 When a body belt and/or safety strap are received, they should be inspected carefully by the employee. At least once each day thereafter, the belt and strap should be examined for any defects that may have developed.

2.04 Change paragraph 5.03 to read:

5.03 The employee's immediate supervisor will inspect all body belts and safety straps monthly.

FABRIC BODY BELTS AND SAFETY STRAPS DESCRIPTION, USE, AND MAINTENANCE

1. GENERAL

1.01 This practice replaces CTSP 405-600-100, CTSP 405-600-603 and CTSP 405-600-604 and is issued to update information on the description, use, and maintenance of fabric (nylon) body belts and safety straps.

1.02 In accordance with the Company's established routine, all body belts or safety straps that have major defects will be *tagged defective,* withdrawn from service immediately, and returned to the storeroom. To prevent reissue or reuse, defective belts and/or straps must be destroyed by being cut into small pieces.

2. DESCRIPTION

2.01 *Body Belt:* The body belt (lineman's tool belt) is fitted with a knife snap, tape thong, ring for utility pouch, four suspension rings, and five leather loops for tools.

2.02 *Safety Strap:* The safety strap is a red centered impregnated nylon strap, 1-3/4 inches wide. It is equipped with pointed drop forged round nose snap hooks and a tongue type buckle. The safety strap is available in two lengths, 7 feet and 9 feet, and is adjustable at 1-inch and 1-1/2-inch increments.

NOTE: Exposure of the red center ply by wear indicates that the strap should be removed from service, as instructed in paragraph 1.02.

3. SAFETY PRECAUTIONS

3.01 When working aloft, a body belt and safety strap shall be worn at all times. They shall be worn when working on poles, cable cars, aerial platforms, truck ladder platforms (when chains are not used), other ladder platforms, and ladders lashed to strand.

3.02 When in use, the safety strap should be adjusted as short as possible to minimize potential falling distance.

3.03 Before climbing a pole, make sure that the tongue of the buckle is properly seated in the desired hole in the safety strap.

3.04 Do not allow a fabric body belt or safety strap to be run over by trucks, trailers, reels, or other heavy equipment.

3.05 Never attach two or more safety straps together for additional length. If one safety strap cannot be lengthened sufficiently, the method of doing the work shall be changed. If tree pruning operations are involved, only a rope sling shall be used.

3.06 Body belts should not be worn while working on the ground. For example, do not use a body belt to assist in piking poles. If the pike pole should slip down between the belt and the craftman's body, serious injury could result.

3.07 Security may be increased by placing the safety strap around the pole at a point directly above a crossarm, strand, pole step, or other secure attachment that will remain in place while work is being performed. Do not place a strap around an insulator pin, bolt, or other insecure attachment. Do not place a strap around a pole within one foot of the top of the pole unless there is a crossarm or cable attachment on the pole *above the strap.*

NOTE: Electric light, power and foreign signal circuit attachments shall never be used as supports for safety straps.

3.08 When either the snap hook or buckle of the safety strap is likely to contact the cable sheath, provision should be made to protect the sheath from damage. This protection may be provided by slipping a cable guard over the cable or by wrapping the cable with muslin or friction tape at the place of contact. See Figure 1.

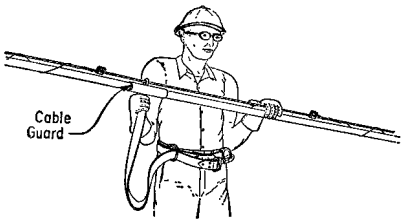


FIGURE 1.

3.09 When a safety strap is placed around a pole, strand, or other support, never engage both snap hooks of the safety strap in the same D ring of the body belt.

NOTE: The body belt buckle and tongue are not designed to carry a craftsman's weight; both D rings must be engaged.

3.10 Make sure that the snap hook and D ring are properly engaged. Do not rely on the feel or the click of the keeper in the snap hook; look and know that the snap hook is properly engaged before placing weight on the safety strap. When engaged in the D ring, the keeper of the snap hook on the safety strap must always be away from the body, as shown in Figure 2.

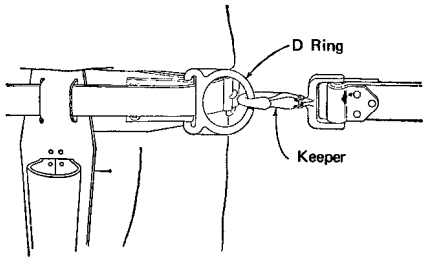


FIGURE 2. View of Craftsman's Right Side

3.11 Additional safety precautions are:

a. Never use an improvised substitute of rope, wire, etc., as a safety strap.

b. Do not punch extra holes in a safety strap.

c. A safety strap should never be used as a means of riding suspension strand.

d. While wearing a safety strap that is not in use, both ends should be snapped into the same D ring. When climbing poles, be very careful that the strap does not catch on pole steps and other attachments.

e. When working aloft, be very careful that the keeper of the snap hook is not accidentally depressed by contact with wires, strand, crossarm braces, guys, and other attachments, or by crossarms, guard arms, cable cars, etc., that may be supported on the safety strap while certain work operations are being performed.

f. When climbing past another employee who has his safety strap in place around a pole, be very careful not to drag climber gaffs over his strap.

g. Avoid swinging rapidly around a pole while wearing a safety strap.

h. Never throw or drop a body belt or safety strap.

i. Do not allow a body belt or safety strap to come in contact with heat by being placed near a furnace, pot of hot solder, torch, or hot soldering copper.

j. Do not stand near a fire while wearing a body belt or safety strap.

[k. Do not place any metal such as rivets on the body side of the belt.]

3.12 Never place or carry tools or materials in the D rings of a body belt; they may prevent the snap hooks from engaging properly or give false indication that they are properly engaged. These items should be carried in holsters or other approved carriers.

3.13 When climbing or working on a pole, do not fasten an uncoiled handline directly to the body belt or to tools carried in the belt. With the handline fastened to the belt, the craftsman could be pulled off the pole if the handline should catch either on an obstruction or a passing vehicle. To allow the handline to pull free of the belt if it should be caught, use one of the following methods to carry or support a handline aloft:

a. Form the end of the handline into a loop and place the loop in the handline carrier.

b. Form the end of the handline into a bight and tuck the bight up under the body belt.

4. USE

4.01 When working on a pole, the following method shall be used to secure the body belt and safety strap:

a. Attach one snap hook to a D ring.

b. Pass the free end of the safety strap around the pole so that the strap rests flat against the pole surface, without turns or twists.

c. Engage the snap hook in the other D ring, making certain that the hooks point outward.

4.02 When working from an extension ladder that is securely lashed to a suspension strand or other support, use one of the following methods to secure the body belt and safety strap. Attach one snap hook to a D ring and either:

a. Pass the free end of the safety strap between two rungs and around one side rail, and engage the snap hook in the other D ring, or

b. Pass the free end of the safety strap around a rung and engage the snap hook in the other D ring, or

c. Pass the free end of the safety strap over the suspension strand so as to loop the strand, and engage the snap hook in the other D ring.

4.03 When working from an extension ladder which is properly placed on the strand but *not lashed,* the following method shall be used to secure the body belt and safety strap:

a. Attach one snap hook to a D ring.

b. Pass the free end of the safety strap around the strand and side rail, between two rungs.

c. Engage the snap hook in the other D ring.

4.04 When working from an aerial platform that is supported by a suspension strand or other support, the following method shall be used to secure the body belt and safety strap:

a. Attach one snap hook to a D ring.

b. Pass the free end across the front of the body, through the other D ring.

c. Engage the other snap hook on the suspension strand. See Figure 3.

FIGURE 3. Method of Using Safety Strap When Working from Aerial Platform

4.05 When working from a truck platform ladder, the safety strap shall be looped through the platform framework, unless the platform is equipped with safety chains. If safety chains are provided, the chains shall be attached to the D rings of the body belt.

5. INSPECTION AND MAINTENANCE

5.01 It is the responsibility of each employee to determine that his body belt and safety strap are in good condition at all times.

5.02 **When a body belt and/or safety strap are received, they should be inspected carefully by the employee. At least once each day thereafter, the belt and strap should be examined for any defects that may have developed.**

5.03 **The employee's immediate supervisor should inspect all body belts and safety straps monthly.**

5.04 Examine the body belt and safety strap visually. If any of the conditions listed in paragraph 5.05 exist, or if the condition of the belt or strap is such that there is any doubt as to its safety, it should be exchanged immediately. (See paragraph 1.02.) A fabric body belt or safety strap should never be subjected to proof load tests.

5.05 *Visual Inspection of Body Belts and Safety Straps:*

a. The important conditions to look for when inspecting a body belt are:

(1) The condition of the steel reinforcing plates holding the D rings.

(2) The condition of the nylon, especially at the reinforcing plates; determine whether the nylon is worn through or crushed sufficiently to affect its strength.

(3) Loose or broken rivets, particularly those in the loops holding the D rings.

(4) Broken or rotted threads in the stitching.

(5) Cuts that would tend to cause the nylon to tear or affect its strength.

(6) Broken or defective buckle.

b. The important conditions to look for when inspecting a safety strap are:

(1) Worn fabric, as indicated by the ply color. When two outer layers of fabric are worn through, the red ply can be seen and the strap should be removed from service.

(2) Cuts, nicks, punctures, etc., that would affect the strength of the strap. The edges should be carefully inspected.

(3) Loose, broken, or missing rivets; or rivets showing excessive wear.

(4) Broken or badly worn steel guard on the ends.

(5) Defective buckle or snap hook, and poor action of the keeper on the snap hook. The keeper should work freely without excessive side play and should close securely under the spring tension.

(6) If holes for the tongue of the buckle are excessively enlarged, remove the strap from service.

(7) Check for acid burns; a strap that has been in contact with acid shall be removed from service.

(8) Charred spots on the surface of the fabric that might have been caused by flames, contact with hot solder pots, furnaces, hot soldering copper, or heated ducts and pipes. If burns are on the flat surfaces and two or more outer layers are burned through (or the red ply is visible), remove the strap from service. If burns are on the edges of the strap and more than 1/8 inch deep, remove the strap from service.

(9) Broken inner fibers. Defects are usually found in the section at which an injury occurred. Breakage of the inner fibers is indicated by limpness and flexibility of the strap. The strap should be examined in short sections and if a soft, flexible section is found, the strap should not be used.

6. CLEANING

6.01 Remove creosote, paint, oil, grease, tar, etc., from body belts and safety straps using RP-6021 waterless hand cleaner applied directly to the straps; then wipe with a clean, dry cloth.

7. STORING

7.01 The following precautions shall be observed when storing body belts and safety straps, or when they are not in use:

a. Keep the belts and straps away from radiators, stoves, steam pipes, fires, and other places where the fabric would be subjected to excessive heat.

b. A damp or wet strap or belt should not be packed in a locker, tool box, grip, or other container. The belt and/or strap should be wiped with a dry cloth and allowed to dry completely before being stored or packed.

c. A body belt or safety strap should never be stored with tools unless the tools are equipped with satisfactory guards. When body belts, safety straps, and climbers are kept in the same container, the climbers shall be fitted with gaff guards to avoid cutting or puncturing the belt or strap.

d. Store body belts and safety straps in a location free from excessive humidity to prevent mildew.

CLIMBERS
DESCRIPTION, USE AND MAINTENANCE

1. GENERAL

1.01 This addendum is issued to correct references to minimum gaff lengths in paragraphs 5.04 a. (5) and 6.02 f.

1.02 This addendum also provides instructions for measuring gaff length.

1.03 With red pencil or ink, make the changes specified in paragraph 2 of this addendum, or file the addendum in front of CTSP 405-601-310.

SPECIAL NOTE TO ALL I & R FOREMEN OR SUPERVISORS: Please notify all holders of Station Installation manuals of the changes covered in this addendum. Refer to Part I, General Information, to make the changes.

2. CHANGES AND CORRECTIONS

2.01 In paragraph 5.04 a. (5), change the minimum safe length of the gaff from 1-1/8 inches to 1-1/4 inches.

2.02 In paragraph 6.02 f., change the minimum safe length of the gaff from 1-1/8 inches to 1-1/4 inches, and change the paragraph to read:

f. Some gauges are marked to indicate minimum safe length of the gaff (1-1/4 inches). If the gauge is not marked, measure the gaff with a ruler. Gaffs that do not meet this requirement shall be replaced.

NOTE: The difference in the length of gaffs for the same pair of climbers shall not vary more than 1/8 inch.

CLIMBERS
DESCRIPTION, USE AND MAINTENANCE

1. GENERAL

1.01 This practice provides updated information on linemen's climbers, and includes the description, use, maintenance, and safety procedures for climbers and associated items such as pads, straps, gaffs, and gaff guards.

1.02 This practice replaces and incorporates information contained in CTSP 405-600-101 and CTSP 405-600-606, and is numbered to place it in the proper Plant Practice subdivision.

1.03 **Climbers are used for ascending, descending, and maintaining the working position on poles when no other means of support is available.**

2. ADJUSTABLE CLIMBERS–DESCRIPTION

2.01 Climbers that are supplied with the 7-3/16-inch sleeve will adjust from 14-3/4 inches to 18-1/2 inches. A longer sleeve (10-3/16 inches), is also available that will allow adjustment up to 21-1/2 inches. See Figures 1 and 2.

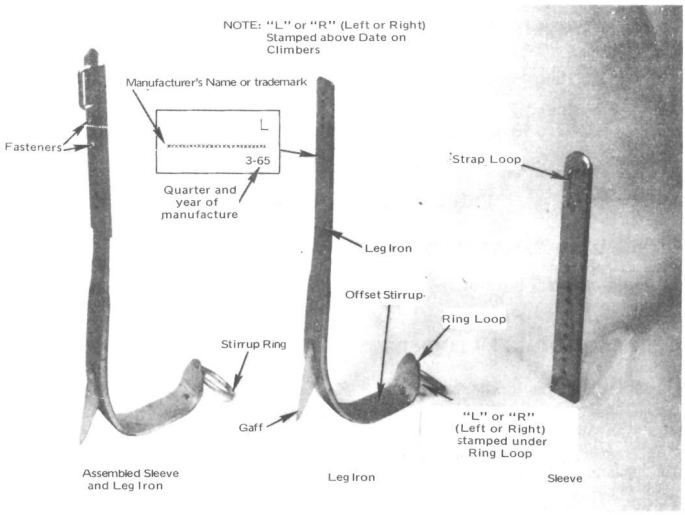


FIGURE 1. Climber

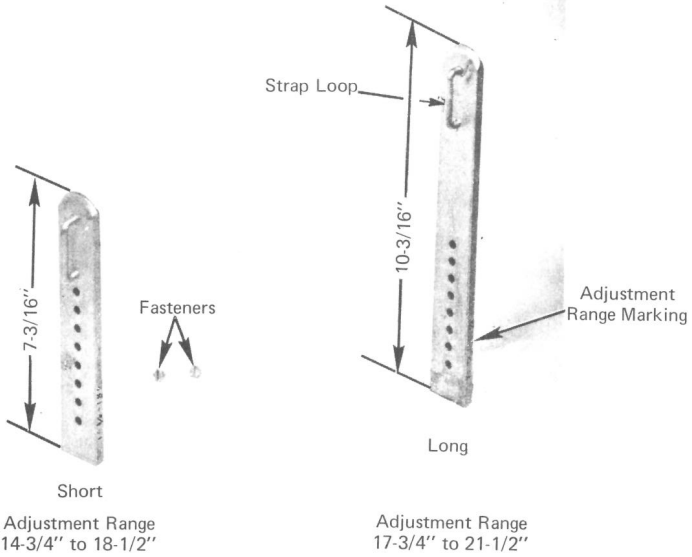


FIGURE 2. Sleeves for Adjustable Climbers

2.02 Adjustments of the sleeve on the shank may be made in increments of 1/4 inch.

2.03 Adjustable climbers are not furnished with straps, pads, or gaff guards; these items must be ordered separately.

3 FITTING ADJUSTABLE CLIMBERS

3.01 Adjustable climbers should be fitted to the legs at the longest comfortable length. Measure the distance from the lower edge of the projecting knee bone to the underside of the shoe at the arch; then subtract 1/2 to 1 inch. See Figure 3.

3.02 After measuring as directed in paragraph 3.01 and Figure 3, assemble the climber by:

a. Sliding the sleeve over the shank and adjusting to the required length.

b. Inserting the locking device from the stirrup side of the shank to secure positioning of the sleeve; then fasten.

NOTE: Shanks shall not be bent to obtain a comfortable fit; use cushion pads. See Figures 4 and 5.

FIGURE 3. Measuring for Climber Length

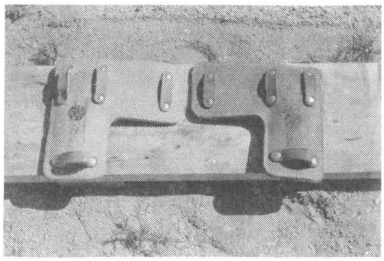


FIGURE 4. Climber Pad

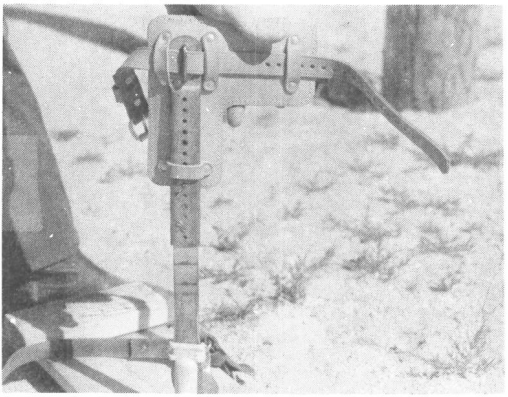


FIGURE 5. Left Leg Climber Pad Installed

4. SAFETY PRECAUTIONS

4.01 The following precautions must be observed when using climbers:

a. When climbing past another employee who has his safety strap in place around the pole, special care should be taken not to gaff him, his safety strap, or other equipment.

b. When climbing past attachments on poles, do not drag climbers or feet against these attachments.

c. Do not use the gaff as a pry.

d. When climbing, do not place the gaff in or near a crack, knot, nail, or tack, etc.

e. Inspect climbers in accordance with paragraph 5.

4.02 Do not wear climbers for work when they are not required, e.g., when walking between poles, when working on the ground, a ladder, a stepped pole where the work can be performed safely from the pole steps, or while traveling in a motor vehicle or any other type of conveyance.

4.03 In cold weather, remove climbers as frequently as work will permit. The metal shanks retain the cold and the straps restrict blood circulation.

4.04 When climbers are not in use, are being transported, or are stored in tool boxes or other storage spaces, they should be equipped with gaff guards. See Figure 6. The gaff guards protect the craftsman, as well as the gaff tips and cutting edges. Guards also prevent damage to safety straps and body belts when stored in the same compartments.

FIGURE 6. Gaff Guard Installed

5. INSPECTION OF CLIMBERS

5.01 Upon receipt of climbers, and at least once a week thereafter, each employee shall inspect his climbers and associated items in accordance with paragraph 5.04.

5.02 Each employee shall make a daily inspection of the climber gaffs to detect nicks or dulled cutting edges. To ensure that climber gaffs are in good condition, they should be tested according to the procedures outlined in paragraph 6.

5.03 Supervisors shall make a periodic inspection of craftsmen's climbers (once a month is recommended).

5.04 Procedures to be followed when inspecting climbers are:

a. If any of the following conditions exist, the climbers shall be tagged defective, returned to the storeroom (for disposal as described in paragraph 8), and exchanged for a pair in good condition:

(1) Fractured gaff or hairline crack.

(2) Loose gaff.

(3) Nicks and depressions in gaff due to impact with a hard object.

(4) Ridge of gaff not straight.

(5) Gaff dull beyond restoration by means of honing or filing; or less than the minimum safe length, i.e., 1-1/4 inches.

(6) Broken or distorted gaff point.

(7) Broken stirrup ring or broken or loose ring loop.

(8) Fractured shank or start of a fracture.

b. If any of the following conditions exist, the defective item shall be replaced:

(1) Fractured sleeve or start of a fracture.

(2) Broken or loose sleeve strap loop.

(3) One layer of fabric worn through on straps; or cuts in straps or enlarged buckle holes that would affect their strength.

(4) Broken or otherwise defective strap buckle.

(5) Broken or otherwise defective clip on foot strap.

(6) Broken or loose rivets on straps or pads.

(7) Broken or torn loop on strap or pad.

(8) Chipped or cracked plastic on gaff guard.

(9) Loose screw or rivet on sleeve.

5.05 Figure 7 shows the ridge of a properly shaped gaff; the ridge is straight.

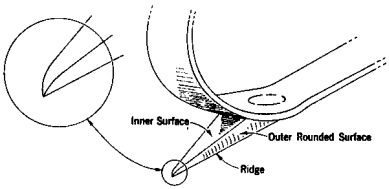


FIGURE 7. Gaff Profile and Point

5.06 Figure 8 shows the properly rounded contour of the outer surfaces on a gaff.

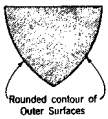


FIGURE 8. Outer Surfaces

5.07 Figure 9 shows that insufficient penetration of the pole will result from a dull gaff.

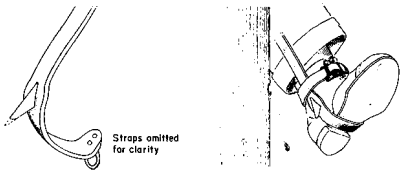


FIGURE 9. Dull Gaff

5.08 Figure 10 shows that ineffective penetration of the pole will result from the ridge not being straight.

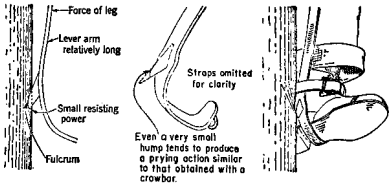


FIGURE 10. Ridge Not Straight

6. TESTING CLIMBER GAFFS

6.01 Climber gaffs shall be tested when received and at least once a week thereafter to ensure that they are properly shaped and sharpened. (Anytime there is doubt about the condition of the gaffs, they should be tested.)

6.02 Use a gaff gauge (see Figure 11) to measure the thickness, width, and length of gaffs:

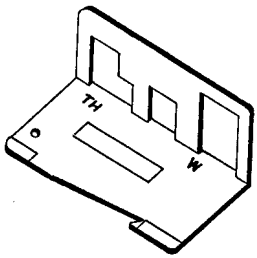


FIGURE 11. Gaff Gauge

a. Insert the gaff as far as possible through the large slot marked TH. The point of the gaff should fall within the line as shown in Figure 12A. This ensures the proper thickness of the gaff approximately 1 inch from the point.

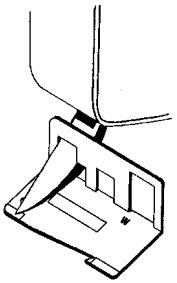


FIGURE 12A.

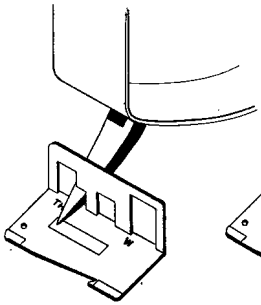


FIGURE 12B.

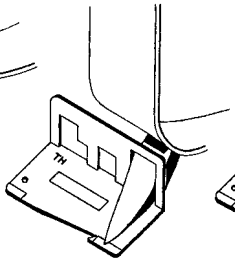


FIGURE 12C.

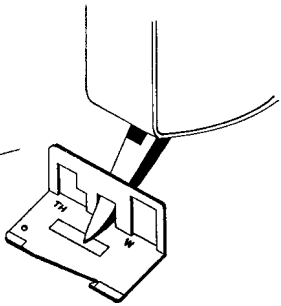


FIGURE 12D.

b. Insert the gaff as far as possible through the small slot marked TH. The point should fall within the two center lines as shown in Figure 12B. This ensures the proper thickness of the gaff 1/2 inch from the point.

c. Insert the gaff as far as possible through the large slot marked W. The point should fall within the line as shown in Figure 12C. This ensures the proper width of the gaff approximately 1 inch from the point.

d. Insert the gaff as far as possible through the small slot marked W. The point should fall within the two center lines as shown in Figure 12D. This ensures the proper width of the gaff approximately 1/2 inch from the point.

e. The small hole in the gauge is used to measure the length of the gaff point. When inserted in this hole, the point should be flush with the other side of the gauge.

f. The gauge is marked to indicate minimum safe length of the gaff (1-1/4 inches). Gaffs that do not meet this requirement shall be replaced.

NOTE: The difference in the length of gaffs for the same pair of climbers shall not vary more than 1/8 inch.

6.03 Gaffs shall also be tested at regular intervals to determine if they are dull or properly sharpened. There are two types of tests:

a. *Cutout Test of Climber Gaffs:*

(1) Place the climber on the leg and fasten the foot strap in the usual manner. Do not fasten the leg strap.

(2) Remove the gaff guard and put on gloves. Place the hand between the leg and the climber pad, palm facing the pole. Place the other hand around the pole for balance. With the leg at about a 30° angle (the normal climbing angle), aim the gaff toward the center of the pole about one foot above the ground line. Lightly jab the gaff in the pole so that it penetrates the wood about 1/4 inch. See Figure 13. Do this at a location where the pole surface is free of cuts.

FIGURE 13. Jabbing Gaff in Pole

(3) Keeping just enough pressure on the stirrup to keep the gaff in the pole (but not enough to cause the gaff to penetrate any deeper), push the climber and hand toward the pole by moving the knee until the strap loop of the sleeve is against the pole as shown in Figure 14.

FIGURE 14. Climber Holding

(4) Make sure the strap loop is held against the pole with pressure from the leg, and *gradually* exert full pressure straight down on the stirrup/ without raising the other foot off the ground (this will maintain balance if the gaff does not hold).

(5) A gaff which is correctly shaped and sharpened will cut into the pole and hold in a distance of 2 inches or less. Measure the cut from the point where the gaff enters the pole to the bottom of the cut at the surface of the pole. See Figure 15. A gaff that is properly shaped but dull or burred will cut in and hold; however, the length of the cut will be more than 2 inches. A gaff that is very dull or deformed in some way will cut out of the pole or plow through the wood for a distance greater than 2 inches. Do not use climbers that cut out or plow through the wood for a distance greater than 2 inches. If the climber gaff is dull, sharpen as directed in paragraph 7.01; then repeat the cutout test.

FIGURE 15. Measuring Gaff Cut

b. *Plane Test of Climber Gaffs:*

(1) Place the climber on a soft pine or cedar board as shown in Figure 16, with the point of the gaff and the loop strap resting against the wood surface. Hold the stirrup of the climber in a vertical position, without exerting any downward pressure, and slide the climber along the wood by pushing forward on the leg iron. If the climber is properly sharpened, it will dig into the wood and begin to hold within a distance of approximately one inch.

(2) If the climber gaff slides along the surface of the wood without cutting and leaves only a line or mark on the wood as shown in Figure 17, the point has not been properly sharpened or the outer surface of the gaff is deformed.

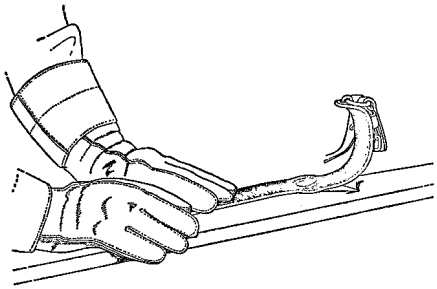


FIGURE 16.

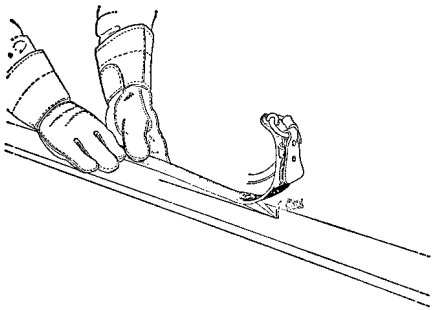


FIGURE 17.

7. MAINTENANCE OF CLIMBERS

7.01 Climber gaffs shall be maintained in a sharpened condition at all times. Use the following procedure for sharpening gaffs:

a. Place the climber in a bench vise with the point of the gaff facing outward and the outer ridge facing downward. Protect the shank by placing wooden blocks between the vise jaws and the shank.

b. Use an approved mill file and work with short strokes. File from the heel toward the point to sharpen the cutting edges. The point of the gaff should then be rounded back approximately 1/4 of an inch. See Figure 18.

NOTE: The straight outer ridge of the gaff is not a cutting edge and should not be filed.

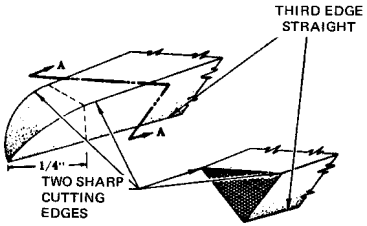


FIGURE 18. Rounding Off Gaff Point

c. If it is necessary to remove any of the outside of the gaff, file from the heel to the point down the sides to retain the original shape. See Figure 19.

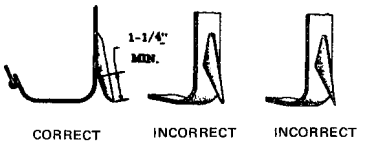


FIGURE 19. Correct and Incorrect Filing of Gaff Point

d. A sharper edge can be obtained on each of the two cutting edges by using a honing stone instead of a file.

NOTE: While using a honing stone, keep the stone well oiled with light machine oil to prevent clogging the stone.

e. If there are any small burrs along the cutting edge, remove them first by holding the stone against the side of the gaff and *carefully following the edge around to the tip.*

f. Hone the inner surface of the gaff by starting the stroke near the shank and continuing over the rounded curve of the tip. To prevent dulling the tip, stop the honing stroke before the stone slides off the end of the gaff. About 20 to 25 strokes of the stone should be sufficient. *Do not attempt to reshape the tip of the gaff.*

7.02 Pads should be maintained clean and pliable for maximum comfort. The following procedures are recommended:

a. About every three months clean the pads with a damp sponge, using a neutral handsoap.

b. With the sponge and clean water, work up a lather using a good grade of saddle soap. Work the lather well into the pad and place the pad in the shade to dry. When the pad is almost dry, rub the leather vigorously with a soft cloth.

c. About every six months, instead of dressing the pads with saddle soap as described in b., clean as in a., and while the leather is still damp apply about 1/2 teaspoon of neat's-foot oil on the loop side of the pad. Apply oil gradually with the hands, using long light strokes to work it into the leather. After oiling, allow the pads to dry overnight and then rub vigorously with a soft cloth to remove any excess oil.

8. DISPOSAL OF DEFECTIVE CLIMBERS

8.01 Under no circumstances shall climbers that have been returned marked *defective* be placed where they might be reissued or reused.

8.02 Prior to disposal of defective climbers, storeroom personnel shall make them useless by *cutting the stirrups in two pieces.*

LEATHER BODY BELTS AND SAFETY STRAPS CARE AND MAINTENANCE

CONTENTS

1. GENERAL

1.01 This practice is reissued to provide additional information on the inspection of body belts and safety straps. It also provides information on maintenance, storing, testing and fitting. **Remove from the file and destroy all copies of CTSP 405-601-601, Issue 1, 1971.**

1.02 The portions of this practice enclosed in brackets [ ] indicate additions and/or revisions.

1.03 Refer to CTSP 405-601-303 for the description, use and maintenance of fabric body belts and safety straps.

1.04 In accordance with the Company's established procedure, all body belts or safety straps that have major defects will be **tagged defective,** withdrawn from service immediately, and returned to the storeroom. To prevent reissue or reuse, defective belts and/or straps must be destroyed.

2. INSPECTION

2.01 It is the responsibility of each employee to determine that his body belt and safety strap are in good condition at all times.

2.02 When a body belt and/or safety strap are received, they should be inspected carefully by the employee. At least once each day thereafter, the belt and strap should be examined for any defects that may have developed.

2.03 The employee's immediate supervisor will inspect all safety straps and body belts monthly.

2.04 Visually examine the safety strap and body belt. If any of the conditions in paragraph 2.05 exist, or if the condition of the strap or belt indicates a safety hazard, it should be exchanged immediately (see paragraph 1.04).

2.05 Visual Inspection of Safety Straps and Body Belts: The important conditions to observe when inspecting a leather safety strap and/or leather body belt are:

a. Cracks, cuts or nicks (particularly cuts or tears on the edges of the straps) that would tend to cause the leather to tear or that might affect the strength of the straps.

[**CAUTION: No extra holes should be punched into the tongue of the body belt or safety strap.**]

b. Broken or rotted threads in the stitching.

c. Broken or defective buckle.

d. Broken or badly worn steel guard on ends of a safety strap.

e. Broken wrench keeper on a body belt.

f. Loose or broken rivets on leather tool holster.

g. Loose or broken rivets, particularly those in the loops holding the D rings.

h. Broken or rotted threads in the stitching of the loops holding the D rings.

[**i.** Metal, such as rivets, exposed on body side of belt.]

j. Poor action of keeper on the snap hook. (The keeper should work freely without excessive side play and should close securely under the spring tension.)

k. Hard or dry leather. (If all the strap requires is oiling, the leather should be treated as instructed in paragraph 3.04.)

l. Burnt leather (see paragraph 2.06).

[**m.** Leather worn thin. If none of the above conditions exist in the strap, it may be used until it is worn to a thickness of not less than 1/8 inch in any portion. Figure 1 indicates a method of measuring the thickness of leather.]

[**n.** Modifications of belt or strap such as the addition of wire hooks.]

2.06 Leather with hard spots, a curved set, or a burnt streak across the face may have become burnt or cooked by being subjected to excessive heat. This may have occurred as a result of:

a. Placing the belt against or near hot steam pipes, radiators, or heaters.

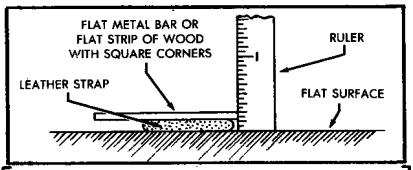


FIGURE 1. Method of Measuring Thickness of Leather

b. Placing the belt near a pot of hot solder, hot soldering copper, or a splicer's furnace.

c. Standing near a fire with the safety strap suspended from the body belt.

NOTE: Burn marks, hard spots, crystallized or brittle leather, or a curved set to the belt, are visual indications that a body belt has been subjected to excessive heat.

3. MAINTENANCE

3.01 Leather body belts should be cleaned and dressed at 3-month intervals. If a belt has been wet frequently from rain or perspiration, or has been in contact with wet paint, clean at shorter intervals. Leather body belts should be cleaned as follows:

a. Remove surface dirt with a sponge dampened (not wet) with water. Do not use gasoline or petroleum products; they will cause the leather to become dry.

b. Rinse the sponge in clear water and squeeze partly dry. Work up a thick lather using a neutral soap, such as castile or white toilet soap (free from alkali).

c. Thoroughly wash the entire length of the belt with a lathered sponge to remove embedded dirt and perspiration, and wipe with a cloth to remove excessive moisture.

d. Repeat step b. using a good grade of saddle soap.

e. Work the saddle soap lather well into all parts of the belt and place it in the shade to dry.

f. When the leather is almost dry, rub vigorously with a soft cloth.

3.02 Paint ingredients have a harmful effect on leather. Therefore, wet paint must be promptly removed from body belts with a dry cloth.

3.03 Creosote is not harmful to leather, but to avoid clothing stains it should be removed from the body belt as soon as possible.

3.04 Oiling: Treating the leather in body belts with saddle soap (paragraph 3.01) will normally keep the belt soft and pliable. However, to keep the leather from drying out and becoming brittle, leather body belts should be oiled approximately every 6 months as follows:

a. Clean the leather with a neutral soap as instructed in paragraph 3.01 b. Oil applied to dry or dirty leather has a harmful effect on the leather.

b. While the leather is still damp, use about 1/4 ounce (two teaspoonsful) of neat's-foot oil and apply the oil gradually with the hands, using long light strokes to work it into the leather. A light, even distribution of the oil is desired.

c. After oiling, the belt should be set aside in a dry, shady place for about 24 hours to permit the leather to dry slowly. When the leather is dry, vigorously rub the belt with a soft cloth to remove excess oil.

NOTE: Do not use mineral oils or greases such as machine oil or vaseline. Leather should never look or feel greasy; this is an indication that too much oil is being used. Leather with too much oil will stretch and is likely to pick up sand or grit which may injure the leather.

4. STORING

NOTE: If a body belt with insufficient oil is received, it should be oiled as instructed in paragraph 3.04.

4.01 When not in use, body belts should be oiled at least once every 6 months. The belt should be oiled 3 months after it has been received for stock, and at intervals no longer than 6 months thereafter as long as it remains in stock.

4.02 Never store or place body belts near radiators, stoves, steam pipes, or in places where the leather would be subjected to excessive heat or dampness. Belts that have become wet should be oiled and then set aside in a dry, shady place and allowed to dry slowly.

5. BENDING TEST

5.01 The bending test should be made on body belts only when the leather is clean and well oiled. The leather should show no cracks other than slight surface cracks when the test is applied. If well defined cracks appear, the belt must not be used, but should be taken out of service.

5.02 Do not make the bending test if the temperature of the leather is below 32°F.; at low temperatures the leather may be damaged by bending it around the test mandrel.

5.03 The bending test should be made as follows:

a. Leather should be bent with the grain (smooth) side out, over a mandrel that is not less than 3/4 inch in diameter. (A 3/4-inch guy rod may be used.) In making this test, pull the leather taut, and wrap it halfway around the mandrel, keeping the leather under tension while the bend is being made. **Do not loop the leather first and then pull it over the mandrel.** This procedure brings the leather into firm contact with the mandrel while the bend is being made, and thus avoids bending the leather too sharply.

NOTE: Do not make the bend test at a buckle hole.

b. Body belts shall be subjected to the bending test at points where it is possible to bend them, such as under the leather tool loops and at the tongue strap.

5.04 If a body belt is subjected to an excessively severe test, such as bending it too sharply (without a mandrel or over too small a mandrel) with the grain side out, the leather may crack because of the excessive strain placed on the grain layer.

6. FITTING BODY BELTS

6.01 The degree of comfort and satisfactory service an employee obtains from a body belt depends, to a large extent, on the location of the D-rings with respect to the prominent portions of the hip bones. Most workers prefer to have the D-rings located slightly in front of the prominent portions of the hip bones. To obtain a properly fitting belt, measure the distance across the back to the desired locations of the D-rings, and order a belt of the size that comes nearest to this dimension. See CTSP 490-025-110, paragraph 2.03.

WOOD BORING BITS AND DRILLS
USE AND MAINTENANCE

1. GENERAL

1.01 This practice replaces CTSP 405-600-605 and provides instructions for the use and maintenance of standard wood boring bits and drills. This practice includes safety precautions to be observed in the use of wood boring bits and drills.

2. STANDARD WOOD BORING BITS

2.01 The standard wood boring bits for telephone use are *auger* bits, *ship auger* bits, *insulator pin* bits and *expansive* bits. The sizes are shown in the following paragraphs. Although a complete list of bits is covered, it is suggested that each employee select only those that have been approved for use in the area and which are required for use in his work. The size of a bit can be readily selected from a kit of bits by the "number" impressed in the shank of the bit. This number indicates the diameter of the bit in sixteenths of an inch. Number "3" indicates a 3/16-inch diameter bit.

2.02 *Auger Bit:* This bit consists of a solid center twist provided with a head containing a single cutter, a single spur, and a lead screw, the threads of which are 14 per inch on the three smaller sizes and 12 per inch on the remaining sizes. See Figure 1.

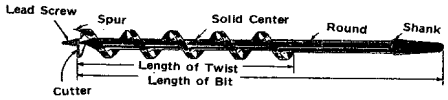


FIGURE 1. Auger Bit.

2.03 Fifteen sizes of *auger bits* are covered, ranging in size from 1/4-inch to 1-inch diameters in increments of 1/16-inch, and from 1-inch to 1-1/4-inch diameters in increments of 1/8-inch. The overall lengths range from 7-1/2-inches to 9-1/4-inches in increments of 1/8-inch. These bits are intended for general use in boring all kinds of wood where the hole depth does not exceed 4 inches for the smaller sizes of bits or 5 inches for the larger sizes of bits. In addition, the bits listed have the following specific uses:

TOOL	OVERALL LENGTH (INCHES)	DESIGNATING NUMBER	SPECIFIC USES
1/4-Inch Auger Bit	7-1/2	4	Inside wiring and installation work.
3/8-Inch Auger Bit	7-3/4	6	Inside wiring, installation work and boring holes in cedar and similar wood poles for pole steps. Also for boring holes when testing poles for hollow heart.
7/16-Inch Auger Bit	7-7/8	7	Boring holes for 3/8-inch bolts used in attaching braces to terminal boxes and crossarms.

Distribution C D E F

TOOL	OVERALL LENGTH (INCHES)	DESIGNATING NUMBER	SPECIFIC USES
1/2-Inch Auger Bit	8	8	Boring holes in chestnut, creosoted pine and similar wood poles for pole steps.
9/16-Inch Auger Bit	8-1/8	9	Boring holes for 1/2-inch bolts used in attaching back braces and vertical braces to crossarms and for 1/2-inch guy rods where the maximum thickness of the pole does not exceed 5 inches.
5/16-Inch Auger Bit	7-5/8	5	
5/8-Inch Auger Bit	8-1/4	10	
11/16-Inch Auger Bit	8-3/8	11	
3/4-Inch Auger Bit	8-1/2	12	
13/16-Inch Auger Bit	8-5/8	13	For general use where
7/8-Inch Auger Bit	8-3/4	14	there is occasional need
15/16-Inch Auger Bit	8-7/8	15	for bits of these sizes.
1-Inch Auger Bit	9	16	
1-1/8-Inch Auger Bit	9-1/8	18	
1-1/4-Inch Auger Bit	9-1/4	20	

NOTE: Number indicates the diameter of a bit in sixteenths of an inch.

2.04 *Ship Auger Bit*—This bit consists of either a solid center or a hollow center twist provided with a head containing a single cutter, a single spur and a lead screw having 12 threads per inch. The solid center twist type of construction bit is similar in design to the auger bit. Figure 2 illustrates the hollow center type.

2.05 Nine sizes of *ship auger bits* are covered ranging from 3/8-inch to 1-5/16-inches in diameter, being available in lengths of 12 inches and 18 inches which are suitable for boring holes to depths of approximately 8 inches and 12 inches respectively. These bits are intended for boring holes through poles, stubbing, building beams, etc.

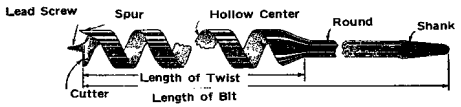


FIGURE 2. Ship Auger Bit.

TOOL	DESIGNATING NUMBER	SPECIFIC USES
3/8-Inch X (*) Inch (**) Center Ship Auger Bit	6	For boring holes through wood for a pair of inside wires. Where practicable a bell hanger bit should be used for holes of this diameter.
1/2-Inch X (*) Inch (**) Center Ship Auger Bit	8	For boring holes through wood for two pairs of inside wires.
11/16-Inch X (*) Inch (**) Center Ship Auger Bit	11	For boring holes through poles for standard 5/8-inch bolts (crossarm, stubbing, cable suspension, eye and machine bolts for deadending strand) and 5/8-inch guy rods.
3/4-Inch X (*) Inch (**) Center Ship Auger Bit	12	For boring holes through wood to a depth of 9-1/2 inches for deadending strand.
13/16-Inch X (*) Inch (**) Center Ship Auger Bit	13	For boring holes through poles for standard 3/4-inch eye bolts and machine bolts for deadending strand and for boring for 3/4-inch guy rods.
7/8-Inch X (*) Inch (**) Center Ship Auger Bit	14	For boring holes through wood to a depth of 10-1/2 inches for cable suspension.
1-1/16-Inch X (*) Inch (**) Center Ship Auger Bit	17	For boring holes through poles for standard 1-inch eye bolts and machine bolts for deadending strand and for boring for 1-inch guy rods. Also for boring holes for loading coil case supports.
1-1/4-Inch X (*) Inch (**) Center Ship Auger Bit	20	For boring holes through wood to a depth of 11-1/2 inches through building beams, etc.
1-5/16-Inch X (*) Inch (**) Center Ship Auger Bit	21	For boring holes through poles for 1-1/4-inch guy rods.

*NOTE: * 12 or 18 depending on the length desired.*
***Hollow or solid depending on the type adopted by the company.*
Designation number indicates the diameter of a bit in sixteenths of an inch.

2.06 The *ship auger bits* are tempered the entire length to prevent the bits being bent when side pressure is applied. The twists are ground and polished to the required dimensions to permit the chips to travel out through the spiral groove without turning and wedging

between the outer edges of the bit and the side of the hole, which would cause the chips beyond that point to pile up and clog the groove of the bit. The cutter of the bit is diametrically opposite the spur, which facilitates sharpening the bit.

2.07 *Insulator Pin Bit:* This bit consists of a solid center twist provided with a head containing a single cutter, a single spur and lead screw having 12 threads per inch. The length of the bit has been limited to 6-7/8 inches to permit operating the brace between crossarms having standard spacing. See Figure 3.

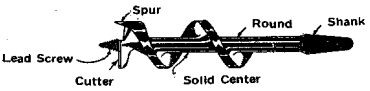


FIGURE 3. Insulator Pin Bit.

2.08 There are two sizes of bits which are intended for the following uses:

TOOL	DESIGNATING NUMBER	SPECIFIC USES
11/16-Inch Insulator Pin Bit	11	Intended for boring holes in crossarms for steel insulator pins and 5/8-inch bolts used in attaching break irons
1-1/4-Inch Insulator Pin Bit	20	Intended for boring holes in crossarms for respacing wooden insulator pins

NOTE: Designation number indicates the diameter of a bit in sixteenths of an inch.

2.09 *Expansive Bit*—This bit consists of a bit shank and round, terminating in a slotted head having a lead screw. The threads are 18 per inch and are provided with a cutter secured to the head with an adjusting clamp and screw. It is available in two sizes, large and small. Each size is furnished with a large and small adjustable cutter, both of which carry scales graduated in 1/32 of an inch to furnish adjustment to 1/16 of an inch on the diameter. The overall lengths of the large and small bits are 9-1/4 inches and 7-5/8 inches, respectively. The small bit has a 1/2-inch diameter head and bores holes from 1/2 inch to 7/8 inch, and 7/8 inch to 1-1/2 inches in diameter depending on whether it is equipped with a small or large cutter. The large bit has a 7/8-inch diameter head and bores holes from 7/8 inch to 1-3/4 inches, and 1-3/4 inches to 3 inches in diameter depending on whether it is equipped with a small or large cutter. See Figure 4.

2.10 Expansive bits are intended for boring holes through boards, where it is desired to cover a wide range of hole diameters with a minimum number of bits (an example of which is boring holes through terminal boxes for cable entrances).

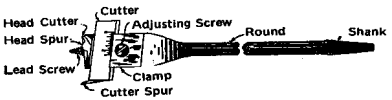


FIGURE 4. Expansive Bit.

FIGURE 5. Installer's Drill. (Bell Hanger Bit)

3. STANDARD INSTALLER'S DRILLS (BELL HANGER BITS)

3.01 The installer's drill (Figure 5) consists of a bit stock shank and long round provided with a short twist drill. The drill point is ground at an angle suitable for drilling in wood in which nails, screws, sheet metal or metal lath may be encountered as well as drilling through plaster walls. It is available in 5 sizes ranging by 1/8 of an inch from 1/4 inch to 3/4 inch in diameter. In general, the size of the drill is impressed on the round in thirty-seconds of an inch. All sizes, as listed below, are intended for boring holes where a variety of conditions may be encountered in connection with inside wiring and installation work.

TOOLS	DESIGNATING NUMBER
1/4-Inch by (*) Inch Bell Hanger Bit	8
3/8-Inch by (*) Inch Bell Hanger Bit	12
1/2-Inch by 18-Inch Bell Hanger Bit	16
5/8-Inch by 18-Inch Bell Hanger Bit	20
3/4-Inch by 18-Inch Bell Hanger Bit	24

*NOTE: *18, 24, or 30 depending on the length desired.*
Designating number indicates the diameter of the drill in thirty-seconds of an inch.

3.02 All installer's drills are provided with a hole through the web of the drill to facilitate fishing wires through the bored hole at the time it is withdrawn.

4. USING BITS AND DRILLS

4.01 Bits and drills will give the best service if they are kept in good repair. If a bit or drill requires pushing on the brace head to cut the wood, the indications are that it is in need of repair. *Never strike the brace with a hammer to start boring with a bit or drill.*

4.02 With bits, the appearance of the chip is an indication of the cutting edge and outlining spur condition. A clean-cut chip means a sharp cutter. A mangled or shredded chip usually means a dull cutter. A bit which does not feed itself properly may be in need of screw point repairs. A bent bit turns hard and ultimately binds, preventing further entrance in the hole. If the chips pile up in the hole, clearance may be too great or the bit may be covered with gummy material or rust. Difficulty of this nature may, however, be experienced when boring cedar poles especially those containing either pipe rot or checks. These conditions are similar to striking another hole, which permits the chips to drop and turn in the spiral groove. As a result, some of the chips tend to wedge between the outer edges of the bit and the side of the hole causing the chips beyond this point to pile up and clog the opening of the twist. There appears to be no way of overcoming this trouble so it will be necessary for employees working on cedar poles to clear the holes during the boring operation when required.

4.03 Before boring through siding, clapboard, panels, thin boards, etc., particularly if the hole is to be located near the end of the board, drill a lead hole in a diameter slightly less than the diameter of the lead screw with the standard automatic drill as a means of reducing the possibility of splitting the wood.

4.04 In general, a hole can be bored completely through the wood without cleaning the hole. After the bit has passed completely through the hole, clear the hole by hitting the head of the brace with the palm of the hand until the bit passes through for three or more inches. Then remove the bit by turning it counterclockwise and pulling on the head until

it is all the way out. Pulling the bit without turning it out may cause the loss of balance and result in an accident. If the bit turns hard making it necessary to clear the hole before completing the boring operation, back the bit out until the screw point is loose and then pull on the head of the brace and at the same time turn the brace clockwise until most of the chips have worked their way out of the hole.

4.05 If a nail or other piece of metal is encountered while boring with a bit, immediately back the tool out to clear the metal and then clean as described above. If the size of the hole permits, remove the obstruction with a cold chisel, and then proceed with the boring. Obstructions in small diameter holes will necessarily have to be bored through with an installer's drill.

4.06 Bits, particularly the expansive bits, have a tendency to break out the wood around the bottom of the hole when completing the boring operations. This can be overcome by firmly backing up the location of the hole with a small block of wood until the bit has passed completely through the hole being bored. This practice should be followed wherever practicable.

4.07 If the cutting edges of an installer's drill are dull, the boring will be difficult. If the edges are not of equal length, a hole larger in diameter than desired is obtained. If the cutting edges do not form a uniform angle with the axis of the drill, only one side will do the cutting. If the cutting edges of the drill have not been backed off sufficiently to provide the proper clearance or the web is too thick, considerable pressure will be required on the brace head to remove only a small amount of wood. When using an installer's drill in solid wood, the hole should be cleared of chips every 10 to 15 turns.

4.08 Bits or drills should not be placed or left on a highway, sidewalk, or property accessible to the public where they or vehicles may be damaged, or where they may constitute a potential hazard to persons or livestock.

4.09 When carrying a bit or drill, always direct the point away from the body and hands.

4.10 Before boring a hole, make certain that there is no obstruction (gas, water, or soil pipe) in the bit or drill path and that it does not come in contact with foreign wires or fixtures. Observe the direction of the lag bolts holding foreign wire pole attachments and obtaining clearance for the through bolt. Bear in mind that walls or other locations may conceal wires, pipes, or sliding doors.

4.11 When stationed on the opposite side of a partition, pole, etc., observe where the bit or drill is coming through. Assume a safe position so there is no chance of injury from the bit or drill suddenly projecting through the wall, pole, etc.

4.12 When boring a deep hole, sight along the bit after it has been started to determine if it will terminate at the desired location.

5. TRANSPORTING AND STORING BITS AND DRILLS

5.01 At all times, take proper care of bits and drills so that they will give satisfactory service and that injury or damage will not result from an exposed point or cutting edge. Bits and drills should be placed in tool rolls, racks or pockets of trucks or tool chests provided for protection purposes.

5.02 New bits and drills should be left in the original container until required for use. If the container is broken and it appears advisable to remove either the bits or drills from the

container or if bits or drills are returned from the field for storage, they should be placed on the shelves with the points facing the back of the shelf.

6. INSPECTION ROUTINE

6.01 Each employee should at all times assume the responsibility for determining that the bits and drills in his possession are in good condition.

7. INSPECTION OF WOOD BORING BITS AND DRILLS

7.01 Bits and drills should be examined to determine their condition as suggested below. In connection with the inspection of bits, the important conditions to look for are:

a. *Auger Bits, Ship Auger Bits and Insulator Pin Bits.*

(1) Broken screw point or threads badly marred.

(2) Dull spur or edge badly nicked or bent.

(3) Spur lower than cutting edge.

(4) Dull or badly nicked cutting edge.

(5) Twist of bit bent.

(6) Round of bit bent.

(7) Shank marred or rounded.

b. *Expansive Bits.*

(1) Broken screw point or threads badly marred.

(2) Dull or bent spur or edge badly nicked.

(3) Spur lower than cutting edge of head.

(4) Dull cutter spur or edge badly nicked.

(5) Top of cutter spur lower than cutting edge of cutter.

(6) Dull or badly nicked cutting edge of head.

(7) Dull or badly nicked cutting edge of cutters.

(8) Round of bit bent.

(9) Shank marred or rounded.

(10) Threads of adjusting screw stripped and slot badly marred.

c. *Installer's Drills (Bell Hanger Bits).*

(1) Dull cutting edges or edges badly nicked.

(2) Cutting edges of unequal length and angle formed with the axis of the drill not uniform.

(3) Insufficient clearance back of cutting edge.

(4) Twist broken, bent or less than 2 inches in length.

(5) Round of drill bent or broken.

(6) Shank marred or rounded.

7.02 If tools for repairing bits and drills have not been provided for that purpose and any of the above conditions are found to exist or if the condition of the bits and drills is such that they do not appear satisfactory from a safety standpoint, they should be exchanged at once for bits and drills in good condition.

7.03 If tools have been provided for repairing bits and drills and if any of the above conditions that warrant repairing are found to exist, they should be maintained in accordance with paragraphs 9 and 10.

8. TOOLS REQUIRED FOR MAINTAINING WOOD BORING BITS AND INSTALLER'S DRILLS (BELL HANGER BITS)

8.01 The following tools are required for maintenance of bits and drills as covered in this practice.

TOOL	USE
File, Auger Bit, 7-Inch	For use in sharpening screw point spur and cutter.
File, Lineman's	For use in dressing shank.
File, Round, Second Cut, 5-Inch	For use in thinning web of drill.
Hammer, Claw, 1-1/2 lb.	For use only in straightening the round of a drill or bit.
Hammer, Riveting, 7 oz.	For use in straightening the outlining spur.
Mallet, Wooden	For use in straightening the round and the twist of a drill or bit.
Paper, Abrasive, Fine	For use in polishing bad rust spots on the shank, center and twist of bits or drills.
Rag, Oily	For treating bits and drills to prevent rusting.
Rule, 2 ft. or 6 ft.	For use in determining the angle of the cutting edge of the drill.

9. MAINTAINING WOOD BORING BITS

9.01 The following maintenance methods have been found satisfactory for use by field forces. The illustrations cover the position for a right-handed man.

a. *Maintaining auger bits, ship auger bits, and insulator pin bits.*

(1) *Resharpening Screw Point*—The threads of the screw point should not be resharpened unless very dull or badly marred. To restore the threads, rest the bit on the edge of a supporting wood surface with the screw pointing upwards. Place an edge of auger bit file on the bottom of the thread near the cutting edge. Revolve the bit slowly and at the same time file the thread using short, light strokes. Continue this until the point of the screw is reached. See Figure 6. A screw point with the initial threads badly marred or broken off should be repointed with a file. If too blunt a point is obtained to take a hold in the wood, the bit is to be returned for a new one.

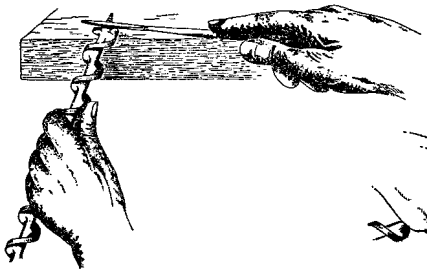


FIGURE 6.

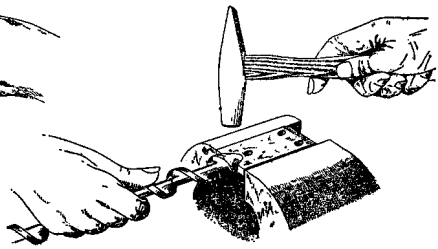


FIGURE 7.

(2) *Restoring Bent Spur*—If the spur of a bit has been bent, it should be straightened with a light hammer such as a riveting hammer as shown in Figure 7. If after straightening the spur the cutting edge appears to be jagged or rolled, the outside surface near the cutting edge may be "touched up" with a file.

(3) *Resharpening Spur*—Hold the bit against a wood support with the point up and then place an auger bit file on the inside of the spur on the front edge which performs the cutting. Sharpen this cutting edge by pressing lightly on the file and keeping it at an angle that will limit the amount of metal removed. See Figure 8. Except for "touching up", never file the outside of the spur as this destroys the clearance and causes the bit to bind or stick. The foremost edge of the outlining spur must extend beyond the cutting edge for efficient boring. If such is not the case, the bit should be returned for a new one.

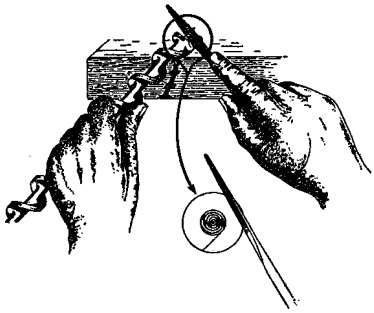


FIGURE 8.

(4) *Resharpening Cutter*–Hold the bit in the left hand with the point down, resting the top of the screw point against the edge of a bench or other suitable support so that the cutting edge is parallel with the edge of the bench or other support. Using light strokes, sharpen the cutting edge to a straight line with an auger bit file, keeping the bevel practically the same as it was when the bit was new. See Figure 9.

(5) *Straightening Bit*–To straighten a bit, bore a hole to the depth of the bend in a solid timber that has a direction opposite to the bend of the bit until the distance traveled is sufficient to remove the bend. If available, a vise may be used for holding the bit. The bit should be protected from injury by placing solid pieces of wood between the sides of the bit and vise jaws. If the bit remains slightly bent, it may be straightened by placing it on a solid, flat, wooden surface and tapping it lightly with a smooth faced wooden mallet or a hammer on the side opposite the bend. This method should also be used for sprung or slightly bent bits. See Figure 10. A badly bent bit that cannot be straightened by these methods in a reasonable time should be exchanged for one satisfactory for use. To determine whether a bit is straight, lay it on a flat surface, then roll it. If it rolls evenly it is straight.

(6) *Squaring Shanks*–Shanks with slightly rounded edges may be squared by filing the flat faces with a lineman's file. See Figure 11. If the shank bit edges are rounded to the extent that the brace chuck will not hold the bit after being filed, it should be exchanged for one satisfactory for use.

b. *Maintaining Expansive Bit.*

(1) *Resharpening Screw Point*–Maintain in accordance with paragraph 9.01 a. (1).

(2) *Restoring Bent Spur*–Maintain in accordance with paragraph 9.01 a. (2).

(3) *Resharpening Head and Cutter Spur*–Maintain in acordance with paragraph 9.01 a. (3).

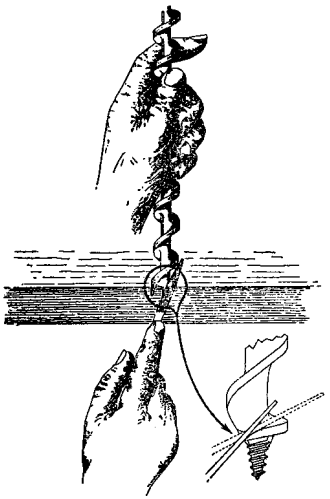


FIGURE 9.

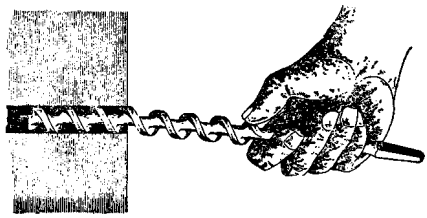


FIGURE 10.

(4) *Resharpening Head Cutter*–Hold the bit with the left hand resting on a solid surface as shown in Figure 12. With an auger bit file, sharpen the cutting edge to a straight line keeping the bevel the same as it was when new.

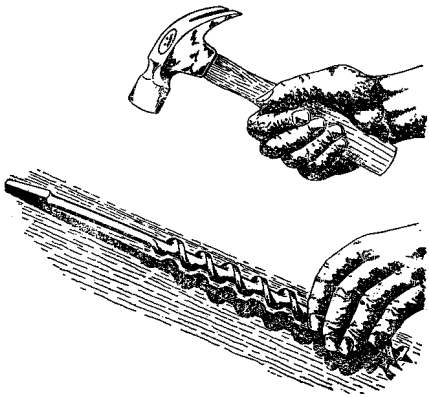


FIGURE 11.

(5) *Resharpening Edge of Cutter*–Move the cutter out to the maximum size hole that the bit is used for. Hold the bit in the left hand with the point up and back of the cutter, resting on a solid support as shown in Figure 13. With an auger bit file, sharpen the cutting edge using light strokes keeping the bevel the same as it was when new. Test the edge by drawing a small stick of wood across the cutting edge. If a sliver of wood is easily removed, the cutting edge is satisfactory for use.

(6) *Squaring Shank*–Maintain in accordance with paragraph 9.01 a. (6).

9.02 Moisture from the hand, as well as that found at seashores and in foggy territories or sap from green timber, etc., may occasionally cause rust spots to appear on a bit. To prevent this, the bit should be wiped with an oily rag. Fine abrasive paper may be used to polish bad spots on the shank, round or twist of bits. Such material, however, should not be applied to any cutting edge, spur, or screw.

10. MAINTAINING INSTALLER'S DRILL (BELL HANGER BITS)

10.01 In general, drills should be returned to the storeroom for resharpening where the work is performed on an abrasive wheel.

10.02 *Straightening Round of Drill*–Maintain in accordance with paragraph 9.01 a. (5).

10.03 *Squaring Shank*–Maintain in accordance with paragraph 9.01 a. (6).

10.04 *Removing Rust*–Maintain in accordance with paragraph 9.02.

10.05 A correctly ground drill should:

a. Provide the cutting edges with a uniform angle with the axis of the drill.

b. Obtain cutting edges with exactly equal length.

c. Obtain sufficient clearance behind the cutting edge.

d. Obtain sufficient groove depth.

11. SAFETY PRECAUTIONS

11.01 Take care and observe the following precautions when handling bits and drills:

a. Bits and drills should not be placed or left on highway, sidewalk or property accessible to the public.

b. Bits should be raised aloft on a pole by means of a canvas bucket or a handline. Bit should not be assembled in a brace to be raised aloft in a canvas bucket.

c. When placing bits and drills on shelves, the points should face the back of shelves.

d. Never transport bits and drills loose in tool boxes or compartments. (See paragraph 5.01.) Tools being returned for junking are exceptions.

e. Do not pull either a bit or a drill from a completed hole; back it out by turning. See paragraph 4.04.

f. Place the bit or drill in brace so that the jaws catch the edges of the shank.

g. When finished with bits and drills, place them in the receptacle provided for the purpose of protection.

h. When stationed on the opposite side of partition, pole, etc., observe where a bit or drill is coming through and assume a position so there is no likelihood of being injured if the bit or drill is suddenly projected through the wall, pole, etc.

12. STANDARD REPAIRS

12.01 The employees in the field, if furnished with maintenance tools, should maintain bits and drills in accordance with the instructions in this practice. All bits and drills requiring other repairs should be returned.

13. DISPOSITION OF WOOD BORING BITS AND INSTALLER'S DRILLS (BELL HANGER BITS)

13.01 Bits and drills found to be defective should be tagged "defective" or "N.G." and returned in accordance with the company's established procedure.

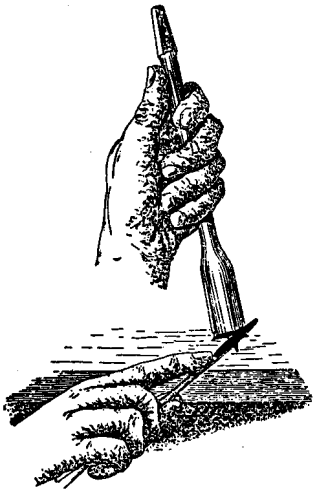


FIGURE 12.

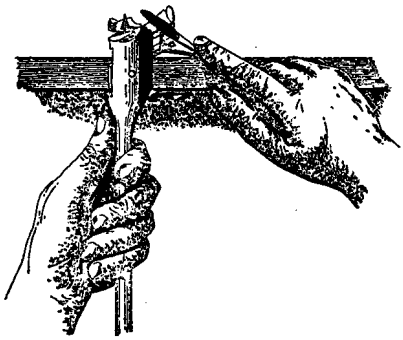


FIGURE 13.

MASONRY DRILLS AND DRILL HOLDERS
DESCRIPTION AND USE

1. GENERAL

1.01 This practice provides the description of masonry drills and drill holders which are used to drill holes in masonry for the anchoring devices that secure the various building attachments associated with drop and block wiring, house and block cables, and underground cables.

2. DESCRIPTION

2.01 The drill holder consists of a length of round tool steel with a tapered socket in one end to accommodate the drill shank and a beveled striking head on the other end. A soft rubber grip is molded around the holder to facilitate holding and turning during the hand drilling operations. An elongated hole located in the socket end is for inserting the ejector to remove the drill from the socket. See Figure 1.

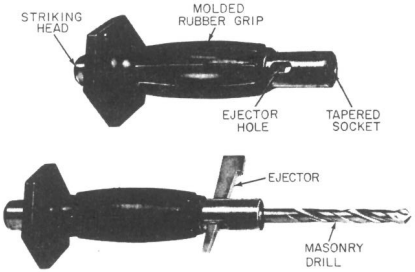


FIGURE 1. Drill Holder

2.02 The masonry drill has a spiral fluting similar to that in twist drills used for drilling metal. The shank of the drill is tapered to fit the socket of the drill holder. See Figure 2.

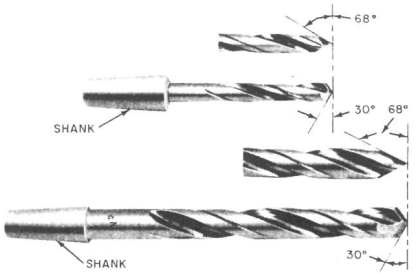


FIGURE 2. Masonry Drills

3. PRECAUTIONS

3.01 Eye protection must be worn during drilling operations in masonry to protect the eyes from flying chips.

3.02 Protective gloves should be worn to protect the hands from flying particles of metal or masonry caused by the drilling.

3.03 Before performing any drilling operations in manholes, the procedures outlined in CTSP 490-150-100 must be performed.

3.04 Do not use a drill holder with a badly mushroomed head. Refer to paragraph 5 to correct this condition.

4. USE

4.01 When drilling in masonry walls, apply light hammer blows and turn the drill slightly between blows for best result. This procedure will require less physical effort and results in faster and cleaner hole drilling.

4.02 Masonry drills give best results when in good condition. If cutting edges are dull, the drilling will be slow and laborious. If cutting edges are not of equal length or the point is off center, the drill will jam and produce a hole larger than the drill size.

4.03 Masonry drills clean the holes while drilling and when removed, the anchors or expansion shields can be inserted.

4.04 To remove a masonry drill from the drill holder, insert the small end of the ejector into the elongated hole at the socket end of the holder so the flat side is in contact with the end of the drill. Push the ejector into the hole until it is seated handtight against the shank of the drill in the socket. A sharp tap with the drilling hammer is usually sufficient to unseat the drill in the socket for easy removal. Direct the point of the drill downward to prevent injury in case the drill is ejected too sharply.

5. MAINTENANCE

5.01 Each craftsman should assume responsibility for the working condition of the drill holder and drills assigned to him.

5.02 The striking head of the drill holder is made purposely softer than the head of the drilling hammer; therefore, with continued use it will spread over or mushroom. When this occurs, the mushroomed edges may be removed and the head redressed on an electric grinder.

CAUTION: Eye protection must be worn when using an electric grinder.

5.03 When the mushrooming begins to shown signs of cracking, the holder is considered unsafe for further use and should be replaced.

5.04 The following defects impair the drilling efficiency of masonry drills:

a. Dull or badly nicked cutting edges.

b. Cutting edges of unequal length and the angle formed with the axis of the drill not uniform.

c. Bent drills.

d. Broken points.

e. Diameter reduced by wear to the point where the drilled hole is too small for anchor.

5.05 Dull or unequal length cutting edges may be restored to efficiency on an electric grinder. Maintain the same angle on the point as originally sharpened. See Figure 2. For all other defects, the drills should be replaced in accordance with local procedures.

ELECTRIC SOLDERING IRON
100, 200, AND 300 WATT COPPER TIP

1. GENERAL

1.01 This practice provides information on the description and use of soldering irons used for central office, PBX and PABX installations.

2. DESCRIPTION

2.01 As shown in Figure 1, the electric soldering irons covered in this practice consist of a molded handle, 2-conductor cord and plug, a 100, 200, or 300 watt heat element within the casing assembly, an air gap insulator safety shield, a replaceable nickled copper tip and two set screws.

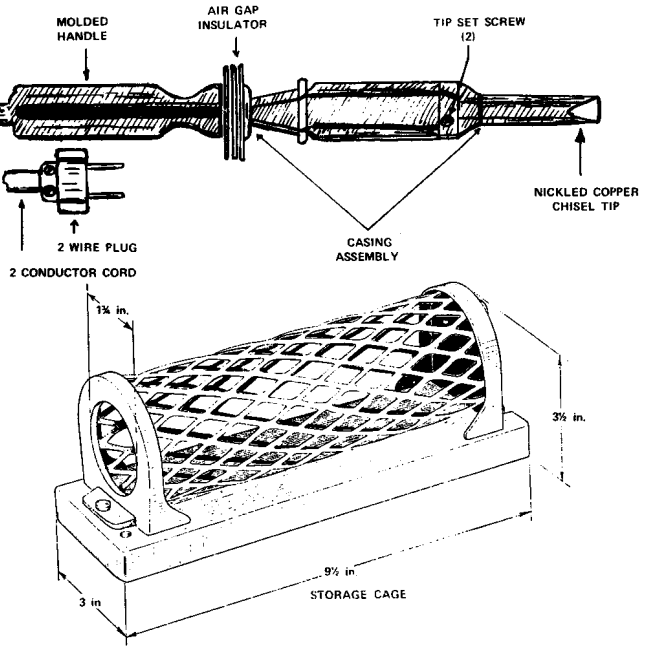


Figure 1.

2.02 These irons have been designed to operate on 115 volt house current or that supplied by a portable generator.

3. USE

3.01 The 100, 200, and 300 watt soldering irons as medium duty tools, will be utilized for soldering a number of cross connections, strapping DTA's and similar work which requires a more constant heat than the light weight iron (described in practice 405-700-001) furnishes.

3.02 New soldering tips will have to be tinned before initial use. To tin a tip proceed as follows:

a. Scruff flat surfaces of (chisel) tip lightly with a file.

b. Obtain working temperature of point.

c. Using rosin core solder, apply a light coat of solder to the working surfaces of the iron. A wiping cloth may be required during this process to wipe excess solder off tip. Only a slight glaze (coat) of solder is required.

3.03 When soldering proceed as follows:

a. Place the tinned tip of the iron upon the wire or connection.

b. Place rosin core solder on the wire or connection until the rosin flows.

c. The rosin will clean the oxides from the metals to be soldered and allow the solder to run smoothly on the connection.

d. A heavy film of solder between the working face of the tip and the joint being soldered eliminates the need for pressure as the solder conducts heat from the tip to the work.

e. Solder should be applied to the joint and should flow onto the metal and into the joint.

f. Do not use excess solder. Slide the iron from the work, do not lift it. This insures an even soldered surface.

g. Avoid a fracture in the joint by preventing movement of the connection until the metal is cooled below the freezing point of the solder.

h. The finished connection should be bright and free of pits.

4. MAINTENANCE

4.01 For maximum efficiency, be sure that the tip is clean at all times. A tip containing foreign residue will not heat properly.

4.02 The soldering iron tip will generally require an occasional touchup with a wiping cloth at working temperature.

4.03 As the tip is used it will become pitted and solder buildup will generally be heavier and require more frequent cleanings.

4.04 It may also be necessary to file away excess solder (cold tip) between periods of use.

4.05 After filing tip, re-tin as outlined in paragraph 3.02.

4.06 If an iron is not functioning properly, check tip for cleaning or replacement. If this does not solve the problem, return the unit to the storeroom.

4.07 When not in use, the soldering iron shall be stored in its associated cage (Figure 1) with the cord wrapped around and firmly secured to the handle.

4.08 The iron should be stored in the workman's truck in such a manner that it will not come in contact with any other hard object that would rupture the cord insulation.

5. SAFETY PRECAUTIONS

5.01 During a work operation, the hot iron shall always be placed in the cage (Figure 1) when not in use, and the complete unit kept clear of any combustible material.

5.02 In checking the iron for heat, never use fingers or hand. Check tip of iron for heat with solder.

WIRE-WRAP TOOLS
DESCRIPTION AND USE

1. GENERAL

1.01 This practice covers the description and use of electric, spring, and hand operated wire-wrap tools.

1.02 Wire-wrapped connections shall be made only on terminals designed for wire-wrapping.

2. WIRE-WRAPPING TOOLS

2.01 The wire-wrapping tools recommended for use are:

a. Electric Wire-Wrap Tool No. 14B1-A (wire gauge capacity 20 through 32).

b. Spring Operated Wire-Wrap Tool No. 14H-1C (wire gauge capacity 20 through 26).

c. Hand Operated Wire-Wrap Tool No. 20557-23 (wire gauge capacity 24 through 26).

d. Hand Operated Wire-Wrap Tool No. 20557-14 (wire gauge capacity 22).

e. Hand Unwrapping Tool No. A-31478-(LH) (wire gauge capacity 20 through 26).

f. Wrapping Bit No. 500131 (wire gauge capacity 22).

g. Wrapping Bit No. 17612-2 (wire gauge capacity 24).

h. Sleeve No. 18840 (wire gauge capacity 22).

i. Sleeve No. 17611-2 (wire gauge capacity 24).

3. DESCRIPTION

3.01 A wire-wrapping tool is basically a metal rod containing two longitudinal holes. The skinned portion of a wire is inserted into the smaller hole and the larger hole is placed over the terminal. See Figures 1 through 4.

3.02 The wire-wrap tools No. 14B1-A and No. 14H-1C are pistol shaped. The No. 14B1-A is electrically driven and the No. 14H-1C is hand driven and is equipped with a spring which restores the tool to normal.

3.03 Wrapping bits and sleeves are provided in different sizes to accommodate the various wire sizes. The bits and sleeves are inserted into the nose assemblies of the wire-wrapping tools. The wire sizes are shown in Part 2.

3.04 The wire-wrapping bit has an axial hole in one end which fits over the terminal on which a wrapped connection is to be made. In the same end near the outer edge is a smaller hole which is the wire feed slot. (See Figure 5.)

3.05 The sleeve has two wire anchoring notches located opposite each other for holding the insulated portion of the lead. This prevents the insulated portion of the wire from wrapping around the terminal. On the same end is a funnel-shaped flare which guides the skinned portion of the wire into the feed slot of the wrapping bit (Figure 5).

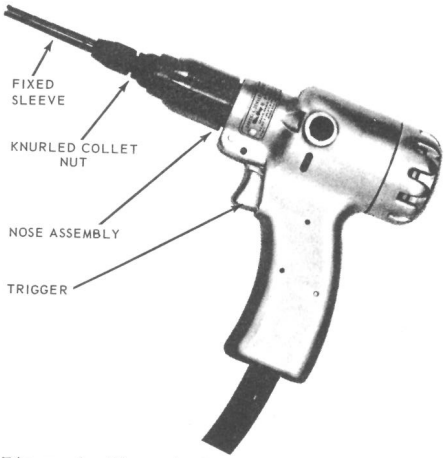


Figure 1. Electric Powered Wire-Wrap Tool

Figure 2. Hand Operated Wire-Wrap Tool

Figure 3. Hand Wrapping Tool.

Figure 4. Hand Unwrapping Tool.

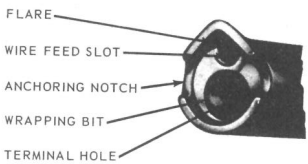


Figure 5. Wire Wrapping Tool Equipped with Associated Bit and Sleeve.

4. PREPARATION

4.01 The gauge of the wire-wrap tool, bit and sleeve shall match the gauge of the wire which is to be used.

4.02 To equip the tool for operation, unscrew the knurled collet nut (see Figure 1) and insert the bit and then the sleeve into the nose piece. Tighten the knurled collet nut by hand. Operate the trigger several times to verify that the wire feed slot stops in line with the flare. If the wire feed slot fails to stop in line with the flare, loosen the knurled collet nut and reposition the sleeve. Failure of the wire feed slot to line up with the flare after repositioning may indicate that the wrapping tool or bit is defective. In this case the wrapping tool and bit should be returned for inspection and repair.

4.03 To remove the sleeve, loosen knurled collet nut and pull sleeve straight out from the wrapping tool.

4.04 To remove the bit, pull it straight out from the wrapping tool until it stops and is free to rotate. Rotate the bit 180° and pull straight out.

5. WRAPPED CONNECTIONS

5.01 *Solderless Wrapped Connections:* The minimum number of turns around the terminal shall be six complete turns for 24 gauge wire, and five complete turns for 22 gauge wire. A skinned length of 1 5/8 inches should be sufficient for 22 and 24 gauge wire to permit the required number of turns around the terminal. More than the required number of turns is permissible (see Figure 6). In order to ascertain that satisfactory connections are being obtained, check them periodically.

5.02 *Soldered Wrapped Connections:* A minimum of three complete turns around the terminal shall be made for soldered wrapped connections. A skinned length of 3/4 inch should be sufficient to permit the required number of turns around the terminal. More than the required number of turns is permissible (see Figure 6).

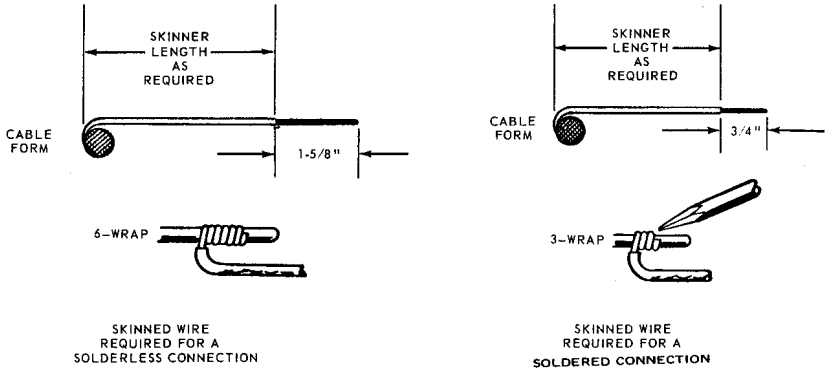


Figure 6. Skinned Lengths Required for Solderless and Soldered Wire Wraps.

5.03 *Skinning Leads:* Care should be used when skinning leads for wrapped connections as it is important that the leads not be nicked or flattened. The wires should not be bent as this makes it difficult to introduce the wire ends into the wire feed slot of the bit.

NOTE: *Before skinning cable conductors on the apparatus side of terminal strips, the wires shall be in their final position.*

5.04 *Wrapping Leads:* Wrap leads as follows:

a. Insert the skinned portion of the lead into the feed slot of the wrapping bit, care being taken to insure that no bare wire is showing. Bond the insulated portion of the lead into the anchoring notch as illustrated in Figure 7. Push the tool onto the terminal while holding the wire taut in the anchoring notch. Use of the left or right anchoring notch is determined by direction of approach, i.e., a lead dressed to the left of the terminal is placed in the left anchoring notch; if dressed to the right, it is placed in the right anchoring notch.

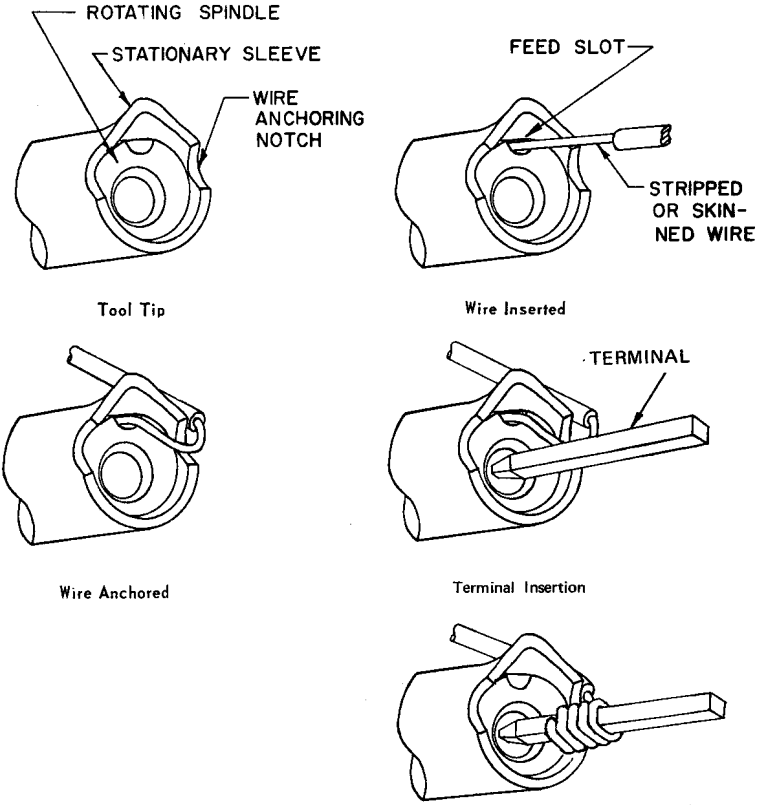


Figure 7. Solderless Wrapped Connection Process.

NOTE: *If the wire is not inserted up to the insulation, a "shiner" may result. A "shiner" shall not be longer than 1/8 inch. A longer length "shiner" is a potential trouble.*

b. The tool shall be inserted over the terminal as far as it will go without touching the terminal moulding.

c. The tool shall be in a direct line with the terminal before operation.

d. Operation of the trigger will wrap the wire on the terminal. The tool will automatically recede as the wire coils on the terminal, producing a finished connection.

e. Insufficient pressure on the tool when wrapping may cause separation between turns. Complete turns may be separated, provided the spaces between inside wraps are no more than .005 inch as gauged by eye. (Figure 8)

Figure 8. Separated Turns Resulting From Insufficient Pressure.

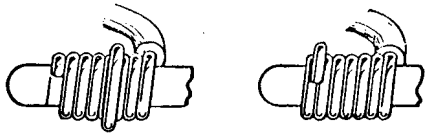


Figure 9. Overriding Turns Resulting From Excessive Pressure.

f. Excessive pressure on the tool when wrapping can cause overriding turns. (Figure 9) Overriding turns are not permissible.

g. It ~~is not~~ required that the wire end be flat against the terminal but a 1/64 inch clearance between the wire end and adjacent terminal must be maintained.

h. If the clearance between the wire end and the adjacent terminal is less than 1/64 inch, and solderless connections are involved, the wire end can be wrapped by placing the tool lightly against the connection and operating the tool.

5.05 *More than one wire per terminal:*

a. Where more than one connection per terminal is necessary, the method of wrapping the second or third connection is determined by the remaining terminal length after the first connection has been made. Each 6 turn connection takes approximately 1/4 inch of the terminal. In order to make a second or third connection, at least 1/4 inch or 1/2 inch of the terminal must be available. (Figure 10 A)

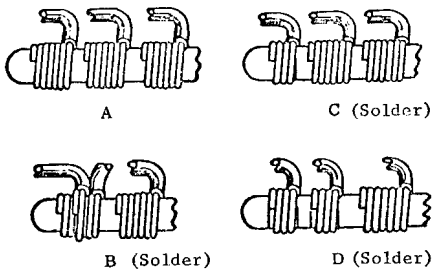


Figure 10. More than One Wire Per Terminal.

b. If there is not sufficient terminal length available for solderless connecting, 1 1/4 to 3 turn connection may be made but must be soldered. (Figure 10 C & D)

c. If there is not sufficient terminal length for a 1 1/4 inch turn connections, wrap the lead over the previous connection and solder. (Figure 10 B)

d. Where it is decided on an installation that it is not practical to apply solderless wire-wrapped connections on terminal strips, the soldering operation can be facilitated if the wrapping tool is not placed on the terminal as far as it will go. A depth guide as shown in Figure 11 and used as illustrated in Figure 12 will position the wrapping tool so as to leave sufficient space for three connections of three turns each. After the first horizontal row of connections has been made on a group of terminal strips, the remaining terminals can be gauged by eye rather than repositioning the guide on each succeeding row of terminals.

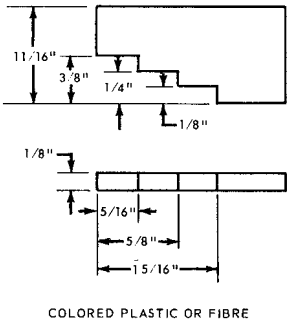


Figure 11. Depth Guide for Soldered Connections on Terminal Strips.

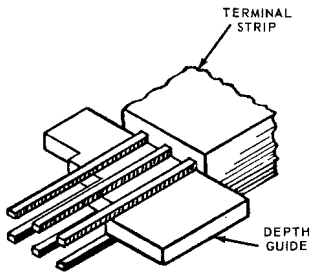


Figure 12. Method of Using Depth Guide for Soldered Connections on Terminal Strips.

5.06 *Soldering Wrapped Connections:*

a. When a terminal contains solder, either on an existing connection or resulting from a previously soldered connection, all connections added to this terminal shall be soldered.

b. When soldering a wrapped connection, a minimum of two adjacent turns of the connection shall be soldered.

c. Where a connection requiring solder is added to a terminal, all connections on that terminal shall be soldered.

5.07 *Removing Wrapped Connections:*

a. The spiral may be unwound with an unwrapping tool or pliers (Figure 13) or, if there is sufficient slack, by hand.

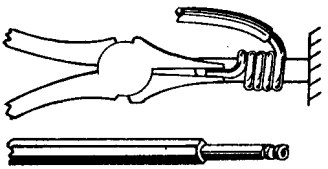


Figure 13. Removing Wrapped Connection.

b. Where a connection has been soldered, a soldering iron should be applied to the connection and the spiral unwound with pliers or by hand. *Do not use the unwrapping tool.*

c. No attempt shall be made to pull the wrap from the terminal by pulling on the lead. This may break the wire and make the wrap difficult to remove.

d. If, for any reason, a wrap must be removed and then reconnected, proceed as follows:

(1) When there is sufficient slack in the lead to obtain the proper skinned length, cut the previously connected lead back, skin and reconnect. Do not rewrap a previously wrapped skinned length as the strength of the wire is reduced by the first connection.

(2) Where there is insufficient slack to make a normal connection, skin 1/4 inch of insulation from the lead and wrap at least 1 1/4 turn of wire, using the wrapping tool or pliers. This wrap shall be soldered.

NOTE: *This does not apply to jumpers. If there is not enough slack, replace the jumper.*

(3) Rewrapped connections made on a terminal that was not previously soldered do not require soldering.

6. PRECAUTIONS

6.01 The bit of the wire-wrapping tool rotates in a thin walled sleeve and, *due to the close tolerance between the two parts, bumping or dropping the tool may result in the bit failing to turn or the wire feed slot failing to line up with the flare on sleeve.*

6.02 When the wrapping tool is not in use, it should be placed in a secure, out-of-the-way location.

6.03 When working on ladders, normal safety practices, such as securing the tool to the ladder with a cord, should be followed to protect both equipment and personnel.

6.04 Since the case of the 14B1-A tool is grounded, care should be taken when connecting terminals associated with working equipment. The appropriate supervisor shall be contacted to have working equipment released if possible. If equipment cannot be released, the connections shall be hand wrapped, using the hand operated wire-wrap tools to complete the connections.

6.05 When it is necessary to connect 20 gauge wire and the 20 gauge wrapping bit and sleeve are not available, the lead should not be wrapped with pliers. The lead should be wrapped around a square or rectangular test terminal, removed, placed on the equipment terminal and soldered. A nail or other object of suitable diameter could be substituted for a test terminal. The described method of wrapping on a test terminal or nail can also be used for 14 gauge wire. All connections made with 20 through 14 gauge wire must be soldered.

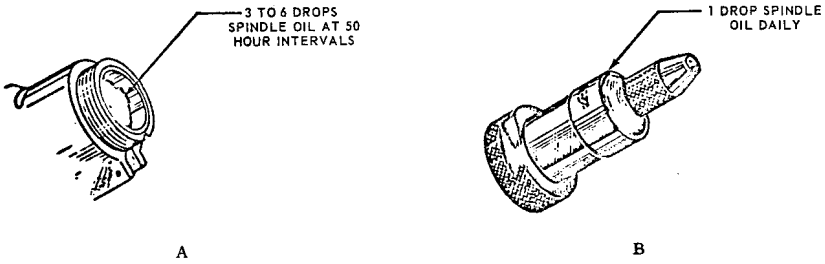
6.06 When solderless connections have been applied, care shall be taken that no testing fixture (either push-on or spring clip type) comes in contact with the connection.

7. LUBRICATION

7.01 The wire wrap tool is assembled at the factory with a light coating of oil on all moving parts. This provides initial lubrication for approximately 50 hours running time. Beyond this, additional lubrication is necessary to maintain top performance.

7.02 At 50 hour intervals, remove the nose assembly and add 3 to 6 drops of spindle oil to the upper clutch block and spindle, as illustrated in Figure 14 A. Replace the nose assembly and run the tool for one or two minutes before starting production.

7.03 The STOP PAWL located under the sleeve on the nose assembly must be lubricated DAILY. Apply 1 drop of spindle oil between the sleeve and guide sleeve assembly (Figure 14 B).



A B

Figure 14. Lubrication Points of Wire Wrap Tool.

8. ORDERING INFORMATION

8.01 The Wire-Wrap tools listed in Paragraph 2.01 are manufactured by the Gardner-Denver Company, Quincy, Illinois.

SCREWDRIVERS
DESCRIPTION, USE, AND MAINTENANCE

1. GENERAL

1.01 This practice covers the description, use and maintenance of screwdrivers and appropriate safety precautions.

1.02 The screwdrivers provided for field use are high grade tools with heat-treated blades. The ends of the blades are ground to fit the screws ordinarily found in telephone work.

1.03 Screwdrivers are furnished in two types: blade type and Phillips. The heavy duty blade type screwdriver is designed for general use with large size wood and machine screws. The light duty blade type screwdriver is for light work with small screws used primarily in apparatus assembly and repair. The Phillips screwdriver is used in any application employing Phillips recessed slot screw-heads.

1.04 The following precautions shall be observed when handling screwdrivers.

a. *Do not use* screwdrivers as drills, chisels, scrapers, or pinch bars.

b. *Do not* carry screwdrivers in pockets where injury to persons or damage to property may result from the exposure of the blade tip.

c. Screwdrivers with broken, chipped or rounded points *shall not* be used.

d. *Always* work in such a position that if the screwdriver should slip it will not cause injury, particularly to the hands or face. If it is necessary to hold small objects, the hand should be kept away from the back of the object so that it will not be struck if the screwdriver slips. This can usually be accomplished by placing the object against some supporting surface. *Avoid holding small objects in the palm of the hand.*

2. DESCRIPTION

2.01 Figure 1 shows screwdriver types and sizes.

2.02 Figure 2 shows the results of improper use and maintenance of blade screwdrivers. Such conditions cause accidents and unsatisfactory workmanship.

2.03 Always use the proper size screwdriver with each size of screw.

3. USE

3.01 In general, a pilot hole will not be required for starting the smaller sizes of screws in soft wood. Pilot holes of the *following* sizes shall be made for the larger sizes of screws where such holes are not already available.

SIZE OF WOOD SCREW

HARD WOOD	SOFT WOOD	SIZE OF DRILL POINT
	No. 6	1/16 Inch
No. 6	No. 8 to No. 10	3/32 Inch
No. 8 to No. 10	No. 12 to No. 14	1/8 Inch
No. 12 to No. 18	No. 18	11/64 Inch

See Figure 1 on following page.

3.02 Before starting screws in metal, be sure the proper size hole has been predrilled and, where necessary, tapped and threaded in the metal.

3.03 After the pilot hole has been drilled, insert the screw. Use both hands when starting screws, one on the handle of the screwdriver and the other on the blade to steady it on the screw. Turn the screw, keeping the centerline of the screwdriver in line with the centerline of the screw. (See Figure 3)

3.04 If it is difficult to turn the screw into the wood, lubricate the threads with a small amount of soap or wax. Be sure the lubricant does not get into the screw slot or on the tip of the screwdriver. If lubricant gets on either of these points, it should be removed to prevent accidents when the screw is being turned.

4. INSPECTION

4.01 Look for the following conditions when inspecting screwdrivers:

a. Point of tip chipped, worn, bent, or improperly shaped.

b. Soft tip (temper destroyed).

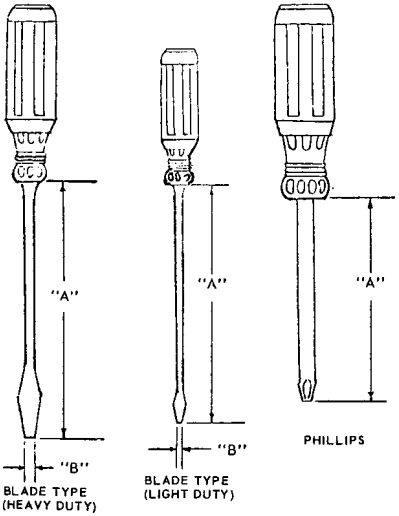
c. Shank bent or loose in handle.

d. Handle broken, split or butt end mushroomed or rough.

4.02 If any of the above conditions are found and cannot be repaired in the field, mark the screwdriver defective and exchange it for one in good condition in accordance with local practices.

4.03 Each employee is responsible for examining his screwdrivers at frequent intervals to determine that they are safe and in good condition.

4.04 Screwdrivers shall be inspected during the periodic tool inspections and employees performing this work shall see that all instructions contained in this practice are followed.



HEAVY DUTY		LIGHT DUTY		PHILLIPS		
"A"	"B"	"A"	"B"	"A"	POINT SIZE	SCREW SIZE *
4"	1/4"	3"	3/16"	3"	1	2-3-4
6"	5/16"	6"	3/16"	4"	2	5-6-7-8-9
8"	3/8"	8"	3/16"	4"	3	10-12-14-16

* ALWAYS USE CORRECT POINT SIZE WITH CORRESPONDING SCREW SIZES.

Figure 1. Screwdriver Sizes

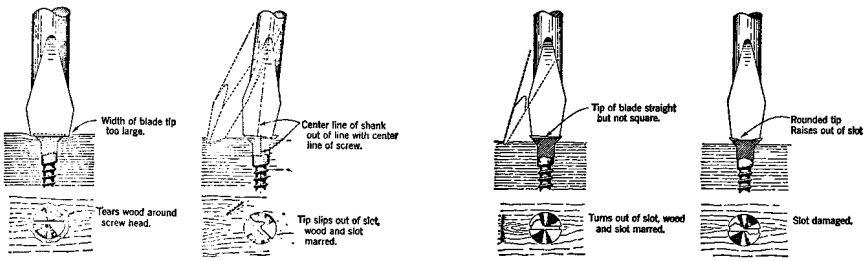


Figure 2.

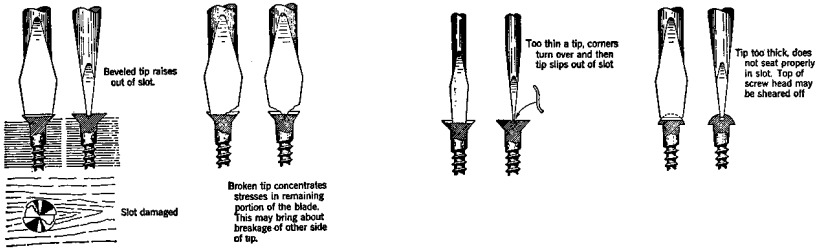


Figure 2

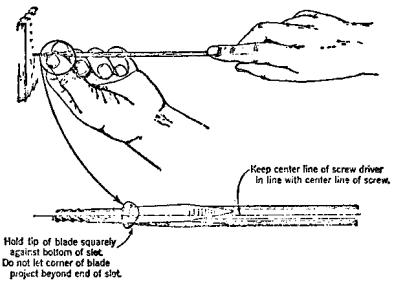


Figure 3

5. MAINTENANCE

5.01 The following method shall be used for repointing blade type screwdriver tips:

a. Select a file designed for sharpening tools. If the teeth of the file are clogged, clean them with the standard file card brush.

b. Select a location that is steady and at approximately the height of the elbows. The surface should be flat so that it can be used as a guide for pushing the file straight across the tip of the screwdriver.

c. Hold the screwdriver blade perpendicular to the flat surface and use the index finger to steady it.

d. Grasp the file securely so that its movements can always be controlled. Place the file on the tip of the screwdriver, parallel with the flat surface and apply sufficient pressure for the teeth to grasp the metal. Move the file forward and parallel to the surface of the tip of the screwdriver (see Figure 4). On the return stroke, the file should be lifted slightly above the surface being filed to avoid dulling the cutting teeth. Continue this process until the desired shape has been obtained.

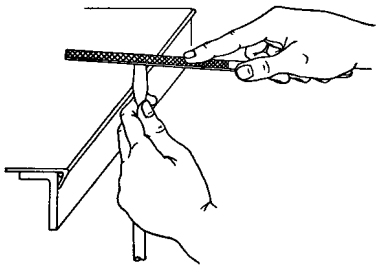


Figure 4. Filing Tip of Screwdriver

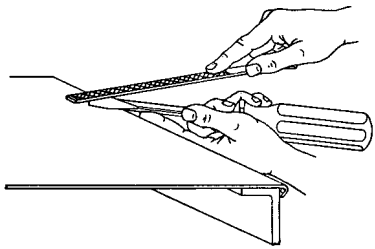


Figure 5. Restoring Tip of Screwdriver

e. Restore the width of the tip as close to its original size as possible with the file (see Figure 5).

f. To restore the thickness of the tip, the entire broad face of the tip should be filed as shown in figure 6.

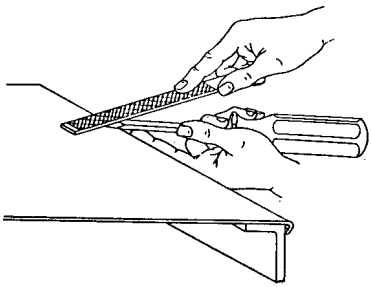


Figure 6. Restoring Thickness of Tip

5.02 *An emery wheel shall not be used for repointing a screwdriver blade.*

5.03 To straighten a bent screwdriver blade, place the bent portion on a solid flat surface with the tip and the shank near the handle resting on the flat surface. Strike the bent section with a mallet or hammer. Start near the handle and continue striking, each blow a little ahead of the last blow, until the tip is reached. This operation should be repeated until the shank is straight. Light blows should be used in order to avoid damage to the shank surface. If a vise is available it may be used by placing the blade of the tool in the vise and applying leverage as required to straighten the shank.

5.04 *Phillips screwdrivers shall not be repointed or filed down.* If the head of the screwdriver is damaged in any way, the screwdriver shall be replaced by a new one.

WOOD EXTENSION LADDERS AND ATTACHMENTS

CONTENTS

1. GENERAL

1.01 This practice is reissued to change the title and to specify that the description and procedures apply to **wood** extension ladders and attachments. Due to the major revision of this practice, brackets indicating changes and/or additions are deleted. **Remove from the file and destroy all copies of CTSP 405-700-320, Issue 1, 1971.**

1.02 This practice provides the proper and safe procedures for handling the various types of wood extension ladders and attachments presently used in the Continental Telephone System. Figure 1 shows a standard wood extension ladder.

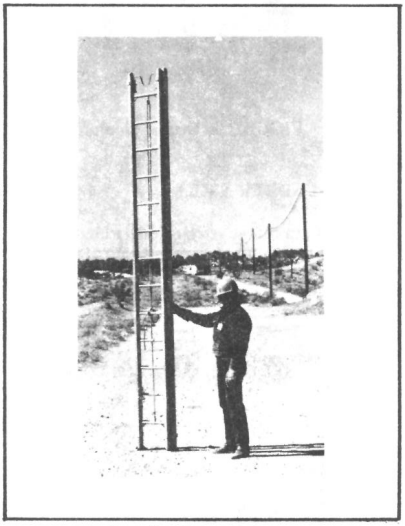


FIGURE 1. Standard Wood Extension Ladder

1.03 The information in paragraphs 4, 10, 11, 12 13, 14, 15, and 16 of this practice also applies to fiberglass ladders. Refer to CTSP 405-700-619 for information on the care and maintenance of fiberglass ladders.

1.04 It is the responsibility of craftsmen to check ladders and attachments to ensure that the equipment is in good working condition.

2. DESCRIPTION

2.01 All ladders referred to in this practice are of the treated wood type. Extension ladders are provided in sizes of 24 feet, 28 feet, and 32 feet. They are equipped with duo safety shoes on the side rails to prevent slipping, and are furnished with strand hooks. Two automatic locks are attached to the side rails of the top section and clasp over the rungs of the bottom section. The top section of the ladder is raised by means of a 3/8-inch manila or synthetic fiber rope. See Figures 2, 3, and 4.

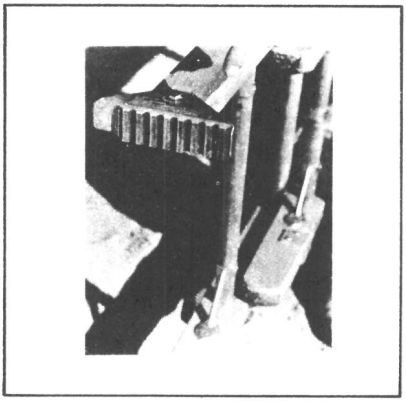


FIGURE 2. Duo Safety Shoes

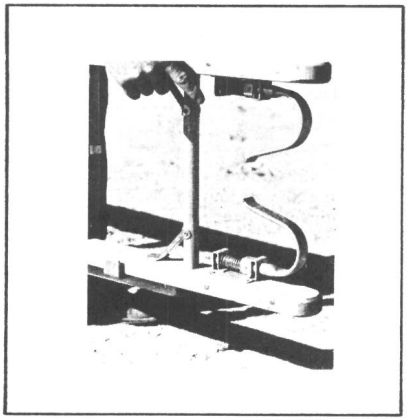


FIGURE 3. Strand Hooks

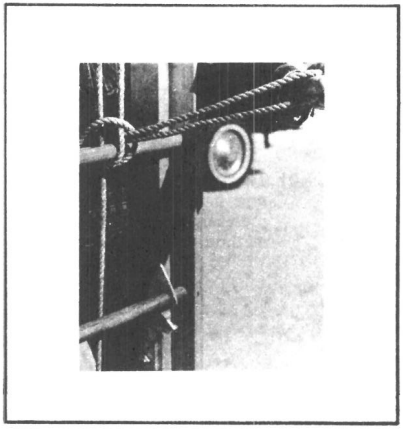


FIGURE 4. Automatic Locks

3. SELECTION OF PROPER SIZE OF WOOD LADDER

3.01 The maximum working length of an extension ladder is from 3 to 4 feet less than the ladder size, depending upon the maximum overlap. See Table A for maximum working lengths of the ladders.

TABLE A

Ladder Size (Feet)	Maximum Working Length (Feet)	Minimum Overlap (Feet)
24	21	3
28	25	3
32	29	3

3.02 Depending upon local conditions, the 24-foot extension ladder will usually meet most requirements for installation and maintenance work. The 28-foot or 32-foot ladders will meet the requirements for construction and splicing operations.

3.03 Always select a ladder of sufficient length for the work to be done. The ladder should be long enough so that the work can be performed when standing no higher than on the fourth rung from the top so that the side rails may be grasped conveniently and safely. Figure 5 shows a ladder of the right length.

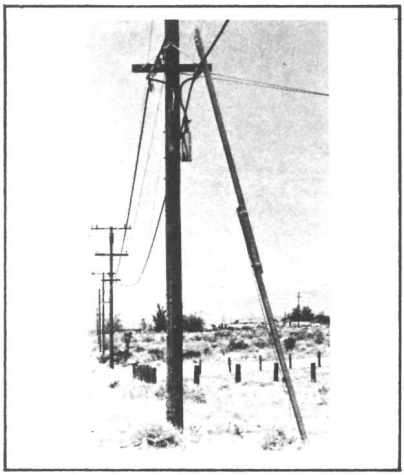


FIGURE 5.

4. SAFETY PRECAUTIONS

4.01 Use only **standard** extension ladders (Figure 1). **Do not use ladders with broken or missing rungs, broken side rails, broken locks, or defective ladder ropes.**

4.02 Do not place ladders on boxes, barrels, or other objects to obtain additional height; use a ladder of sufficient length for the job at hand.

4.03 When the surface on which the base of the ladder is resting is such that the ladder may have a tendency to slip, follow the instructions given in paragraph 11.02.

4.04 Do not place a ladder inside or opposite an angle formed by wires or cables where loosening of the wire or cable attachments might cause the ladder to move or fall.

4.05 In areas exposed to vehicular traffic, place the ladder on the strand from the field side of the cable whenever possible to avoid danger from passing vehicles. If vehicular traffic is not a problem, the ladder may be placed against the strand from the street side of the cable.

4.06 If a ladder must be placed at a work location where it could be struck by passing vehicles and a Company vehicle is available, the truck should be parked with brakes set to provide maximum protection for the ladder without obstructing traffic. In addition, warning signs, flags, traffic cones, or flashing signals should be placed to divert the flow of traffic from the work area, as instructed in CTSP 490-050-101. See Figure 6.

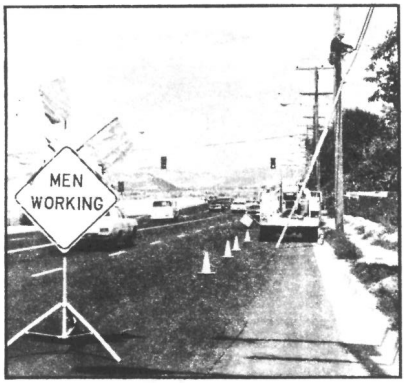


FIGURE 6.

4.07 When raising or lowering the top section of an extension ladder, keep hands and feet off the rungs. When the top section is being lowered, stand clear so that it will not strike the feet. See Figure 7.

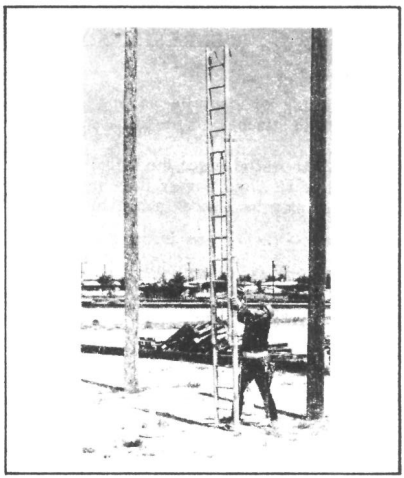


FIGURE 7.

4.08 Avoid spilling or spattering paraffin on a ladder as wood coated with paraffin is very slippery and this could cause an accident.

4.09 Before climbing an extension ladder, make certain that the ladder locks are properly engaged and the ladder rope is securely tied to one of the rungs of the bottom section. See Figure 8.

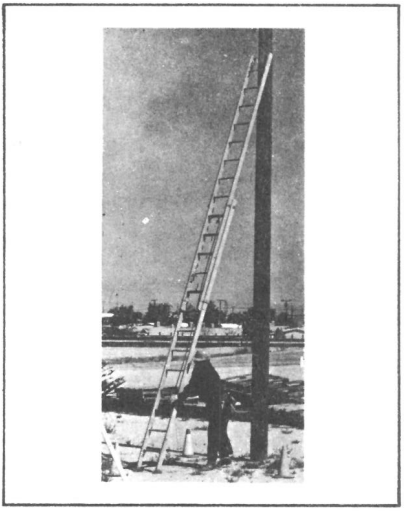


FIGURE 8.

4.10 When the ladder is to be used on aerial cable, turn the hooks to the working position before the ladder is raised. Ladder hooks should be placed on the cable strand as shown in Figure 9, unless the ladder is to be lashed to the strand as covered in paragraph 13.

4.11 Do not hurry when going up or down a ladder; take one step at a time and always face the ladder, being sure to have both hands free to hold the sides of the ladder. See Figure 10. Be especially careful when going up or down ladders in wet or icy weather.

4.12 Do not climb a ladder while wearing climbers.

4.13 Only one person at a time is permitted on a ladder.

4.14 The craftsman should always remember to first make the ladder secure, and then make himself secure on the ladder, so that he will not fall if he slips, loses his balance, or something unexpected occurs. The manner in which the craftsman secures himself to the ladder will depend on the security of the ladder, and the nature of the work to be done.

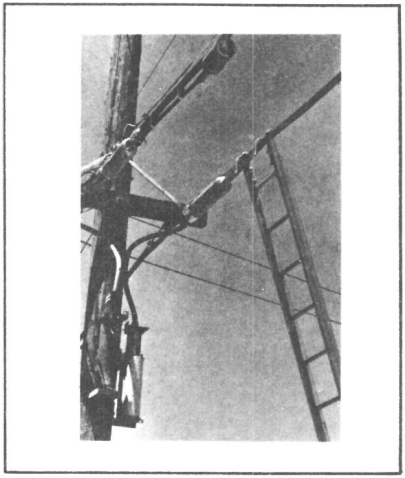


FIGURE 9. Ladder Hooks on Cable Strand

FIGURE 10.

4.15 If the ladder is lashed to the pole, the craftsman may increase his safety by passing his

safety strap around one rung of the ladder, then around the pole and the opposite outer side rail of the ladder and into the D ring of the safety strap. See Figure 11.

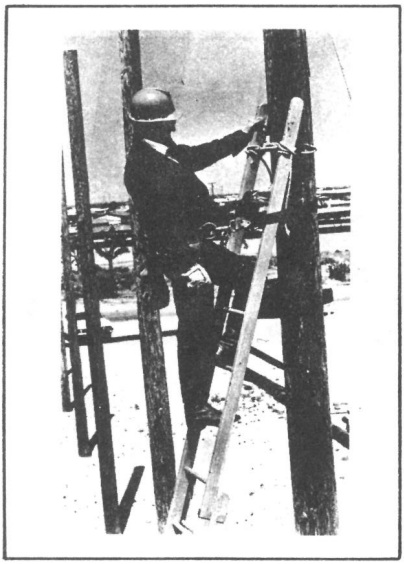


FIGURE 11.

4.16 If the ladder is attached to strand, pass the safety strap around one outer side rail of the ladder, over the strand, under and over the rung of the ladder, over the strand again and around the opposite outer side rail of the ladder and into the D ring of the safety strap.

4.17 When a ladder is lashed, or otherwise secured so that it cannot fall, the craftsman may increase his security by placing one leg between two rungs of the ladder.

4.18 Do not throw tools or materials to a craftsman working on a ladder: raise them by means of a handline. See Figure 12. Be careful that tools or materials being used aloft cannot fall on persons passing below.

4.19 When working on a ladder, do not attempt to lean so far to the side that the outside shoulder is more than 12 inches beyond the side rail. Loss of footing in this position may cause loss of balance and

FIGURE 12.

the weight being shifted to one side of the ladder may cause it to slip at the top. Descend and move the ladder to the proper location.

4.20 When working from ladders, **do not allow drop wires, lashing wires, handlines, or ladder ropes to dangle to the ground where they may be struck by passing vehicles.** A wire or rope caught on a passing vehicle may pull the ladder and cause it to fall, or it may pull the craftsman off the ladder. When not in use, the handline shall be tied to the lower portion of the ladder or pulled aloft.

4.21 Do not slide down an extension ladder.

4.22 Never carry an extension ladder from one location to another while it is extended. First lower the ladder and secure the ladder rope, then extend it again at the new location.

4.23 When carrying a ladder on the shoulder, point the safety shoes forward and downward.

4.24 When carrying or removing a ladder from a vehicle, avoid swinging it into the path of passing vehicles or pedestrians.

4.25 Do not place ladders where they may come in contact with power lines.

4.26 Do not tie drop wires or pulling lines to ladders.

4.27 Do not use a ladder in a horizontal position as a platform, runway, or scaffold.

4.28 Do not place a ladder against a suspension strand which is held under tension by a strand puller only.

5. ROUTINE INSPECTION OF WOOD LADDERS

5.01 Each time a ladder is used, the employee shall determine that it is in good condition and that there is no indication of deterioration or damage that may affect its strength. **Ladders not in storage shall be examined visually once each week.**

5.02 Every 6 months (or if a ladder has been dropped or otherwise abused or damaged), all sections of a ladder shall be examined according to the procedures in paragraph 6.

5.03 Definitions of terms used in ladder inspection are:

a. Cracks are fractures across the lengthwise fibers of the wood, usually resulting from mechanical stresses.

b. Decay is disintegration of the wood due to action of wood-destroying fungi.

c. Splits are lengthwise separations of the wood extending in the direction of the grain.

d. Delamination is separation of ply in the laminated side rails of extension ladders.

5.04 Paragraph 7 describes defects in side rails that can be detected visually.

5.05 Extension ladders shall be inspected when the wood is dry as absorption of considerable moisture causes swelling which tends to conceal defects.

5.06 Every 2 months the supervisor shall inspect the ladders used by his forces. Inspection under dead weight load may be omitted.

5.07 The supervisor shall ensure that the craftsmen comply with the inspection routine.

6. METHOD OF INSPECTING WOOD EXTENSION LADDERS

6.01 Examine the ladder to determine the condition of all parts. To facilitate careful inspection, place the ladder at a convenient height in a well lighted area. **If any defects are found that cannot be taken care of by the craftsman, or if the condition is such that there is doubt about the ladder being safe to use, it should be tagged DEFECTIVE and exchanged at once for a ladder in good condition, in accordance with local routine.**

6.02 Separate the ladder sections and place **one section at a time** on two supports located a few inches from the ends of the side rails. These supports should be high enough to permit the craftsman to examine the underside of each rail thoroughly.

6.03 Place a weight of approximately 100 pounds at a point approximately 2 feet from one end support. The weight should be supported evenly by the two side rails. Examine the under edges and the faces of each rail carefully for signs of any defects. Particular attention should be given to the points where the rungs are joined to the side rails, as these are points where fractures are most likely to occur.

6.04 Repeat the procedure in paragraph 6.03 with the weight placed at the midpoint of the ladder section. See Figure 13.

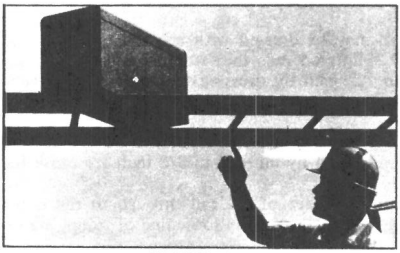


FIGURE 13.

6.05 Turn the section over and repeat the inspections described in paragraphs 6.03 and 6.04. **The suggested loading is not a strength test of the section, but rather a means for disclosing defects and therefore is of no significance unless a careful visual examination is made while the section is under load.** Under no circumstances shall an **extended** ladder be inspected in this manner, nor shall a weight appreciably in excess of the 100 pounds (such as the weight of a person) be applied to a ladder section being inspected.

7. VISUAL INSPECTION OF WOOD EXTENSION LADDER SIDE RAILS

7.01 Look for damage to the side rails which may appear as a fine crack, as a fold or crease in the wood fibers, or as a splintering of the wood fibers. Such defects are usually caused by overloading the ladder or subjecting it to a hard blow by dropping it or through some other accident and may subsequently result in failure of the ladder under normal load. Cracks or fine wrinkles (compression failure) in the wood fibers are most likely to occur at rung positions; a very careful inspection is usually required to detect them. In most instances the wrinkles or creases appear alone, but in some cases there may also be some splintering of the wood fibers in the opposite side of the rail. See Figure 14.

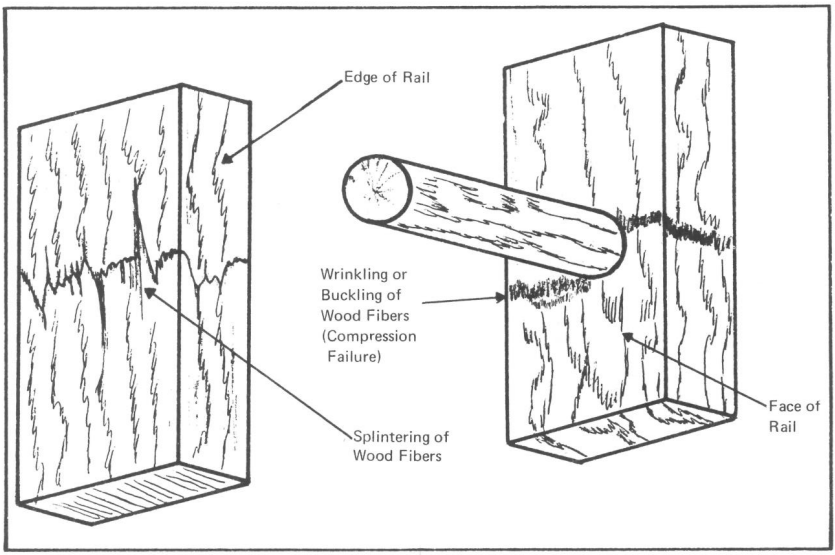


FIGURE 14.

7.02 Slightly splintered rails may be dressed with a wood rasp, file, knife, sandpaper, or other suitable means. Badly splintered rails that would require the original width of the rail to be reduced more than 1/2 inch by dressing to remove the projecting fibers are cause for rejection.

7.03 Splits that extend to an edge of a side rail and cannot be removed by dressing without reducing the original rail width by more than 3/8 inch are cause for rejection.

7.04 Splits that extend from one face of the rail through to the opposite face and are more than 24 inches in length, or that result in loosening of rungs, are cause for rejection.

7.05 Worn, crushed, or excessively indented rails are cause for rejection. (Top or bottom edge of narrow side worn or depressed 3/8 inch or less is permitted.)

7.06 Decay, particularly where rungs join side rails, is cause for rejection.

7.07 Loose rungs and rung braces will cause excessive longitudinal play in side rails, i.e., more than 3/4 inch. This may be checked and measured as shown in Figures 15 and 16. Longitudinal play in excess of 3/4 inch is cause for rejection.

7.08 Check for protruding nails. These shall be driven flush and set with a nail set.

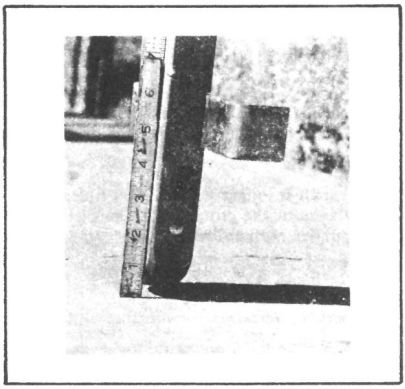


FIGURE 15.

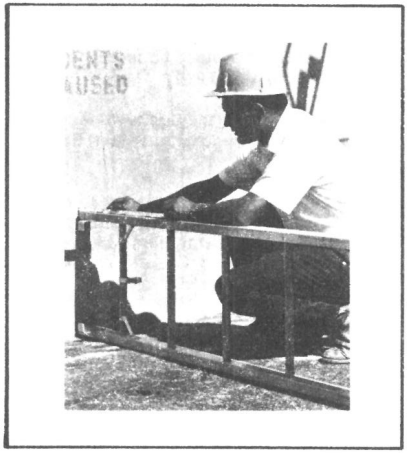


FIGURE 16.

8. VISUAL INSPECTION OF WOOD EXTENSION LADDER RUNGS AND FITTINGS

8.01 Excessively worn rungs, severely bent rungs, loose or missing rungs, are cause for rejection.

8.02 Check for cracked, split, badly splintered, or decayed wooden rungs. Sometimes a break will occur in the portion inside the side rail. Such a defect is not visible but may be detected by rapping the rung with a hammer handle near each side rail and comparing the sound with that obtained from striking other rails. Do not strike rungs with the hammer head.

8.03 The following defects on ladder fittings are cause for rejection:

a. **Broken, badly bent, or cracked guide irons.**

b. **Loose rivets.**

c. **Broken locks or improper action of locks.** (The spring shall function to keep the hook in position to engage the rung.)

d. **Excessively worn, seriously frayed, or rotted ladder rope.** Replace the rope, attaching it to the ladder by means of a rope eye splice.

e. **Broken, cracked, or badly distorted ladder hooks.**

f. **Broken, badly worn, or otherwise defective shoes.**

g. **Broken or defective braces.**

h. **Broken or defective pulley** (the pulley sheave shall revolve freely).

i. **Broken or defective pulley shackle** (never use wire as a substitute for the shackle).

9. CARE OF WOOD LADDERS

9.01 If properly handled and cared for, a ladder can be used for a considerable time without repairs or replacement. Craftsmen using extension ladders shall maintain them in accordance with the instructions given in this practice. Extension ladders that require repairs which cannot be made on the job shall be returned to the storeroom as instructed in paragraph 6.01.

9.02 When lowering the top section of a ladder, check its downward movement with the extension rope to ensure that the top section does not strike the ground or pavement sharply.

9.03 A craftsman shall not attempt to lower a ladder which is longer than 32 feet unless he has assistance. Dropping a ladder for even a short distance to the ground may damage the side rails and subsequently result in the rails breaking under normal loads.

9.04 Never use a ladder as a skid.

9.05 Keep ladder rails free from splinters. Splinters may be removed by dressing with a rasp, knife, sandpaper, or other suitable means (see paragraph 7.02).

10. CARE OF LOCKS AND PULLEYS ON EXTENSION LADDERS

10.01 Keep locks, springs, and pulleys on extension ladders lubricated by applying oil sparingly on the movable parts at least once a month. This will make them operate easier and add to their service life. Ensure that locks are securely fastened to the side rails. Test each spring to see that it is capable of returning the catch to position. Examine the keeper to see that it operates properly. See that the pulley is held securely at the middle of the rung.

10.02 One type of lock with which standard extension ladders are equipped is shown in Figure 17.

11. LADDER FOOTING

11.01 Use care in positioning ladders before climbing them. Place the foot of the ladder on the ground or other firm support so that distance A (as shown in Figures 18 and 19) is approximately 1/4 of distance B. If distance A is greater than 1/4 of distance B, there is danger of imposing excessive

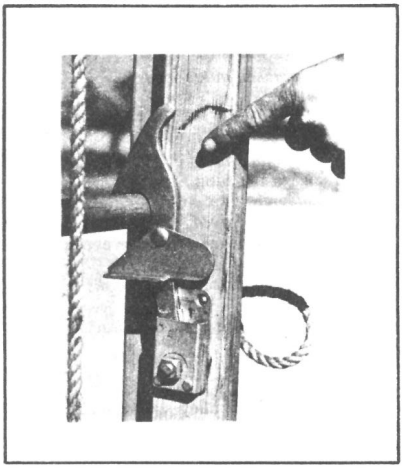


FIGURE 17.

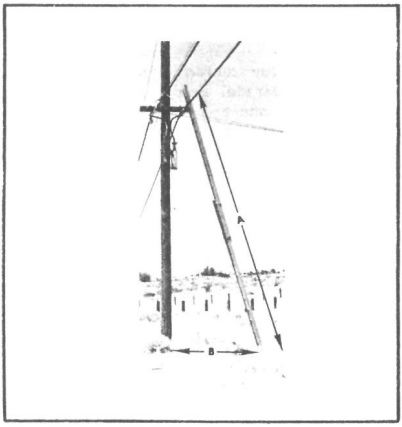


FIGURE 18.

stresses on the ladder. If distance A is considerably less then 1/4 of distance B,the ladder will be pitched so steeply that the work cannot be done safely. In any case, if the base of the ladder is likely to slip, the ladder shall be braced, fastened, or securely held.

11.02 Set a ladder only on secure footing. Set both feet of the ladder at the same level and on a line

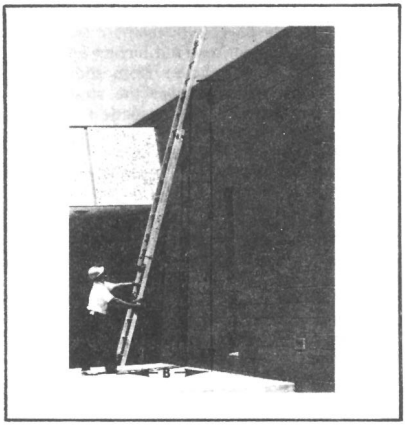


FIGURE 19.

parallel to the surface on which the top of the ladder rests. If necessary, remove earth from beneath the high side to bring it to the level of the lower side. **Never increase the length of a side rail by nailing a board to it.** If a ladder leans to either the right or the left, it is not properly placed. If the ladder cannot be leveled, select another location. Always place an extension ladder with the top section to the front. A well placed ladder is shown in Figure 20.

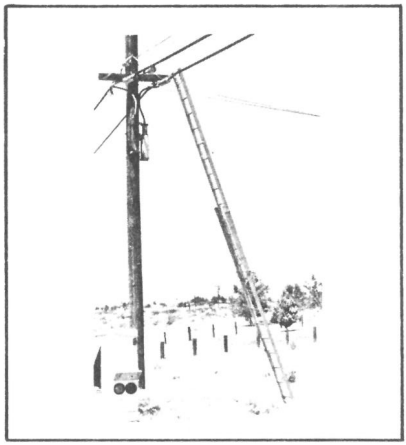


FIGURE 20.

11.03 When it is impossible to avoid placing the base of the ladder on the surface where it might slip, such as on wet or oily pavement, a smooth floor, or icy or metal surfaces, tie the base of the ladder securely in place. If this is impractical, the ladder must be held by another craftsman. The person holding the ladder shall be on the alert at all times to protect the person on the ladder and anyone passing below him. Never leave a raised ladder unattended under these conditions. The ladder might slip and cause injury, damage, or both.

11.04 Avoid placing a ladder in front of a doorway, especially where the door opens toward the ladder. Avoid placing a ladder near passageways, near moving machinery, or at locations where vehicles or pedestrians may strike or displace it. When these conditions cannot be avoided, or when a door cannot be secured in the open position or locked with no possibility of its being opened inadvertently, make arrangements to have the ladder guarded by another craftsman. Also, use warning devices to alert people to activity beyond a closed door.

12. SUPPORTING THE TOP OF EXTENSION LADDERS

12.01 Objects against which the top of the ladder will be placed shall be sufficiently rigid and have ample strength to support the ladder and the craftsman on it. Certain work operations performed from a ladder (for example, moving a cable manually) will increase the load on the ladder; this shall be taken into account when judging the strength of the upper support for the ladder.

12.02 Before placing a ladder against suspension strand, test the strength of the suspension strand and its supports. See CTSP 490-360-700.

12.03 When using a ladder on a strand having a fairly steep slope, secure the ladder with rope to prevent the top of the ladder from sliding along the strand. Before raising the ladder, throw or place a handline over the strand and secure one end on the handline to the second rung from the top of the section of the ladder.

12.04 After placing the ladder on the strand, pull the other end of the handline taut and secure it to an adequate support on the uphill side of the ladder, such as a pile, tree, or digging bar firmly placed in the ground. If no such anchorage can be obtained, the ladder may be secured to the cable and strand by throwing or placing the handline over the strand again (so that the rope passes twice around the cable and strand), and then tying the rope securely to a rung on the lower section of the ladder.

12.05 When a ladder is placed against the strand and heavy work such as pulling or lifting is to be done, lash the ladder to the strand with a short length of rope. Where the cable is supported in rings, pass the lashing rope around the strand only; where the cable is lashed, pass the lashing rope around the strand and cable. **Do not move the base of the ladder after the upper end has been secured to the strand.**

NOTE: When pushing or pulling heavy loads from a working position on a ladder, take care not to place undue stress on the ladder.

12.06 When using a ladder on a suspension strand that is attached to a building wall, wherever possible, place the ladder so that it will tend to push the wall attachment against rather than away from the building wall.

12.07 When placing a ladder against a tree, select the tree trunk or its larger limbs for support. When it is necessary to place a ladder so the top rung rests against a tree trunk or similar object, a handline may be thrown or placed with a wire raising tool or tree pruner handle over a tree limb, tied to the top rung of the ladder, and used to assist in raising the ladder. After the ladder has been placed, tie the free end of the handline to one of the lower rungs, thereby holding the ladder until a more secure lashing is made. The ladder shall be lashed securely at one or two points in a manner which will prevent the ladder from twisting or sliding when the craftsman's weight is put on one side. The lashing can be performed in the following manner with a second rope.

a. Make a slip noose about 15 feet from the free end of the rope so that the noose will tighten when the free end of the rope is pulled.

b. Place the slip noose over the top end of one side rail.

c. Pass the free end of the rope down behind and under the top rung, then toward the front of the ladder, around the rail, and then to the back of the tree or pole.

d. Make two complete wraps around the **tree** or **pole**, then pass the rope twice around the opposite rail below the first rung, and then up behind the rung.

e. Reverse the direction of wrapping and make two half-hitches on the rail so that the ladder is lashed tightly to the **tree** or **pole.** See Figure 21.

NOTE: Never place an extension ladder against a window sash. If it is not possible to avoid placing a ladder in front of a window, lash a board to the

FIGURE 21.

ladder to provide support on each side of the window frame.

13. LADDER HOOKS

13.01 The ladder hooks provided on extension ladders are shown in Figure 22.

13.02 When not in use, turn the hooks in between the rails. To rotate a hook, push it toward the lower end of the ladder, turn it 90°, then release it. The coil spring locks the hook in either of two positions. Turn ladder hooks in between the rails when the ladder is to be placed against a building wall or other flat surface.

13.03 Ladder hooks on extension ladders should be used on lashed, ring-supported, and self-supporting cable when the ladder is not lashed to the strand.

CAUTION: When using ladder hooks on aerial cable, make certain the ladder is placed on firm and level footing to prevent the ladder from twisting or sliding along the strand.

13.04 When using a ladder (even if the ladder is lashed to the strand), and especially when placing and removing the ladder, a greater margin of safety is provided with the hooks in the working position.

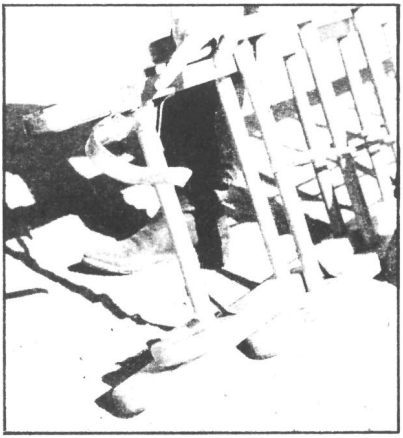


FIGURE 22.

14. TRANSPORTING LADDERS ON MOTOR VEHICLES

14.01 When transporting ladders on trucks or other motor vehicles, always fasten them securely in their proper position, using the straps or other devices provided for the purpose. Never use wire for securing a ladder to the brackets of a truck. A ladder hanging loosely on the brackets of a truck will soon be marred, cracked, and weakened by road shocks.

15. ONE-MAN METHOD OF CARRYING A LADDER

15.01 Carry extension ladders in the closed position with the shoes pointed downward and to the front and the ladder hooks turned in between the side rails. Secure the end of the ladder rope by tying it with a clove hitch around one rung of the top section and the adjacent rung of the bottom section.

15.02 To carry an extension ladder, first place it in the vertical position with the side rails of the bottom section on the outer side. Tilt the ladder until the bottom section side rail rests against the chest and shoulder; then lift the ladder to the shoulder until the exact point of balance is obtained. The proper carrying method is shown in Figure 23.

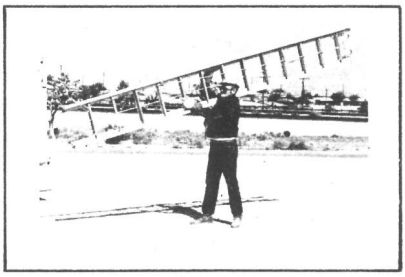


FIGURE 23.

15.03 Do not lift or carry a ladder by grasping the ladder rope.

16. TWO-MAN METHOD OF CARRYING A LADDER

16.01 First, secure the free end of the ladder rope with a clove hitch around one rung of the top section and the adjacent rung of the bottom section, and turn the ladder hooks in between the side rails.

16.02 To pick up a ladder, the two men take positions at opposite ends and, lifting together, lift the ladder as shown in Figure 24. Carry the ladder with the shoes forward.

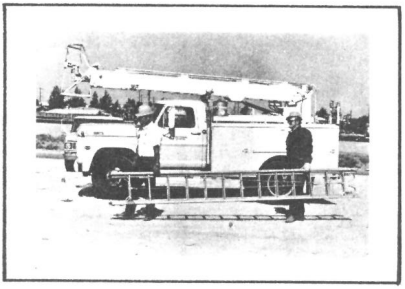


FIGURE 24.

17. METHOD OF RAISING AND LOWERING WOOD EXTENSION LADDERS

17.01 The following is a one-man method of raising a 24-foot or 28-foot ladder to suspension strand. (When two craftsmen are available, this method may also be used for raising longer ladders to the strand.) This method of handling ladders keeps the ladder under control at all times and provides a temporary lashing to the strand before climbing.

17.02 Where ground conditions allow, place the ladder on the ground at a right angle to the suspension strand, with the base of the ladder directly under the location of the work.

17.03 While they are lying on the ground, 24-foot and 28-foot ladders can be extended to within a few feet of the vertical height of the strand before raising the ladder.

NOTE: Ladders of greater length should be extended only two rungs.

17.04 Where ground conditions do not permit placing the ladder as described above (for example, where the end of the ladder would interfere with traffic on a road or street), the base of the ladder can be moved back from its position under the work location as required. It can also be placed parallel to the suspension strand, with the base directly under the work location. In either of these positions, extend the ladder only two rungs.

17.05 Throw a handline over the strand at the location where the ladder is to be supported. If there is a possibility of the handline becoming involved with tree branches, power wires, etc., place the handline over the strand with tree pruner handles, taking care to avoid contact with power wires. In doing this, take care that the free end of the handline does not interfere with passing vehicles.

17.06 Tie the near end of the handline to the bottom rung of the ladder, using a clove hitch and two half-hitches. Take the other end of the handline to the top of the ladder. Check the handline where it passes over the strand to be sure it does not cross over itself, and pass the free end behind the second rung from the top, and then out on the top side of the ladder. See Figure 25.

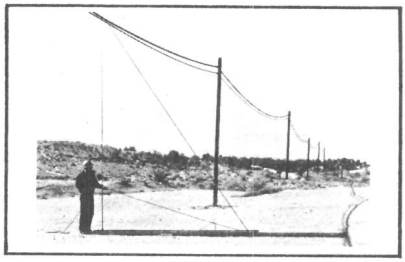


FIGURE 25.

17.07 Pull the handline hand over hand. As the top end of the ladder is raised off the ground, keep both feet in position to block any movement of the base of the ladder to the rear. See Figure 26.

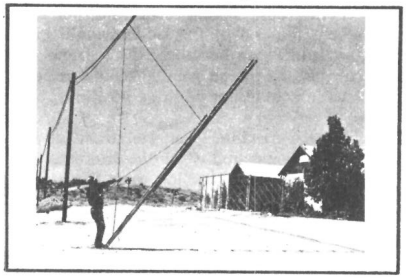


FIGURE 26.

17.08 Continue pulling the free end of the handline until the ladder is in a vertical position under the strand as shown in Figure 27.

17.09 As mentioned in paragraph 17.04, if the ladder base was not placed under the strand, the base should be moved directly under the strand. To do this, tie the free end of the handline to a ladder rung with a clove hitch and two half-hitches and move the base of the ladder in position under the strand. Untie the free end of the handline and pull on the handline until the ladder is vertical as shown in Figure 27.

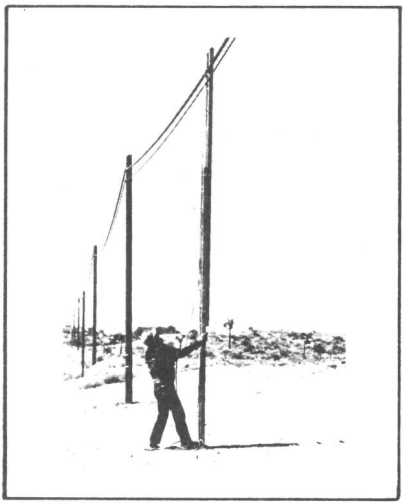


FIGURE 27.

17.10 With the ladder positioned vertically under the strand, hold the ladder in this position with one hand on the side rail. Allow about 1 foot of slack in the free end of the handline, and hold this slack with the same hand on the side rail. Use the other hand to tie the rope around the second or third rung with a clove hitch and two half-hitches. (If desired, the rope may be doubled or the tie may be made around two rungs to avoid having excess rope lying on the ground.) The ladder is secured to the strand and cannot fall as long as the handline is tied to the ladder.

17.11 Untie the ladder extension rope, taking care not to untie the handline. Pull on the ladder extension rope and extend the ladder until the top section is above the strand, perferably with the second rung level with the strand, and engage the ladder locks. See Figure 28.

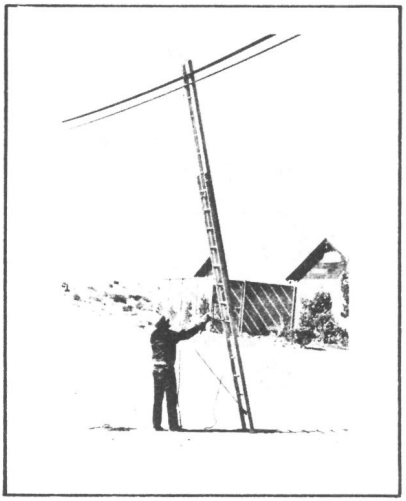


FIGURE 28.

17.12 To lock the top section after it has been raised to the desired height, continue raising it until the ends of the lock hooks are just above the rung to be engaged; then lower the top section until the inside curve of the lock hooks rests directly on the rung. Make sure that both locks are engaged.

17.13 Move the foot of the ladder out to its working position, allowing the top of the ladder to rest on the strand. It should not be necessary to extend the ladder further. However, if necessary to do so, untie the handline, extend the ladder, and retie the handline.

17.14 To lower the ladder, move the foot of the ladder back under the strand. Leaving the handline over the strand tied at both ends, untie the ladder extension rope. Lower the top section until it is extended two rungs above the bottom section and secure the ladder locks. Untie the upper end of the handline and lower the ladder gently to the ground by slowly paying out the handline. If the top end of the ladder tends to swing, move the foot of the ladder back while holding the handline securely.

17.15 A 28-foot extension ladder may be raised or lowered by one man in the manner shown in Figure

29, if the foot of the ladder is securely embedded in earth or is placed against the base of a wall, a pole, or other secure object.

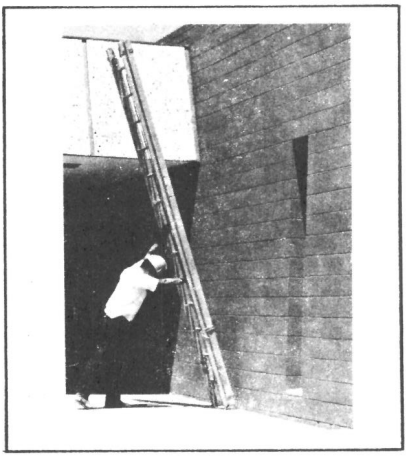


FIGURE 29.

17.16 A 32-foot extension ladder should be raised with the foot of the ladder held securely by one craftsman, while a second craftsman walks the ladder up to a vertical position similar to that shown in Figure 30. As an alternative, if the foot of the ladder can be placed against the base of a wall, one craftsman can raise the ladder as described in paragraph 17.15.

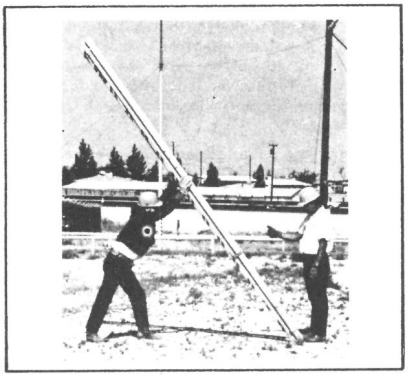


FIGURE 30.

17.17 When raising or lowering extension ladders, it is imperative that the craftsman handling the ladder maintain a secure footing at all times.

17.18 When lowering ladders, follow the reverse of the procedures for raising ladders.

18. HANDLING AND RAISING TOP SECTIONS OF 24-FOOT AND 28-FOOT WOOD LADDERS

18.01 After the ladder has been raised to an upright balanced position, stand in front of the ladder with one foot against the base of the ladder to prevent it from kicking out. Place the other foot in a bracing position to the rear of the ladder to provide a firm stance. See Figure 31. Untie the ladder extension rope and raise the ladder.

FIGURE 31.

18.02 After locking the top section, allow the top of the ladder to move slowly toward the support. When the ladder is in place against the support, tie the ladder rope securely to one of the rungs of the bottom section with a clove hitch and two half-hitches.

18.03 As an alternate method, after the ladder has been raised to an upright balanced position on a firm footing, balance the ladder with one hand and move behind the ladder in a position to operate the ladder rope with the other hand.

18.04 Pull the ladder rope to raise the top section two or three rungs at a time, engaging the locks after each pull. Take care to prevent the lower guide iron from striking the hand holding the side rail. Lock in place as instructed in paragraph 17.12.

19. LOWERING TOP SECTION OF 24-FOOT AND 28-FOOT WOOD LADDERS

19.01 Stand at the base of the ladder and raise the upper section about 6 inches by means of the ladder rope to release the ladder locks. Allow the upper section to descend slowly by applying the necessary drag on the rope. The drag on the rope should hold the ladder in the balanced position. See Figure 32. Take care to prevent injury to the hand holding the side rail. Do not allow the top section to strike the ground or pavement sharply.

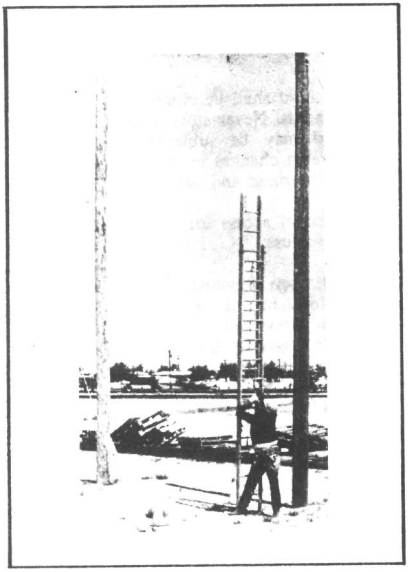


FIGURE 32.

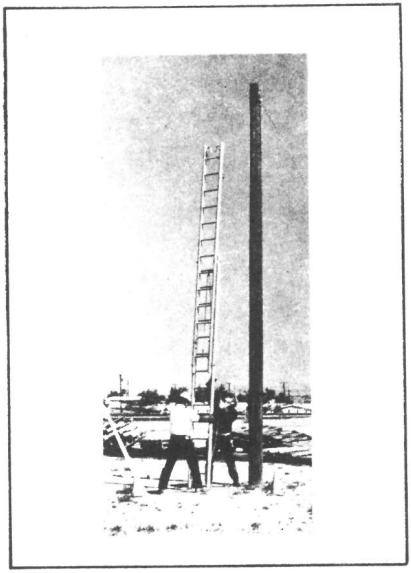


FIGURE 33.

20. RAISING AND/OR LOWERING TOP SECTION OF 32-FOOT WOOD LADDERS

20.01 One craftsman shall hold the side rails of the lower section on the front side of the ladder during the raising and lowering of the upper section by another craftsman. Take care to prevent the ladder guide irons from striking and injuring the hands of the craftsman holding the side rails. The ladder is raised by the second craftsman as described in paragraph 18.04 and shown in Figure 33.

20.02 The craftsman holding the ladder shall keep his feet and legs clear of the side rails and bottom rung of the lower section while the upper section is being lowered. The craftsman lowering the top section shall check its downward movement with the ladder rope so that the top section does not strike the ground or pavement sharply.

21. STORAGE OF WOOD LADDERS

21.01 Ladders that are **not being used** shall be stored in a well-ventilated area, where they will not be exposed to the elements. Never store ladders near radiators, stoves, steampipes, or in places where the wood may be subjected to excessive heat or dampness. Such conditions bring about extreme changes in the moisture content of the wood, causing the wood to split or crack and the rungs and hardware to become loose.

21.02 Store ladders to provide ease of access for inspection and to prevent danger of accident when withdrawing a ladder for use.

21.03 Where ladder racks have not been provided, store ladders in a vertical position. Where this is not practical, lay the ladders in a horizontal position, one on top of the other. Place wooden spacers between the floor and the lower ladder and between ladders to prevent side rails from becoming damaged by guide irons. Do not store ladders in any position where there is a chance of pressure being placed on them that might cause warping or twisting. Not more than six ladders should be placed in one stack. Heavy objects shall not be permitted to rest on ladders in storage.

21.04 Ladders stored in a horizontal position should be supported at a sufficient number of points (at least 3 points for 24-foot ladders and 4 points for the longer ladders) to avoid sagging and permanent set.

INSULATING GLOVES
LEATHER PROTECTORS, FABRIC LINERS
AND GLOVE BAG

1. GENERAL

1.01 This practice covers the description, care, and maintenance of insulating gloves provided for the protection of Continental Telephone Company workmen against electric shock, and the precautions to be followed in their use.

2. TYPES OF INSULATING GLOVES

2.01 All types of insulating gloves are of the gauntlet type and are made in sizes 10, 11, and 12. The size indicates the approximate number of inches around the glove, measured midway between the thumb and finger crotches. The length of each glove, measured from the tip of the second finger to the outer edge of the gauntlet, is approximately 14". See Figure 1.

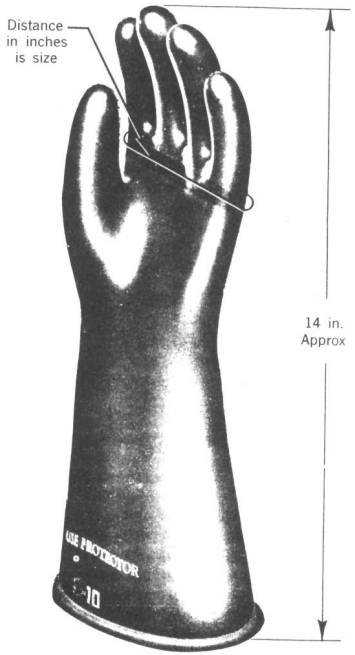


FIGURE 1. Insulating Glove.

3. LEATHER PROTECTOR GLOVES

3.01 Leather protector gloves must always be worn over insulating gloves to prevent mechanical damage to the insulating gloves. Leather protector gloves do not provide protection from electrical shock by themselves and should never be worn except over insulating gloves.

3.02 Leather protector gloves *are not* to be worn as a substitute for work gloves.

3.03 Leather protector gloves are of the gauntlet type. The overall length is about 13" and the cuff is about 4-1/2" wide. See Figure 2.

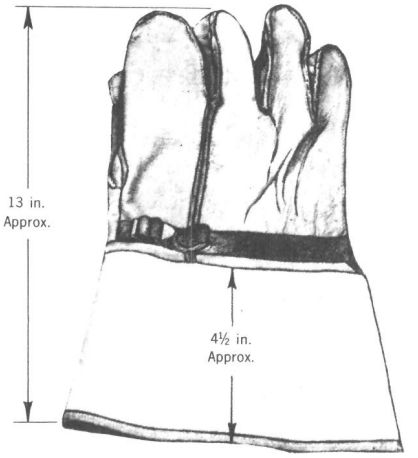


FIGURE 2. Leather Protector Glove.

3.04 Leather protector gloves are made of deerskin using the moccasin style outseam construction (seams sewn outside at the back of the fingers and thumb). These gloves are somewhat more flexible and less bulky.

3.05 Leather protector gloves are made in three sizes for use over insulating gloves of similar size designations.

3.06 Leather protector gloves are to be given reasonable care in their use. Oil, grease, paint, etc., on the palm and finger surfaces of the gloves impairs their usefulness for work operations. All foreign matter should be immediately wiped off the gloves with a soft, dry cloth.

3.07 Inspect leather protector gloves before and after use.

4. FABRIC LINER GLOVES

4.01 Fabric liner gloves are formfitting gloves made of lightweight interlock knit cotton cloth They are equipped with 3" wide rubberized fabric gauntlets. The overall length of the gloves is about 10-3/4". See Figure 3.

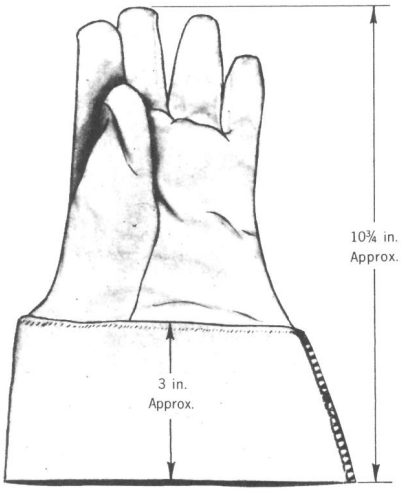


FIGURE 3. Fabric Liner Glove.

4.02 Fabric liner gloves are available in the following sizes:

a. Size 7 for insulating glove size 10.

b. Size 8 for insulating glove sizes 11 and 12.

4.03 Fabric liner gloves may be worn inside all types of insulating gloves for warmth in cold weather and for absorbing perspiration in warm weather.

5. RUBBER GLOVE BAG

5.01 The rubber glove bag is provided for carrying and storing insulating gloves, associated leather protector, and fabric liner gloves.

5.02 The rubber glove bag is made of cotton duck. A snaphook is provided for suspending the bag from the body belt.

6. PRECAUTIONS

6.01 Except in emergencies (such as to prevent serious injury or loss of life), Continental Telephone employees will not handle electric power wires or associated switches, and will arrange to have the work required on these circuits performed by properly qualified employees of the Power Company.

6.02 Continental Telephone employees will not handle telephone wires that are known or suspected to be energized until the contact conditions have been cleared by the Power Company.

6.03 In general, conditions under which insulating gloves should be worn are covered in the CTSP 490-050 Series on various field operations. However, because of the complicated nature of the conditions encountered under which insulated gloves should be worn, it is impractical to provide a complete set of rules covering all of the specific cases in which they are to be used. Therefore, where workmen must handle wires or other objects on which there is any possibility of an abnormal voltage being introduced, insulating gloves are to be worn. Workmen wearing insulating gloves must avoid body contact with wires, poles, vehicles and any other object which might be energized.

6.04 Insulating gloves are inspected and subjected to an electrical test to ensure their insulating value when purchased from the manufacturer and periodically thereafter according to the company's established routine.

6.05 Workmen and storekeepers are to see that insulating gloves receive their periodic electrical tests in accordance with the company's established routine.

6.06 Insulating gloves are never to be worn inside out as this stresses the curved portions of the gloves. Exposure to ozone is more pronounced at points where rubber is stressed, causing these points to be more susceptible to deterioration.

7. INSPECTION OF INSULATING GLOVES

7.01 It is the responsibility of the employee to be certain that his insulating gloves are in good condition.

7.02 Each employee shall inspect his insulating gloves in accordance with this practice as follows:

a. At the time he receives the gloves.

b. Each time before using them.

c. Each time after using them.

d. A minimum of once each month if not used.

7.03 The supervisor is to inspect the insulating gloves periodically and is to see that all instructions contained in this practice are complied with.

7.04 The visual inspection of insulating gloves is to be made to determine their safety. If any of the following conditions exist, the gloves are to be replaced in accordance with the company's established practice:

a. Cracks, cuts, or nicks that would tend to cause the glove to tear. Such defects within 1" of the open end of the gauntlet may be disregarded if of a minor nature.

b. Deterioration or ozone cracking. This is best detected by rolling the surface between the thumb and forefinger and watching for fine surface cracks.

c. Glove worn sufficiently to affect the mechanical strength. This is best detected by stretching the glove as follows:

(1) Grasp the gauntlet end of the glove with one hand and pull on each glove finger with the other hand.

(2) Pull the glove by grasping at both sides.

(3) Pull the fingers apart.

NOTE: Worn spots are indicated by undue stretching or, in severe cases, by tearing of the glove.

(4) Check the date stamped on the gauntlet to ensure that the gloves are being used within the proper dates.

NOTE: The above inspections are to be made on both the inner and outer surfaces of the insulating gloves.

8. AIR TEST OF INSULATING GLOVES

8.01 The air test is to be made before and after each use of the insulating gloves. Make this test as follows: (See Figure 4.)

a. Hold the glove at each side of the edge of the gauntlet.

b. Revolve it about the edge of the gauntlet as on an axis, thus rolling it toward the palm and confining the air to the palm and fingers.

c. Hold the rolled-up gauntlet tightly in one hand.

d. Squeeze the palm of the glove with the other hand so as to place the confined air under pressure.

8.02 If any puncture exists, it is indicated by excaping air and the hole in the glove should be evident.

8.03 If a puncture is found or if the condition of the gloves is such that there is any doubt as to their safety, replace the gloves at once.

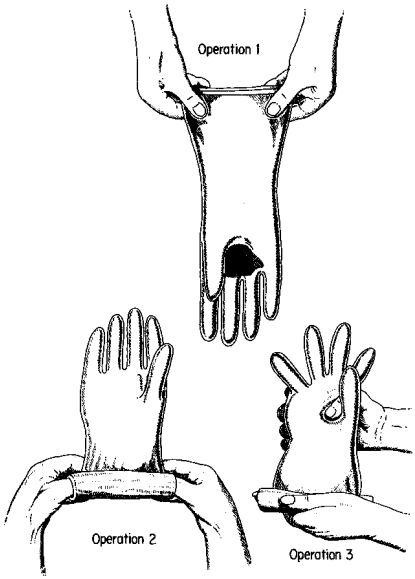


FIGURE 4.

9. CLEANING OF INSULATING GLOVES

9.01 Insulating gloves shall be cleaned when:

a. They become wet from perspiration.

b. They are subjected to contact with dirt, mud, paint, creosote, or any other foreign matter.

9.02 Perspiration, mud, dirt, and other foreign matter that does not adhere firmly to the glove may be removed with clear water.

9.03 Paint and creosote should be removed as soon as possible, because some oils have a deteriorating effect if allowed to remain on the glove.

9.04 The following method has been found satisfactory for removing paint or creosote from the glove:

a. Wipe the gloves with a dry cloth, removing as much wet paint or creosote as possible.

b. Clean the entire glove thoroughly with a cloth moistened with one of the following:

(1) Dry-cleaning fluid.

(2) Petroleum spirits.

(3) Trichloroethylene.

NOTE: *Do not* use an excessive amount of the cleaning fluid and *do not wipe over the test date.*

IMPORTANT: *This cleaning should be done in a well-ventilated location as these materials are either flammable or their vapors constitute a health hazard. As soon as each glove has been cleaned, it should be wiped thoroughly with a dry clean cloth.* **Do not use gasoline to clean insulating rubber gloves.** Gasoline has a very low flash point and its use presents a much more serious fire hazard than the above mentioned cleaning fluids.

9.05 After insulating gloves are used, they should be thoroughly dried so that moisture from the hands does not penetrate and cause the glove to deteriorate. After each use, gloves should be turned inside out and laid flat to dry. After the gloves have been dried, they should be turned right side out and placed in the containers ready for use.

10. STORAGE

10.01 Fabric liner gloves and leather protector gloves should be stored with the insulating gloves so that they will be available for use. All gloves should be dry before being stored.

10.02 Fabric liner gloves, insulating rubber gloves, and leather protector gloves should be separated during storage.

10.03 Insulating gloves deteriorate even when not in use. This deterioration is caused by ozone in the atmosphere reacting with the glove material to produce fine surface cracks. Ozone deterioration will be materially reduced if the gloves are:

a. Laid out flat, right side out without bends or folds.

b. Protected from:

(1) Light.

(2) Edged tools.

(3) Pressure due to heavy objects.

c. Stored in a ventilated room away from ozone producing equipment such as electric motors and generators.

d. Stored away from steam pipes, radiators or places subject to heat.

10.04 For maximum protection of the gloves, one of the following methods of storage should be used:

a. On motor vehicles—Insulating gloves, leather protector, and fabric liner gloves should be kept in the glove bag with the flap secure.

b. With tool bags—Insulating gloves, leather protector, and fabric liner gloves should be kept tightly closed in the glove bag, which should be attached to the tool bag.

NOTE: Care should be taken to attach the glove bag so that it will be flat against the side of the tool bag which is away from the body.

c. When insulating gloves, leather gloves, and fabric liner gloves are being carried for intermittent use, they should be kept in the glove bag.

d. If they are stored in lockers or central offices, the gloves should be kept in the container in which they were returned from electrical testing.

11. DISPOSITION OF INSULATING GLOVES REQUIRING ELECTRICAL TESTING

11.01 Storekeepers are responsible for insulating gloves in the storerooms and workmen are responsible for insulating gloves which they have in the field. The dates of return for tests are stamped inside the glove cuff.

11.02 Workmen are to see that gloves in the field are returned to the storeroom or office prior to the "Return for Test" date. Replacement gloves should be available before returning the gloves to be tested.

11.03 Storekeepers should see that all gloves in their possession are returned for inspection on the dates indicated to the authorized inspection agency. However, if gloves are held beyond this date, they should not be used or issued until retested.

11.04 Before being returned to the authorized agent, all insulating gloves should be given a careful inspection in accordance with paragraph 7 and a careful test in accordance with paragraph 8. Gloves with obvious defects should be disposed of in accordance with paragraph 12.

12. DISPOSITION OF DEFECTIVE INSULATING GLOVES

12.01 Gloves with obvious defects should have the front cut open from the fingers to the top of the gauntlet and should be disposed of as junk in accordance with the company's established routine.

TEST SET 81AW
TEST PROCEDURES

1. GENERAL

1.01 This practice describes the 81AW test set used for conductor identification and continuity tests on inside wire, drop wire, block wires, inside wiring cable, etc.

1.02 Store the test set in a dry location.

2. DESCRIPTION

2.01 The 81AW test set (Figure 1) consists of a buzzer, switch and capacitor which are contained in the top of a plastic case. The bottom of the case houses two type D dry cell batteries.

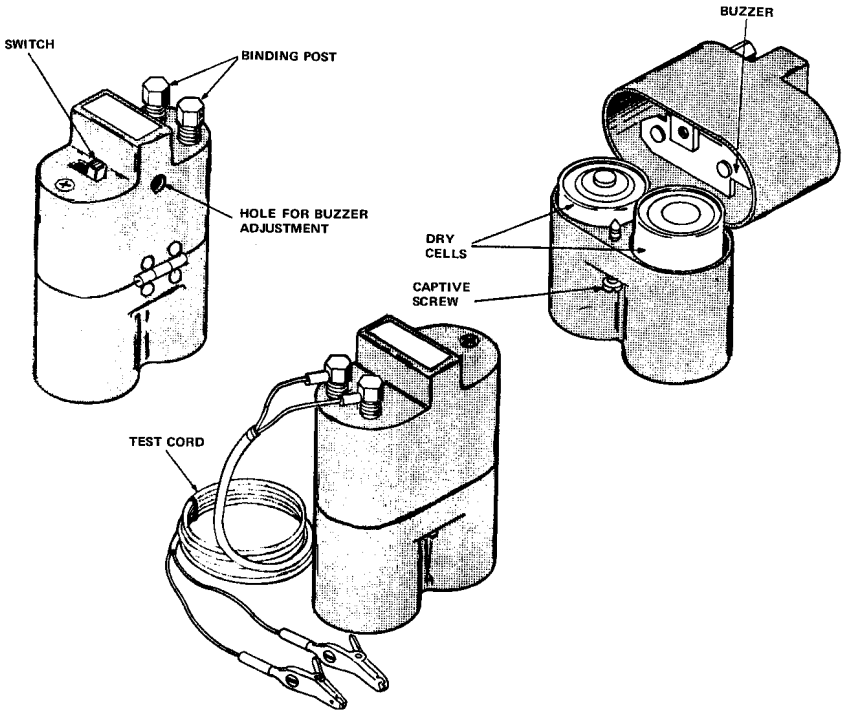


FIGURE 1. 81AW Test Set.

2.02 The switch on top of the case has three positions.

a. OFF

b. C = For DC continuity tests

c. T = For buzzer tone

2.03 A test cord assembly attaches to the binding posts. It consists of cord tips on one end and test clips on the other end.

3. OPERATION

3.01 Care should be exercised when using this test set that foreign potentials, either AC or DC, are not present. Carelessness will result in damage to the buzzer or annoyance to customers.

3.02 The switch must be placed in the OFF position when the set is not in use.

3.03 *Shorted Conductors:* With the switch in the OFF position, connect the test set to the conductors to be tested, either directly or by using the test cord.

3.04 Operate switch to the C position. If the buzzer operates, there is a short across the pair. If the buzzer does not operate, a further test should be made by placing a hand test set in series with the 81AW test set. If there is a click in the receiver, the pair is shorted.

3.05 Connect the 81AW test set across the pair of conductors to be tested, and operate the switch to T to start the buzzer.

3.06 Assuming the locations of both ends of the pair are known, go to the other end with a hand test set and connect it across the pair.

a. If the buzzer tone is heard, the pair is not open.

b. If the buzzer tone is not heard, the pair is open on one side or both sides.

c. Each side can be checked if a good conductor (metallic or ground) is available between the two points.

3.07 Connect the test set between one side of the pair to be tested and the good conductor.

3.08 Connect the hand test set between the side of the pair being tested and the good conductor at the other location.

a. Buzzer tone is an indication the side is not open.

b. No buzzer tone is an indication that the side is open.

3.09 *Tracing Conductors:* Connect the 81AW test set to the pair to be traced, and test to be sure the pair is not shorted.

3.10 Operate the switch to the T position to start the buzzer, and go to the location where it is desired to identify the pair.

3.11 Connect the hand test set (switch in the C, or capacitor position) across each pair of wires until the buzzer tone is heard. If tone cannot be heard on any pair, this indicates the pair to be located does not appear at the point being tested, or one or both sides of the pair are open.

4. MAINTENANCE

4.01 Do not mishandle or drop the test set.

4.02 Replace weak cells immediately. The dry cells must be placed in the test set in series: one right side up and the other upside down. Occasionally it may be necessary to clean the cell contact springs. They are readily removable.

4.03 The upper section of the test set contains a hole to be used for screw driver access to the buzzer for adjustment. The correct adjustment procedures are:

a. Operate the switch to the T position; the buzzer should operate.

b. Set the adjusting screw until the volume and pitch of the tone are highest; then turn the adjusting screw counterclockwise 1/8 turn.

4.04 To test the set:

a. Operate the switch to the T position; the buzzer should operate.

b. Operate the switch to the C position; the buzzer should not operate.

c. With the switch in the C position, short the two terminals; the buzzer should operate.

PROTECTION
PORTABLE ELECTRIC POWER TOOLS
GROUNDING

1. GENERAL

1.01 This addendum is reissued to update the Continental Telephone System standard for portable electric power tool cords (CTSP 405-705-320) and to clarify how equipment shall be marked to indicate double insulation.

1.02 Existing standard catalogs and practices indicate that portable electric drills are equipped with a 3-conductor cord that provides a ground for the drill housing.

1.03 With red pencil or ink make the change specified in paragraph 2 of this addendum and file in front of CTSP 405-705-320. In the margins of the subject paragraphs, write the words "See Addendum".

1.04 Issue 1 of addendum should be removed from file and destroyed. File this addendum directly in front of CTSP 405-705-320.

2. CHANGE

2.01 Change paragraph 1.01 to read as follows:

1.01 This practice describes the procedure for the proper grounding of portable electric power tools and methods of obtaining effective grounds. Portable power tools shall be grounded, unless those tools or appliances are protected by a system of double insulation. Where double insulation is used, the equipment shall be distinctly and permanently marked by the manufacturer to indicate the double insulation.

PORTABLE ELECTRIC POWER TOOLS GROUNDING

1. GENERAL

1.01 This practice describes the procedure for the proper grounding of portable electric power tools and methods of obtaining effective grounds.

1.02 The grounding of portable electric tools protects the operator from electric shock caused by insulation breakdown on current carrying parts within the tool housing. Grounding prevents the presence of voltage on the tool frame.

1.03 Grounding as described in this practice is accomplished by a third conductor used to connect the tool housing to the local power grounding system or to other equivalent grounds, such as a cold water pipe.

1.04 Permission should be obtained from the property owner or an authorized person before connecting the power tool to an outlet receptacle on a customer's premises.

2. PRECAUTIONS

2.01 Use only electric tools provided by the company.

2.02 *Electric power tools must always be adequately grounded.*

2.03 Before connecting a tool to a power supply, check the tool apparatus plate to be certain that the proper voltage and current type (AC or DC) is available.

2.04 Replacement cords should have equal or larger gauge wire than the original cord.

2.05 All cords assembled or repaired locally should be tested for continuity of the grounding conductor before connecting the tool to a power supply.

2.06 Make certain that the grounding connections do not become disengaged while the tool is being operated.

3. PROVISIONS FOR GROUNDING

3.01 The adapters shown in Figure 1 permit connections when the outlet receptacle is not the same type as the plug.

3.02 All electric power tools (except lamps and soldering coppers) should be equipped with a 3-conductor cord which terminates in a 3-blade plug (see Figure 2). Lamps and soldering coppers do not require grounding.

3.03 The 3-blade standard plug supersedes two other types of plugs; 3-blade crowfoot and the 2-blade parallel with an external attached pigtail grounding wire.

3.04 Extension cords are required for connecting power tools to outlet receptacles located away from the work area. This is usually a 50' cord with 16 gauge conductors having a standard plug at one end and a standard connector at the other.

CAUTION: The extension cord (Figure 3) should not be used with portable electric tools where conductors of a larger size are required.

3.05 The pigtail grounding terminal on adapters or attachment plugs should be connected to a suitable conductor as shown in Figure 4.

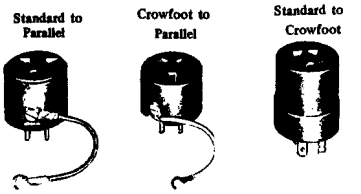


FIGURE 1. Adapters.

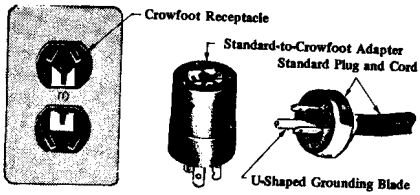


FIGURE 2. Standard-to-crowfoot Adapter.

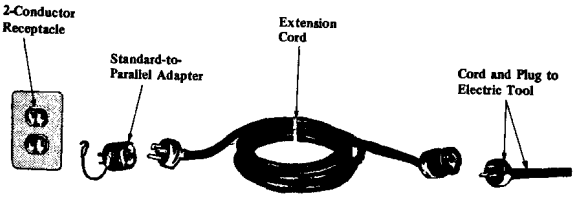


FIGURE 3. Typical Cord Make-up.

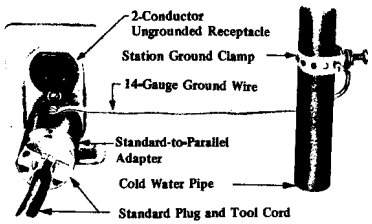


FIGURE 4. Ungrounded 2-conductor Receptacle.

4. METHOD OF GROUNDING

4.01 *3-Wire Grounding Type Receptacles*—The most satisfactory method of providing an effective ground is through the connection of a 3-blade plug to a comparable 3-wire receptacle. See Figure 5.

NOTE: The standard to crowfoot adapter must be used when the receptacle is a crowfoot type and the plug is standard. See Figure 2.

4.02 *2-Wire Receptacles (Ungrounded Outlet Box)*–Where electrical connections are to be made at 2-wire parallel receptacles, proceed as follows:

a. Locate a nearby grounded object (such as a cold water pipe) to which the ground wire or grounding cord may be attached.

b. Attach a ground wire to the green ground terminal on the plug or adapter and to the grounded object selected, making certain a good metallic connection is achieved at both ends. See Figure 4.

c. Insert the adapter or plug into the receptacle for tool operation.

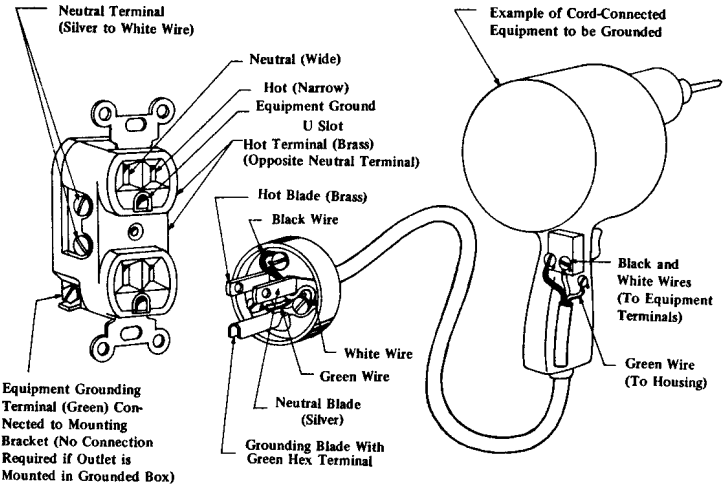


FIGURE 5. Wiring of 125-volt Standard Plug and Receptacle.

4.03 *2-Wire Receptacles (Grounded Outlet Box)*–Where it is known that a building is wired with metallic conduit, armored cable, or nonmetallic sheath cable with a grounding conductor, the outlet boxes may be grounded. Under these conditions and only after it has been found that the boxes are grounded, the grounding pigtail terminal on the adapter or plug may be fastened under the coverplate screw of the receptacle. See Figure 6. In grounding to a 2-conductor receptacle (Figure 6), connect pigtail to coverplate screw before inserting adapter into the receptacle.

NOTE: If grounding cannot be accomplished as outlined in this practice, the electric tool must not be operated. Nonelectric tools should be used to complete the job.

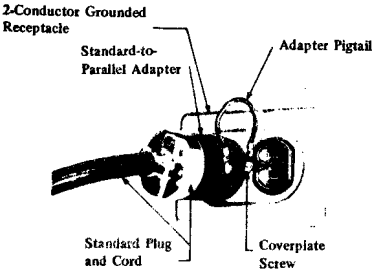


FIGURE 6. Grounded 2-conductor Receptacle.

MILLER FALLS MODEL 185 AUTOMATIC HAND DRILL

1. GENERAL

1.01 This practice covers the description and use of the Miller Falls 185 Automatic Hand Drill, CTS #74-50-061-9. (See Figure 1). This practice is being reissued to reflect the System approved hand drill.

1.02 The Miller Falls 185 automatic hand drill is to be used on wood trim, paneling and siding to drill pilot holes for placing screws (generally used by Outside Installers).

2. DESCRIPTION

2.01 The automatic drill is a push-type drill. It is used with drill points suitable for drilling small holes in light metal or wood. The handle serves as a magazine for ten drill points.

2.02 Drill points furnished with the automatic drill are listed in Table A.

3. OPERATION

3.01 To remove a drill point from the magazine:

a. Hold drill with magazine pointed down. Press spring lock forward and turn magazine cap to the desired drill point size.

b. Remove the desired drill point by tilting the magazine downward.

c. Turn the magazine cap back to its original position.

3.02 To insert a drill point:

a. Grasp the cylinder of the drill in the palm of the hand with the thumb against the back of the chuck sleeve.

b. Slide the chuck sleeve forward past the end of the chuck body.

c. Insert drill point in the chuck and release the chuck body.

d. Rotary action of the drill is created by the forward stroke or push of the handle.

TABLE A. DRILL POINTS

QUANTITY	SIZE INCHES	INTENDED USE	REMARKS
1	1/16	Wood	Straight-fluted carbon steel drills, suitable for drilling wood
1	5/64	Wood	
1	3/32	Wood	
1	7/64	Wood	
1	1/8	Wood	
1	9/64	Wood	
1	5/32	Wood	
1	11/64	Wood	

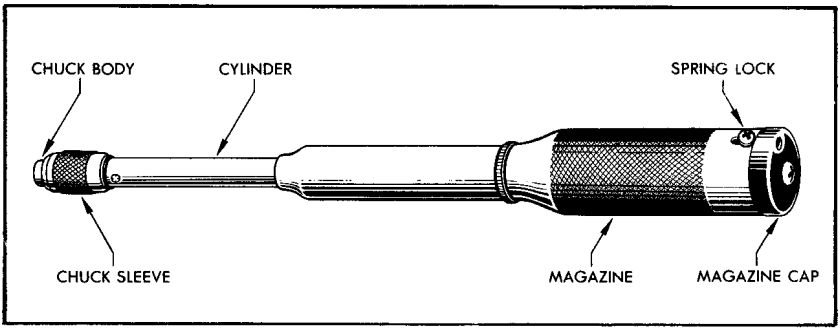


FIGURE 1. Miller Falls 185 Automatic Hand Drill

4. PRECAUTIONARY MEASURES

4.01 Observe the following precautions to prevent accidents and damage to tools or materials:

a. Keep both hands behind the drill point during operation.

b. Use suitable eye protection when the drill is used.

c. Remove the drill point from the chuck when not in use.

d. Do not use drill points that are bent.

e. Mark the location to be drilled and remove the apparatus before drilling holes.

f. Start guide holes with a center punch when metal is being drilled.

g. Use only enough pressure to operate the drill. (This is particularly important when using the small 1/16-inch drill point).

h. Hold the drill at a right angle to the surface being drilled.

UC 250 UTILITY CLAMP
DESCRIPTION AND INSTALLATION

1. GENERAL

1.01 This practice provides description and installation procedures for the UC 250 Utility Clamp.

1.02 The purpose of the UC 250 Utility Clamp is to provide support for wire and cable runs for inside installations.

2. DESCRIPTION

2.01 The UC 250 Utility Clip, Figure 1, is manufactured of spring steel and is so constructed that it may be installed without the use of hardware or tools.

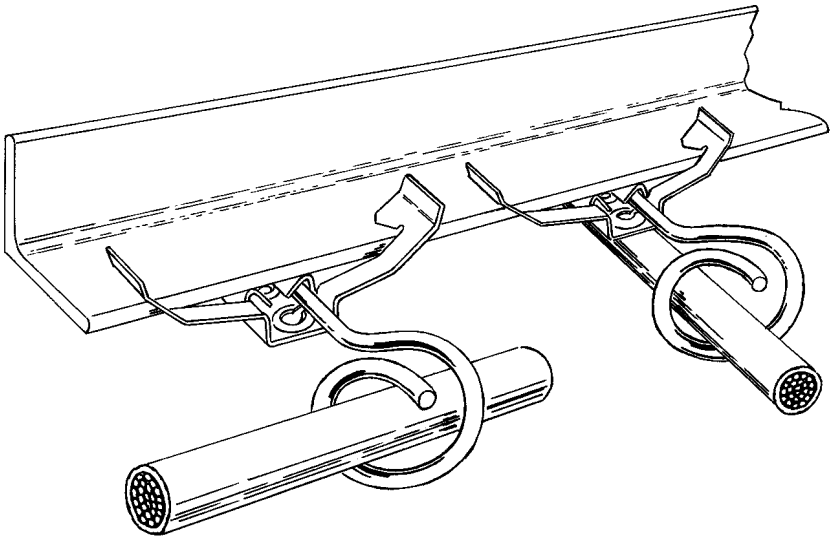


FIGURE 1

2.02 The clip may be attached to structural beam flanges ranging in thickness from 1/8" to 3/8", to wire from 12 through 8 gauge and to suspension rods ranging in diameter from 3/16" through 3/8", see Figures 2 and 3.

2.03 Bridle rings or drive rings may be fitted to the loops located at the center of the assembly, Figure 2, or the loops may accommodate a No. 8 sheet metal screw.

2.04 Two threaded depressions are provided on one side of the clip. One of the depressions accepts a 10-24 machine thread and the other a 1/4-20 machine thread. See Figure 2.

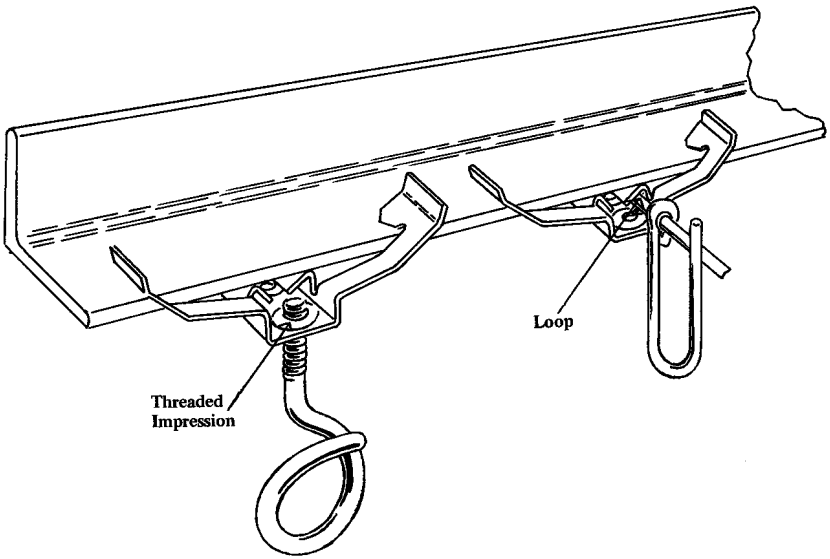


FIGURE 2

3. INSTALLATION

3.01 To install the UC 250 Utility Clip, proceed as follows:

a. Position the open slot of one end of the clip so that the wire, rod or flange rests against the top inside corner of the slot.

b. Support the center section of the clip while performing step c.

c. Apply pressure to the opposite end of the clip until the open slot has clearance with the supporting member.

d. In order to preserve the self supporting feature of the utility clip, apply only that pressure which is necessary to accomplish the installation.

e. Apply pressure in the required direction until the support member rests against the inside corners of both slots. See Figure 3.

f. Attach the appropriate supporting ring or screw to the spring clip.

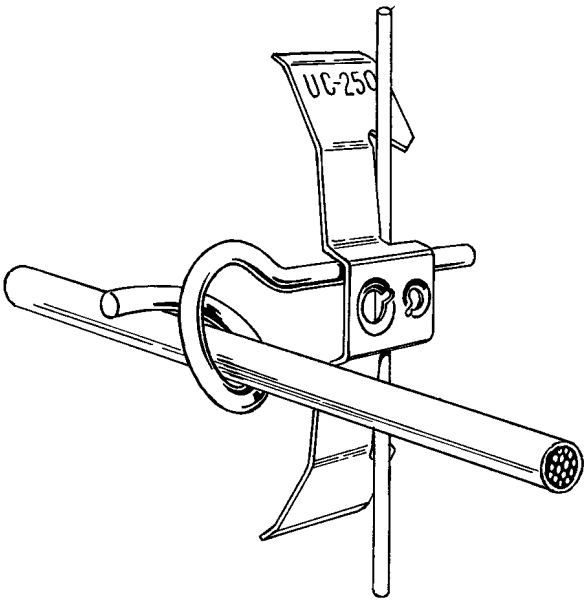


FIGURE 3

HEAD PROTECTION
DESCRIPTION AND USE

CONTENTS

1. GENERAL

1.01 This practice covers the safety requirements for head protection and includes the description, use and care of safety headgear.

1.02 Safety caps are designed to act as both a shield and a shock absorber to protect against head injuries. The headgear is also designed to provide protection against electric shock in case of accidental contact with electrically energized objects.

1.03 The use of safety caps in no way reduces the need for good job planning or the requirements for observing the safety precautions specified in other Continental Telephone System practices.

1.04 The Continental Telephone System standard safety cap meets the Class A and B standards (ANSI-Z-89.2-1971):

a. Insulation Resistance: 20,000 volts (30,000 volts to breakdown).

b. Impact Resistance: Average of 850 to 1,000 lbs.

c. Penetration Resistance: 3/8 inch.

d. Weight: Not to exceed 15.5 ounces.

e. Flammability: 3 inches per minute burn rate.

f. Water Absorption: 0.5% maximum.

2. SAFETY REQUIREMENTS—DESCRIPTION AND USE

2.01 The safety cap consists of a molded, high-impact white plastic shell equipped with detachable suspension which is adjustable to different head sizes. The Continental Telephone logo is embossed on the front; pressure sensitive reflective strips (avocado and orange) are located on the front and back of the shell for night safety visibility and conformance to Company identification. A glare resistant underbrim is furnished. The safety cap is illustrated in Figure 1 and shall be worn by all personnel engaged in outside plant or installation and repair work whenever they are subjected to conditions which could result in (1) head injuries from falling or moving objects or striking against stationary objects or (2) electric shock from accidental contact with electrically energized objects. It is not feasible to cover every situation requiring the use of headgear; however, careful observance of the principles and precautions given below will do much to prevent head injuries and electric shock. The following are the more common work operations and conditions under which the safety cap shall be worn:

a. Performing all kinds of work, i.e., line, splicing, installation, and repair work, from aerial lifts or truck mounted ladders.

b. Performing line work aloft such as from poles, ladders and platforms.

c. Working with, or in the vicinity of construction apparatus and equipment such as derricks, booms, winches, take-up reels, earth boring machines, cable trailers, tractors, trenches, and cable plows.

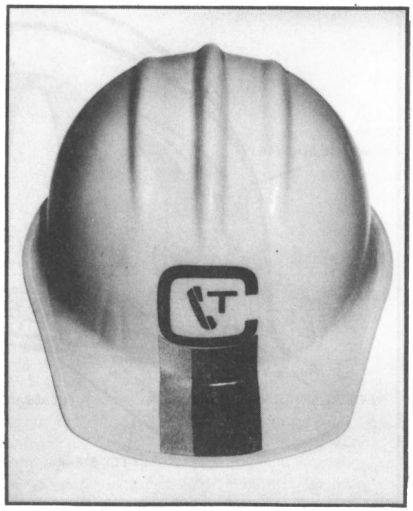


FIGURE 1. Safety Cap

d. When below work being done aloft or when performing overhead work from the ground such as placing cable blocks on strand, raising wire, and pruning trees.

e. All pole placing and removal work.

f. Entering, leaving, and working in manholes.

g. Working in any area or enclosure where headroom is insufficient such as crawl spaces, cellars, and steam tunnels.

h. Working in trenches, splicing pits, or other excavations of three feet or over in depth.

i. When in or near buildings under construction or being demolished.

j. When in an industrial establishment or on other premises.

k. Storm restoration work.

l. Performing blasting operations or when in the vicinity of such operations.

m. At any time there is exposure to high voltage electrical contact.

2.02 The suspension for the safety cap consists of a molded plastic band with a vinyl sweatband and nylon crown straps attached. The crown straps are not adjustable, but are fixed to provide clearance between the top of the head and the inside of the cap shell. The suspension has six points which attach to the cap using delta shaped plastic clips. The sweatband is a moisture absorbing microporite brow pad which is attached in the front of the headband. Sizing buttons are located on either side and are adjustable in increments of 1/16 inch of standard hat sizes. Detailed illustration is shown in Figure 2. Instructions for headband adjustment are:

a. Unsnap sizing buttons and decrease band size.

b. With buttons still unsnapped, put helmet on head.

c. Remove helmet and snap sizing buttons into nearest hole. The suspension is now permanently set to head size.

d. The headband may be raised or lowered front and/or rear by removing hangers from "V"

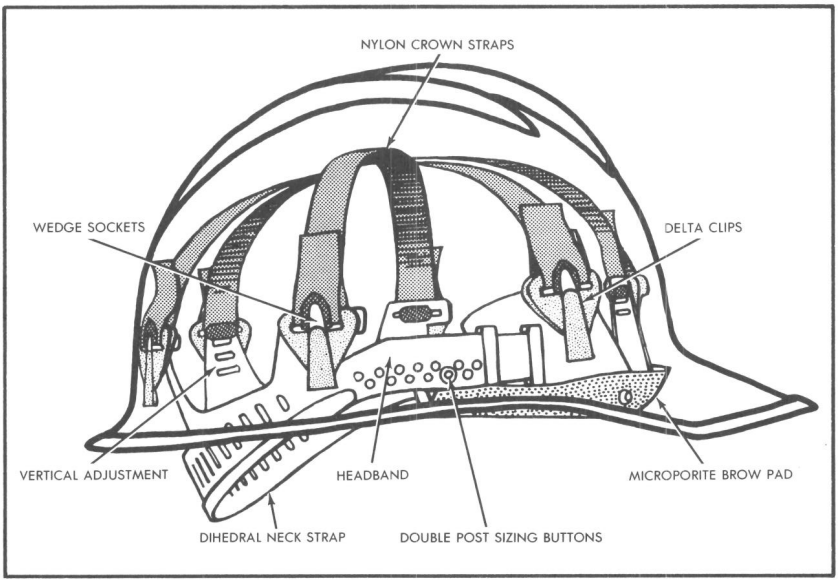


FIGURE 2

slots and repositioning the "L"-shaped plastic key. Be sure to reseat hanger firmly before wearing helmet. The dihedral neck strap may be raised or lowered vertically by separate adjustment.

e. The suspension is shown in Figure 3.

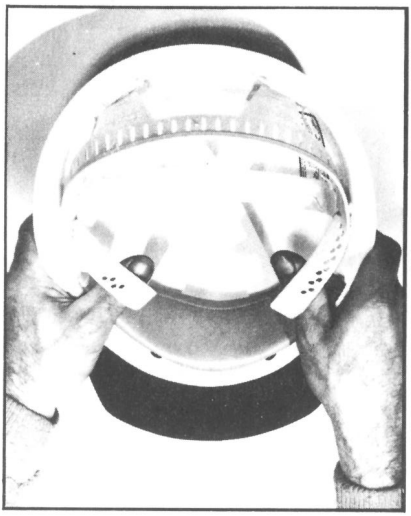


FIGURE 3

2.03 Winter liners with ear flaps for use with safety cap are available as accessory items. The liner is worn with the suspension over the liner as illustrated in Figure 4.

2.04 Chin straps are made of an elastic material, fully adjustable, available as an accessory, and snap into the plastic hangers located on the inside, underbrim portion of the shell. The chin strap is for use during windy weather to prevent the safety cap from falling off.

2.05 When a safety cap is being worn and it is necessary to use a head telephone set, use the following procedure:

a. Hold the safety cap in both hands, inverted, with the front facing away from you. The edge of the brim should rest approximately in the center of the palm of each hand. The position of the hands is such that the thumbs are directly over the center supporting tabs of the sweatband. See Figure 5.

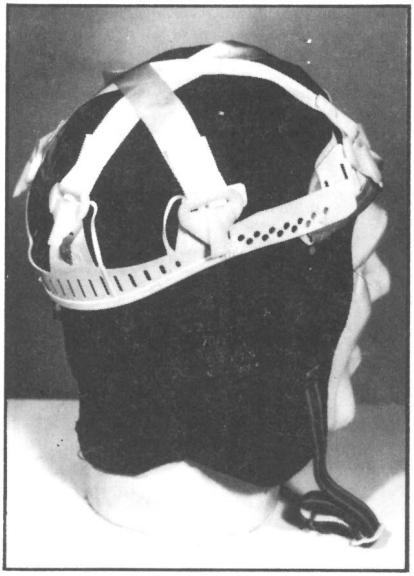


FIGURE 4

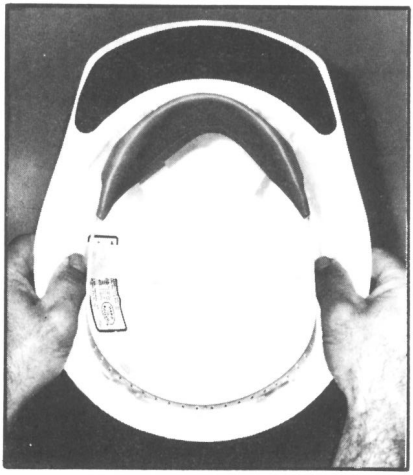


FIGURE 5

b. Slide each thumb down the outside of the sweatband tab attached to the side suspension strap hanger keys to the plastic angle button which holds the suspension to the hanger key. This will snap the buttons out of the slots in the hanger key when a steady pressure is applied, freeing the supporting tabs from the sweatband. See Figure 6.

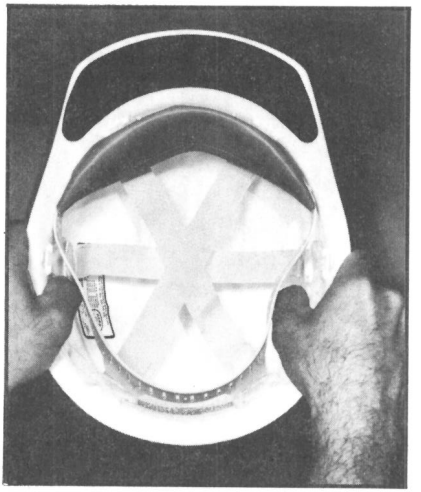


FIGURE 6

c. Remove the angle buttons from the slots in the tabs. The sweatband is now being held in the cap or hat at four points, two in front and two in back. The cap or hat is now ready to have the headset installed. Rotate so the front of the cap or hat faces you. See Figure 7.

d. Place the headset in position by threading the headpiece bracket (from either left or right side depending on which ear the receiver is worn) between the sweatband and the side hanger key, sliding it along the nylon cross strap so the leather pad rides on the strap and the strap is between the bracket supporting wires. Continue to slide the free end under the two long straps and emerge between the sweatband and the side hanger key. The headset is now installed. Hold the headset in this position, spreading the bracket toward the sides of the safety cap. See Figure 8.

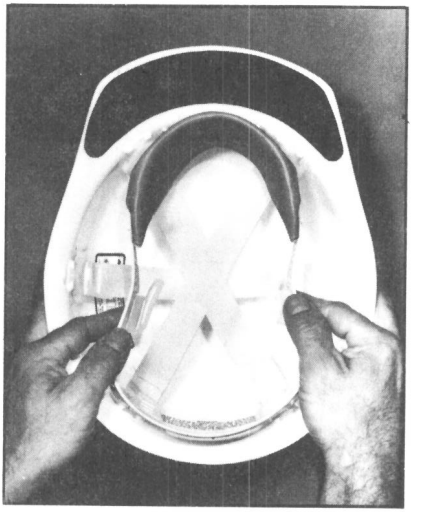


FIGURE 7

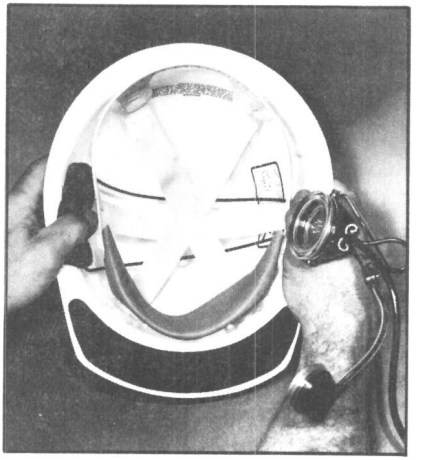


FIGURE 8

e. Place the safety cap on the head and position the receiver on the ear. The cap or hat with the headset installed is now properly worn. The headset bracket being secured between the sets of nylon straps is held in a secure position, regardless of the movement of the head or of the safety cap relative to the head. The receiver can be moved from the ear either forward or back without disturbing the position of the headset bracket on the head. When not needed, the headset can be removed easily from the safety cap.

NOTE: Releasing the two side supports of the suspension does not in any way affect the safety of the safety cap. The six point suspension has not been changed, which is the basic protection. The sweatband merely holds the cap on the head and being attached in four points just as effectively accomplishes this purpose. When the safety cap is not worn with the headset, it is not necessary to reattach the side supports of the sweatband.

2.06 The safety cap can be worn with a dielectric bracket and visor which are accessory items. When used with safety headgear, this combination gives face-eye protection as illustrated in Figures 9 and 10 for protection against impact.

2.07 The safety cap should be stored where it will not be damaged by other tools. Proper storage of the cap is by use of a cap rack, which is available.

CAUTION: Do not store the safety cap on the rear shelf of an automobile as it could be hurled forward in a collision.

3. CARE—CLEANING—INSPECTION AND TESTING

3.01 Maintenance should include all safety caps being initialed or marked in some manner to prevent random exchange among workers. Craft personnel should wipe dust or moisture from the caps before storing them.

3.02 A schedule should be established and maintained for the periodic inspection of all safety caps. Electrical safety caps should be inspected visually each day by the wearer for defects such as cracks, pit marks, or other abrasions that have occurred through use. It is recommended that management arrange for periodic electrical test of such caps. Safety caps should be periodically returned to the supplier or a local accredited test center for dielectric test per ANSI-Z-89.2-1971. The interval between testing shall not exceed one year.

3.03 Caps used primarily for electrical protection must be destroyed when they are found to contain cracks, abrasions, or other physical damage, or when they fail to pass an electrical proof test.

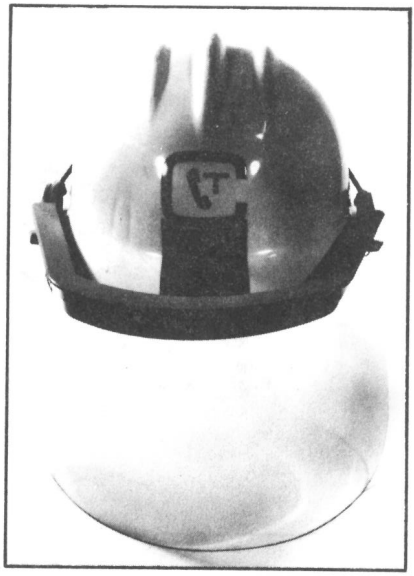


FIGURE 9

3.04 The worker can turn in a cap if it is found to be damaged or in need of a new suspension or sweatband. Caps turned in with sound shells may be transferred to other employees if the shell is thoroughly cleaned, sterilized, and supplied with a new suspension.

3.05 Tars, paints, oils, and other adherent dirt should be removed with nonflammable and nontoxic solvents. Because some solvents can be harmful to dielectric caps, the cap manufacturer should be queried before choosing a solvent.

3.06 A common method of cleaning the shells is to dip them into a tank of hot water, not in excess of 140°F., and containing a good detergent for at least one minute. These hats should then be scrubbed and finally rinsed in clear hot water (maximum temperature 140°F.). (Hats should be dipped using wire baskets to prevent hand and arms burns.) After rinsing, they should be wiped dry and inspected for damage that might show up. If cleansing facilities are unavailable, use a sanitizing spray to clean the shells and wipe dry for inspection. New suspensions

FIGURE 10

should be installed and the entire unit placed in a plastic bag, paper bag, or box to protect it against dust and handling damage.

4. ORDERING INFORMATION (INCLUDING REPLACEMENT ITEMS AND ACCESSORIES)

4.01 The following descriptions and catalog numbers cover the complete safety cap and accessories:

a. Cap, Model No. 302, white with Continental Telephone logo and reflectorized stripes, front and rear—complete with suspension: CTS #74-86-033-0.

b. Yellow dihedral 6 point suspension system, Part #ESDMY: CTS #74-86-052-6.

c. Green underbrim decal for glare prevention pressure sensitive: Part #UBG.

d. Chin strap, Part #ES-42: CTS #74-86-051-8.

e. Liner, winter (available in small, medium and large sizes), Part #EL-33: CTS #74-86-048-8, small; #74-86-053-4, medium, #74-86-050-0, large.

f. Dielectric bracket: Part #300.

g. 8 inch x 15 inch x .040 clear visor for use with #300 dielectric bracket for impact protection to face and eyes: Part #840.

PROTECTOR BLOCKS
RECTANGULAR TYPE

1. GENERAL

1.01 This practice covers the use and maintenance of the protector blocks most commonly used.

1.02 Protector blocks usually consist of a pair of carbon blocks, which, when installed in a protector mounting, provide a small air gap between a line conductor and ground. A low impedance path is provided to ground when abnormally high voltages are applied to the line, which may be caused as a result of lightning or contact between telephone conductors and power lines.

2. TYPES OF PROTECTOR BLOCKS

2.01 The *rectangular type* protector block is shown in Figure 1.

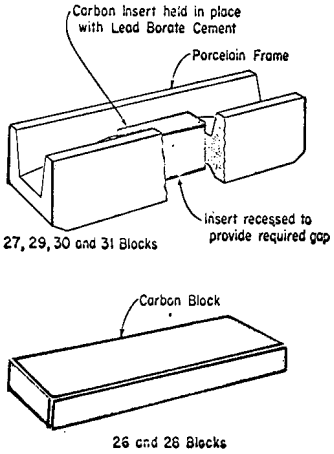


FIGURE 1

2.02 The rectangular protector block may be used in the 83A, 84A, and 87A mounting assemblies and in the 104A and 108A mountings.

2.03 The design of the protector is such that one of the blocks is made of carbon and the other of porcelain with a small carbon insert. When placed in a protector mounting, the carbon block is in contact with the ground electrode; and the carbon insert of the porcelain block is in contact with the line terminal through a protector spring which holds the assembly in place.

2.04 Protector block characteristics are shown in Table 1.

TABLE 1

Code Designation	Gap	60-Cycle R.M.S. Breakdown Voltage	Color Code on Porcelain	Common Use
26*–27	.003 in.	350	White	C.O. and Station Prot.
28*–29	.003 in.	350	White	C.O. Protection
26*–30	.006 in.	700	Blue	Cable Protection
26*–31A	.010 in.	1000	Yellow	Special Applications

2.05 In certain localities where equipment such as phantom repeating coils associated with open wire lines are located outdoors on poles, excessive maintenance is sometimes experienced with 0.006" blocks. In such cases 0.010" blocks are recommended. Where such protection is used it is recommended that a separate set of the 0.010" protector blocks be used on each side of the phantom repeating coil between each open wire conductor and a common ground consisting of two or three ground rods in parallel.

Benefits from the use of 0.010" blocks ahead of the 0.006" blocks may also be obtained where excessive maintenance has been experienced with the 0.006" blocks due to lightning. The use of double protection is not generally recommended but may be found helpful in special cases for circuits in which the avoidance of even occasional service interruptions from standard cable pole protection is desired. Where used, it is desirable to locate the 0.010" blocks about two to four spans ahead of the cable pole with the ground plate connected to about three ground rods in parallel at the base of the pole.

3. PRECAUTIONS

3.01 If there is any indication or reason to believe that a power contact has occurred, make a check from the ground to be certain that safe working conditions exist before performing any work at a protected terminal or protector mounting location.

4. PLACING PROTECTOR BLOCKS

4.01 Rectangular porcelain and carbon blocks will be placed by holding the assembly firmly by hand and pressing into place in the protector mounting so that the protector spring rests squarely against the carbon insert of the porcelain block. Avoid sliding motion between the blocks as any loosened carbon particles are a potential service hazard.

5. INSPECTION AND MAINTENANCE

5.01 Both the porcelain and carbon blocks shall be handled with care and should be kept in the original shipping cartons or in an approved holder such as the 3A type.

5.02 In the event the porcelain and carbon blocks are removed from the protector mounting to clear trouble or for any other reason, they shall be inspected and cleaned as covered in 5.03 to 5.05.

5.03 Porcelain and carbon blocks will be inspected for indications of chips and cracks. Both sides of the carbon block may be used. If one side shows pitting and the other side is satisfactory.

Reject porcelain blocks if subject to any of the following defects:

a. Porcelain blocks which have a chip or crack in the porcelain that extends to the carbon insert.

b. Porcelain blocks that have both walls of the spring groove chipped at the same end.

c. Porcelain blocks that show evidence that the carbon insert has moved.

5.04 Clean porcelain and carbon blocks which pass inspection, outlined in 5.03.

5.05 After cleaning the porcelain and carbon blocks, they shall be inspected for further evidence of defects as follows:

a. Do not reuse any blocks in which the carbon sparking areas are glazed, scratched or cracked, or show signs of soft or unduly roughened spots on those areas.

b. Do not reuse any blocks which cannot be cleaned free of dirt or other foreign matter.

6. OPERATED PROTECTOR BLOCKS

6.01 Ordinarily, lightning discharges will cause an arc across the air gap between the carbon insert and the ground block, but will not heat them sufficiently to melt the cement used for holding the insert in place.

6.02 Protector blocks operated by lightning to the extent of very heavy pitting or blackening indicates that the plant has been exposed to frequent or severe lightning discharges. Such information may be useful in the investigation of cable troubles resulting from lightning.

6.03 A cross with electricity will cause a discharge or repeated discharges of such duration that the heating of the carbon insert will melt the cement holding it and allow the mounting spring to push it into direct contact with the solid carbon block, thus permanently grounding the line.

6.04 Power may be of low voltage and generally is applied for a much longer period of time than lightning. The effect being to make deep pits with whitish deposits or to ground the blocks permanently. Blocks thus damaged by power are usually unfit for further service.

6.05 Protector blocks operated by power are indicative of an irregular plant condition. It is important, therefore, in order to take the necessary action to preclude further trouble, to make a careful inspection for direct or swinging contacts or inadequate separations between telephone and electric plant. Any cases where protector blocks are operated by power for which the cause has not been determined should be reported to the supervisor for further investigation.

6.06 Moisture may also cause deterioration of carbon protector blocks. At damp locations, moisture may accumulate between the protector blocks and establish a high resistance path for current. Electrolytic action will cause the carbon to soften and crumble and small particles of carbon will eventually bridge the gap between the two blocks, placing a permanent ground on the line. A cavity results, rendering the carbon blocks unfit for further service. The associated porcelain block with the carbon insert is not affected and remains serviceable.

SOLDERING METHODS

1. GENERAL

1.01 This practice covers the method of making and removing soldered connections, the use of soldering irons, and safety precautions that must be observed during soldering operations. This practice replaces CTSP 400-300-006.

1.02 Soldering is the process of fusing three metals (wire, terminal, and solder) by the application of molten solder. This bond is made by raising the temperature of the wire and terminal to the melting point of solder. The rosin flux in the solder excludes air during the heating which minimizes oxidation. Before soldering, the terminals and wires must be thoroughly cleaned of all enamel, grease, dirt, and oxides.

1.03 It is essential that the wire is connected so that it is in the proper position and rests firmly against the terminal. A properly soldered connection will have a definite, thin strip of solder on both sides of the wire to form a secure mechanical connection and a good electrical connection. See Figure 1.

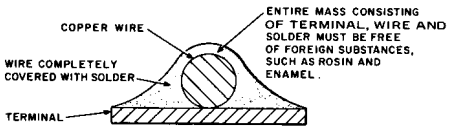


FIGURE 1. Cross Section of a Properly Soldered Connection

1.04 The point of soldering is generally on the right side or on the top of the terminal.

1.05 When soldering neoprene or plastic insulated wire, considerable care shall be taken that the copper soldering tip or other heat source is not applied to the connection any longer than necessary to make a good connection; these materials have a tendency to recede with excessive heating.

1.06 Do not allow neoprene and plastic insulated wire without a textile covering to come in direct contact with another terminal which is being soldered. Special care shall be taken to avoid even momentary contact between the copper soldering tip (or other heat source) and the insulation of these types of wire.

1.07 Methods of holding soldering irons are:

a. The hand grip is generally found applicable on horizontal terminals such as those on the vertical side of a distributing frame. See Figure 2.

b. The pencil grip is generally found applicable on vertical terminals such as those on the horizontal side of a distributing frame. See Figure 3.

FIGURE 2. Hand Grip Method of Holding Soldering Iron

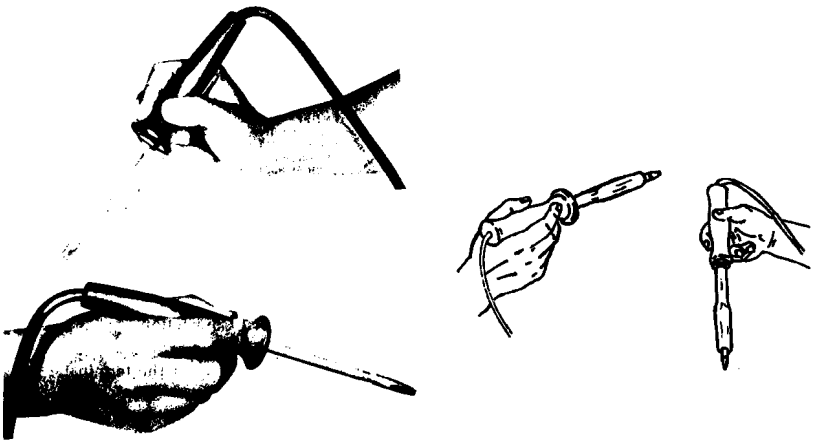


FIGURE 3. Pencil Grip Method of Holding Soldering Iron

2. TOOLS AND MATERIALS

2.01 The following tools and materials are required to perform the soldering procedures outlined in this practice:

a. Soldering iron holder (includes wiping pad).

b. Soldering iron, 100 watts.

c. Soldering iron (Ungar).

d. Orange stick.

e. Spudger.

f. File.

g. Safety goggles or safety glasses, one piece clear plastic lenses.

h. Longnose pliers.

i. Distributing frame bag.

j. Aloxite cloth (emery cloth).

k. Solder, rosin core, 40/60 (40% tin, 60% lead).

3. SAFETY PRECAUTIONS

3.01 Do not *flip* solder from the soldering iron; personal injury or damage to nearby equipment may result.

3.02 Judge the temperature of the soldering iron by applying a piece of solder on the tinned surface of the tip and observing whether or not the solder melts.

CAUTION: Do not test the temperature of the iron by holding it near hands or face; serious burns may result.

3.03 Safety goggles or glasses shall be worn when cleaning terminals and unsoldering wires.

3.04 Do not place a warm or hot soldering iron on the floor, equipment, or in any other place except in the guard or holder or on the rest provided for this purpose.

3.05 Do not remove a soldering iron from its holder to store it (as in a locker) until it has thoroughly cooled.

3.06 Wherever possible, use the distributing frame bag to protect the equipment below.

3.07 When inserting the copper tip into a handle, do not strike the point of the tip forcibly against any surface. This could damage the iron coating, as well as blunt the point.

3.08 It is not possible to do satisfactory work with a dirty or stubby copper tip. Also, it is not possible to properly solder a connection on which either the wire or terminal has not been thoroughly cleaned.

3.09 To avoid causing a poor connection, do not disturb a newly soldered connection until the solder has thoroughly cooled.

3.10 Do not allow a hot soldering iron to come close to semiconductor devices such as transistors, diodes, etc., as they can be damaged by excessive heat.

3.11 Avoid overheating when soldering on pigtail equipment. See paragraph 12.

3.12 When soldering to electron tube contacts, be very careful not to misalign or overheat the contacts. See paragraph 13.

3.13 An electric soldering iron may break down internally in such a way that the metal parts of the iron become crossed with the heating circuit. Also, the insulation of the power cord may become frayed and defective. These conditions could result in personal injury or equipment damage. Refer to paragraph 4 of CTSP 405-700-001 and CTSP 405-700-002 for inspection and maintenance procedures.

4. TYPICAL USES OF SOLDERING IRONS AND SOLDERS

4.01 Typical uses of soldering irons are:

a. The 100 watt soldering iron is standard for general and continuous use.

b. The 74-26-081-2 (Ungar) soldering iron should be used where small size, light weight, and quick heating are desirable. This iron can be equipped with a short shank for general use or a long shank for special use, such as on switchboard multiples. Normally, this iron is equipped with a 1/4-inch wide tip. Heater assemblies with 3/16- and 1/8-inch wide tips are also available.

4.02 Typical uses of solders are:

a. The 40/60 rosin core is generally used to solder wire to terminals.

b. Solders with greater than 40% tin content are used where heat sensitive equipment or insulation is involved, or where the nature of the soldering operation requires a solder with a lower melting point.

5. SHAPING COPPER SOLDERING TIPS

5.01 Plain copper tips may be shaped by filing. Refer to paragraph 4 of CTSP 405-700-002.

NOTE: IRONCLAD TIPS, INCLUDING THOSE COATED WITH A DIELECTRIC, SHOULD NOT BE RESHAPED.

6. TINNING COPPER SOLDERING TIPS

6.01 *Plain copper tips:*

a. File approximately half an inch (3/8" to 5/8") of the surface of one side of the tip until it is bright and clean. See Figure 4.

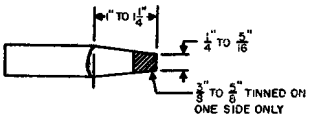


FIGURE 4.

b. Heat the copper tip to soldering temperature; quickly file the side of the tip which was previously cleaned, then apply rosin core solder until the surface is well tinned. Use a wiping pad to remove any excess solder. Only one side of the tip should be tinned. The tinned area may be confined by rubbing the untinned portion of the tip with a rubber eraser or rubber matting.

NOTE: Continuous heating of an idle iron will destroy the tinned area.

6.02 Before replacing a soldering iron in a holder or on a rest, remove any excess solder on the tinned side of the tip. If the tip is reheated, the excess solder will tend to cause pitting. Surplus solder may be removed by wiping the tip on the wiping pad.

6.03 *Ironclad tips:*

a. The ironclad tips are furnished initially with one side of the tip tinned. If the soldering iron is to be idle for an extended period, leave an excess of solder on the tip. To clean the tip, heat the iron and then flow solder over the tip. Rub the tip on the wiping pad to distribute the solder over the tip and to wipe off any excess solder.

NOTE: Do not wipe the tip on anything other than the wiping pad as this may destroy the tinning.

b. After cleaning the ironclad tip, if it is apparent that retinning is necessary, proceed as follows:

(1) While the tip is hot, wipe off as much of the old solder as possible, using the wiping pad. Then allow the tip to cool; otherwise, it cannot be cleaned satisfactorily.

(2) When the tip is cold, rub the surface to be tinned on a piece of emery cloth until the surface is bright. Do *not* use a file to clean the tip. Take care to remove as little of the iron as possible as the iron coating is less than 1/64 inch thick. If the iron coating is penetrated, a short tip life will result.

(3) When the surface is clean heat the tip and apply solder as it is heating. As soon as the rosin begins to melt, spread the rosin over the surface to prevent it from tarnishing before the solder is melted.

(4) As soon as the solder begins to melt, spread the solder over the surface until the desired area is tinned. Rub the tip on the wiping pad to wipe off any excess solder.

7. SOLDERING WIRE TO NOTCHED TERMINALS

7.01 Apply rosin core solder to the tip of a hot soldering iron momentarily, leaving a small amount of molten solder on the tip. Apply the tip to the terminal and wire as shown in Figure 5, Step 1. As the terminal and wire attain proper soldering temperature, the molten solder will spread over the surfaces of the terminal and wire. As this occurs, a small amount of additional solder is immediately applied to the heated joint as shown in Figure 5, Step 2, so the molten rosin will protect the joint as the soldering process is completed.

NOTE: When soldering connections made with wires of gauges larger than those of distributing frame wire (particularly if the wire is untinned), a longer period of time must be allowed for heating the wire and terminal with the soldering iron before the solder is applied to the copper tip. This will permit the melted flux to flow over the heated wire. Experience will give the period of time required for heating the wire sufficiently to take the flux and solder; it should not be so long as to cause excessive oxidation of the surface of the wire. A satisfactory job cannot be done if the solder is run onto a cold or improperly heated terminal, even though the copper tip is sufficiently hot. On the other hand, the connection should be soldered and the copper tip removed from the terminal as quickly as possible to avoid damage to the insulation on the terminal strip.

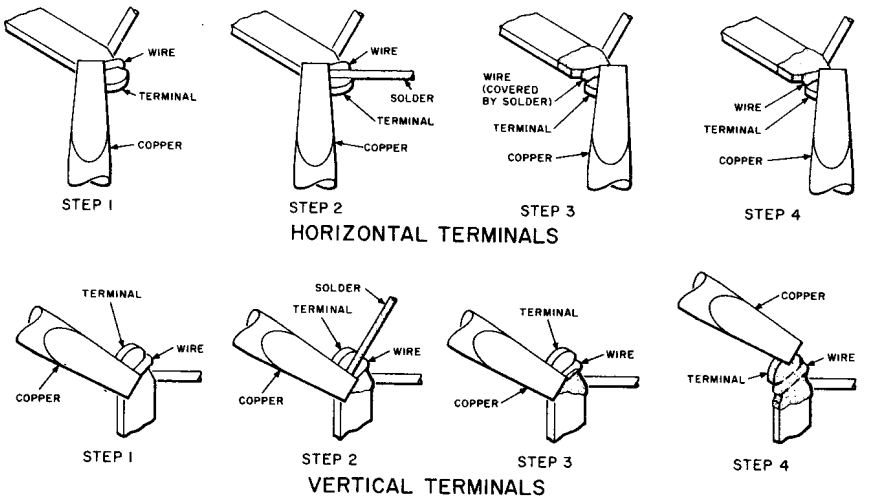


FIGURE 5. Soldering Wire to Notched Terminals

7.02 When the solder has melted and flows freely, bring the copper tip down over the terminal with a forward movement so the solder flows over the wire, completely covering it as shown in Figure 5, Step 3. Draw the copper tip off the terminal, carrying with it any surplus solder to leave a clean, smooth joint as shown in Figure 5, Step 4.

7.03 Only a small amount of solder is needed to make the joint illustrated in Figure 6, which shows a thin coat of solder spread smoothly over the wire, completely covering it. If too much solder is used, a lumpy connection will result which may cause trouble.

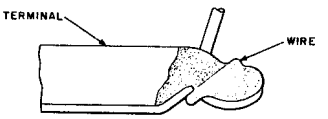


FIGURE 6. Example of Properly Soldered Connection

7.04 Improper soldering technique on vertical terminals may result in a cross or short circuit between adjacent terminals as shown in Figures 7 and 8.

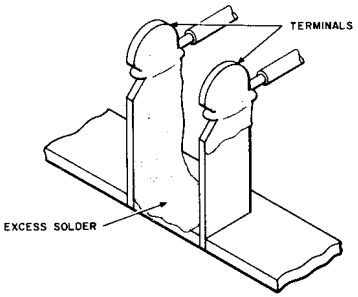


FIGURE 7. Excessive Solder on Vertical Terminals

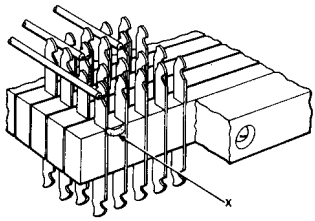


FIGURE 8. Excessive Solder on Terminal Strips

7.05 Figure 9 illustrates an improperly soldered connection; the solder has sweated to the terminal only, while between the solder and the wire there is a layer of rosin which insulates the solder from the wire. A connection of this type is due to one of the following causes:

a. Cold copper soldering tip.

b. Copper soldering tip held on the connection an insufficient length of time.

c. Improper manipulation of soldering iron.

d. Untinned or uncleaned terminal or wire.

8. SOLDERING WIRE TO PERFORATED TERMINALS

8.01 Perforated terminals are those on which the wire is brought through the hole, such as on equipment units, jacks, and lamp sockets. The method of soldering is the same as for notched terminals outlined in paragraph 7. Sufficient solder should be used to fill the hole. This ensures that a good electrical and mechanical connection has been made. See Figure 10.

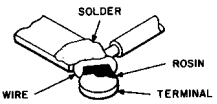


FIGURE 9. Example of Improperly Soldered Connections

9. SOLDERING WRAPPED CONNECTIONS TO WIRE TERMINALS (INCLUDING SQUARE CROSS SECTION) AND PUNCHED TYPE TERMINALS 1/16-INCH OR LESS IN WIDTH

9.01 When soldering wrapped connections to punched and wire type terminals, it is not necessary to cover the entire wrapped end with solder. Ordinarily, all turns of wire will

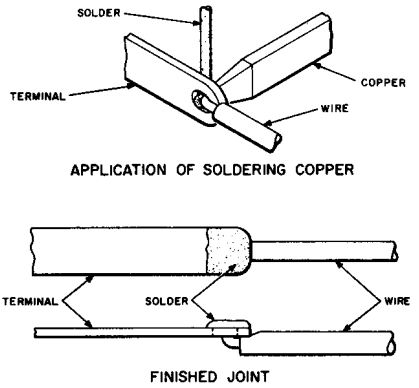


FIGURE 10. Soldering Wire to Perforated Terminals

become covered with solder at the soldered side of the terminals. Where more than two turns have been wrapped, it is necessary to solder only two adjacent turns to the terminal.

10. SOLDERING WIRE TO TUBULAR TERMINALS

10.01 When soldering wire to a tubular terminal, first apply a little solder to the wire with the copper tip. Then, connect and solder the wire to the terminal as outlined in a., b., *or* c.:

a. *Skinned End of Wire Folded Back* (Figure 11): When the connection is made by folding back the skinned end of the wire, the length of bare wire from the skinning point to the fold should be slightly less than the depth of the terminal. Insert the folded wire into the tubular portion of the terminal so the spring effect of the folded wire will hold it in place before soldering. Then hold the copper tip against the side of the terminal until the solder can be flowed into the tube.

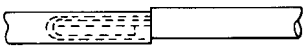


FIGURE 11.

b. *Skinned End Inserted Without Fold* (Figure 12): When soldering connections to *cutaway tubular* terminals such as on U.S. Components Co. plugs and connectors, insert the wire into the tubular portion of the terminal and fill the cutaway portion with solder.

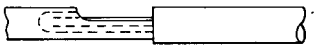


FIGURE 12.

c. *Wire Wrapped Around Terminal* (Figure 13): When the connection is made by wrapping the wire around the terminal, solder the turn nearest the insulation for at least one-half the circumference of the terminal.

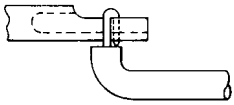


FIGURE 13.

d. Hold the copper tip against the terminal for another instant; then remove the copper tip and hold the wire in place until the solder sets.

11. SOLDERING WIRE TO SPUN-IN, STAND-OFF, AND SIMILAR TYPE TERMINALS

11.01 When soldering connections to spun-in, stand-off, and similar type terminals, completely cover the wire with solder for at least one-half of the circumference of the terminal.

NOTE: When soldering connections to stand-off terminals (terminals insulated from their mounting studs by means of insulating material), take special care to avoid overheating as excessive heat may loosen the terminal from the insulating material.

11.02 *Spun-In Terminals*: These terminals are frequently used for mounting pigtail equipment. Make the connections as follows (see Figure 14):

a. Where the pigtail equipment is located on the side of the panel opposite the terminal, the pigtail leads should be brought through the terminal and bent over the terminal end.

b. Where the pigtail equipment is located on the same side of the panel as the terminal, connect the pigtail leads by wrapping approximately one full turn around the terminal.

c. Connecting wires should be connected in a manner similar to the pigtail leads.

d. Where surface wiring and/or pigtail leads are to be connected and it is necessary to provide for future connections such as installer wiring, connect the surface wiring and/or pigtail leads to the inner end of the terminal.

NOTE: Some spun-in terminals do not have wire retaining ridges. In such cases, connect wires in the same relative locations as described above. On slotted spun-in terminals, connect wires in the same relative locations as described above, except that pigtail connections may be made through the slot in the terminal.

11.03 *Stand-Off and Grooved Type Terminals*: Connect wires as shown in Figure 15, using one full turn of wire.

11.04 See CTSP 410-600-420 for the method of soldering and unsoldering wrapped connections.

NOTE:
THE ILLUSTRATION SHOWS THE PREFERRED CONNECTING LOCATION FOR PIGTAIL LEADS AND CONNECTING WIRES (LEADS OTHER THAN PIGTAIL LEADS). HOWEVER, THE CONNECTIONS MAY BE REVERSED OR BOTH CONNECTIONS MAY BE MADE AT THE INNER OR OUTER END OF THE TERMINAL.

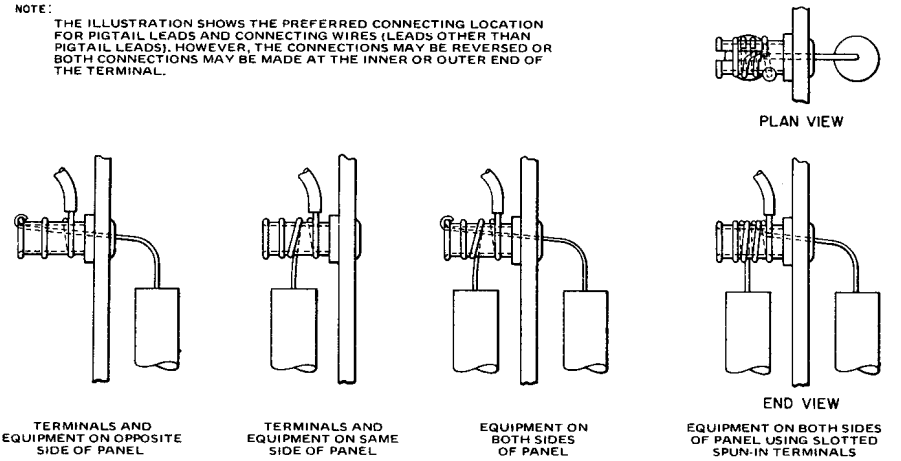


FIGURE 14. Plier Connections to Spun-In Terminals (Solder Not Shown)

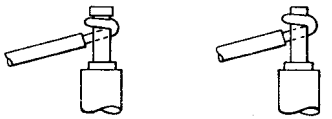


FIGURE 15. Stand-Off and Grooved-Type Terminal (Solder Not Shown)

12. PIGTAIL EQUIPMENT

12.01 Pigtail equipment such as electrolytic capacitors, carbon and composition resistors, thermistors, and diodes are usually mounted by means of their wire terminals. Equipment of this type can be damaged by excessive heat during a soldering operation, either by heat being transferred to the equipment body by conduction through the pigtail or by holding the soldering iron too close to the equipment. When soldering leads closer than one-half inch from the body of the component, a *heat sink* is recommended to restrict the flow of heat into the pigtail equipment. To further aid in keeping the amount of heat to a minimum, use a solder with a high tin content such as the 60-40 percent solder which has a low melting point.

13. ELECTRON-TUBE SOCKETS

13.01 To prevent damage or misalignment of the contacts on electron-tube sockets, and to reduce the possibility of overheating the contacts and body material, use a *heat sink* during wiring and soldering operations.

14. UNSOLDERING CONNECTIONS

14.01 Use a wiping pad to remove all surplus solder from the copper tip. Place the copper tip against the soldered connection and remove as much of the solder as can be drawn off on the copper tip.

14.02 Using a pair of longnose pliers and keeping the hot copper tip on the connection, grasp the wire to be removed a short distance back from the terminal. Apply a light, steady pull to the wire until it becomes unfused from the soldering surface. Then carefully unhook or unwrap the wire to disengage it from the terminal. *Extreme care must be taken not to flip or spatter the solder.*

NOTE: Disconnecting a wire by melting the solder and jerking it free from the terminal may result in personal injury or damage to nearby equipment.

14.03 After removing the wire from the terminal, use the copper soldering tip and an orange stick or spudger to remove all excess solder from the terminal.

14.04 Solder-wrapped connections need not be unsoldered to remove the connections. Cut the wire, unwrap with longnose pliers, and then remove solder as directed in paragraph 14.03.

PART III
COMMON CUSTOMER EQUIPMENT GENERAL INSTALLATION

PRACTICE NUMBER	TITLE
475-025-200	Public Relations Plant Personnel
475-050-301	Installer/Repairman Customer Trouble Ticket & Readout—Install-Form 155A Description and Method of Completion
475-100-001	**Addendum**—General Station Installation
475-100-001	General Station Installation Procedures
475-300-001	Drop Wire Disposition with Discontinuance of Service
475-300-403	**Addendum**—Stringing Sags and Span Limits
475-300-403	Stringing Sags and Span Limits
475-300-406	Drop Wire At Aerial Terminals
475-300-407	Drop and Station Wire Separation and Mechanical Protection
475-300-408	Drop Wiring Tree Interference
475-300-410	Span Clamps—Strand Attachments
475-300-411	Drop Wire Clamps Installation
475-300-412	Drop and Block Wiring—Tree Attachments Installation
475-300-414	Drop and Block Wiring—Terminal Post Caps and Insulators
475-300-417	Drop and Block Wiring—Wiring At Strand Mounted Terminals
475-300-420	Drop and Block Wiring—Guard Arm Hooks Installation and Requirements
475-300-500	Station Wire and Cable Attaching and Fastening
475-300-700	Drop and Block Wiring—Testing and Fault Locating
475-301-401	Drop Wiring—Pole-to-Pole and Pole-to-Building Spans Placing Drop Wire
475-301-405	Drop Wiring—Power Exposure Up to 300 Volts Placing Drop Wire
475-301-410	Drop Wiring—Power Exposure 300 to 750 Volts Placing Drop Wire
475-301-605	Drop Wiring—Power Exposure Up to 300 Volts Lowering and Replacing Drop Wire
475-301-610	Drop Wiring—Power Exposure 300 to 750 Volts Lowering and Replacing Drop Wire
475-302-401	Drop Wiring—Fastening and Equipping First Attachments of Drop Wire Runs to Building
475-302-405	Drop Wiring—Drop Wire Runs On and Inside Buildings Fastening and Equipping Intermediate and Last Attachments
475-305-402	Selection of Route For Station Wire and Cable
475-305-405	Concealing Wire and Cable Without Conduit or Raceways

PRACTICE NUMBER	TITLE
475-310-412	Drop and Station Wiring Attachments on Aluminum, Steel, and Vinyl Siding
475-400-401	**Addendum**—Portable Telephone Installation
475-400-401	Portable Telephone Installation
475-400-409	Wire Terminal Type 107A2 and 101B Installation

PUBLIC RELATIONS
PLANT PERSONNEL

1. GENERAL

1.01 Public relations is defined as the art of developing goodwill and understanding between a person, firm, or institution and the public. Good customer contacts by plant personnel will contribute greatly to building and maintaining a favorable reputation in the community. Each visit to a customer's premises should be considered an opportunity to improve the customer's appreciation and understanding of the service we render.

1.02 Courtesy and friendliness must be shown at all times. When we perform our work efficiently and cheerfully, the customer recognizes and appreciates it.

1.03 Personal consideration for others is one of the most important aspects of good public relations in the plant job. We must give special attention at all times to our appearance, conduct, and actions to make the best impression for ourselves and our company. For example:

a. Drive company vehicles safely and courteously.

b. Do not park a company vehicle in the customer's driveway or anywhere that might inconvenience other drivers or pedestrians.

2. CONTACT WITH CUSTOMERS

2.01 A favorable first impression is an important factor in creating good customer contacts. Your appearance should be such that you will be welcomed anywhere your job takes you.

2.02 Always let the customer know immediately that you have arrived to start the job. Be considerate of the customer when gaining admittance. Call the customer by name and introduce yourself by name: "Mrs. _____ I am _____ with the telephone company. I have come to (install) (repair) your telephone." If the customer seems unsure of your identity, show her your I.D. card.

2.03 If no one is at home, leave the "no access" card in the prescribed manner.

3. GOING ABOUT THE JOB

3.01 While good service is important in achieving good public relations, the little things we do greatly affect our customer's reactions. Complete answers to a customer's questions, courtesy, and an eagerness to be helpful are some of the "little things" that are so important in the telephone business. Other indications of your courtesy and consideration include:

a. Explain and demonstrate the advantages of complete telephone service. When talking to customers, use the customer's language, not "telephone terminology."

b. Let the customer indicate where the telephone is to be located.

c. Show the customer where wiring should be placed and where it will be necessary to drill or bore holes; get consent before starting the job.

d. When it is necessary for you to enter a closed room, request permission.

e. If it is necessary to move furniture or fixtures, request the customer's permission. Always return these items to their original location when the job is completed.

f. Let the customer know where you are, especially if you have to leave the premises before the job is complete.

g. Plan your work so that you do not have to make trips back and forth from your truck.

h. Keep tools and materials close to your work area.

i. Be careful of children who may want to watch or "help" you.

j. If you must smoke, smoke away from the customer's home.

k. Clean up after the job is completed.

l. Protect the customer's property, using care not to soil carpets or walls. Do not stand on chairs, stools, or other items that belong to the customer; use company step ladders.

m. If you accidentally damage any furniture or property, show the damage to the customer, apologize, and inform him that your supervisor will make proper settlement. Report the damage to your supervisor as quickly as possible.

3.02 Whenever a new or change of address order is completed, the customer should be offered a telephone directory. Another service our plant personnel are in a position to render our customers is assisting them in the proper use of their telephone directories. These instructions should be given in a manner that both pleases and educates our customers:

a. Impress the customer with the time saving advantages of looking up the desired number in the directory.

b. Point out that information in the introductory pages explains how to make local and DDD calls, as well as emergency and telephone service calls.

c. If available, give the customer a copy of the "Personal Telephone Booklet" and show how convenient it is to use this handy reference for frequently called numbers or DDD calls.

3.03 Handling Customer Complaints–Sometimes a plant employee will encounter a situation where the customer is very critical of something that has happened between him and the company. As far as the customer is concerned, the plant employee *is* the telephone company and must be willing to assume responsibility for any errors, etc. Do not "pass the buck" or place the blame on a mysterious "they" which would give the customer an impression of a disorganized company. Take advantage of the situation to see what can be done to correct the misunderstanding. If you cannot correct the situation yourself, be sure that the matter is referred to someone in the company who can.

4. LEAVING THE JOB

4.01 Let the customer know the job has been completed. Be sure all furniture and/or fixtures are put back in place and gather up all tools and equipment.

4.02 A friendly "Goodbye, Mrs._____ I hope you enjoy your telephone service, " always leaves a good impression

4.03 Close the door carefully and quietly. Use the walkway to your truck and be careful of shrubbery and flowers.

4.04 When you can, try to keep customers informed about our business and our problems; the better informed our customers are about us, the more likely are we to enjoy all the benefits of a good company reputation. Always remember that you, as an individual and a representative of the company, can best promote goodwill and understanding between our company and the public.

INSTALLER/REPAIRMAN CUSTOMER TROUBLE TICKET & READOUT-INSTALL—FORM 155A DESCRIPTION AND METHOD OF COMPLETION

1. GENERAL

1.01 This practice provides a description and method of completion of the Installer/Repairman Customer Trouble Ticket & Readout-Install report, Form 155A.

1.02 Form 155A is similar to Form 155 which is used in the Summary of Reported Troubles (SORT) plan and described in CTSP 400-950-023. However, Form 155A is for the use of installers, repairmen, or combination men **only.**

1.03 Form 155A **is not to be routed to the Data Processing Center,** but it is recommended that employees who use this form should be familiar with the procedures of the SORT plan which are covered in the CTS 400-950 series of practices.

1.04 The primary purpose of Form 155A is to provide Plant with a standard dispatch ticket for installation and repair.

2. DESCRIPTION AND USE OF FORM 155A PADS

2.01 Each pad of Form 155A contains 50 tickets. Trouble codes are printed on the inside front cover and the back cover as follows:

a. The inside front cover lists the Customer Trouble Report Codes. See Exhibit I.

b. The inside back cover lists the Disposition of Trouble Codes. See Exhibit II.

c. The outside back cover lists the Cause of Trouble Codes. See Exhibit III.

2.02 The front side of Form 155A is the Customer Trouble Ticket which is designed to record all information pertaining to troubles that require dispatching. The Customer Trouble Ticket should be used to record trouble visits, routines and preventive maintenance work or other assignments not otherwise covered by a standard work order. See Exhibit IV and paragraph 3.

2.03 The reverse side of Form 155A is the Readout-Install portion, which is designed to record all information pertaining to an installation that is dispatched by telephone.

3. COMPLETION OF CUSTOMER TROUBLE TICKET—FRONT SIDE OF FORM 155A—EXHIBIT IV

3.01 The following information must be filled in to correctly close out a trouble ticket:

a. Name and address of customer.

b. Telephone number of customer.

c. Aux Line—TRK/STA (if applicable).

d. Originating equipment.

e. Trouble reported.

f. Time received.

g. Class of service.

h. Urgency.

i. Facilities and test information.

j. Disposition code (taken from the inside back cover of the Form 155A pad).

k. Trouble cause (written).

l. Cause code (taken from the back cover of the Form 155A pad).

m. Time cleared.

n. Employee number.

3.02 At the end of each working day, craftsmen will turn in the pad or completed tickets 155A used that day to the supervisor.

4. COMPLETION OF READOUT-INSTALL PORTION—REVERSE SIDE OF FORM 155A—EXHIBIT V

4.01 When an installer calls in for his work assignment, the dispatcher will read the information

to him from the Contact Memo. The installer will record this information on the Readout-Install portion of Form 155A as follows:

a. Name and address of customer.

b. Telephone number assigned to the customer.

c. Order number (taken from the Contact Memo).

d. Install instructions.

e. Assignment blocking for cable and terminal.

f. Cross connect information (when applicable).

g. Central office information (when applicable).

h. Bridging number (if any).

i. Remarks (any information regarding the order or change in the original instructions/information that might be of interest to the supervisor.

4.02 Upon completion of each order, the installer should call in and clear out his order.

4.03 At the end of each working day, craftsmen will turn in the pad or completed tickets used that day to the supervisor.

NOTE: It is suggested that supervisors retain the completed copies of Form 155A on file for a period of 90 days and then discard them.

CUSTOMER TROUBLE REPORT CODES

GROUP 1—CAN'T DIAL

11—No Dial Tone
12—Can't Break Dial Tone
13—Receiver Off on Line
14—Won't Accept Coins
15—Slow Dial Tone
16—Double Connection Lift Rec.
17—Can't Dial D.D.D.

GROUP 2—CAN'T COMPLETE CALL

20—Busy Signal While Dialing
21—Dial Tone Returns While Dialing
22—Can't Raise Operator
23—No Ring Back Tone
24—Busy Signal On Completion of Dialing
25—Called Party Should Answer
26—Reaching Wrong Number
27—Reaching a Recording
28—Double Connection While Dialing
29—Ring Trip

GROUP 3—CAN'T HEAR—CAN'T BE HEARD

30—Double Connection While Talking
31—Can't Hear
32—Can't Be Heard
33—Cuts Off—Cuts Back
34—Clicking on Line
35—Dial Tone While Talking
36—Garbled Copy (Data/Teletype)
37—Noisy
38—Crosstalk
39—Other (Specify)

GROUP 4—CAN'T BE CALLED

41—Bell Doesn't Ring
42—Can't Break Ring
43—Bell Rings, No One On Line
44—Receiving Wrong Rings
45—Other (Specify)

GROUP 5—TELEPHONE SET

51—Telephone Set (All or Part) Broken/Damaged
52—Loose Mounting
53—Station Wiring Broken/Damaged
54—Lamps/Keys
55—Other (Specify)

GROUP 6—MISCELLANEOUS

60—Lease Equipment
61—Recording/Answering Equipment
62—Automatic Dialer
63—Data Set/Typewriter
64—Paystation Equipment (incl. Booth)
65—PBX/PABX Common Equipment
66—Key System Common Equipment
67—Identifying Wrong
68—Outside Plant Defect
69—Other (Specify)

GROUPS 7, 8, and 9—EXCLUDED

71—Referred In
81—Detected
91—Customer Excluded

EXHIBIT I. Inside Front Cover

DISPOSITION OF TROUBLE CODES

GROUP 1–STATION SETS

110 Transmitter
115 Receiver
120 Cord
125 Handset
130 Ringer
135 Dial Rotary
140 Dial Touch Tone
145 Lamp/Light
150 Network
155 Switch Hook
160 Coin Chute
165 Coils
170 Housing
175 Common Equipment
180 Other (Specify)

GROUP 2–OTHER STATION EQUIPMENT

210 Automatic Answering Device
215 Automatic Dialing Unit
220 Teletypewriter/Data
225 Mobile Radio
230 Key System Common Equipment
235 Booth
240 Other (Specify)

GROUP 3–STATION WIRE

305 Drop Aerial
310 Drop Buried
315 Protector
320 Inside Wire or Cable
325 Ground Wire
330 Other (Specify)

GROUP 4–PBX, PABX, CENTREX

410 Keys, Cords and Plugs
415 Lamps and Jacks
420
425
430 Switch Mechanism
435 Trunk Equipment
440
445 Common Equipment
450 Batteries/Power Equipment
455 MDF and Protection
460 Other (Specify)

GROUP 5–OUTSIDE PLANT

510 Cable-Aerial
515 Cable-Underground
520 Cable-Buried
525 Aerial Wire, Including C Wire
530 Pole Line (Guys, Poles & Arms)
535 Distribution Wire, RD, SD, and UD
540 Protection
545 Fibre
550 Cable Terminal Aerial
555 Cable Terminal House
560 Cable Terminal Pedestal and U.G.
565 Other (Specify)

GROUP 6–CENTRAL OFFICE

Common
610 Frame
611 Trunk Signaling Equipment
612 Ringing Equipment
613 Power Equipment
Dial Switching
630 Line Equipment
631 Bank or Shelf Wiring
632 Misc. Subline Equipment
633 Linefinder
634 Selector 1
635 Selector 2
636 Selector 3
637 Selector 4
638 Selector 5
639 Connector
640 Reverting Call Switch
641 Tickets Equipment
642 Paystation Repeaters
643 Common Control, Electromechanical
644 Common Control, Electronics
645 Crossbar Switch
646 Identifying Equipment
647 Other (Dial)
Manual
650 Switchboard
Circuit Equipment
660 Carrier, Subscriber
661 Carrier, Toll and Exchange (EAS)
662 Radio, Microwave
663 Radio, Mobile Base Station
664 Multiplex
665 Test Jacks
666 Voice Amplifier
667 Trunk Equipment
668 Lease Line Equipment
669 S.F. Sending Equipment
670 Other Signaling Equipment
Miscellaneous
680 Commutator
681 Other (Specify)

GROUP 7–OTHER TROUBLE CODES

710 Receiver Off Hook (Incl. CPH)
715 Test O.K.
720 Found O.K. Central Office
725 Found O.K. Outside
730 Referred Out

CAUSE OF TROUBLE CODES

GROUP 1–MANMADE

11–Company Workman
12–Other Workman
13–Customer Action
14–Other (Specify, incl. vandalism)

GROUP 2–PLANT OR EQUIPMENT

20–Dirt
21–Deterioration
22–Adjustment
23–Wet
24–Broken
25–Defective

GROUP 3–WEATHER

30–Lightning
31–Rain or Flood
32–Wind
33–Sleet and Ice
34–Snow

GROUP 4–TRAFFIC OVERLOAD

40–All Trunks Busy
41–All Senders Busy
42–All Ticketers Busy
43–Other (Specify)

GROUP 5–MISCELLANEOUS

51–Insects and Animals
52–Trees and Foliage
55–Other (Specify)

GROUP 6–UNKNOWN

61–Unknown (TOK, FOK/CO, FOK/OS)
62–Referred Out

CLASS OF SERVICE CODES

1–BUS (Business)
2–RES (Resident)
3–RUR (Rural)
4–PPS (Public Paystation)
5–SPPS (Semipublic Paystation)
6–PBX, PABX
7–CEN (Centrex)
8–KEY (Key System)
9–MOB (Mobile)
0–OTH (Other)

CLEARING TIME CODES

01–0-1 Hour
02–1-2 Hours
03–2-3 Hours
04–3-4 Hours
05–4-5 Hours
06–5-6 Hours
07–6-7 Hours
08–7-8 Hours
09–8-9 Hours
10–9-10 Hours
11–10-11 Hours
12–11-12 Hours
13–Over 12 hours but the same day
24–Less than 24 hours but not the same day
25–Over 24 Hours

EXHIBIT II. Inside Back Cover

EXHIBIT III. Outside Back Cover

475-050-301 Form 155A

CUSTOMER TROUBLE TICKET

Name and Address:

Cust. Tel. No. | Aux. Line — TRK/STA

Originating Equip. | Connecting No.

Trouble Reported | Code

TIME RECEIVED

Mo	Day	Time AM PM	B/S 1	A/S 2	Rec'd By

CLASS OF SERVICE

Bus 1	Res 2	Rural 3	PPS 4	SPPS 5	PBX 6
Centx 7	Keys 8	Mobile 9	Other 0		

URGENCY		APPT TIME	APPT ERROR	
Emerg 1	OOS 2	AM PM	Missed 1	No Access 2

FACILITIES & TEST INFO

Cable	Pair	Term	BP	Party	Route

Test

Tstd By	Time Tstd	Time Disp	Mo	Day

Trouble Found & Work Done | Code

Trouble Cause | Code

FIELD COPY

TIME CLEARED

Mo	Day	Time AM PM	Clearing Time

ADVERSE REPORT | EMPLOYEE NO.

Repeated 1	Subsequent 2	Install 1	

EXHIBIT IV

Form 155A

READOUT — INSTALL

Name:

Address:

Telephone Number

Order Number

INSTALL

Service	Color	Type	Location

ASSIGNMENT

CABLE		TERMINAL	
Number	Pair	Number	B.P.

CROSS CONNECTS

Dist. Ca.	Dist. Pr	Dist. Box No.	

CENTRAL OFFICE

LF, GP, LLF.	LF, TERM	B.B. No.	Conn. No.	Ring Des.	Pty. No.

VG	HG	VF	LLA #	ANI	CLASS

BRIDGING NO.

Remarks:

EXHIBIT V

INSTALLATION
GENERAL STATION INSTALLATION PROCEDURES

1. GENERAL

1.01 This addendum is to correct wiring information and to add number card installation information.

1.02 With red pencil or ink, make the changes shown in paragraph 2 of this addendum. In the margins of the subject paragraphs write the words "See Addendum".

1.03 File this addendum directly in front of CTSP 475-100-001.

2. CHANGES

2.01 Change paragraph 4.01 f. to read:

f. Terminate inside wire green conductor on terminal L1 (tip +) and inside wire red conductor on L1 (ring -).

2.02 Add paragraph 4.04 which reads:

4.04 Be sure number is stamped on the number card and promptly installed in the telephone.

INSTALLATION
GENERAL STATION INSTALLATION PROCEDURES

1. GENERAL

1.01 This practice covers the general installation and testing procedures to be followed in making a new telephone installation, reinstallation, reconnection of left-in station, or inside move.

1.02 In case the customer objets to regulations covered in this practice, and satisfactory arrangements cannot be made, consult your supervisor before proceeding with the installation.

2. GAINING ACCESS FROM CUSTOMER

2.01 No attempt to gain access to customer's premises shall be made without the consent of the owner or his agent. Entry should not be made unless accompanied by some authorized person other than a telephone employee.

2.02 Always be willing to show identification before entering the premises; be neat, courteous, and adept in all work.

3. LOCATION OF TELEPHONE

3.01 In choosing the best location for the telephone, be guided by a location's advantages, disadvantages, and the following desirable environmental conditions:

a. Moderate, normal-temperature range.

b. A nonexplosive atmosphere.

c. A water-free or low humidity area.

NOTE: If the location has a surrounding factor which conflicts with one of these conditions, special station equipment and procedures, as covered in other appropriate practices, shall be used.

3.02 The telephone location shall be chosen with the following advantages kept in mind :

a. Acceptable to customer.

b. Suitable for maintenance.

c. Easily heard ring.

d. Free from accidental mechanical damage.

e. Free from off-hook trouble.

f. Close to conduit facilities.

g. Close to approved bellbox cabinet or telephone set alcove (LWH, 12 x 9 x 12 inches).

3.03 Try to avoid, wherever possible, the following objectionable features when selecting a telephone location:

a. Site readily accessible to small children.

b. Site close to grounded object or water (sink drainboards, bathtubs, radiators, etc.)

c. Necessity to drill holes.

d. Need to have wire and cable exposed.

e. Finely finished mounting surface (marble, ceramic tile, glass tile, expensive paneling).

f. Closeness of fluorescent fixture (minimum separation, 24 inches).

3.04 On Desks or Tables

When installing a telephone on a desk or table, these considerations shall be kept in mind:

a. Which hand does customer use?

b. Will holes be drilled?

c. Will cable and wire be exposed?

3.05 This procedure shall be observed before installing the telephone on a table or desk:

a. Inspect the desk for special manufacturer-provided features (built-in connecting block brackets or knock-out holes with rubber grommets for telephone line cord).

b. Determine if connecting block can be located high on one of desk panels just below top of the desk to hold line cord off floor.

c. If part of the telephone circuit is contained in a housing separate from the telephone set housing, check to determine whether this part can be located inside the knee well of the desk or on the underside of the table.

4. INSTALLING TELEPHONE

4.01 Proceed as follows in installing the telephone:

a. Refer to practices covering the particular type of telephone being installed or to manufacturer's drawings.

b. Install the drop, protector, ground, and station wiring as covered in other practices.

c. Terminate the locally grounded conductor of the inside wire to the ground terminal of the telephone set connecting block for desk mounted sets or to the ground terminal in wall mounted sets.

d. Connect one clip of a hand test telephone to the ground terminal.

e. With the other clip of the hand test telephone, contact in turn the green and red inside wire conductors. If the inside wire is poled correctly, a click will be heard in the hand test telephone receiver as red conductor is contacted. If not, rearrange the drop wires at protector.

f. Terminate inside wire red conductor on terminal L1 (ring -) and inside wire green conductor on L2 (tip +).

NOTE: For most telephones the ring (negative line) connects to red (or ridged) interior wire conductor; right-hand station protector terminal; and right-hand cable terminal stud. (Ring Red, Right Ridged)

4.02 Use the following procedure when connecting telephones equipped with SATT dials to party lines.

a. Perform the procedure described in paragraph 4.01 a. through e.

b. Connect one clip of the hand test telephone to the red inside wire.

c. Connect the other clip to one of the line terminals of the connecting block on desk mounted sets or the line terminal in wall mounted sets.

d. With the telephone handset on hook, listen on the receiver of the test set for one or a series of clicks while dialing a 5 on the telephone set dial. If nothing is heard, move the test clip on the line terminal to the other line terminal and test in the same manner.

NOTE Refer to practices for individual telephone sets or manufacturer's drawings. The switch hook arrangement on some telephones (for example: A.E. Co. self compensating) is such that access to internal telephone set wiring will be required to verify that ground pulses are actually being applied to the tip line cord conductor.

e. Terminate the green conductor (tip +) of the inside wire on the terminal on which the click or clicks were heard and the red conductor (ring -) of the inside wire to the other terminal.

4.03 For reinstallation or reconnection of telephones with SATT dials, use procedure a. and/or b. below:

a. Check polarity of wiring at the protector or station connecting block.

b. Check the polarity of the telephone set as described in paragraph 4.02.

5. TESTING

5.01 After the installation is completed, perform tests to verify ringing, dial speed, and noise level.

5.02 Proceed as follows :

a. Bell rings - verify through ring-back.

b. Dial speed - verify that dial operates within speed tolerances.

c. Noise level - make talking test when "O.K.'ing" service order.

5.03 Before leaving customer's premises, assure that customer is familiar with operation of the particular telephone set installed.

DROP AND BLOCK WIRE DISPOSITION WITH DISCONTINUANCE OF SERVICE

1. GENERAL

1.01 This practice describes the disposition of drop and block wire with discontinuance of service or temporary disconnection.

1.02 The ends of all disconnected wires, which are intended for future use, shall be tagged at the points of disconnection. The tag shall indicate the address of the building end of the drop wire.

2. DISPOSITION OF WIRE

2.01 All drop and block wire shall be left in place, with disconnections made at appropriate locations, except in the following instances where they shall be removed :

a. On service disconnections where the wire run may create an unsafe condition.

b. Upon request of the property owner or his authorized agent.

c. In connection with rerouting or repair work.

3. DISCONNECTIONS

3.01 Disconnect the drop wire at the cable terminal for individual lines, party lines connected at terminal binding posts, generator feeds, and battery feeds which are not exposed to contact with foreign circuits of more than 300 volts potential, or with lightning disturbances (see Figure 1).

3.02 At aerial cable terminals, wire terminals, and outside building terminals, the drop shall be doubled back at the first ring and taped to itself with three wraps of friction tape (Figure 2).

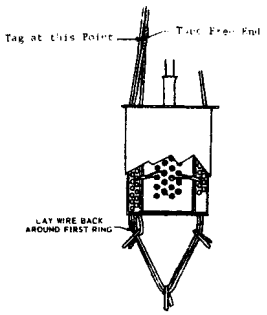


Figure 1. Drop Wire Disconnected at Pole Mounted Terminal

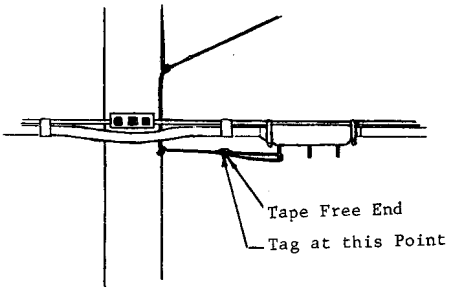


Figure 2. Drop Wire Disconnected at Strand Mounted Terminal

3.03 At cross-connecting terminals, open wire leads, and party line taps outside of the terminal, remove the jumper wires, bridging connectors, and bridged drop wires, respectively. Tape as described in 3.02.

3.04 At underground cable terminals, tape bare wire after folding it back neatly inside the terminal. Be sure rubber grommets and gaskets are sealing properly.

3.05 Where the line is subject to possible contact with foreign circuits of more than 300 volts potential or with lightning disturbances, use the following procedure:

a. Disconnect party lines and other bridged circuits at the bridging point.

b. Twist the free end of the wire back on itself beyond the first ring or point of attachment, and tape as shown in Figure 3.

c. The station protector shall remain in place unless the subscriber requests that it be removed.

d. If the station protector is removed:

(1) The drop wire shall be removed.

(2) Where protectors are mounted inside buildings, plug the drop wire entrance hole. Where the protector is mounted outside the building, tape the inside wire and bend the ends back into the entrance hole and plug the hole.

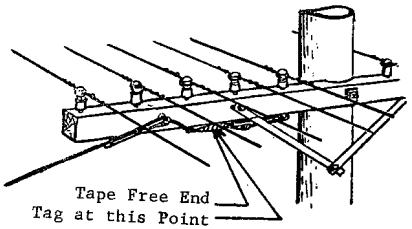


Figure 3. Drop Wire Disconnected at Open Wire Location

DROP AND BLOCK WIRE
STRINGING SAGS AND SPAN LIMITS
INSTALLATION

1. GENERAL

1.01 This addendum is to provide information to reduce drop wire vibration and dancing.

1.02 With red pencil or ink make the addition as shown in paragraph 2 of this addendum. In the margin of the subject paragraph write the words "See Addendum".

1.03 File this addendum directly in front of CTSP 475-300-403.

2. ADDITION

2.01 Add paragraph 1.05 which reads as follows:

1.05 Drop wire should be twisted one complete turn for each ten feet of span length at the time of installation to reduce vibration and dancing.

DROP AND BLOCK WIRE STRINGING SAGS AND SPAN LIMITS INSTALLATION

1. GENERAL

1.01 This practice prescribes the recommended span length limits for drop wires and also the minimum sags at which drop wire shall be placed.

1.02 For the following reasons, it is important that the proper sag be provided in drop wiring:

a. Drop wires which are too taut will sometimes vibrate at buildings and cause undesirable noises.

b. Insufficient sag and stretching the wire will shorten its life or will place excessive strain on the drop wire supports.

1.03 Whenever practical, run the drop wire under rather than over obstacles to avoid contacts due to stretching the wire.

1.04 Where it is impractical to obtain the minimum desirable sag because of clearance requirements or obstacles, provide as much sag as conditions allow.

2. SPAN LENGTH LIMITS

2.01 Pole-to-pole spans of drop wire shall not exceed 200 feet.

2.02 Where a cable lead or an extended messenger is available for intermediate support, pole-to-pole drop wire spans may exceed 200 feet.

2.03 Where pole-to-pole span lengths without cable or extended messenger exceed 200 feet, consult your supervisor before placing intermediate supports.

2.04 Span lengths to privately owned poles shall not exceed 160 feet and they shall be limited to one drop wire. For span lengths longer than 160 feet consult your supervisor.

2.05 The length of pole-to-building drop wire spans shall not exceed 160 feet unless specific approval is obtained. Intermediate attachments between pole and building shall be used where span lengths exceed this limit or where proper sag for normal span lengths cannot be obtained.

2.06 In span clamp-to-building spans, the tension in the span shall not be great enough to pull the cable or messenger out of line. Intermediate attachments between the span clamp and the building shall be made to obtain the required ground clearance if enough ground clearance cannot be maintained without pulling cable out of alignment.

3. SAGS FOR DROP WIRE

3.01 The minimum sags for drop wire are shown in Table 1. Since these sags are minimum, they shall be increased up to 20% wherever possible, depending upon field conditions. The sag values shall never be decreased without prior approval of the supervisor.

3.02 To determine the sag in the drop wire, sight between the attachments at both ends of the drop wire and determine the distance between the drop wire at its lowest point and the straight line between attachments. See Figure 1.

TABLE 1

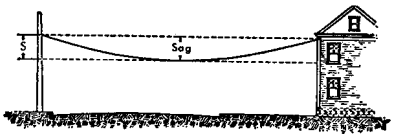
Parallel Drop Wire Sag

(18 AWG Coppersteel Conductors)

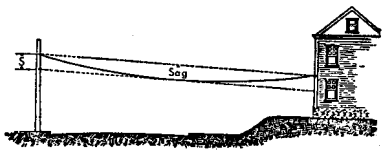
	Pole to Building Spans		Pole to Pole or Span Clamp Spans		
SPAN LENGTHS	STORM LOADING AREA LIGHT AND MEDIMUM	HEAVY	STORM LOADING AREA LIGHT AND MEDIMUM	HEAVY	NO. OF INTERMEDIATE ATTACHMENTS
50′ or less	6″	6″	6″	6″	NONE
51′ to 75′	1′	1′	1′	1′	NONE
76′ to 100′	2′	2′	1-1/2′	1-1/2′	NONE
101′ to 125′	3′	4′	1-1/2′	2′	NONE
126′ to 160′	4′	6′	2-1/2′	3′	NONE
161′ to 200′*	--	--	2-1/2′	2-1/2′	1
201′ to 249′	--	--	4-1/2′	4-1/2′	1
250′ to 300′	--	--	7′	7′	2
Over 300′	--	--	See Note #2		

* NOTE 1: For span lengths from 160 feet and up, minimum sags are computed before intermediate attachments are made. The attachments are to be evenly spaced and placed to provide proper ground clearance.

NOTE 2: For spans over 300 feet in length, intermediate attachments shall be approximately 80 feet to 100 feet apart.



Attachments on Same Level



Attachments on Different Levels

Figure 1. Sighting Drop Wire Sag

DROP & BLOCK WIRING

DROP AND BLOCK WIRE AT AERIAL TERMINALS

1. GENERAL

1.01 This practice describes the methods and procedues to be used in the wiring of terminals on aerial and block wire.

1.02 When terminating drop or block wires, not more than two pair of wires should be bridged on one binding post.

1.03 When working in a terminal, perform the following:

a. Remove foreign matter with a terminal brush.

b. Report broken or missing terminal covers to your supervisor.

c. Trim frayed wires to prevent leakage between conductors or binding posts.

d. Turn down finger tight all nuts of unused binding posts to keep contact surfaces as clean as possible.

e. Pull any excess slack out of wires in ring run.

f. Rearrange any disconnected wires in accordance with existing practices covering disposition of wires.

g. Pull drop wires tight enough to provide a neat appearance but not so tight that sharp bends will be placed on the wires at the rings.

h. Use plastic insulated twisted pair station wire or main frame jumper wire for cross-connecting within outside terminals.

i. Use only the approved terminal wrench to tighten lugs.

j. Be sure terminal cover is on properly before leaving terminal.

2. SELECTION OF RINGS

2.01 Drive rings should be used for ring runs on poles and arms. Bridle rings should be used for building terminal ring runs where the use of drive rings creates a safety hazard.

2.02 Tables A and B should be used as a guide to ring capacities and correct usage of rings.

2.03 See Figure 14 for an illustration showing typical drive ring pole attachments.

TABLE A

Ring Type	Drop Wire	Bridle Wire
7/8" Drive Ring	8	12
Type C (1/4") Bridle Ring	12	16
*Type A (1-5/8") Bridle Ring	26	26

*Use Type A ring for wire runs serving terminals larger than 26 pair.

TABLE B

Ring Type	Use With
7/8" or 1-1/4" Drive Ring	Guard Arms
1-1/4" Toggle Bridle Ring	Cable Arms

3. CABLE TERMINALS

3.01 After cutting the drop wire to the proper length, cut the insulation between the conductors with a drop wire slitting tool for a distance of approximately 3". Use diagonal pliers to remove sufficient insulation (approximately 1") from each conductor to permit proper terminating. Be careful not to nick the conductors with the diagonal pliers.

3.02 Nuts and washers found to be dirty or corroded should be cleaned with emery cloth. If corrosion is severe, nuts and washers should be replaced.

3.03 Terminate the plain conductor on the lefthand binding post or fuse, and the tracer conductor on the righthand binding post or fuse. If fuses or binding posts are on a vertical plane, terminate the plain conductor on the top fuse or binding post of the pair, and the tracer conductor on the bottom fuse or binding post of the pair. Figure 1 shows termination twisted pair wire and parallel wire.

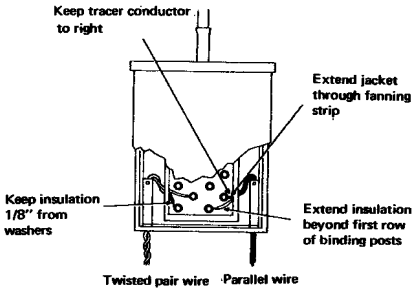


FIGURE 1. Terminating Twisted Pair and Parallel Wire

3.04 The nuts on fuses and binding posts should be turned down with a terminal wrench to obtain firm contact and the conductors arranged so that they will be separated from adjacent binding posts.

3.05 When two conductors are terminated on the same binding post, place first conductor under the lower washer and the second conductor between the washers (see Figure 2).

3.06 When necessary to terminate a third drop wire, use a drop wire terminal to bridge the additional wire outside the cable terminal. Remove one drop wire from the terminal binding post and place it and the third wire in the drop terminal (see Figure 3).

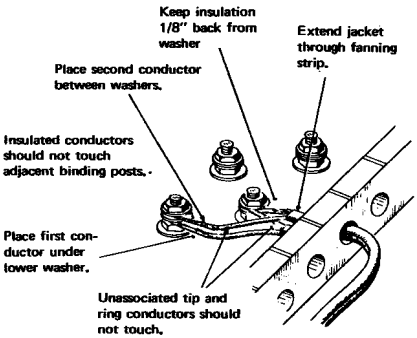


FIGURE 2. Two Conductors Terminated on One Building Post

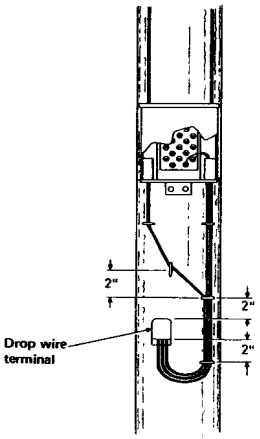


FIGURE 3. Termination of Additional Wire

4. POLE AND BUILDING MOUNTED TERMINALS

4.01 Use 7/8" drive rings at 11 pair terminals to provide wiring facilities (see Table A).

4.02 Do not force drop wire through rings. If the capacity of the 7/8" drive ring is exceeded, the terminal should be checked by your supervisor.

4.03 Separation of rings on poles shall not exceed 24". If existing rings are spaced more than 24" apart, an additional ring should be centered between the two rings.

4.04 Run the drop wires down the side of the terminal (opposite the side on which wires are to be terminated) and through the three rings below the terminal. When slack is required to transfer a drop wire to another cable pair, remove the wire from the lower ring and run it through the two top rings beneath the terminal.

4.05 When the necessary slack cannot be obtained by routing the drop wires as described in paragraph 4.04, splice out the drop wire in the vertical run above the terminal and run the wire through all three rings below the terminal (see Figure 4).

4.06 For terminals having a wiring channel in the center of the terminal, place wiring facilities on poles as shown in Figure 5.

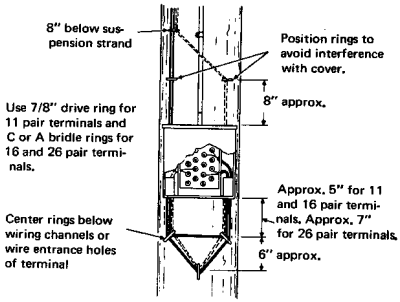


FIGURE 4. Rerouting Drop Wire Below Terminal

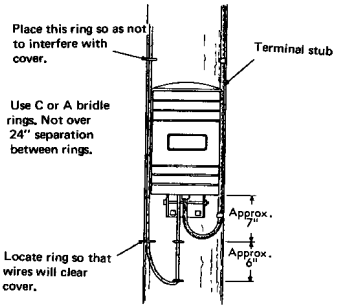


FIGURE 5. Terminals with Center Wiring Channels

4.07 Place wiring facilities for cable terminals mounted on buildings according to Figures 6 and 7.

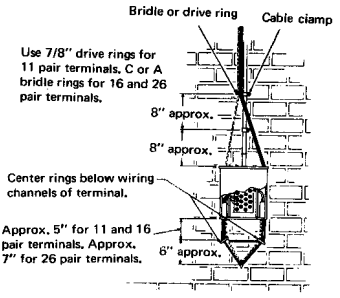


FIGURE 6. Building Mounted Cable Terminal (Top Entrance)

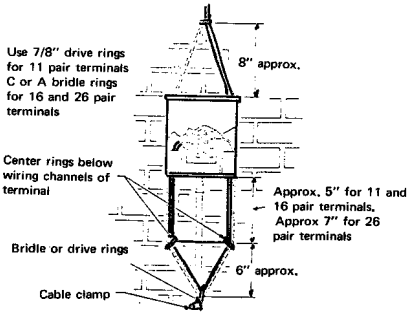


FIGURE 7. Building Mounted Cable Terminal (Bottom Entrance)

5. TYPE B AND TYPE BB TERMINALS

5.01 Run drop wire through the two rings at the end of the fuse chamber or binding post chamber on which the wire is to be terminated. Provide slack by cutting off the wire at the opposite fanning strips after pulling the drop wire taut through the fanning strip hole.

5.02 For cross-connections, use plastic insulated twisted pair station wire or main frame wire. Terminate the plain conductor on the left-hand binding post and the tracer conductor on the right-hand binding post.

5.03 Terminate wires according to procedure described in paragraph 3.01.

5.04 Run cross-connect wires through rings (see Figure 8) and provide slack by cutting the shortest conductor at the binding post of the pair furthest from the fanning strip.

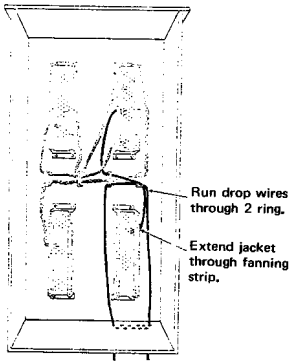


FIGURE 8. Cross-Connecting Wires

5.05 If two or more distribution cable pairs are required to form a party line, connect the pairs to the feeder cable pair. Run cross-connect wires in type B terminals through rings located at the top of the terminal.

6. TYPE BD, BE, BF AND BG TERMINALS

6.01 Wires should be terminated according to the procedure described in paragraph 3.01.

6.02 Follow the procedure described in paragraph 5.05 for connecting distribution cable pairs.

6.03 Provide wiring facilities on poles in accordance with Figures 9 and 10.

6.04 Run the drop wire through one of the wire entrance holes in the bottom of the terminal and as near the back of the terminal as practicable. The drop wire should be run upward on the side of the chamber opposite the binding post on which it is to be terminated, through the two rings at the top of the terminal and downward to the proper wiring hole for the assigned cable pair.

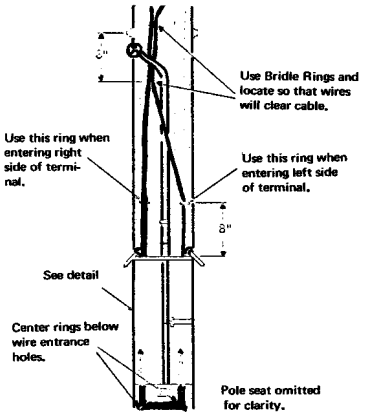


FIGURE 9. Pole Wiring Facilities

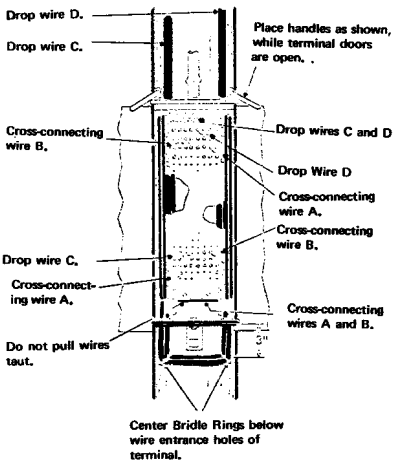


FIGURE 10. Cross-Connecting Terminal Wiring

6.05 When slack is required to transfer a drop wire, remove the wire from one or both rings at the top of the terminal. If additional slack wire is needed for subsequent changes, splice out the drop wire inside the terminal between the bottom and the first ring at the top of the terminal. Run the wire through these two rings as described in paragraph 6.04.

7. CROSS-CONNECT TERMINALS

7.01 Run cross-connecting wires through the holes immediately above the binding posts to the right of the wiring holes, and use the holes immediately below the binding posts to the left of the wiring holes (see Figure 10).

7.02 For Type BD 304 and Type BD 404 terminals with binding posts to the right of the wiring holes use the lower two wiring holes for the nearest two pairs of binding posts. Use the higher hole for the furthest two pairs of binding posts. When the binding posts are to the left of the wiring holes, reverse the procedure.

7.03 When cross-connecting cable pairs are in an adjacent half of the chamber, run cross-connecting wires in the channel at the rear of the face plate extension, passing in the rear of the guards at the bottom of the chamber. Do not run cross-connecting wires in the rings provided for drop wires at the top of the terminal.

7.04 Terminate wires according to the procedure outlined in paragraph 3.01.

7.05 Dispose of cross-connecting wires and drop wires in accordance with existing practices.

8. SHEATH MOUNTED TERMINALS

8.01 Run drop wires to the terminal from the adjacent pole except where wires are distributed from a span clamp located between the terminal splice and the pole, or from cable extension arms.

8.02 Run wires through all rings at the rear of the terminal, around the ring at the far end, and then below the terminal to the proper wire entrance holes of the assigned binding posts. Do not pull wire tightly around the last ring. If slack is required for reconnections and changes, remove the wire from one or two terminal rings in order to reach the binding posts. Splice out the drop wire behind or near the terminal and run the wire through the ring at the far end as for an initial installation.

8.03 Drop wire runs to sheath mounted terminals are shown in Figure 11. The same method applies to terminals installed on ring supported cable. Run wires through rubber grommets in wire entrance holes. Place two drop wires through a wire entrance hole when required.

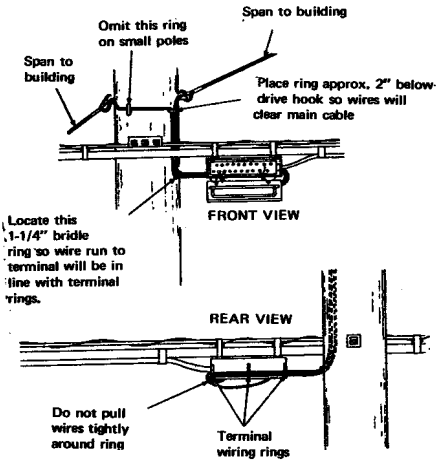


FIGURE 11. Drop Wire Run to Sheath Mounted Terminal

8.04 Two wires may be bridged on a pair of binding posts of the sheath-mounted terminals. Wires terminated on the same binding post should enter the same wire entrance hole. Where three or four wires are to be bridged, use drop wire terminals in the normal manner to tap the drops between the pole and the last wiring ring on the back of the terminal.

8.05 Run wires from terminal to guard arm as illustrated in Figure 12.

8.06 Terminate drop wires in sheath mounted terminals by cutting the wire to the proper lengths (see Figure 13).

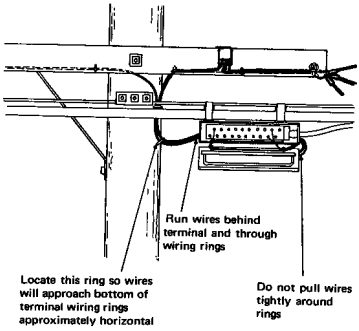


FIGURE 12. Wire Run from Terminal to Guard Arm

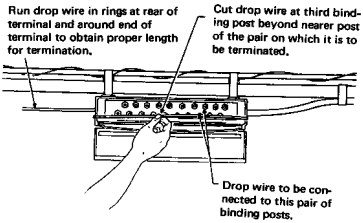


FIGURE 13. Drop Wire Termination

8.07 Pair numbers of the terminal progress from left to right, regardless of whether the stub is brought out of the right or left side of the terminal.

8.08 Terminate the plain conductor on the left-hand binding post and the tracer conductor on the right-hand post of each pair.

8.09 Replace lost or damaged grommets. For installation at the wire entrance, cut through the rim of the grommet at a point in line with the scored portion. Place the grommet around the wire so that the groove is completely engaged with the edge of the wire entrance hole.

9. READY ACCESS TYPE TERMINALS

9.01 Ready access terminals are for use on plastic insulated conductor cable and will accomodate cables up to two and two-tenths inches outside diameter.

9.02 Drop wires are inserted through the proper grommet hole in the base so that they match the binding posts on the terminal block. The grommets should be pierced with a screwdriver or similar tool. The wire is then threaded through the drop wire retainer rings which are attached to the base (see Figure 14). Enough slack should be allowed for future rearrangements.

9.03 It is not necessary to remove the cover to work in the installed unit. Remove the semicircular cover clamps, free the clips holding the cover to the base and lift one side of the neoprene cover for working space.

9.04 The ready access terminal enclosure provides for splicing with or without the No. 105 terminal blocks. The unit can be mounted anywhere along the cable.

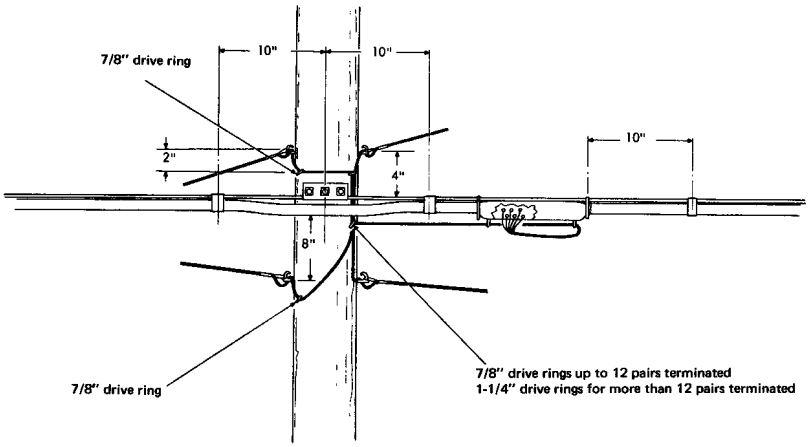
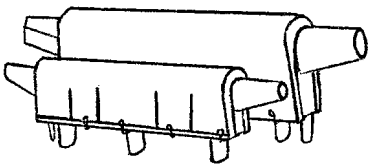


FIGURE 14. Ready Access Terminal



Ready Access Closure

DROP AND STATION WIRE SEPARATION AND MECHANICAL PROTECTION

1. GENERAL

1.01 This practice is reissued to include information contained in CTSP 475-300-404 and current separation and mechanical protection information.

1.02 All copies of CTSP 475-300-404 should be destroyed.

1.03 If any differences exist between clearances specified in this practice and those specified by the National Electrical Code, those which are the most stringent will apply.

2. MATERIAL

2.01 The following material may be required:

a. E wire guard, CTS #02-26-021-2.

b. P wire guard, CTS #02-26-023-9.

c. Plastic tube 3/8 inch x 6 inches, CTS #20-79-004-0.

d. Vinyl tape (see CTS Tape, Vinyl).

e. D drop wire clip, CTS #68-11-016-2.

f. D drive ring (see CTS Ring, Drive).

g. Insulated screw eye (see Eye, Screw, Insulated).

h. C porcelain knob, CTS #68-34-001-0.

i. E drop wire clip, CTS #68-11-017-1.

3. GENERAL PRECAUTIONS

3.01 All wire installed in explosive atmospheres shall be placed in accordance with the instructions pertaining to that equipment.

3.02 Wire shall not be placed in pipe or conduit containing electric light and power wires or cables. Wires shall not be placed in the same outlet box or junction box, unless separated from the electric light and power wires by a suitable insulating partition.

3.03 Whenever practicable, avoid running telephone wire in the same conduit, molding, or runway with signal circuits which are operated by battery or from a step-down transformer. Strict adherence to this recommendation will minimize the possibility of interference by either or both parties during placing or maintenance activities.

3.04 Cold water pipes sweat under certain conditions; therefore cross wire **over** rather than under the pipes.

3.05 Exposed drop wire shall not enter a building through the same entrance hole with protected telephone wires.

4. DEFINITION OF TERMS

4.01 The following definitions are for terms applying to electrical conductors used in Tables A, B, and C.

a. Bare Wires: A conductor having no covering or insulation whatsoever.

b. Open Wiring: A wiring method using clamps, knobs, tubes, and flexible tubing for the protection and support of insulated conductors run in or on buildings, and not concealed by the building structure.

c. Electric Service Drop: The overhead service conductors between the last pole or other aerial support and the first attachment to the building.

d. Nonmetallic Sheathed Cable: An assembly of two or more insulated conductors having an outer sheath of moisture resistant, flame retardant, nonmetallic material.

5. SEPARATIONS

5.01 Separations specified in Tables A, B, and C apply to crossings and parallel runs.

NOTE: The separations shown in Tables A, B, and C are minimum requirements. Greater separations shall be provided where readily obtainable.

5.02 In Tables B and C, the specified separations must be obtained for parallel runs.

5.03 The specified separations must be obtained at crossings designated **NO LESSER ALTERNATIVE** in Tables B and C.

5.04 Separations and protection requirements for wiring which are placed on outside walls of buildings and are to be extended to off-premises stations, outdoor stations, loud ringing bells, etc., are the same as those specified for drop and station wire, shown in Table B.

5.05 Separations of less than 6 feet between drop, station wiring, or telephone ground wires and **lightning wires or rods** are permissible under the following conditions:

a. Where telephone, power, and lightning rod ground connections are made to a common grounding medium as specified in CTSP 475-500-410.

b. Where separate driven ground rods are used for telephone, power, and lightning rod installations, **and the ground rods are bonded together** as specified in CTSP 475-500-410.

NOTE: The separation should not be less than 4 inches in any case.

5.06 Table A lists the minimum separations that shall be obtained between drop wire in the span to a building and foreign conductors or metallic objects.

5.07 Table B applies only to telephone wiring (drop or station) attached to the building and feeding a protector (fuseless or fused).

5.08 Table C applies only to telephone wiring between the protector (fuseless or fused) and the telephone equipment and to telephone wiring requiring no protector.

5.09 Tables B and C list the minimum separations between telephone wiring and foreign conductors or metallic objects outside or inside buildings.

6. MECHANICAL PROTECTION

6.01 Where it is not practicable to obtain recommended minimum separation at crossings other than those shown as **No Lesser Alternative** in Tables B and C, or where wire or cable runs are subject to mechanical damage, abrasion, or excessive heat, a protective covering is required as shown in Figure 1. The protective covering should be used as follows:

a. Plastic tube, P wire guard, or two layers of vinyl tape extending 2 inches beyond each side of object being crossed.

b. P wire guard, plastic tube, or two layers of vinyl tape shall be used in all cases where telephone wiring is subject to abrasion or mechanical damage. E wire guard (plastic tubing) may be used in place of vinyl tape or P wire guard on station wiring within buildings where improved appearance is desired. See Figure 2.

6.02 Where station wire passes through wall or floor adjacent to wall or baseboard, protection with vinyl tape or E wire guard is not required unless wire is subject to mechanical damage or abrasion.

6.03 Figures 3 through 16 are typical examples of wiring that requires protection.

NOTE: **Do not run wires or cables through removable gratings.**

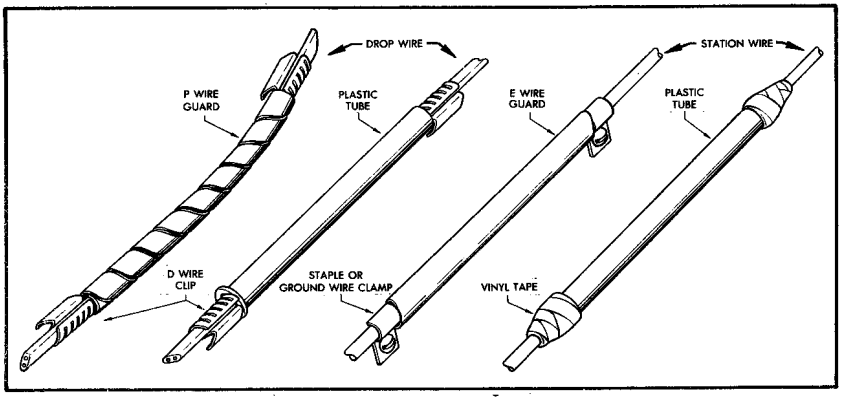


FIGURE 1. Securing Wire Guards

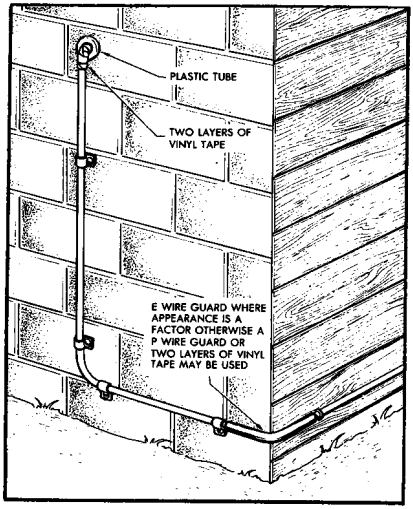


FIGURE 2. Use of Vinyl Tape or E Wire Guard on Station Wire

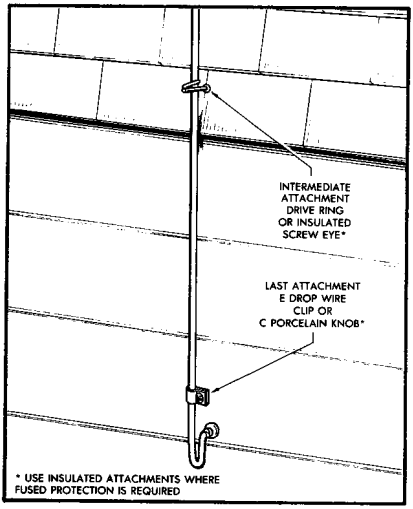


FIGURE 4. Drop Wire Crossing Wood or Stucco on Wood Building Projection

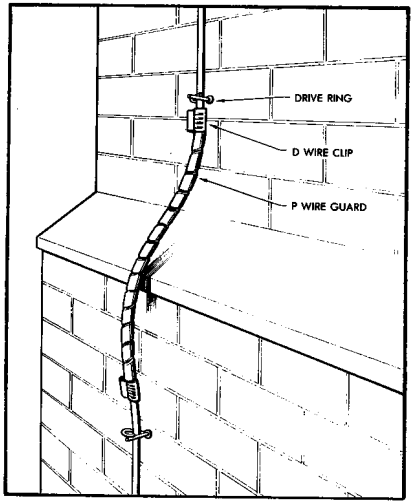


FIGURE 3. Drop Wire Crossing Masonry Building Projection

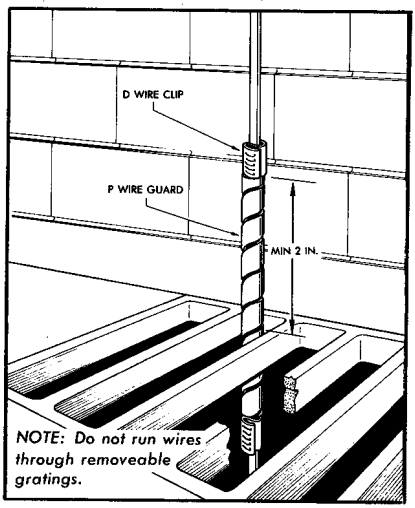


FIGURE 5. Protecting Drop Wire Run Through Stationary Metal Grating

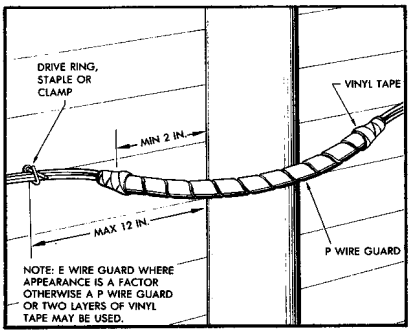


FIGURE 6. Station Wires Crossing Over Pipe

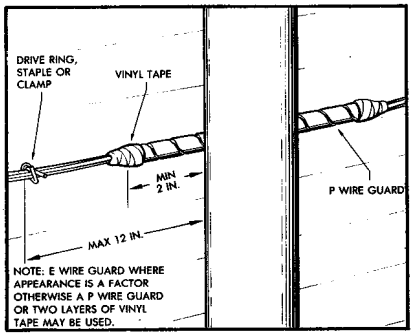


FIGURE 7. Station Wires Crossing Behind Pipe

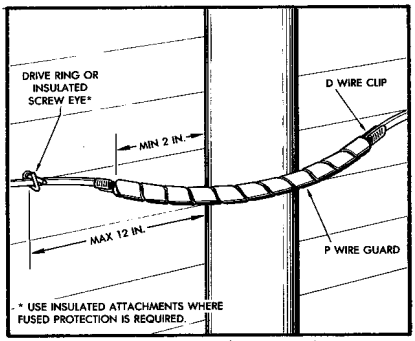


FIGURE 8. Drop Wire Over Pipe

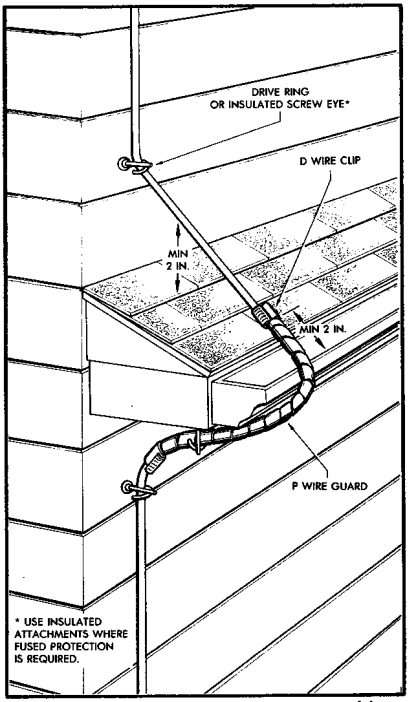


FIGURE 9. Drop Wire Crossing Building Overhangs and Gutters

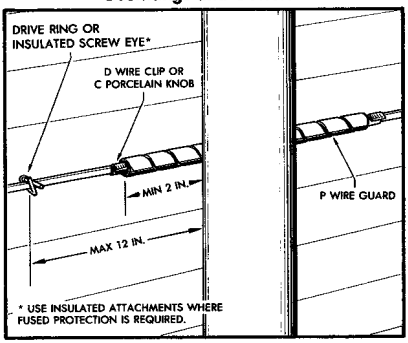


FIGURE 10. Drop Wire Crossing Behind Pipe

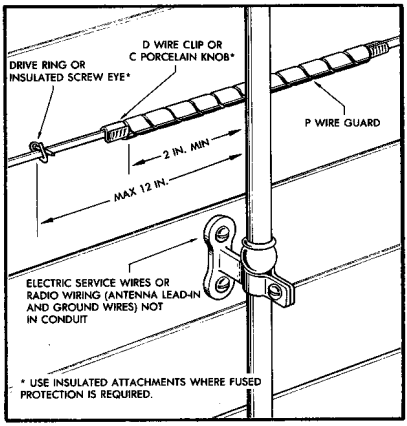


FIGURE 11. Drop Wire Crossing Behind Foreign Wire

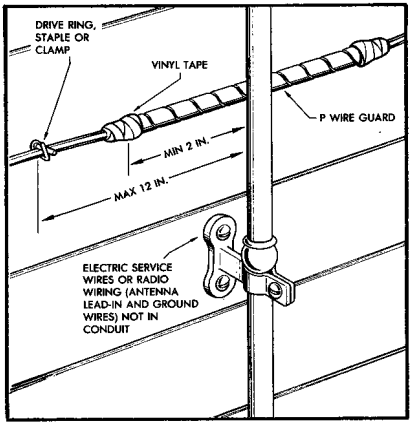


FIGURE 12. Station Wires Crossing Behind Foreign Wire

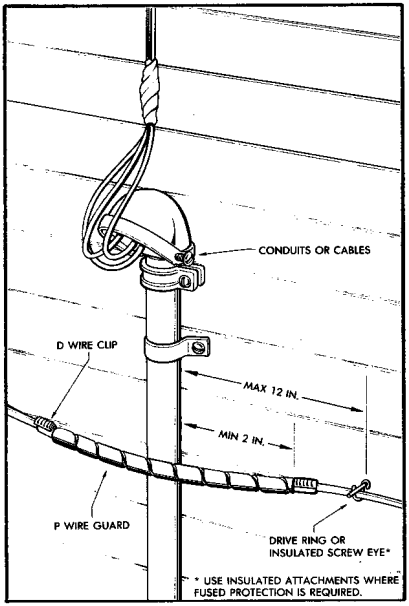


FIGURE 13. Drop Wire Crossing Over Conduit

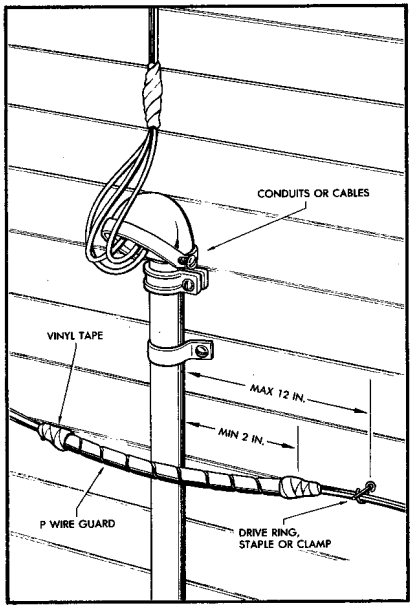


FIGURE 14. Station Wires Crossing Over Conduit

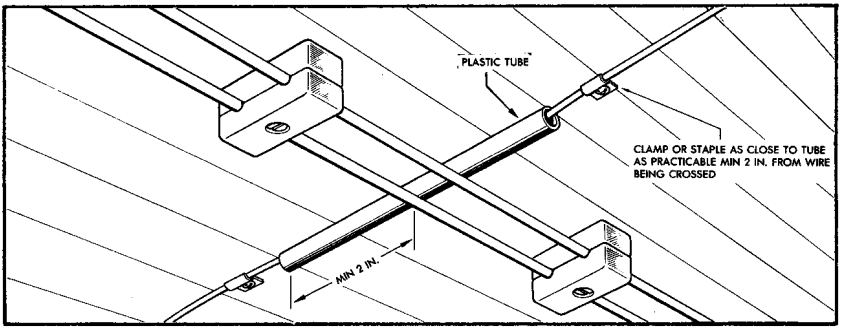


FIGURE 15. Station Wire Crossing Open Electric Light Wires (Drawing 1 of 2)

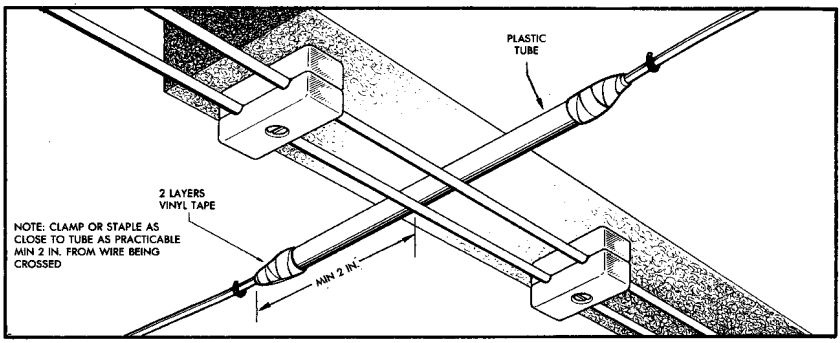


FIGURE 15. Station Wire Crossing Open Electric Light Wires (Drawing 2 of 2)

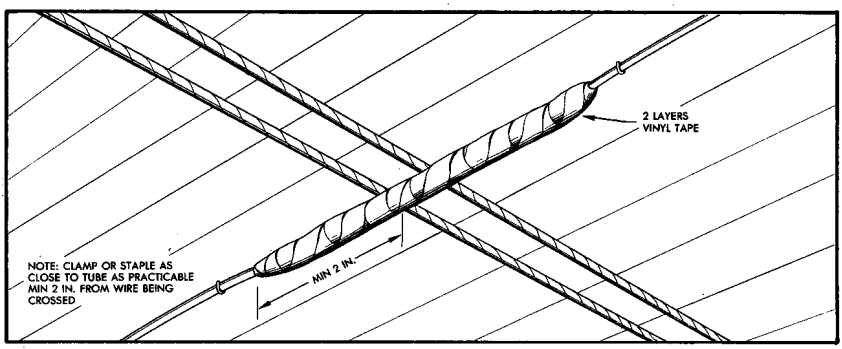


FIGURE 16. Station Wire Crossing Signal Wires

TABLE A. Drop Wire Spans to Buildings

Minimum separations between drop wire spans to buildings and type of plant involved, are as follows:

TYPE OF PLANT INVOLVED		DROP WIRE SPAN TO BUILDING MINIMUM SEPARATION	
		CROSSING	PARALLEL
Electric Supply	Electric service drops or open wiring not over 750 volts.	2 ft.	1 ft.
	Wires in conduit, or in armored or nonmetallic sheath cable.	4 in.	4 in.
Radio and Television	Antenna lead-in and ground wires.	2 ft.	1 ft.
Signal Wires	Open wiring.	2 ft.	1 ft.
	Wires in conduit or cable.	4 in.	4 in.
Communication Wires	Foreign open wiring.	2 ft.	1 ft.
	Foreign wires in conduit or cable.	4 in.	4 in.
	Community television systems coaxial cables with shields at ground potential.	4 in.	4 in.
Metallic Objects	Rain spouts, gutters, etc.	4 in.	4 in.
Ground Wires	Ground wires (except radio, television, and lightning ground wires).	4 in.	4 in.
Lightning	Lightning wires and rods.	6 ft.	6 ft.
Signs	Neon sign and associated wiring from transformer.	1 ft.	1 ft.

TABLE B. Wiring Between Building Attachment and Telephone Protector

This table applies only to telephone wiring (drop or station) attached to buildings and feeding a fuseless or fused protector. Minimum separations between telephone wiring outside or inside buildings, and type of plant involved, are as follows. Separations apply to crossings and parallel runs.

TYPE OF PLANT INVOLVED		MINIMUM SEPARATIONS	PROTECTION REQUIRED IF MINIMUM SEPARATIONS CANNOT BE OBTAINED SEE NOTE 1
Electric Supply	*Bare light or power wire of any voltage.*	5 ft. See Note 2	No Lesser Alternative See Note 2
	Electric service drops or open wiring not over 750 volts.	4 in.	P Wire Guard extending 2 inches beyond each side of object being crossed
	Wires in conduit, or in armored or nonmetallic sheath cable, or power ground wires.	2 in.	
Radio and Television	Antenna lead-in and ground wires.	4 in.	
Signal Wire	Open wiring or wires in conduit or cable.	2 in.	
Communication Wires	Foreign open wiring and wires in conduit or cable.	2 in.	
	Between exposed and unexposed Telephone Company wires.		
	Between exposed Telephone Company wires.	None	
	Community television systems coaxial cables with shields at ground potential.	None	
Metallic Object	Downspouts and gutters.	2 in.	P Wire Guard or two layers of vinyl tape required in all cases to resist abrasion
	Stationary gratings, etc.	2 in.	
Telephone Ground Wire		None	
Sign	Neon signs and associated wiring from transformer.	6 in.	P Wire Guard, 12 inches long See Note 3
Lightning System	Lightning rods and wires.	6 ft.	See Paragraph 5.05.
Pipe	Steam or hot water or heating ducts.	3 in.	See Note 4
Telephone Ground Rods to Other Ground Rods.		6 ft.	No Lesser Alternative

Note 1: Applies only to crossings. For parallel runs the indicated minimum separations must be maintained.

Note 2: *Power is to be turned off if working above bare wire.* Ladders shall be placed to maintain a 5-foot minimum clearance.

Note 3: To prevent accidental breakage, avoid neon sign location of alternate run is possible.

Note 4: Excessive heat may damage plastic-insulated wires, therefore avoid heating ducts and other heat sources.

TABLE C. Separation and Physical Protection for Wiring Between Protector and Telephone Equipment

This table applies only to telephone wiring from fuseless or fused protector to telephone equipment and to telephone wiring requiring no protector. Minimum separations between telephone wiring outside or inside buildings, and type of plant involved, are as follows. Separations apply to crossings and to parallel runs.

TYPE OF PLANT INVOLVED		MINIMUM SEPARATIONS	PROTECTION REQUIRED IF MINIMUM SEPARATIONS CANNOT BE OBTAINED SEE NOTE 1
Electric Supply	*Bare light or power wire of any voltage.*	5 ft. See Note 2	No Lesser Alternative See Note 2
	Open wiring not over 300 volts.	2 in.	See Note 3
	Wires in conduit, or in armored or nonmetallic sheath cable, or power ground wires.	None	
Radio and Television	Antenna lead-in and ground wires.	4 in.	See Note 3
Signal or Control Wires	Open wiring or wires in conduit or cable.	None	
Communication Wires	Community television systems coaxial cables with shields at ground potential.	None	
Telephone Drop or	Using fused protectors.	2 in.	See Note 3
	Using fuseless protector or where no protector required.	None	
Telephone Ground Wire		None	
Sign	Neon signs and associated wiring from transformer.	6 in. See Note 4	Station wire with a grounded shield or lead cable with sheath grounded. Ground requirements same as for signaling ground. See CTSP 475-500-410
Lightning System	Lightning rods and wires.	6 ft.	See Paragraph 5.05
Pipe	Steam or hot water or heating ducts.	3 in.	See Note 5
Stationary Grating, Metal Shutter Grillwork, etc.		P Wire Guard, or two layers of vinyl tape required in all cases to resist abrasion.	

Note 1: Applies only to crossings. For parallel runs the indicated minimum separations must be maintained.

Note 2: *Power is to be turned off if working above bare wire.* Ladders shall be placed to maintain a 5-foot minimum clearance.

Note 3: Plastic tube; E or P wire guard; or two layers of vinyl tape extending 2 inches beyond each side of object being crossed.

Note 4: To prevent accidental breakage, avoid neon sign location if alternate run is possible.

Note 5: Excessive heat may damage plastic-insulated wires, therefore avoid heating ducts and other heat sources.

DROP AND BLOCK WIRING
TREE INTERFERENCE

1. GENERAL

1.01 This practice describes methods of avoiding or correcting tree interference to drop wire runs.

1.02 Tree pruning shall be done in accordance with local and state laws. Consult the proper authorities before trimming any trees.

2. AVOIDING TREE INTERFERENCE

2.01 When making a drop wire run, avoid running drop wires through tree foliage and branches to prevent damage to insulation due to abrasion. Obtain clearance in terms of feet rather than inches between drop wires and tree branches or foliage to avoid contact as a result of tree growth.

2.02 By one of these methods, tree interference can usually be avoided:

a. By locating the first building attachment to obtain tree clearance.

b. By positioning span clamps so that future growth of trees will not cause interference.

c. Providing required joint-use clearances can be obtained, distribute from a different pole or different point on the same pole than would ordinarily be selected.

d. By running drop wire below the bottom branches of the tree.

e. By contacting buildings other than the one to be served, provided that the property owner's permission has been secured in advance and the building is on the same premises.

f. By trimming trees, as per paragraph 4.08, when permission can be obtained from the proper authorities.

g. By obtaining a reassignment to another terminal, provided the length of the drop wire will not exceed the maximum limit.

2.03 Locating first building attachment.

a. Select a location for the first attachments which will be free of tree interference, when possible. A longer span of drop wire (not to exceed 200 feet) or longer building run is perferred to running a drop wire through trees. Drop wires may be run over driveways where adequate clearance is available.

b. Consider the type of tree as some grow very rapidly and could cause damage to drop wires in the future. Since limbs will be lower when weighted down with sleet, snow, or foliage and will be higher during other periods, consider the season when running drop wires over or under branches.

3. WIRE GUARDS

3.01 Wire guards shall be placed on drop wires under the following conditions:

a. When it is otherwise impractical to obtain clearance from branches, twigs, and foliage for a two-year period.

b. Where drop wire runs through a tree or foliage require protection from abrasion.

c. Where drop wires pass adjacent to guy wires or other obstructions liable to cause damage.

3.02 Installing wire guards.

a. Extend wire guard protection at least three feet beyond each side of the tree when protection is required from twigs or foliage in order to provide for future growth. Use care to center a tree guard at the point of contact with tree limbs, trunks, or branches.

b. The "P" wire guard, consisting of a helically wound plastic tape, shall be used to provide protection from tree damage. After the wire guards are positioned, secure them by placing a "D" clip at each end. Do not tape or seal the ends of the tubing. This action allows water to drain out and air to circulate thereby preventing corrosion.

c. Crimp the "D" clip with a pair of pliers as shown in Figure 1.

4. TREE TRIMMING

4.01 Where drop wires cannot be routed to obtain clearance, trimming of trees is generally the preferred method to avoid abrasion of drop wire, rather than the placing of wire guards.

4.02 When trees should be trimmed that are on state highways, county roads or city streets, contact your supervisor for proper authorization before trimming any tree. Where trees are on private property, make every reasonable effort to obtain consent to trim the trees.

4.03 When trimming trees, give attention to good public relations and to complying with safety practices, especially in regard to adequate warning signs. Observe these precautions when trimming trees:

a. Keep street and highways clear of branches.

b. Protect fences, lawns, etc., against damage from falling branches.

c. Keep the public from entering the area in which branches are likely to fall.

d. Do not leave tools where they can cause accidents.

4.04 When requesting permission to trim trees on private property, the owners should be informed of the extent of tree pruning and should be told how the work will be done. In order to maintain the health and good appearance of the tree, only trained and experienced workmen should be assigned to trim trees. Brush shall be removed at the time the tree is trimmed unless other specific arrangements are made.

4.05 When the property owner objects to the trimming of his tree, all reasonable efforts should be made to overcome his objections and, at the same time, to retain his good will. Some of the following subjects may develop his interest and overcome his objections:

a. Reference to other nearby tree trimming which has been satisfactory with the property owner.

b. Poor service or lack of service to himself and possibly his neighbors due to contact of the wires with branches of the tree.

c. The pruning of fruit trees with the thought of improving the yield.

d. The tools provided to do a scientific job.

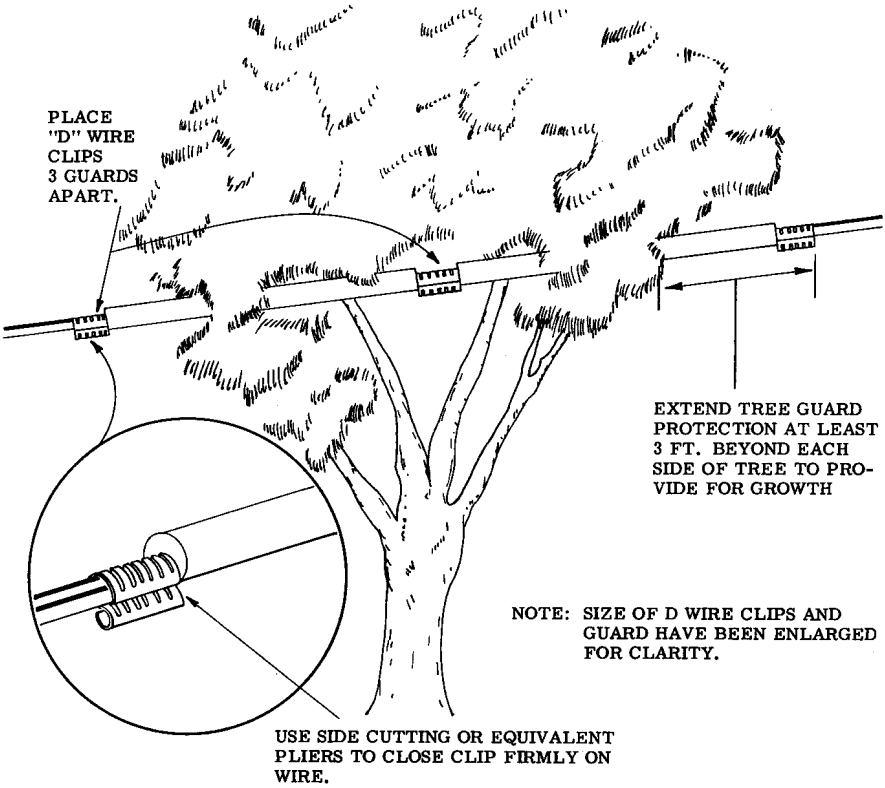


Figure 1. Positioning P Wire Guards

4.06 It is better to approach the property owner for the privilege of pruning fruit trees during the dormant season. When trimming these trees, the shape is secondary to the health of the tree and every effort shall be made to do the work in a careful and scientific manner.

4.07 Trimming trees in the fall and winter permits branches to be removed easily, and trees which require heavy trimming will not bleed excessively during the dormant season. Although the dormant period is the most favorable trimming time, summer pruning has the following advantages:

a. Cuts heal more rapidly and therefore, there is less chance for injurious agents to become established.

b. Opening of the tree to sunlight often retards some insects and fungus diseases.

c. Pruning will often stimulate fruit growth.

d. Often the clearance obtained during this season is more lasting.

4.08 Well shaped trees are a good advertisement of workmanship. If a little extra time is required to produce good results, it is time well spent. When trimming trees, observe the following methods:

a. Use a flush cut on a limb at the point of intersection with the main branch or trunk. (A flush cut is one having the cut surface parallel to the remaining limb so that no stub remains.) A treated flush cut will prevent or retard sprout growth, make the cut inconspicuous, and will heal more rapidly. Where upright limbs are cut, an angle should be made on the final cut to provide a watershed. Such cuts shall be made at crotches or joints.

b. Large limbs should be roped first to prevent breaking off at the cut. If the limb is very large, it should be taken down in sections. Use care not to underestimate the weight of limbs. Use a block and tackle, if necessary, to eliminate a safety hazard.

c. On large limbs, the cut is made from the top side with a preliminary cut on the underside to prevent splitting or peeling of the bark. The final cut should be flush with the supporting surface and without a rough surface. Do not attempt to make an undercut meet the top cut, but complete the top cut to leave a smooth surface. Use a top cut whenever conditions permit, because it produces less strain on the butt and supporting ropes.

d. Make a bottom saw cut when it is necessary to raise a large limb during the sawing operations (where wires are underneath the limb).

e. Where it is necessary to swing a limb sideways because of obstructions, make a side cut on the opposite side on which the limb is to be swung. This action will allow the bark and remaining wood to serve as a hinge. If there is a possibility of the limb splitting, wrap a few turns of rope beneath the cut to prevent splitting beyond that point.

f. Shade trees should be trimmed to provide not less than one year's clearance, as they are weakened by repeated loss of foliage. Shade trees should be rounded off symmetrically and without holes to detract from the tree's beauty. Some irregularities will result from trimming vertical growth on lateral branches; however, when leaves come out, a more even appearance will result.

g. Particular attention should be given to trimming those vertical or horizontal branches which grow in the direction of the drop wire. If practical, provide as much as three years' clearance.

h. Fruit trees should be trimmed so that they will produce more fruit on the smaller outside branches; therefore, as few as possible of these branches should be removed.

i. The ultimate object in tree trimming should be to train the branches to grow either above or below the drop wire.

SPAN CLAMPS–STRAND ATTACHMENTS

1. GENERAL

1.01 This practice describes the use and installation of the universal span clamp and methods of running drop wire from the span clamp to the pole. The uses and methods of placing other types of span clamps are quite similar to those of the universal span clamp.

1.02 Span clamps are used only when it is impractical to serve the customer directly from the pole, guard arm or cable arm in the normal manner. Some of the conditions which require the use of a span clamp are:

a. To prevent drop wires from crossing each other on the span.

b. To avoid crossing private property other than the property being served. Span clamps shall be placed on property lines wherever possible.

c. To avoid tree interference in pole to building runs.

d. To provide pole climbing space.

e. To avoid buildings and other obstacles.

f. To obtain clearance from clotheslines, power service drops and other obstacles.

1.03 The following limiting conditions should be observed in placing span clamps:

a. Bronze strand is used in corrosive areas. Never use a universal strand clamp with bronze strand; use a bronze strand clamp instead.

b. Where a span clamp is required to provide climbing space on a jointly used pole, and where there is a cable splice, place the span clamp on the side of the pole opposite the cable splice.

c. When a span clamp must be placed on the splice side of a pole to provide climbing space, place the span clamp wherever convenient to maintain a distance of 30 inches from the pole, but never directly over the splice.

2. INSTALLATION PROCEDURES

2.01 Universal span clamps may be used on lashed (figure eight) and ring supported cable. A clamp shall not support more than two drop wires at one time.

2.02 The following procedure is used to place span clamps:

a. Loosen the nut of the clamp until the jaws open sufficiently to place the clamp on the strand.

b. Place the clamp on the strand between the wrappings of prepared lashed cable, with the hook side of the clamp facing the building to be served. The sheath of lashed cable is protected with a lashed cable support placed as described in paragraph 2.03.

c. Take up on the nut until the clamp is firmly bolted to the strand.

2.03 A lashed cable support is placed on the sheath of lashed cable as follows:

a. The cable support buckle is held as close to the span clamp as possible.

b. The first wrap of the support is placed on the cable only, passed between the lashing wire and the cable and through the buckle.

c. The second wrap is placed under the strap and over the lashing wire and the wrap threaded through the buckle.

d. The wrapping is snugly pulled around the cable, the free end bent back on the buckle and the excess cut off, leaving approximately one inch. The tail should be tucked under the buckle.

2.04 Figures 1 and 2 illustrate the universal span clamp installed on lashed or figure eight cable.

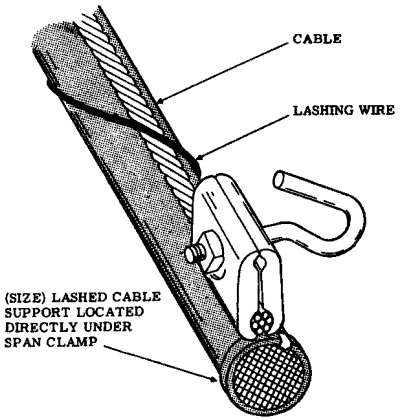


FIGURE 1. Lashed Cable

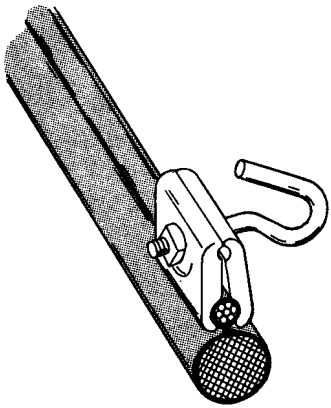


FIGURE 2. Figure Eight Cable

3. RUNNING DROP WIRE TO SPAN CLAMP

3.01 Since two drop wires per span clamp are the maximum, place the second strand clamp 4 inches beyond the first when 3 drop wires are required. This spacing of clamps will prevent chafing of the drop wires. If more than 4 drop wires are required from a pole to pole or strand to building run, report it to your supervisor.

3.02 Where a span clamp is more than 4 feet from the pole, support the drop wire as shown in Figure 3. The drop wire clamp on the span to the building shall be attached in the top position clearance between the drop wire and cable.

3.03 Where the distance between a span clamp and cable suspension bolt is less than 4 feet, the drop wire is supported as shown in Figures 4 and 5.

3.04 Where drop wires are run from guard arms to span clamps, support the drop wire as shown in Figure 6.

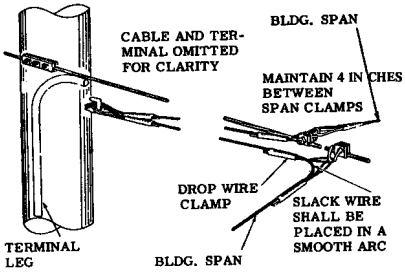


FIGURE 3. Span Clamp More Than 4 Feet From Pole

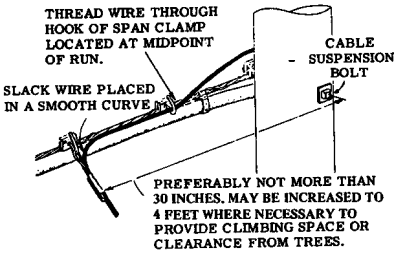


FIGURE 4. On Lashed Cable

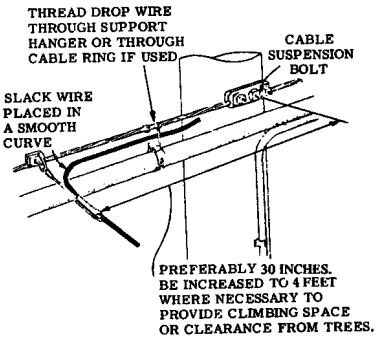


FIGURE 5. On Ring Cable

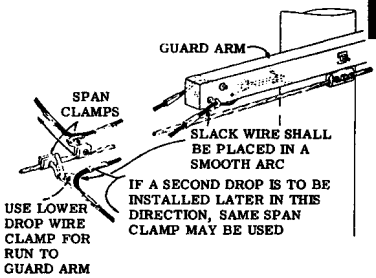


FIGURE 6. Runs From Guard Arms To Span Clamp

DROP WIRE CLAMPS INSTALLATION

1. GENERAL

1.01 This practice provides the description of and installation procedure for the PS-6 drop wire clamp.

2. DESCRIPTION

2.01 The PS-6 drop wire clamp (Figure 1) consists of a stainless steel wedge, bail, shell, and plastic shim. The plastic shim makes removal easy and prevents installation damage.

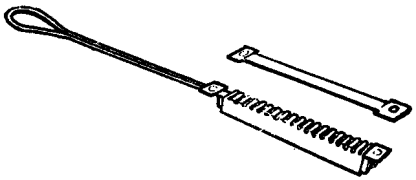


FIGURE 1. Drop Wire Clamp

2.02 Drop wire clamps are used for attachment to poles, crossarms, and the first attachment on buildings. The PS-6 drop wire clamp is designed for use with reinforced dumbell wire.

3. INSTALLATION

3.01 Following is the installation procedure for the PS-6 drop wire clamp:

a. Place the bail over the hook or knob by spreading the shaft (not the eye) of the bail.

b. Pinch the shaft of bail together while pulling the eye toward the knob. This action will cause proper positioning of eye on the knob.

c. Place the shell of the clamp over the wire with the narrow end pointing toward the knob or hook. The wire should be flat in the shell before the wedge is inserted. See Figure 2.

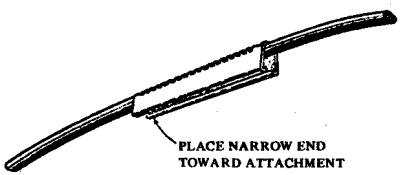


FIGURE 2. Placing Clamp Shell

d. Place the plastic shim under the drop wire inside the clamp shell by inserting the shim edgewise and twisting its end until the shim snaps in place. See Figure 3.

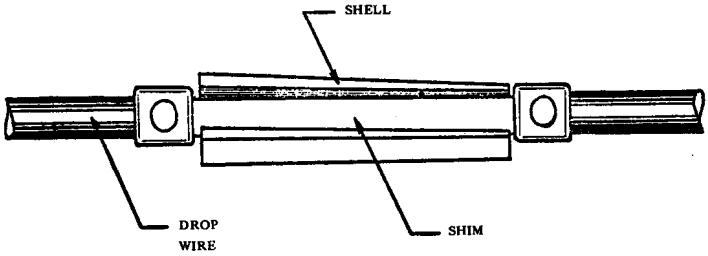


FIGURE 3. Insert Shim In Clamp Shell

e. Insert the wedge loosely under thy clamp with point of wedge directed toward the attachment. If necessary, bend the loop of the clamp at the point of contact with the wedge to facilitate inserting the wedge. Do not bend the drop wire excessively. See Figure 4.

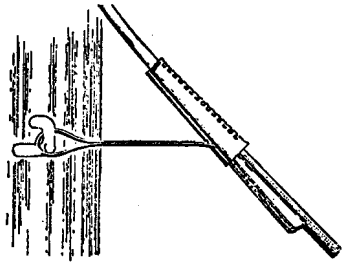


FIGURE 4. Inserting Clamp Wedge

f. Where necessary to adjust slack, slip the wire through the loose shell until the proper amount of sag has been secured. During this operation, hold the shell in this position with the thumb, as illustrated in Figure 5.

g. When the proper sag has been obtained, pull the shell firmly against the wedge. Tap the wedge firmly with a blunt tool to drive it home.

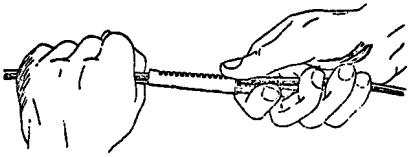


FIGURE 5. Obtaining Proper Sag

3.02 In case the drop wire clamp leaves the groove of the knob at an appreciable angle, give the clamp three half-turns to prevent the bail from pulling off the knob. Twist the clamp by hand with the shell in place. Remove the shell and install the drop wire. Reassemble the clamp.

DROP & BLOCK WIRING

TREE ATTACHMENTS – INSTALLATION

1. GENERAL

1.01 This practice provides information on the installation of tree attachments used on drop wire runs.

1.02 Since tree attachments can be a source of trouble, they are to be used only where no other means of obtaining the proper clearance is available. Tree attachments shall not be made unless permission to place poles cannot be obtained or where poles would not provide the proper clearance.

1.03 With permission of the owner tree attachments may be used under the following conditions :

a. Tree attachments may be made to shorten the span from highway to building, provided the installation can be made so that wires will have the proper clearances.

b. Where it is necessary to raise the drop wire to clear a tree limb or to obtain the required clearance from foreign circuits.

c. Do not attach drop wires to tree limbs or trunks which are less than 3 inches in diameter because of the greater movement of smaller limbs.

d. When tree attachments are used, allow at least one foot more sag in each span than specified in the sag table to compensate for the swaying of the tree.

1.04 A ladder shall be used to climb trees whenever it is found necessary to make a tree attachment. *Tree* climbers may be used when use of a ladder is not practical. Never use pole climbers to climb trees. The gaffs on climbers used for pole climbing are generally not long enough to penetrate the bark and thus will not enter solid wood far enough to obtain a firm hold.

2. INSTALLATION

2.01 To limbs or trunks 6 inches or more in diameter:

a. Drop wire attachments to limbs or trunks 6 inches or more in diameter shall be made with drive hooks and drop wire clamps. Do not attach more than three drop wires (6 clamps) to one drive hook. See Figure 1.

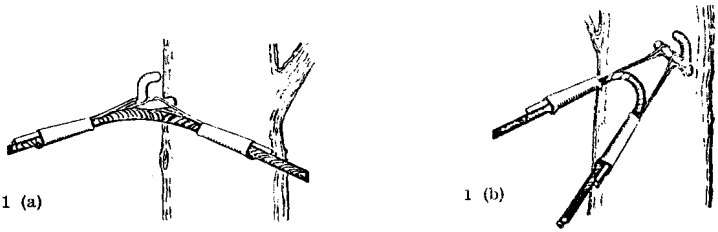


Figure 1. Tree Attachment To 6-Inch Diameter Trunk

2.02 To limbs or trunks from 3 to 6 inches in diameter:

a. Use C bridle rings and drop wire clamps when attaching drop wires to limbs or trunks from 3 to 6 inches in diameter. Not more than one drop wire clamp may be attached to one bridle ring. See Figure 2.

b. Do not use bridle rings for attaching drop wires which cross streets or highways when there is a pull away from the limb. On drop wires not requiring double deadends, the drop wire may be attached to bridle rings with a straight drop wire clip, as illustrated in Figure 3.

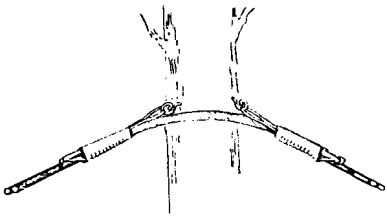


Figure 2. Tree Attachment To 3- To 6-Inch Diameter Trunk

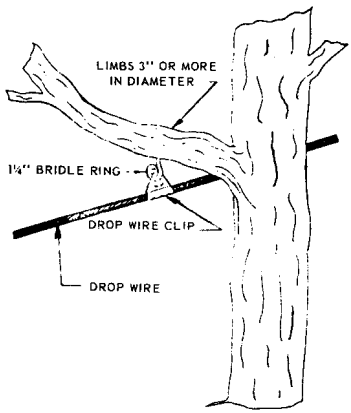


Figure 3. Drop Wire Clip Tree Attachment

DROP AND BLOCK WIRING

TERMINAL POST CAPS AND INSULATORS

1. GENERAL

1.01 This practice presents the protective measures to be taken on circuits used for special service requirements.

1.02 These measures consist of placing binding post caps and insulators on the binding posts of special service lines in all cable terminals at which the circuits are brought out, including multiple appearances. This is to prevent service interruptions due to accidental contact.

1.03 Among the special service lines which require protection from accidental contact are:

a. Military circuits.

b. Private line service furnished to the government.

c. Special facilities for use in a major disaster.

d. Remote control, signal and alarm including fire, police burglar alarm, and various instrument metering circuits.

e. PBX battery and generator supply for hospitals, police, fire departments, and others who perform emergency service for the public.

f. Teletypewriter, including ticker service lines.

g. Telephotograph and television.

h. Carrier telegraph and telephone.

i. Radio telephone.

j. Program supply (e.g. radio, etc.).

k. Miscellaneous circuits on which special protection is prescribed by order.

1.04 Extreme care shall be exercised when working on or near protected lines not to interfere with, or do unauthorized work on these lines. This could cause a momentary open, short circuit cross or unbalanced condition which could result in serious service interruptions.

1.05 The red binding post cap or any binding post insulators shall be removed only when authorized by the local testboard or by a service order for service discontinuance. Then all caps and insulators associated with a particular service shall be removed at the time the service order (for service discontinuance) is completed. In the event that such caps are overlooked, they shall not be removed for subsequent reuse of pair unless authorized by the local testboard.

1.06 Designation tags shall be used only at working appearances and when specified on service orders. In such cases, tags shall be attached to the drop, block, or cross-connecting wire at a point in the wire run of the terminal so that the tag or attaching string cannot come in contact with any binding posts.

2. BINDING POST CAPS AND INSULATORS

2.01 The binding post cap is a red neoprene cap with a tear slit and hole. The cap, which can be used on a working or non-working binding post, completely covers the cable terminal binding posts. The caps provide protection against accidental contact. See Figure 1.

2.02 For special service lines which end in terminals not suited to use of binding post caps, the binding post insulator is provided. It is a phenol fiber sleeve, slotted lengthwise. See Figure 2.

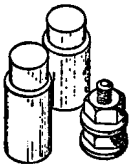


FIGURE 1. Binding Post Cap

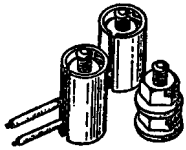


FIGURE 2. Binding Post Insulator

3. PLACING BINDING POST CAPS

3.01 Use this procedure to position binding post caps:

a. Thoroughly clean the binding posts to be protected and the terminal face plate.

b. Tighten the spare nuts of the binding post, finger tight.

c. Check that all moisture around binding post has been removed.

d. Force the cap, but do not twist, over the binding post until its skirt is in good contact with the face plate.

e. Position any appropriate drop or bridle wires inside the hole at the end of the slit in the cap.

4. PLACING BINDING POST INSULATORS

4.01 This procedure is used to position binding post insulators:

a. Follow procedures outlined in paragraph 3.01 a. through c.

b. Force the insulator over the binding post until its skirt is in good contact with the face plate.

c. Be sure the fit is snug; if necessary, wrap plastic tape around the binding post inside the insulator.

d. Position any appropriate wires inside the slot.

5. DESIGNATION TAGS

5.01 Aluminum designation tags are available for identifying all types of services. In no case shall the circuit numbers of special service lines be on designation tags. Tags are to be used *externally* at terminal, protector and connecting block locations.

6. MATERIAL INFORMATION

ITEM	CATALOG NO.
Binding Post Cap	68-34-008-7
Binding Post Insulator	70-58-047-2
Metal Designation Tag	51-77-020-2

DROP & BLOCK WIRING

WIRING AT STRAND MOUNTED TERMINALS

1. GENERAL

1.01 This practice provides procedures for the routing and terminating of drop and block wiring at strand mounted terminals.

2. WIRING AT SHEATH MOUNTED CABLE TERMINALS

2.01 Drop wires should preferably be run to the terminal from the adjacent pole, except where they distribute from a cable extension arm or from a span clamp installed between the terminal and terminal splice. A drop wire distributing from a span clamp so located should be run directly from the span clamp to the terminal.

2.02 Route drop or block wires through the three rings (or the two hangers in older design terminals) at the rear of the terminal, around the ring (or hanger) at the far end, and below the terminal to the proper wire entrance holes of the assigned binding posts. Do this on initial wire connection and also on reconnections if the wire is long enough to reach the binding posts without being pulled tightly around the last ring (or hanger). If it is necessary to obtain slack for reconnections, the wire may be removed from one or two terminal rings (or one hanger) in order to reach the binding posts. If sufficient slack cannot be obtained in this manner, splice out the shortened wire behind or near the terminal and route the wire through the three rings (or two hangers) as for an initial connection.

2.03 Typical illustrations of drop wire runs to strand-mounted terminals are shown in Figure 1 through Figure 4. Lashed cable is illustrated but the same general methods apply to terminals installed on ring-supported cable.

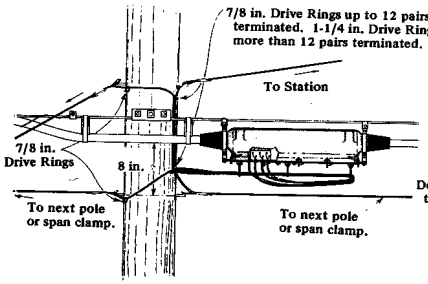


FIGURE 1–Wiring 49-Type Terminal at Pole

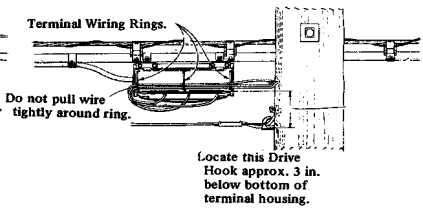


FIGURE 2–Rear View of Running Wires to Terminal from Drive Hooks

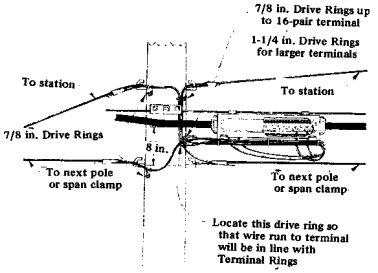


FIGURE 3–Wiring 61-Type Terminal at Pole

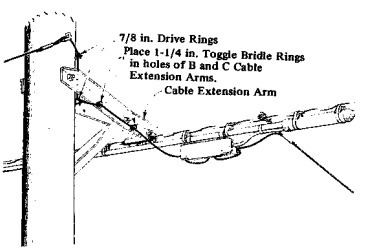


FIGURE 4–Running Wires to Terminal from B or C Cable Extension Arm

2.04 Where the terminal is installed on a cable which is supported by strand attached to a building, place a cable ring for the drop or block wires approximately 3" beyond each end of the terminal, with the rings not encircling but resting against the outside of the main cable. The wires entering the terminal should pass through one of these rings before being run through the three terminal rings, as illustrated in Figure 5. Where there is less than 2" separation between the strand and the building wall, disregard the wiring rings at the rear of the terminal and place three 7/8" drive rings in corresponding positions in the building wall, approximately 3" below the terminal.

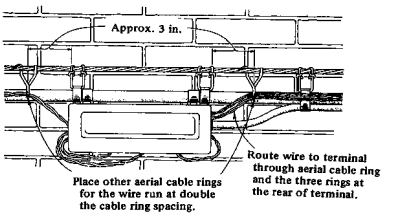


FIGURE 5–Running Wires to Terminal Installed on Strand Supporting Block Cable Attached to a Building

2.05 When running wires to a terminal installed on strand supporting cable attached to a building, cut, drop, or bridle wire to the proper length for termination. See Figure 6.

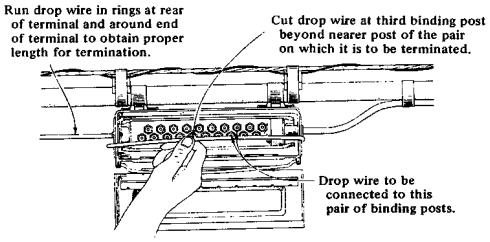


FIGURE 6–Obtaining Proper Length of Wire for Termination

2.06 Terminate drop and block wires at the terminal as follows:

a. Skin and clean the ends of the conductors. With C drop wire it is necessary to remove approximately 2 1/2" of the outer covering.

b. Break through the grommet in the wire entrance hole immediately below the proper pair of binding posts, using long-nose pliers or other suitable tool. In older design terminals, it is necessary to break through the cork strip at the center of the wire entrance hole before the wire can be inserted through the slit in the rubber strip located behind the cord strip.

c. Insert the wire through the grommet as illustrated in Figure 7, and terminate it on the binding posts in the usual manner.

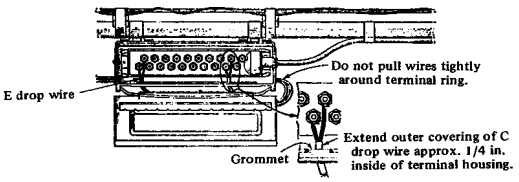


FIGURE 7–Terminating Wires at Terminals

2.07 Two wires may be bridged on a pair of terminal binding posts. Wires terminated on the same binding post should enter the same wire entrance hole. Where 3-4 wires are to be bridged, bridle wires between the terminal and a 101B wire terminal should be run through the three rings at the rear of the sheath-mounted terminal in the usual manner.

2.08 When connecting service cables or buried wire to strand-mounted terminals, run bridle wires from a 101B wire terminal or D wire terminal in the same manner as drop or block wires.

2.09 When a wire is disconnected from the binding posts, straighten the ends of the conductors sufficiently to avoid dislodging the grommet and pull the wire out of the terminal. Tape the end of the disconnected wire to itself at a point behind the terminal which will not cause the wire to be pulled tightly around the end ring (or hanger).

2.10 Lost or deteriorated grommets should be replaced. To install the grommet where a wire enters the terminal, cut through the rim of the grommet at a point in line with the scored portion. Place the grommet around the wire so that the groove is completely engaged with the edge of the wire entrance hole.

DROP AND BLOCK WIRING

GUARD ARM HOOKS INSTALLATION AND REQUIREMENTS

1. GENERAL

1.01 This practice covers the installation of guard arm hooks, and the methods of running drop wires from guard arms.

2. GUARD ARM HOOK INSTALLATION

2.01 A properly installed guard arm is shown in Figure 1.

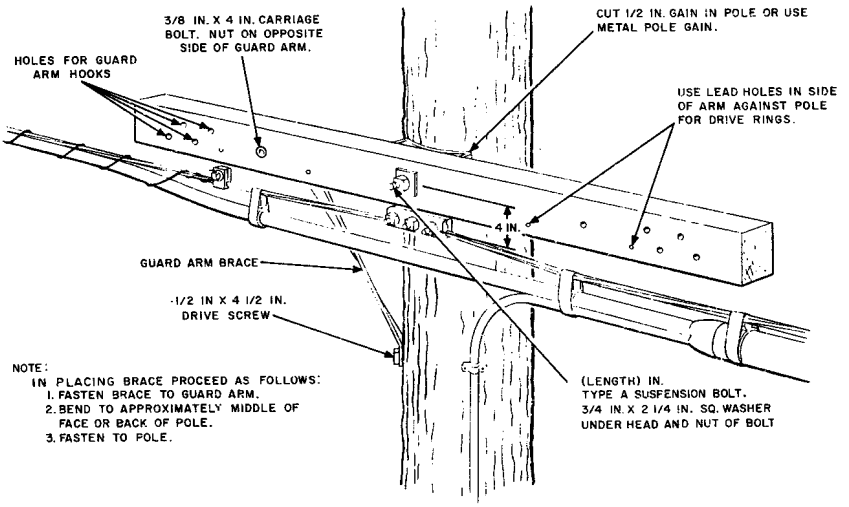


FIGURE 1. Guard Arm Installed

2.02 A metal pole gain installed (as shown in Figure 2) may be used to avoid the necessity of cutting a gain in the pole.

2.03 Guard arm hooks are used to attach wires to guard arms and also to cross arms other than the DE-type when more than two drop wires must be attached to the same hook. On a guard arm, install the hooks in the holes provided at the ends of the guard arm. See Figure 3. When the guard arm hooks are used on a crossarm, it may be necessary to drill a 9/16 or 5/8 inch hole for each hook required in the side of the crossarm. Center the hole between the top and bottom of the arm and between pins or closer to the pole if adequate clearances can be obtained and climbing space is not obstructed.

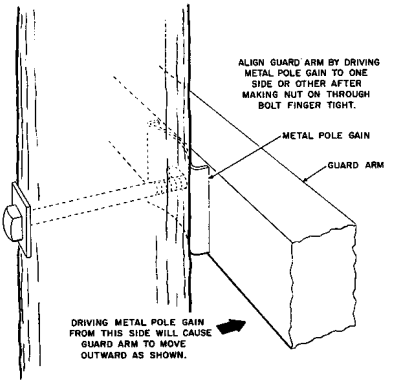


FIGURE 2. Metal Pole Gain Installed

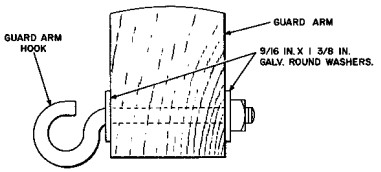


FIGURE 3. Guard Arm Hook Installed

2.04 A total of five drop wires, pulling in any direction, may be attached to one guard arm hook. When placing B or C multiple drop wire, consider one multiple drop equal to three drop wires.

3. WIRE RUNS FROM GUARD ARMS

3.01 Distribute drop wires from a guard arm as shown in Figures 4 and 5.

3.02 Attach the drop wire clamp to the guard arm hook by passing the wire tail of the clamp over the hook. Pass the drop wire through the hook, unless the hook is congested, and secure the drop wire in the clamp. Run the wires on the guard arm and pole in a neat manner with sufficient slack so there will be no strain or sharp bends in the drop wire at the drive rings, hooks, or clamps.

3.03 If brackets and knobs have been previously installed on the guard arm and are in serviceable condition, drop wires may be distributed from vacant grooves of the knobs. No more than two drop wires shall be attached to a T knob or more than one drop wire attached to an S knob.

3.04 When installing, removing, or rearranging drop wires, it may be necessary to place and distribute from a new guard arm hook at the opposite end of the guard arm instead of using an existing hook, in order to balance the load on the guard arm.

3.05 When several drop wires are attached to one guard arm and are run to the same building, it is desirable to distribute from both ends of the guard arm to equalize the load, provided the required climbing space will be maintained.

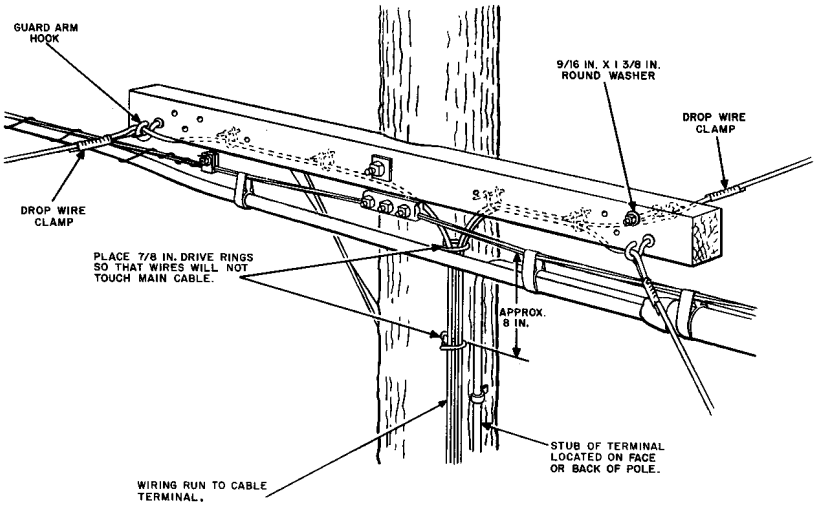


FIGURE 4. Cable Terminal Mounted on Face or Back of Pole

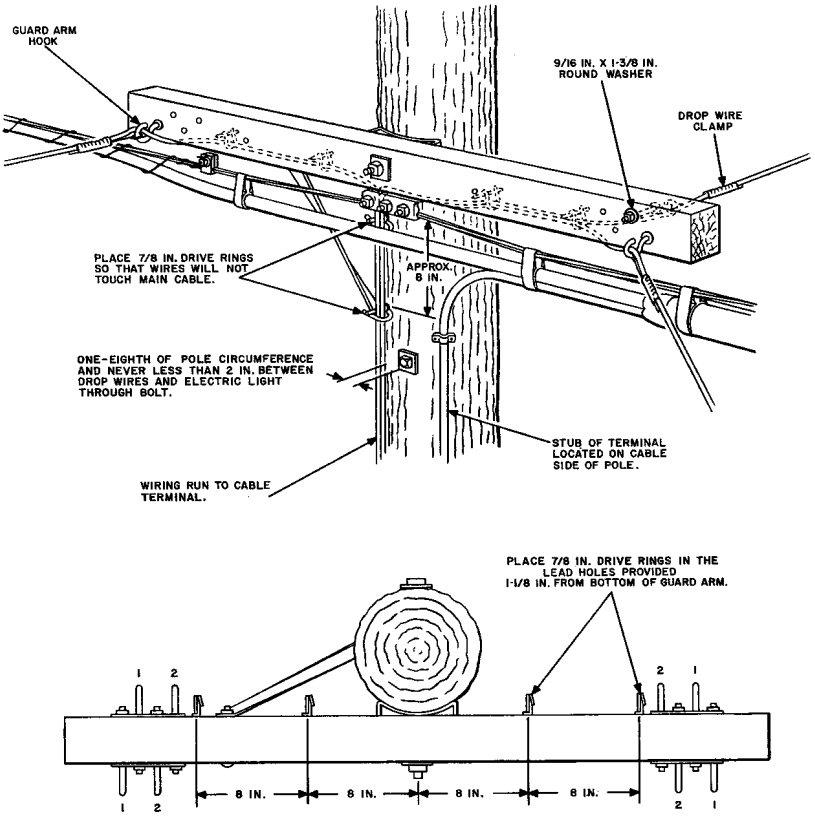


FIGURE 5. Cable Terminal Mounted on Cable Side of Pole

3.06 When making runs along the lead from guard arm to guard arm or from guard arm to pole, dead end the drop wires as shown in Figures 6, 7, and 8.

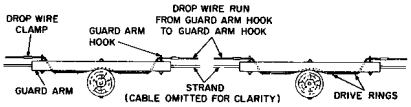


FIGURE 6. Drop Wire Run Along Lead From Guard Arm to Guard Arm

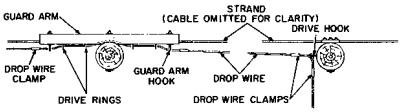


FIGURE 7. Drop Wire Run Along Lead From Guard Arm to Pole

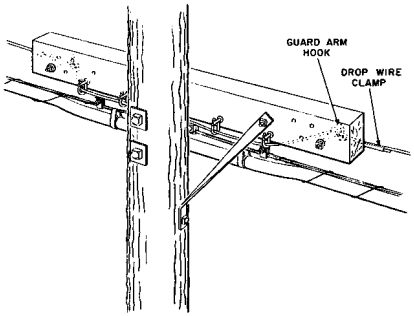


FIGURE 8. Wiring at Intermediate Guard Arm for Run Along the Lead

STATION WIRE AND CABLE ATTACHING AND FASTENING

CONTENTS

1. GENERAL

1.01 This practice provides information on the proper type and size of attachments and fasteners to be used for various surfaces when attaching station wire and cable. For information on fastening drop wire, refer to CTSP 475-302-401 and CTSP 475-302-405.

2. SURFACES ENCOUNTERED

2.01 Use galvanized fasteners outdoors and enameled or nongalvanized fasteners indoors.

2.02 Masonry or Substantial Brick Veneer:

a. In general, the same fasteners apply in making attachments to masonry and substantial brick veneer. Veneering is considered substantial when:

(1) The veneer thickness is 3-3/4 inches (as observed at an outside corner).

(2) The bricks are joined firmly with mortar.

b. On masonry and substantial brick veneer, drill holes for all attachments as close to the center of bricks as practicable and use care to avoid damaging and loosening the bricks. In the case of face brick or ornamental types of brick, holes for intermediate and last attachments may be drilled in the seam to avoid breakage.

2.03 Thin-Wall Brick Veneer: Thin-wall brick veneer is considered as veneering having a thickness of less than 3-3/4 inches (as observed at an outside corner, some corners are mitered) or having bricks that loosen or crack easily when drilled. Make attachments to thin wall veneering as follows:

a. First Attachment: Attach to suitable woodwork with galvanized wood screws. When suitable woodwork is not available, attach to the brick veneer surface by drilling a clearance hole in the seam to permit a galvanized wood screw to be passed through the brick portion of the wall and screwed into the wood backing or studding. The screw should penetrate at least 1 inch into the wood backing or studding.

b. Intermediate and Last Attachments: Attach to brick veneer with suitable anchoring device. Drill holes in center of bricks; if bricks begin to crack or loosen, make the attachments to seams or to wood trim. On slab type veneering (approximately 1 inch thick), secure intermediate and last attachments to the wood backing in the manner specified for first attachments.

2.04 Wood:

a. Staples, galvanized wood or tapping screws, or nails are generally the standard fasteners on wood; however, hollow wall anchors, plastic anchors, or toggle bolts are recommended as fasteners on plywood and masonite when a more substantial fastener is needed for heavier apparatus.

NOTE: Do not use staples on exterior surfaces in damp climates.

b. On woodwork, drill lead holes for fasteners and screw type fixtures to avoid splitting the wood and to obtain maximum holding power. Locate fasteners in studding where practicable.

c. Studs in buildings of wood frame construction may usually be located by one of the following methods:

(1) **Buildings finished with clapboards:** By location of heads of nails used in fastening clapboards to studding, or where clapboards join.

(2) **Buildings finished with shingles or stucco:** By sounding; by locating studs in cellar or attic; by location of heads of nails used in fastening trim to studding.

2.05 Stucco on Wood: For stucco on wood buildings, attach to substantial wood trim with galvanized wood screws. Where required to install fixtures on stucco finished walls, drill a clearance hole for tapping screw or screw-type fixture, preferably by means of an installer drill in a ratchet brace or electric drill with masonry bit. If there is a wood backing, the spring of a hammered drill will knock the stucco loose. Use care to avoid cracking the stucco. Locate screws in studding where practicable.

2.06 Plaster on Lath, Rock Lath, Plaster Board: Plastic anchors, hollow wall anchors or toggle bolts are used to make attachments. However, when a substantial fastener is required for heavier apparatus, it will be necessary to locate the studding as in paragraph 2.04 c. and use tapping screws. The holding power of hollow wall fasteners is such that any movement or shifting of weight tends to loosen them. This must be considered at all times so that costly maintenance and hazards are not built into plant. If wood lath is used under plaster and can be entered by a slanting lead hole, a secure attachment can usually be made. Locate the lath before drilling the attachment hole.

2.07 Rigid Composition Shingles:

a. In general, galvanized wood screws are required in making attachments through composition shingles.

b. On buildings finished with rigid composition shingles, make attachments to substantial wood trim where practicable. If suitable wood trim is not available, locate the clearance holes for fasteners on the shingles as follows:

(1) Rectangular shaped shingles installed with the long dimension horizontal: Locate the hole midway between the vertical edges of the shingle and approximately 3/4 inch above the bottom edge.

(2) Rectangular shaped shingles installed with the long dimension vertical: Locate the hole at the midpoint of the visible shingle height and approximately 3/4 inch from either vertical edge.

(3) Shingles installed in diamond formation: Locate the hole near a nail hole and approximately 3/4 inch from either exposed edge of the shingle.

c. When more than one screw is required to attach a drop wire fixture, observe the following in locating the clearance hole for the screw:

(1) House bracket: The distance between the edge of the shingle and the nearest hole should be approximately 3/4 inch.

TABLE A. Spacing Requirements of Attachments

FASTENERS		SPACING				
		HORIZONTAL		VERTICAL RUN		FROM CORNER
		FEET	INCHES	FEET	INCHES	INCHES
Cable Clamps	More than 12-pair cable		16	4		2
	Less than 12-pair cable		16		16	2
Cable Clasps	More than 12-pair cable		14	3		2
	Less than 12-pair cable		14		14	2
Adhesive Clips			12		12	2
Station Wire Clamps			16		16	2
Ground Wire Nail			16		16	2
Staples	Station Wire		7-1/2		7-1/2	1
	25-pair inside wiring cable		12		12	2
Adhesive Cable Tie		4				2 thru 8-1/2*
Bridle Rings		4		8		2 thru 8-1/2*
Drive Rings		4		8		2 thru 8-1/2*
Wire Loops		4		8		2 thru 8-1/2*
Toggle Bridle Rings		4		8		2 thru 8-1/2*
Beam Clamp		4		8		2 thru 8-1/2*
Utility Clip	Used on Beams	4		8		2 thru 8-1/2*
	Used on Hanger Wires	As Required				

When changing direction of wire or cable runs where wire loops, bridle rings, drive rings, toggle bridle rings, and beam clamps are used, the fasteners should be spaced to hold the wire or cable at approximately a 45-degree angle.

TABLE B. Clearances and Lead Holes for Fasteners and Screw-Type Fixture

FASTENER OR FIXTURE	CLEARANCE HOLE			LEAD HOLE		
	SIZE AND TYPE OF DRILL					
	INSTALLER	POINT	CARBON STEEL TWIST	INSTALLER	POINT	CARBON STEEL TWIST
	IN.					
Toggle Bolt	Clearance Hole					
1/4	5/3 or 3/4					
5/16	5/8 or 7/8					
Toggle Bolt Ring 3/4 and 1-1/4	3/4					
S and L Insulated Screw Eyes	3/16 by 5-1/2		No. 12 or 3/16		3/32	No. 42 or 3/32
Bridle Rings 1-1/4—1-5/8					1/8	
Drive Rings 5/8 and 7/8					3/32	No. 42 or 3/32*
1-1/4					11/64	
Angle Screw 5/16	5/16 by 7-1/2		5/16		11/64	No. 18 or 11/64
3/8	3/8 by 8		3/8	1/4 by 6-1/2		1/4
Tapping Screw + No. 7		11/64	No. 20		5/64	
No. 8		No. 13	11/64		3/32 or No. 333	
No. 10	3/16 by 5-1/2		No. 12 or 3/16		3/32	No. 42 or 3/32
No. 14	1/4 by 6-1/2		1/4		1/8	No. 30 or 1/8
Wire Loop Fasteners, Drive Anchors, Plastic Anchors, Hollow Wall Anchors	*The maximum holding power of these anchoring devices in any given quality of masonry depends upon obtaining a drilled hole corresponding to the outside diameter of the unexpanded anchor and of sufficient depth to allow the nail to be driven its full length. The diameter and length are generally indicated on the anchor. The depth of hole required varies with the thickness of the fixture to be installed at the point of support. In all installations the minimum depth of hole required is equivalent to the length of the anchor plus the distance the nail or screw will extend beyond the anchor (approximately 3/16 inch).*					

NOTES:

1. *Installer drills are bit stock twist drills and are used in the ratchet brace.*
2. *Carbon steel twist drills are straight shank drills and are used in the hand drill.*
3. *Drill points are used in the automatic drill and will drill lead holes approximately 1-1/2 inches deep. Where deeper holes are required, use twist drills in the hand drill.*
4. *Use masonry drills for drilling the seam between bricks.*
5. *Use masonry drills or star-faced stone drills in drilling holes for toggle bolts. Two sizes of holes are listed to cover the different types of approved toggle bolts. Drill the smaller hole if it will accommodate the toggle bolt.*
6. *Apply paraffin wax or soap to the threads of wood screws or screw-type fixtures to facilitate turning them into wood.*

* *Do not drill lead hole in poles.*

\+ *Tapping screws have an AB thread suitable for sheet metal or wood and are available with pan head.*

(2) Corner bracket: The bracket should be located so as to bear evenly on the shingles with the hole nearer the porcelain knob located approximately 3/4 inch from the edge of the shingle.

NOTE: Because of the brittleness of rigid composition shingles, and where mounting of attachments cannot be avoided, the following precautions shall be observed.

(1) Place ladder carefully against the shingles.

(2) Use only well-sharpened drills.

(3) Never use drills which require the use of a hammer on composition shingles.

(4) Do not apply excessive pressure to the brace when drilling clearance holes through the shingles.

(5) Wood screws should not be tightened excessively as the pressure on the shingle might cause it to break.

2.08 Metal and Vinyl (Siding, Paneling, or Desk):

a. Be sure protrusion of fasteners will not cause damage or injury. Fasteners for siding, paneling, or desks can be of the following variety: tapping screw, plastic anchor, toggle bolts, or hollow wall anchors. There is also a possibility of using an adhesive clip for a wire. See CTSP 475-310-412 for information on attaching to aluminum, steel and vinyl siding.

b. Aluminum and vinyl siding presents other problems. The customer should be contacted to determine the type of siding and method used to install it. This will determine type of fastener or attachment to be used. Permission should be obtained at this time for proposed wire runs, etc. See CTSP 475-310-412.

c. When using an extension ladder against metal, vinyl or aluminum siding, use care to prevent damage.

CAUTION: It is possible for foreign voltage to be present on buildings covered with metal siding. Test siding with B voltage tester before starting any work.

3. ATTACHING AND FASTENING GROUND WIRE

3.01 Fasteners (Figure 1): Space ground wire fasteners as follows:

NOTE: If possible, locate nail or tapping screws that are used for fasteners so they will enter studding.

a. Space 24 inches apart on ordinary ground wire runs.

b. Space 16 inches apart when wire is subject to displacement.

c. Place on every beam when spanning beams. (Avoid spanning beams unless there is no alternative.) Stay as close to wall as possible.

d. Place within 3 inches of wall when run parallel to wall on beams (to discourage articles being hung on wire).

NOTE: Staples are not recommended for use in plaster.

4. ATTACHMENTS USED IN FINISHED ROOMS AND OFFICES

NOTE: Refer to Table A for spacing requirements.

4.01 Staples: Table C shows the staples recommended for wood surfaces with finishes available.

TABLE C. Selection of Staples

STAPLES				
FINISH	SIZE (INCHES)		SHAPE OF CROWN	USE
	LENGTH	WIDTH		
*Zinc or Ivory	3/8	5/32	Rounded	With station wire and small gauge ground wire in all type wood
†Vinyl				
*Zinc or Ivory	3/8	3/16		
†Vinyl				
*Zinc Coated	5/8	1/2	Flat	Inside wire cables up to 1/2-inch in diameter

* *For indoor use.*

† *For outdoor use or where appearance is unimportant.*

NOTE: Staples are not recommended for use in plaster or on exterior surfaces in damp climates.

4.02 Ground Wire Nail: This nail is used to fasten ground wire to plaster or wood surfaces. It can be used with station wire if care is taken to ensure that the wire is sufficiently secured by the arm of the nail.

4.03 Station Wire Clamp: This clamp is used to support station wire. Table D lists fasteners to be used with clamps.

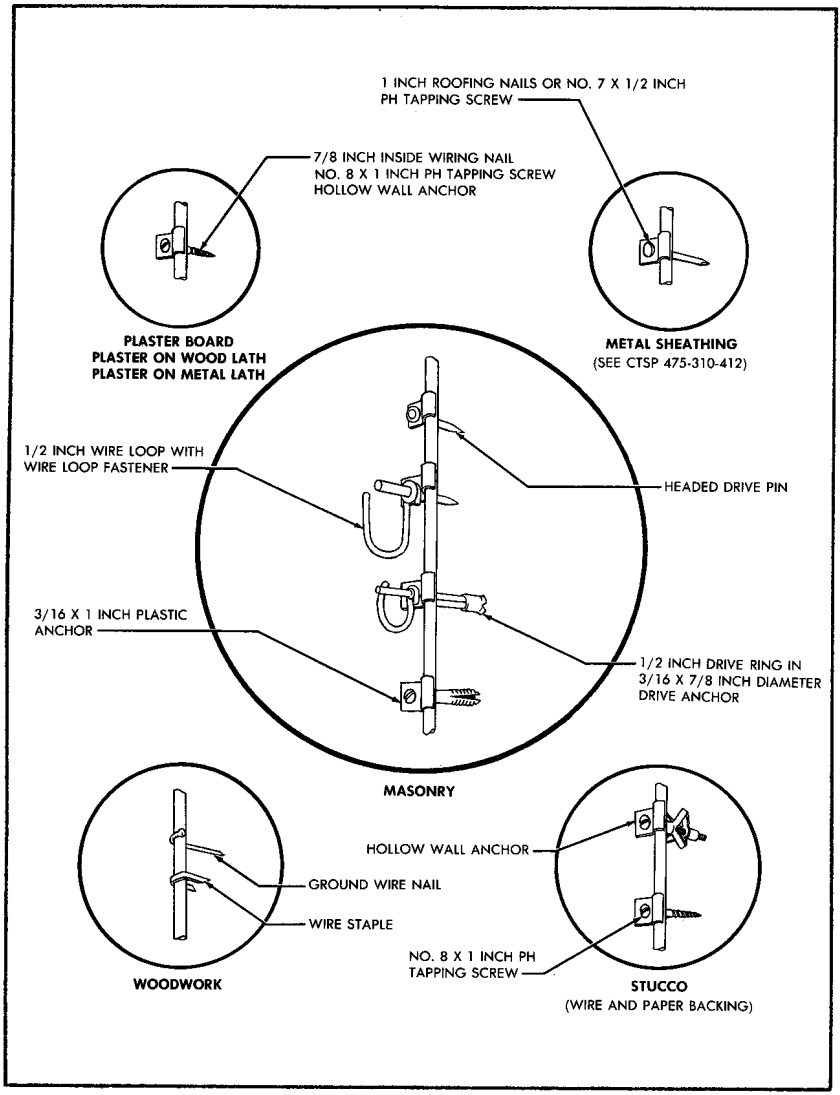


FIGURE 1. Fasteners for Ground Wire

TABLE D. Fasteners for Station Wire Clamp

SURFACE	FASTENER
Vinyl or Asbestos Siding See CTSP 475-310-412	No. 7 x 1/2 in. PH tapping screw
	No. 6 x 5/8-in. galvanized wood screw. Plastic Anchor, 3/16 x 1 in.
Wood, Indoors	No. 7 x 1/2 in. PH tapping screw
Wood, Outdoors	No. 6 x 5/8-in. RH galvanized wood screw
Stucco (Wire and Paper Backing)	No. 8 x 1-in. PH tapping screw or Hollow-Wall anchor (correct size)
Masonry	No. 2 Masonry Fastener

4.04 Cable Clamps and Cable Clasps: These attachments are used to support inside wiring cable or more than one station wire. Table E lists fasteners to be used with clamps and clasps.

4.05 Adhesive Cable Clips (Figure 2):

a. The adhesive cable clips are extruded vinyl, used as a fastening clamp for cable or wire on wooden and metal furniture. These clips have a pressure sensitive foamed, vinyl adhesive backing and are available in four sizes. See Table F.

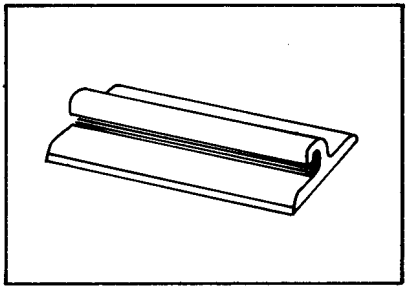


FIGURE 2. Adhesive Cable Clips

b. Use these clips to secure or store unsightly and hazardous slack in inside wire, cables, and telephone cords.

c. Space on 12-inch centers for horizontal and vertical runs. From corners they shall be placed on two-inch centers.

d. The adhesive clips can be mounted on most dry, clean, and smooth surfaces. To mount, pull off wax-covered paper from the back of the clip. Press the adhesive clip against the area chosen for mounting.

e. To remove the adhesive clip, pry up one corner until the edge can be grasped by the fingers and lift off clip. Do not scrape mounting surface with screwdriver or any other tool to remove remainder of adhesive. Remove surplus by saturating with hot water and peeling off by hand.

NOTE: Do not try to reuse adhesive clip.

5. ATTACHMENTS USED IN CELLARS, FACTORIES OR WHERE APPEARANCE IS UNIMPORTANT

NOTE: In general, the same types of attachments used in finished rooms apply for cellars, factories or where appearance is unimportant. However, they should be of an appropriate finish. In addition to these attachments, drive rings, wire loops, and toggle bridle rings are also available for use at these locations.

5.01 Drive Rings (Figure 1): Drive rings are formed steel loops having a pointed shaft suitable for hammer-driven attachment to wood or masonry surfaces. On wood surfaces, attach drive rings to beams or studding (to avoid injury below the 6-foot level use bridle rings). On masonry surfaces, use with drive anchors. Table G shows sizes of rings and anchors.

NOTE: For masonry surfaces, wire loops with wire loop fasteners are preferred.

5.02 Wire Loop (Figure 1): Wire loops are formed sections of wire used with wire loop fasteners as an intermediate support for station wires and inside wiring cables attached to masonry surfaces (to avoid injury below the 6-foot level use bridle rings). Table H shows sizes of wire loops.

NOTE: Wire loops with the wire loop fastener are preferred over drive rings in masonry surfaces because the fasteners are driven directly into the masonry surface without a predrilled hole.

TABLE E. Fasteners for Cable Clamps and Cable Clasps

SURFACE	CLAMP NO.	CLASP NO.	FASTENER	REMARKS
	COLOR			
	GALVANIZED OR BEIGE	BEIGE		
Woodwork	No. 3 and 5*	No. 17 CTS # 68-11-053-7	No. 7 x 1/2-in. PH tapping screw	
	No. 6, 8, 10	No. 17 CTS # 68-11-051-5 No. 14 CTS # 68-11-055-3	No. 7 x 1/2-in. PH tapping screw	
Plywood, Masonite	No. 3 and 5*	No. 17 CTS # 68-11-053-7	No. 7 x 1/2-in. PH tapping screw Hollow Wall Anchor 1/8 in. x 3 in. toggle bolt	Make tapping screw attachments at stud locations. Use No. 1 Hollow Wall Anchor on wall thickness 1/16 in. to 1/4 in. Use No. 2 Hollow Wall Anchor on wall thickness 1/4 in. to 3/8 in. Use No. 3 Hollow Wall Anchor on wall thickness 3/8 in. to 3/4 in.
	No. 6, 8, 10	No. 19 CTS # 68-11-051-5 No. 14 CTS # 68-11-055-3	No. 7 x 1/2-in. PH tapping screw 3/16 in. x 1 in. Plastic Anchor Hollow Wall Anchor 1/8 in. x 3 in. toggle bolt	
Plasterboard, Plaster on Wood Lath, and Plaster on Metal Lath	No. 3 and 5*	No. 17 CTS # 68-11-053-7	No. 7 x 1/2-in. PH tapping screw Hollow Wall Anchor	Make tapping screw attachments at stud locations. Use No. 1 Hollow Wall Anchor on wall thickness 1/16 in. to 1/4 in. Use No. 2 Hollow Wall Anchor on wall thickness 1/16 in. to 3/8 in. Use No. 3 Hollow Wall Anchor on wall thickness 3/8 in. to 3/4 in.
	No. 6, 8, 10	No. 19 CTS # 68-11-051-5 No. 14 CTS # 68-11-055-3	No. 8 x 1-in. PH tapping screw 3/16 x 1 in. Plastic Anchor Hollow-Wall Anchor	

* *Inside wiring clamp only.*

TABLE F. Adhesive Cable Clips

CTS NO.	LENGTH (INCHES)	WIDTH (INCHES)	INTERIOR DIAMETER (NOMINAL)	ACCOMMODATES WIRE OR CABLE DIAMETER FROM
68-11-001-4	1-1/4	3/4	3/16	11/64 to 15/64
68-11-002-2	1-1/2	3/4	1/4	15/64 to 5/16
68-11-003-1	1-3/4	1	5/16	19/64 to 13/32
68-11-004-9	2	1	3/8	25/64 to 1/2

TABLE G. Drive Rings

DIMENSIONS IN INCHES				ANCHOR SIZE (IN.)	
SIZE	D	W	L	DIA.	L
1/2	1/2	1/2	2-1/16	3/16	7/8
5/8	5/8	3/4	2-1/4	1/4	1
5/8L	5/8	3/4	2-3/4		
7/8	7/8	1-1/2	2-9/16	1/4	1
7/8L	7/8	1-1/2	3-1/16		
1-1/4	1-1/4	2-3/8	2-15/16	5/16	1-1/4
1-1/4L	1-1/4	2-3/8	3-7/16		

L sizes have extra long shafts and cannot be used with Drive Anchors.

5.03 Toggle Bridle Ring (Figure 3): This attachment, available in two sizes, 3/4 inch and 1-1/4 inch, is used to attach station wire and cable to hollow surfaces. A predrilled 3/4-inch clearance hole is required.

NOTE: For best results and a secure installation, clearance holes should be restricted to 3/4-inch diameter.

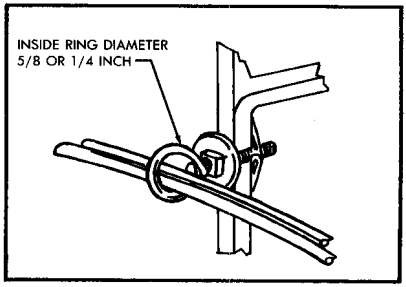


FIGURE 3. Toggle Bridle Ring

TABLE H. Wire Loop

WIRE LOOP SIZE NO.	WIDTH OF OPENING	LENGTH OF LOOP (INSIDE)	MASONRY FASTENER FOR		
			CONCRETE	MORTAR	BLOCK*
1/2	1/4-in.	3/4-in.	3	4	5
5/8	1/2-in.	1-1/8-in.			
7/8	5/8-in.	2-1/16-in.			
1-1/4	5/8-in.	2-3/4-in.			

** Cement or cinder blocks.*

6. ATTACHING TO STEEL STRUCTURES

6.01 Beam Clamp (Figure 4): The beam clamp, equipped with an A, K, or M bridle ring, is used to support wire runs on I beams, angle irons, etc., on beam thickness up to 3/4 inch.

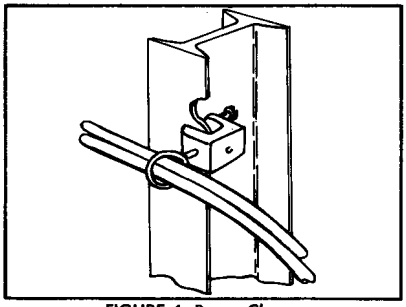


FIGURE 4. Beam Clamp

6.02 Utility Clip (Figures 5 and 6):

a. The utility clip provides a means of attaching drive rings or bridle rings to hanger wires and rods used in false-ceiling construction. It can also be used to grip the flanges of structural steel framework. See CTSP 405-705-402 for description and installation information.

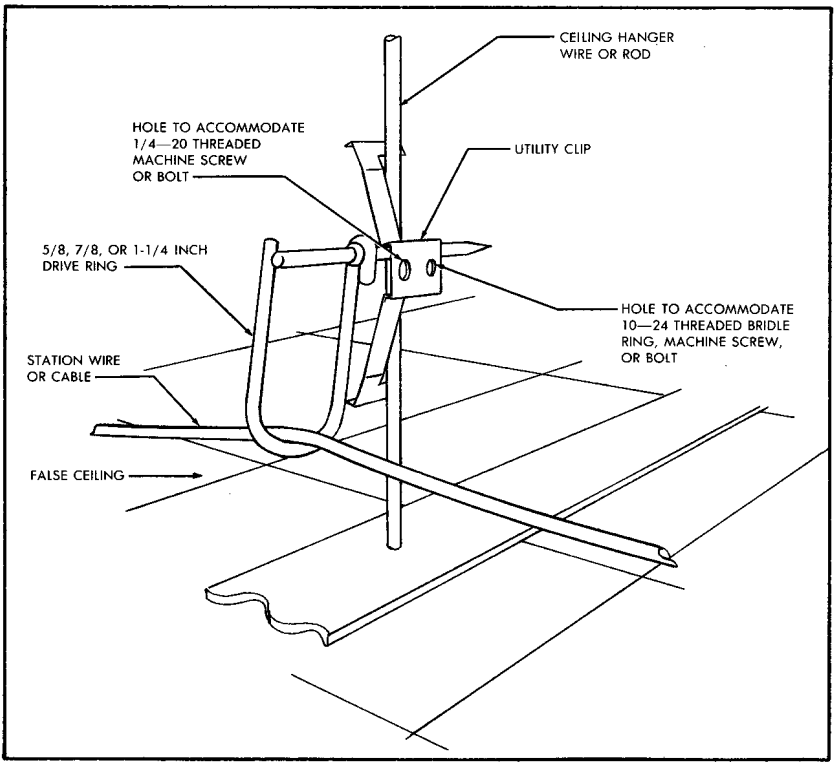


FIGURE 5. Utility Clip On Rod

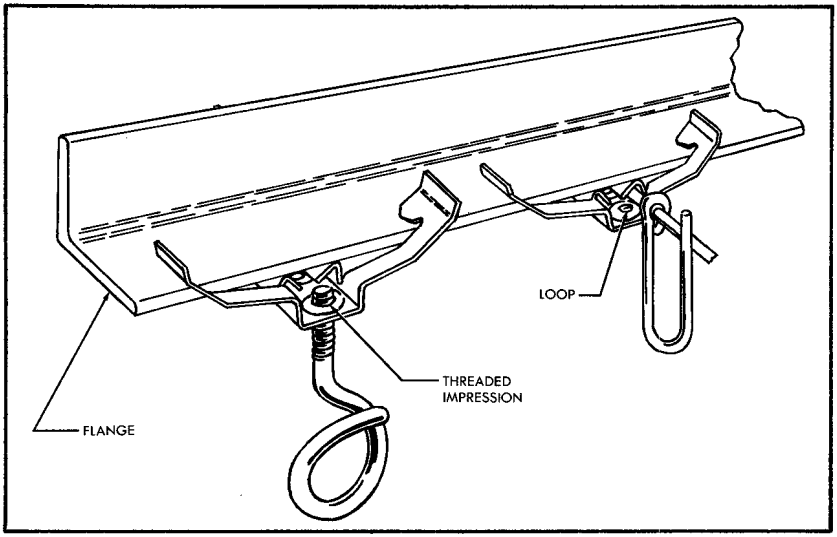


FIGURE 6. Utility Clip On Angle Iron

b. This notched spring-steel clip has two loops, each providing a fit for the drive rings. In addition, two holes are provided in the face of the clip which will accommodate either a No. 10-24 threaded bridle ring, machine screw, or bolt or a 1/4-20 threaded machine screw or bolt. The clip is intended for inside use only.

6.03 This clip may be attached to flanges from 1/8 inch to 3/8 inch, to wire from 12 through 8 gauges and to suspension rods 3/16-inch through 3/8-inch in diameter.

7. ADHESIVE CABLE TIE (FIGURE 7)

7.01 The adhesive cable tie is intended for use on various smooth flat surfaces in customer telephone installations to group wires, cords, and inside wiring cables in an orderly harness.

7.02 The tie consists of a C cable tie and a molded plastic base. It can be mounted using the self-adhesive backing, or knockouts are provided if more secure mounting is required.

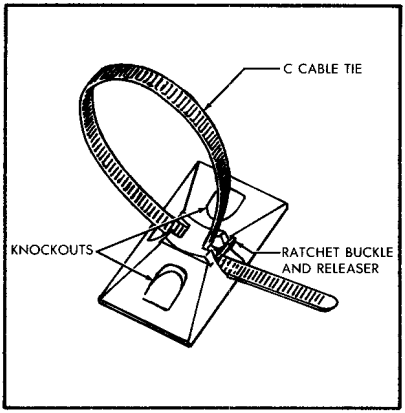


FIGURE 7. Adhesive Cable Tie

DROP AND BLOCK WIRING
TESTING AND FAULT LOCATING

1. GENERAL

1.01 In locating trouble in the drop and block wire plant, time and effort can be saved by analysis and systematic procedure by the workmen. Certain types of trouble are apparent and can be detected by a visual inspection; other types show very little external evidence of their existence and require electrical tests to locate them.

1.02 Knowledge of plant conditions throughout the territory involved greatly assists a workman in locating trouble.

1.03 Knowing the location of foreign construction operations which might interfere with the telephone plant will assist in many instances in locating the cause of trouble. Consultation with the people in charge of the construction, before they have progressed to a point where the telephone plant is endangered, will frequently prevent interference with the telephone service. When it is noted that the telephone plant will interfere with the progress of building operations or other construction work, the condition should be reported or corrected in accordance with local procedures.

1.04 In order that the workman may proceed efficiently to locate the cause of trouble, he should have the following information:

a. Telephone number.

b. Name and address of customer, given in sufficient detail.

c. Cable numbers, pair numbers, and terminals. Where terminals are not stenciled or otherwise marked, use binding post identification.

d. Number of pole on which drop or drops terminate (on other than cable lines), if available.

e. Nature of trouble as diagnosed by test or from report.

f. Whether or not station is out of service.

g. Other items of special information as:

(1) Any indications (such as the operation of protective equipment) that there may be foreign current on the line.

(2) Special effort is necessary to restore service quickly such as to hospitals, doctors' offices, etc.

(3) Trouble is such that the entire line from the terminal to the station should be inspected.

1.05 After securing the necessary information, the workman should proceed as follows:

a. If the line is not out of service, the workman should inform the customer that the line is being repaired. When party lines are involved, the work forces must monitor all working lines before opening, short circuiting, crossing, grounding, placing trouble clearing equipment or applying tone for identification.

b. When the line is out of service, the workman should began by visiting the points where trouble conditions are known to exist. If the fault is not found at these points and subsequent tests reveal that the trouble is in drop or block wire, the investigation should be continued in accordance with the methods given in paragraphs 3, 4, 5, and 6.

c. After the troubles have been cleared, the customer should be informed by the work forces that the work has been completed and that the line is back to normal.

d. Each workman should be familiar with CTSP 400-300-019, Monitoring of Working Lines.

1.06 Hand test sets can ordinarily be used on common battery circuits to make the necessary electrical tests on the line to locate faults. These sets should be used so that a trouble may be located quickly without making unnecessary tests. Proper use of the test set enables the repairman to locate many troubles without the aid of the test deskman or the operator. Tests sets used should be provided with leads ending with approved type clips equipped with test points so that contacts may be made with conductors by piercing the insulation with these points. No other method of establishing contacts with conductors through the wire insulation should be used. When making tests which depend on a click being heard in the receiver of the test set, be sure that the click is heard both upon the make and the break of the contact.

1.07 When it is necessary in locating a fault in drop or block wire to open the line at various points for the testing purposes, first select points where disconnections can readily be made such as binding posts, bridging connectors, etc. In general, no wires should be cut until tests have isolated the fault between two adjacent points. After an inspection has been made and further tests are required to locate the fault, one conductor of the wire may be cut to make the test.

1.08 Before leaving a worked on or repaired line, suitable tests should be made in accordance with local procedures to determine that the line is in good working condition.

1.09 Whenever there is any indication (such as the operation of protective equipment) of the presence of foreign current on a line, suitable precautions should be taken to prevent the possibility of electric shock.

1.10 The detailed procedures to be employed to locate the various types of faults in the drop and block wire plant are outlined in the following paragraphs.

2. GROUNDS

2.01 Two types of grounds are commonly encountered in the drop and block wire plant:

a. *Low resistance grounds*—This type of ground is usually the result of a complete breakdown of the insulation on a conductor due to deterioration or abrasion and contact with grounded objects such as guys, suspension strand, ground wires, rain spouts, conduit, etc., establishing a low resistance path to ground.

b. *High resistance grounds*—This type of ground may be caused by complete or partial breakdown of the insulation on a conductor and the establishment of a poor contact with grounded objects so that the path to ground is of high resistance, except in wet weather. It may also be caused by complete breakdown of the insulation on a conductor and contact with objects such as wood poles, trees, buildings, etc., that do not afford a low resistance path to ground. Troubles of the latter class are frequently of varying intensity, appearing usually during wet weather, and usually must be located either under wet weather conditions or by a visual inspection for the point where the insulation is faulty.

3. COMMON BATTERY CIRCUITS – LOCATING GROUNDS IN THE DROP AND BLOCK WIRE PLANT

3.01 *Low resistance grounds*–Information as to which side of the line is grounded is important. This is especially true if the cause of the fault is not found by visual inspection and tests must be made to more accurately determine its location. This information, if it is available, should be obtained when the trouble is referred for clearing. If it is not available, the side that is grounded should be determined during the tests that are necessary to isolate trouble to a drop or block wire.

3.02 The drop or block wire in which the fault is located should be found by the following test:

a. Disconnect all drop, block, or bridle wires bridged to the grounded line from the binding posts in the cable terminal, placing the wires so that they may be reconnected in their original position upon test completion. (If it is known which side of the line is grounded, it is necessary to disconnect only the wires on the grounded side of the line.)

b. Connect one clip of the test set to a suitable ground such as the metal terminal case or suspension strand and touch the other clip to the binding post on which battery normally should be found. See Figure 1. If no battery click is heard in the receiver, touch the other binding post. (If battery click is still not heard, there is other trouble on the line which must be corrected before proceeding with trouble location in the drop or block wire.)

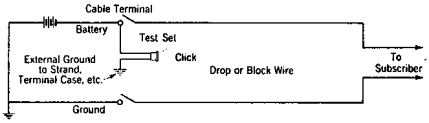


FIGURE 1. Test to Determine Battery Side of Line

3.03 When a battery click is heard, connect the clip to the binding post carrying battery and remove the other clip from the external ground. Touch this clip to the conductors of the drop wire. A battery click will be heard in the receiver when the grounded wire is touched. See Figures 2 and 3.

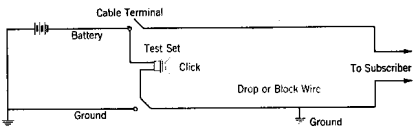


FIGURE 2. Ground Side Grounded

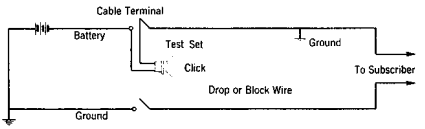


FIGURE 3. Battery Side Grounded

Note whether or not the insulation on the grounded wire carries a tracer. This knowledge will be helpful if subsequent tests at other points are necessary (unless an intervening splice has been made in a nonstandard manner and the tracer reversed). Before reconnecting the wires disconnected to make this test, be sure to test every wire separately to determine whether or not it is clear.

3.04 After the fault has been isolated to a particular drop or block wire, a careful inspection for the conditions causing the ground should be made before testing at other points to further isolate the fault. This is desirable as low resistance grounds in the drop and block wire plant are usually caused by conditions that are readily discovered by visual inspection.

3.05 If a visual inspection of the wire that is grounded does not disclose the fault, further tests are necessary to definitely locate the source of the trouble. In making these tests, if the ground is on the battery side of the line:

a. Open that side of the line.

b. Then attach one clip of the test set to the binding post or wire end on the central office side of the open.

c. Touch the end of the wire that leads away from the central office with the other clip. See Figure 4.

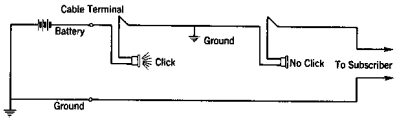


FIGURE 4. Battery Side Grounded

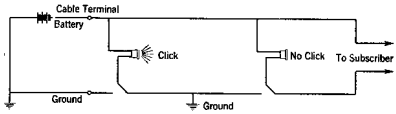


FIGURE 5. Ground Side Grounded

However, if the external ground is on the ground side of the line:

a. Open that side.

b. Establish a contact with the battery side of the line by attaching a clip of the test set to a binding post or (if the test is at a point in the wire) by piercing the insulation of the conductor carrying battery with the point of the test set clip.

c. Touch the exposed end of the wire that leads away from the central office with the other clip. See Figure 5.

The test, if on an individual line will indicate by a click in the receiver that the ground is located toward the station or by absence of a click that it is located in the direction of the central office. On a party line, the click indicates that the ground is located in the portion of the wire that is directly affected by the test and absence of the click indicates that the ground is either toward the central office or in a portion of the wire which is not affected by the test at that particular point.

3.06 In locating grounds on party line, it is desirable to start at a point where the circuits to all parties are common and are carried on a single pair of conductors. Then test the wires to each individual party until the wire that is in trouble is found.

3.07 *High resistance grounds*–Trouble of this type is frequently of varying intensity and in some instances appears only under severe moisture conditions. Often the trouble is caused by the cumulative effects of lowered insulation at several entirely different points in the drop or block wire plant; this condition is frequently found on party lines. If the resistance of the contact to ground is high, it is difficult to obtain a positive indication by testing with the hand test set under low resistance grounds. In this case, it is advisable to first determine

that the fault is not located toward the central office by disconnecting the drop or block wire at the cable terminals and having the circuit tested from the central office (when testing facilities are available). On a party line if this disconnection reduces the leak to ground but does not entirely clear the line, leave the wires disconnected until similar tests have been made where other wires are bridged to the line so that all the conditions contributing to the leak may be isolated and cleared. On party lines where the disconnection has either cleared the fault or has had no effect on the leak to ground or on individual lines, reconnect the wires immediately after the test has been concluded and the result reported. After the wire or wires which cause or contribute to the leak are determined, the fault usually may be found by making careful visual inspection. If the points of faulty insulation are not found, it is necessary to further isolate them by opening the faulty conductor at various points and having the circuit tested from the central office when testing facilities are available.

NOTE: Where leaks to ground exist at several points due to faulty insulation on different sides of the line, the trouble may be referred to the workman as a short and a ground. This possibility should be understood when starting to clear such a trouble.

4. OPENS

4.01 Opens in the drop and block wire plant are of three classes:

a. Opens—A complete open in a line is usually due to a break in one or both conductors of a drop or block wire, to a wire disconnected from a binding post or bridging connector, or to an improper or split pair connection at a cable terminal.

b. Intermittent Opens—The common causes of an open of this type are loose connections at binding posts or bridging connectors, improperly made splices, corroded wires, kinks, etc.

c. High Resistance Connections—High resistance connections are ordinarily caused by improper cleaning of wires before attaching them to binding posts or bridging connectors; also by the formation of corrosion on wires, binding posts, nuts, and washers.

Opens of the first class are easily recognized and are usually referred to the workman. High resistance connections causing only poor transmission and noise and not causing cutouts are often not identified as opens and therefore are not referred to the workman.

4.02 *Common Battery Circuits—Locating Opens in the Drop and Block Wire Plant*—To locate an open in the drop or block wire plant, isolate the fault by making successive tests at different points in the line with the hand test set. See Figure 6.

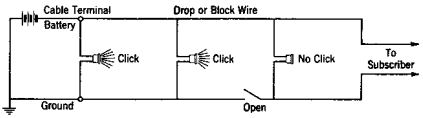


FIGURE 6. Test for Locating an Open

To make the test, bridge the test set across the line. If a battery click is heard in the receiver on the make and on the break of the contact, the open is away from the central office. If these clicks are not heard, it is situated toward the central office. When clicks are

heard on one test and the test at the next point in the line no clicks are heard, the fault is located between the points at which these two tests were made. After the fault has been isolated to one span or section, the wire in this span or section should be carefully examined, if necessary lowering the wire to do so. If the fault cannot be found, it should be eliminated by replacing the wire in that span or section. When locating an open, the test set should be bridged across the line on the *far* side of any wire support on every test. If the trouble is at a wire support, and if procedures in this practice are followed, the direction of the fault is shown. Verification of the fault at the support consists of repeating the test on the near side of the support. During the tests, wires should be shaken as described in paragraph 4.03.

4.03 *Intermittent opens*—Intermittent opens in the drop and block wire are frequently difficult to locate and generally require a close inspection. If it is not detected by the inspection, resort to tests to locate the fault. When making a test on the line, the wires toward the central office should be moved at knobs or other supporting fixtures; the wire in the span or section toward the central office should be shaken. A succession of battery clicks or a fluttering noise in the receiver indicates that the open is near to the point of movement, and it ordinarily can then be found by a careful inspection. Check all connections at binding posts, bridging connectors, etc., to be sure that they are tight.

4.04 *High Resistance Connections*—High resistance connections are generally indicated by noise and occasionally by cutouts. Connections may appear tight and in good condition on visual inspection and yet the contact afforded may be so poor that noise is introduced into the circuit. The cause of this type of trouble ordinarily can be located by bridging the test set across the line near the various connections on the side away from the source of battery and listening for noise. Moving the wires at connections or tightening screws or locknuts may clear the trouble; but, to prevent its recurrence, all wires found to be faulty should be removed at the connecting point, and thoroughly cleaned before replacing. Where the trouble is not definitely found at any connection, the wires should be removed, cleaned, and replaced at all binding posts or bridging connectors, etc. When the trouble is at the binding posts of a cable terminal and the nuts and washers are dirty and corroded, the spinning should be removed from the top of the binding post with the binding post cutter and the nuts and washers should be replaced with new ones before re-establishing the connection.

5. SHORT CIRCUITS

5.01 Short circuits in drop and block wiring are of two general classes:

a. Low Resistance Short Circuits—These are due to a complete breakdown of the insulation between the two wires and the establishment of a low resistance path from one wire to the other. Frequent causes are injury to or deterioration of insulation at supporting fixtures; abrasion at knobs, rings and at contacts with poles, trees, buildings, etc.; and injury due to interference by foreign workmen, building operations, etc.

b. High Resistance Short Circuits—These are due to the establishment of a high resistance path between the two wires, caused by either a partial breakdown of the insulation or a complete breakdown of the insulation which has resulated in only a poor or high resistance contact between the wires. The usual causes for this type of short circuit are similar to those given for the first type, differing only in that the deterioration of or injury to the insulation is less severe.

5.02 *Common Battery Circuits—Locating Short Circuits in the Drop and Block Wire Plant*—In locating a low resistance short circuit in the drop or block wire plant, first isolate the fault to a particular portion of the wire. To do this, disconnect one side of the line at various

convenient points (such as at binding posts, bridging connectors, or protectors) and connect the test set in the line. See Figure 7.

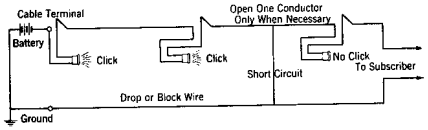


FIGURE 7. Tests to Locate Short Circuits

If a battery click is heard on the make and on the break of the connection, the short circuit is located away from the central office. If no click is heard, it is in the portion of the circuit toward the central office. When the clicks are heard at the point one test is made and are not heard at the point the next test is made, the fault is located between these two points.

5.03 After the fault has been isolated on a particular portion of the wire, make an inspection of this section, noting especially the condition of each wire support. Location of the fault is facilitated if, while making this inspection, the test set is bridged across the line near each wire support and the wire is moved at the support and in adjacent spans. If this disturbance of the wire causes the short circuit to shake out even momentarily, this will be indicated by a fluttering noise or a series of clicks in the receiver. Then, by making a careful inspection of the wire near the point it was moved, the fault can usually be found.

5.04 If the short circuit cannot be located by the inspection, it becomes necessary to further isolate it to a particular span or section by repeating at various points the test outlined in paragraph 4.02, cutting one conductor of the wire when necessary to permit testing. After the fault has been isolated to a particular section or span, make a careful inspection of the wire in that section or span, if possible with the wire lowered. If the fault is not found, cut out and replace the wire.

5.05 *High Resistance Short Circuits*–High resistance short circuits often cannot be located by the tests described for low resistance short circuits. In this event it becomes necessary to obtain assistance by having the condition of the circuit observed at the testing equipment in the central office while one side of the line is opened at various points. When a disconnection at one point causes the fault to disappear and a disconnection at an adjacent point does not, the fault is located between the two points at which these tests were made. After the fault has been isolated in this manner to a particular section or span, make a careful inspection of the wire in that section or span (if possible with the wire lowered) and then if the fault is not found, cut out and replace the wire.

6. CROSSES

6.01 Crosses in the drop and block wire plant result from the establishment of an electrical contact between one conductor of a drop or block wire and one conductor or binding post of another line. Troubles of this nature are less common than grounds, opens, or short circuits and are to a large extent limited to localities where two or more working block or drop wires are in close proximity. Common causes of crosses in drop and block wiring are:

a. Breakdown of the insulation on wires in ring runs on poles or buildings due to deterioration, abrasion on rings, or injury from external sources.

b. Breakdown of insulation on wires in close proximity in building or pole runs due to deterioration, abrasion, or other injury.

c. Improper dressing and connecting of wires at cable terminals so that wires or ends of wires touch adjacent binding posts of other lines.

6.02 When the trouble to be located is a cross, the work is greatly facilitated if certain information is obtained:

a. The line number of each of the lines that are crossed together.

b. The cable number and pair number at crossed lines.

c. Cable terminal locations–all terminals where drops terminate on either of the crossed lines.

d. Number of each pole on which drops of either line terminate (on other than cable lines), if available.

6.03 *Common Battery Circuits–Locating Crosses in the Drop and Block Wire Plant*–In isolating a cross to a portion of the plant such as to the drop or block wire plant or to a portion of a drop or block wire, make the following test: See Figure 8.

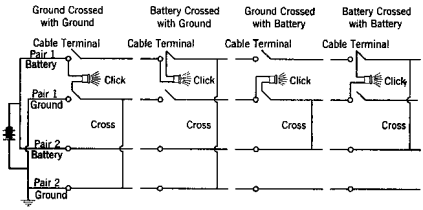


FIGURE 8. Tests to Locate Crosses

a. Disconnect all wires of one crossed line from the binding posts or bridging connectors, using care to place the wires so that they may be properly reconnected in their original position after testing.

b. Attach one clip of the test set to one of the pair of binding posts or bridging connectors from which the wires were disconnected. With the other clip, touch in turn each of the wires just disconnected.

c. If no battery click is heard on the make and break of any of the contacts, transfer the clip on the binding post or bridging connector of the same pair and repeat the test.

If clicks are heard, the wire causing the clicks when touched is crossed with another line. The cross is in the portion of the wire that is affected by the tests at this point. If no clicks are heard on either test, the cross is not located in the portion of the circuit which is affected by the tests at this point. On party lines, this test should be made at every point at which a drop or block wire is bridged to the circuit until the fault is isolated to the line

of a particular party. After it has been determined that the fault is located on the station side of a cable terminal, there is still the possibility that the inside wiring of the station is crossed with another line. Therefore, to determine that the cross is located in the drop or block wire, the above test should be repeated at the protector or connecting block at the customer's premises.

6.04 After the fault has been isolated in a drop or block wire, it usually can be found by carefully inspecting the entire length of the wire. If it cannot be found by inspection, it must be further isolated by repeating tests at suitable points, if necessary cutting a conductor to permit testing. If it is necessary to cut a conductor, repairs should be made after testing is complete.

7. HIGH RESISTANCE CROSSES

7.01 When the cross is of high resistance and the test set cannot successfully be used to locate the fault, request that the condition of the line be observed at the testing equipment in the central office while disconnections are made at various points in the circuit. The fault can be isolated in this manner to a particular portion of the drop or block wire and can then be discovered by visual inspection. In areas where testing equipment suitable for this test is not available at the central office, the operator may be called and requested to talk or ring on one of the crossed lines while the test set is bridged to a suitable disconnected portion of the other circuit. If the ring or the operator's voice is heard in the test set, the cross is in the portion of the circuits under observation and when by suitable repetition of this test the fault is isolated to a sufficiently small section of the drop or block wire, it can be found by visual inspection.

DROP WIRING

PLACING DROP WIRE POLE-TO-POLE AND POLE-TO-BUILDING SPANS

CONTENTS

1. GENERAL

1.01 This practice provides the methods for making pole-to-pole and pole-to-building runs of drop wire. Information on the placement of drive hooks and pole attachments is also provided.

1.02 This practice replaces in its entirety CTSP 475-300-409, all copies of which should be removed from the file and destroyed.

1.03 If brackets and knobs have been previously installed and are only partly filled, distribute from the vacant grooves of the knobs if the existing installation does not present a hazard or potential impairment to service.

1.04 In running drop wires, requirements must be observed which apply to clearance between telephone wires and foreign wires, foreign equipment, vertical clearances, quantity of distribution attachments, and climbing space on jointly used poles.

1.05 Drop wire should be twisted one complete turn for each ten feet of span length at the time of installation to reduce vibration and dancing.

1.06 For correct stringing sags and span limits, see CTSP 475-300-403. For measuring clearances and separations in outside plant, see CTSP 490-060-001.

1.07 Drop wire should not exceed 500 feet in total length from terminal to protector.

2. RUNS FROM TERMINAL POLES NOT REQUIRING GUARD ARMS

2.01 On terminals which do not require guard arms, distribute drop wires from hooks placed on the pole. On pole-to-building spans, use drive hooks located above the suspension strand. On spans from pole-to-pole and from pole-to-span clamps, use the drive hook located below the cable. Pass the drop wire through the drive hook only where sharp bends will not occur in the wire.

2.02 The wiring arrangements for strand mounted and pole mounted terminals are shown in Figures 1, 2, and 3.

2.03 Wiring on the pole shall be run with enough slack to prevent sharp bends at fixtures. Where drop wire passes through a drive hook, provide slack in the form of a smooth curve. For terminals requiring guard arms, refer to CTSP 475-300-406.

2.04 Attach the drop wire clamp to the drive hook by passing the bail of the clamp over the hook. The clamp shall pull against the shank of the drive hook where the direction of the drop wire span is such that the clamp will not pull around the end of the hook. Otherwise, place the clamp to pull against the hook end.

2.05 Where careful inspection determines that existing brackets and knobs are serviceable, drop wire may be distributed from vacant grooves, not exceeding the normal limit for which the knob was designed.

3. DROP WIRE RUNS ALONG THE LEAD

3.01 Use drive hooks to attach the drop wire runs to poles along the lead. Existing pole brackets may be used if they are serviceable and located as specified for drive hooks.

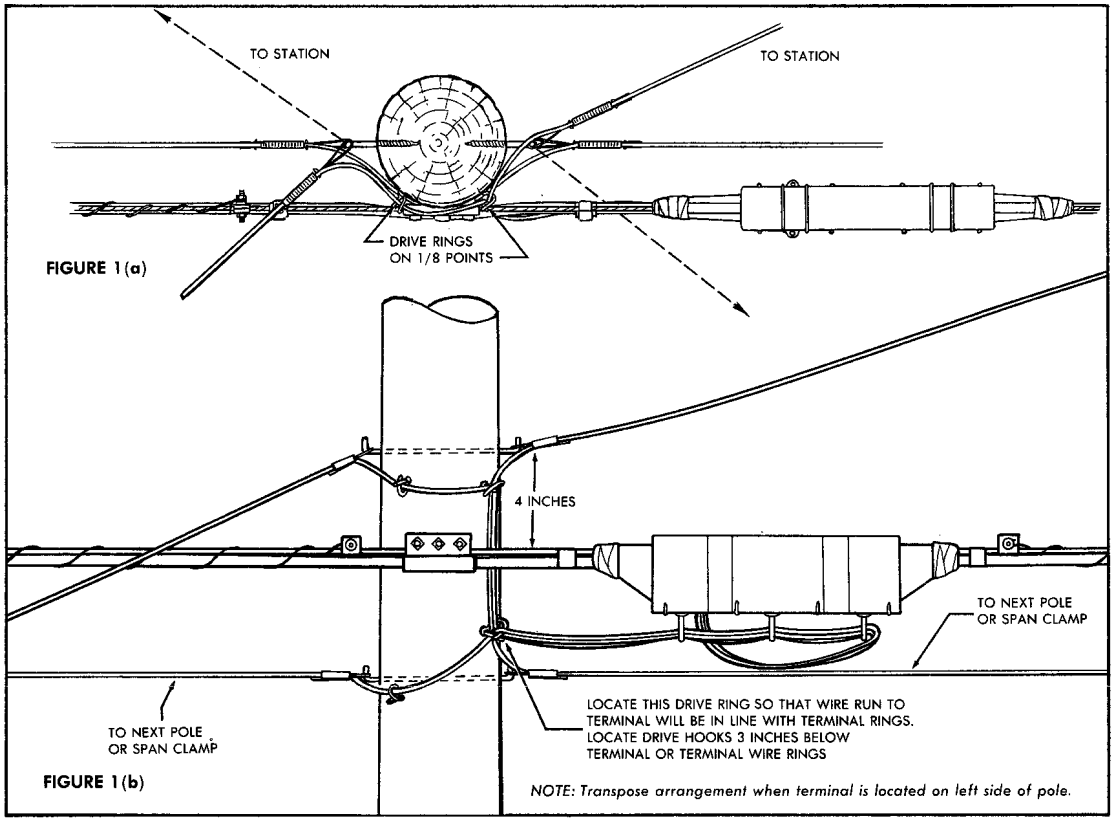


FIGURE 1. Strand Mounted Terminal

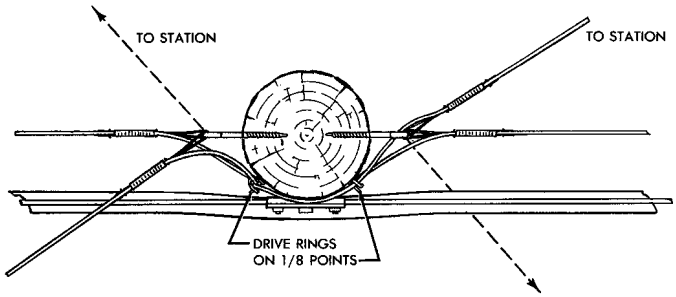


FIGURE 2(a)

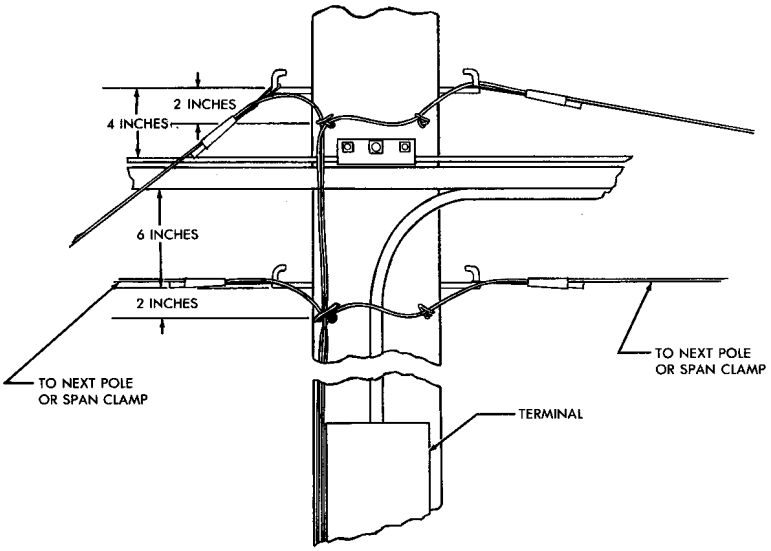


FIGURE 2(b)

FIGURE 2. Terminal Mounted on Cable Side of Pole

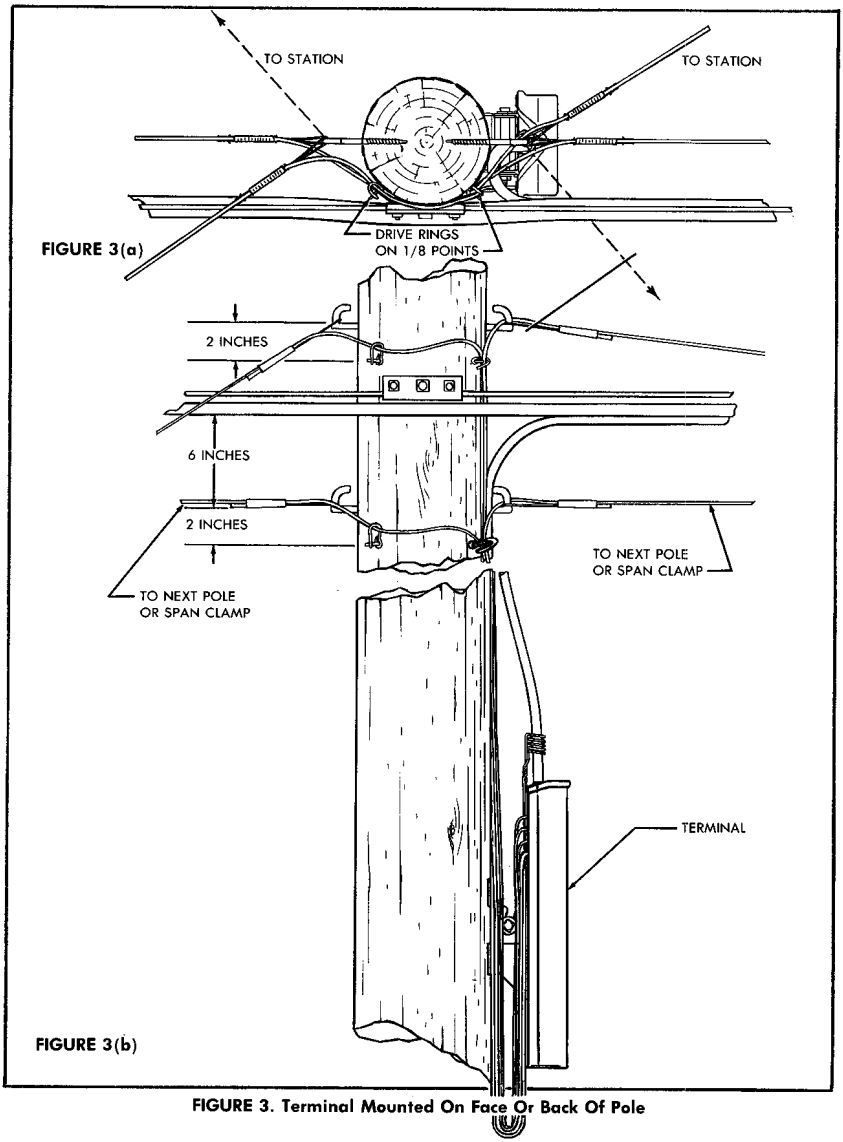


FIGURE 3. Terminal Mounted On Face Or Back Of Pole

3.02 Notify your supervisor before adding the drop wire run:

a. If an unusual amount of trouble has developed in a group of drop wires in the same run.

b. If an excess of five drops has been placed along a lead not carrying cable.

c. If when placing the first or any additional drop wire along the lead, it appears that more drops will be needed in the near future.

d. Where it is necessary to parallel cable with a total of four or more drop wire sections. (The total may consist of four or more drop wires in one pole-to-pole section, one drop wire run for four or more pole-to-pole sections, etc.)

3.03 Do not run drop wires along the lead on poles of an established open wire line run on crossarms without authorization of your supervisor.

4. DROP WIRE RUNS ALONG LEAD CARRYING CABLE

4.01 Run aerial cable drop wire below the cable as shown in Figure 4. To serve a station from wire that is strung along a lead, make a vertical run to a drive hook that is placed above the strand on the serving pole with proper clearance from power.

4.02 One or more intermediate strand pickups shall be used where required ground clearance in the span cannot be obtained with wire strung at minimum sag. See CTSP 475-300-403.

4.03 Where intermediate strand pickup fails to provide the required ground clearance, the drop wire may be placed above the suspension strand. Drive hooks are to be placed at such a height that the drop wire does not whip against the cable or strand, and that the appropriate joint use clearances are obtained.

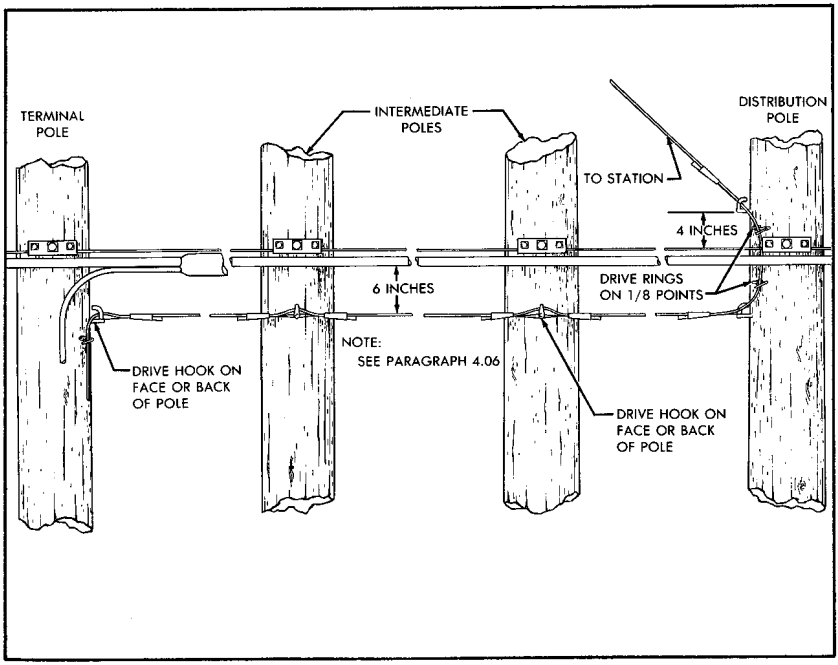


FIGURE 4. Drop Wire Run Along Lead Carrying Cable

4.04 On straight line poles or inside corner poles where the pull of the wire is away from the pole, use a single drive hook to support the drop wire. On outside corner poles where the angle will cause the drop wire to rub against the pole, use two drive hooks to support the wire.

4.05 Distribute drop wires from drive hooks at poles other than terminal poles, as shown in Figures 4 and 5.

4.06 Aerial drop wire must be 6 inches below cable or terminal. If the size of the terminal interferes, the wire shall be 3 inches below the terminal or terminal rings.

5. DROP WIRE RUNS ALONG LEAD NOT CARRYING CABLE

5.01 The procedures for placing drop wire along a lead not carrying cable and on one carrying cable are basically the same. If clearances permit, drop wire shall be placed at a height where it will not interfere with future placing of cable.

6. PARTY LINE TAP ALONG THE LEAD

6.01 A party line tap along a pole-to-pole drop wire run is to be made where several spans of drop wire would otherwise be used. Make the party line taps as illustrated in Figure 7.

7. DRIVE HOOKS

7.01 Place drive hooks on the face or back of poles, above or below the cable; maintain required clearances from the ground, foreign wires and trees. On intermediate poles, drive hooks may be placed in the sides of the poles. See Figures 4 and 6. Drive hooks shall occupy a pole area not more than 8 inches in vertical extent, nor more than 1 inch in width. No more than four hooks are to be placed in each of these areas. Refer to paragraphs 4.01 to 4.06 for the placing of initial drive hooks.

7.02 When placing more than one drive hook on the same side of the pole, stagger the hooks as shown in Figure 8: Where possible, obtain greater than the minimum vertical separation between hooks.

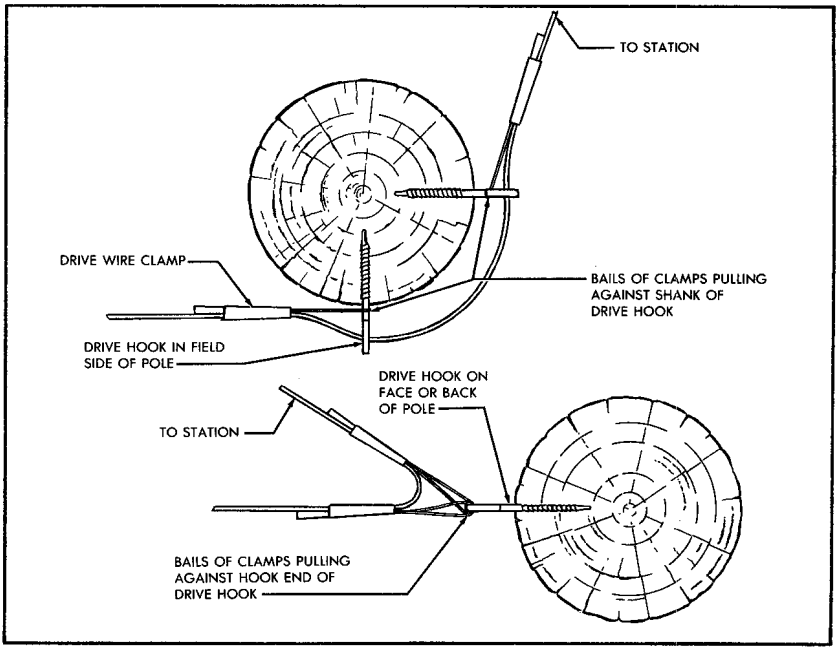


FIGURE 5. Drive Hook Distribution From Poles Without Cables

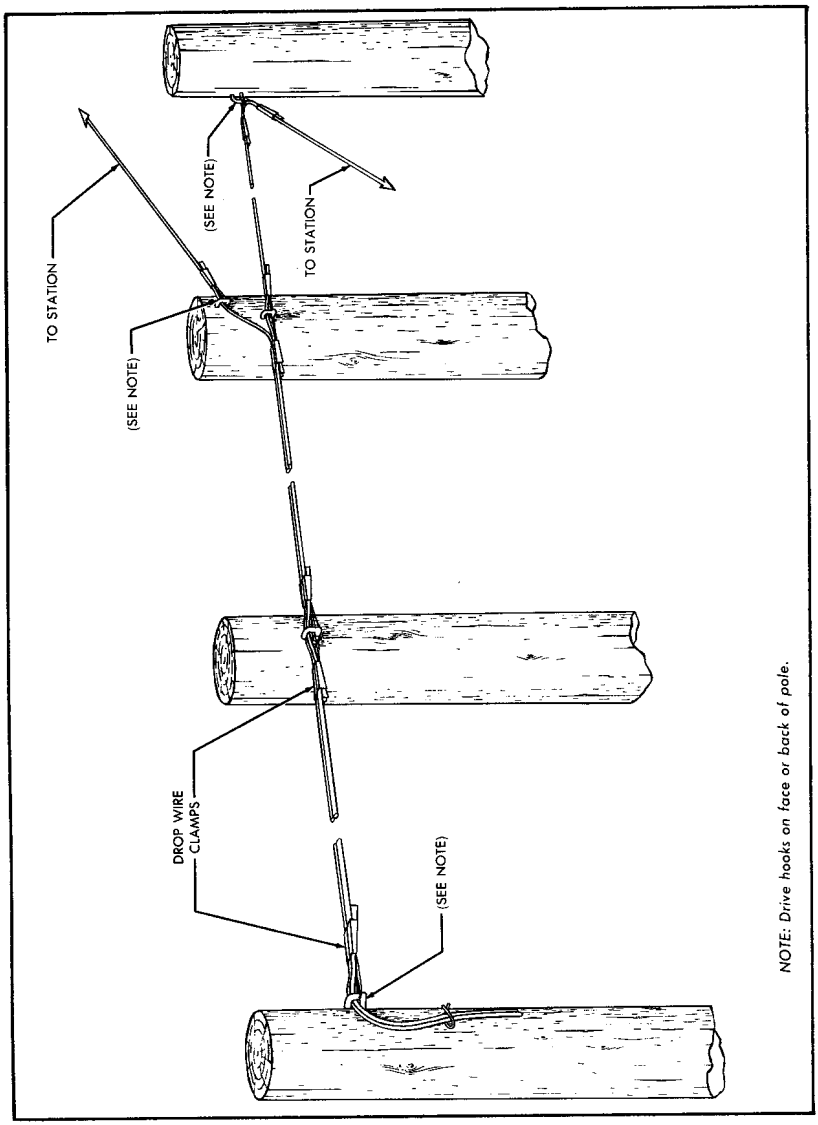


FIGURE 6. Drop Wire Run Along Lead Without Cable

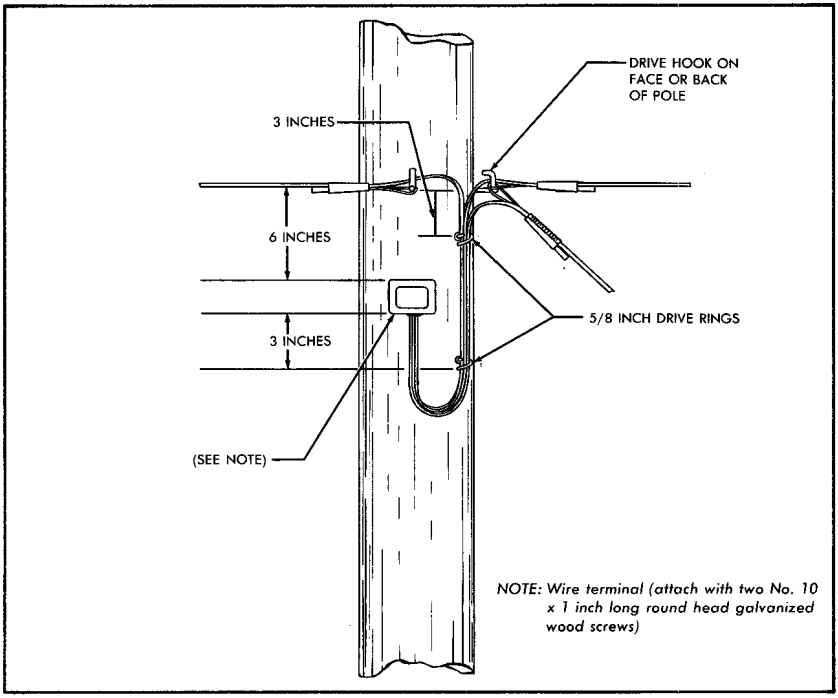


FIGURE 7. Party Line Tap Along The Lead

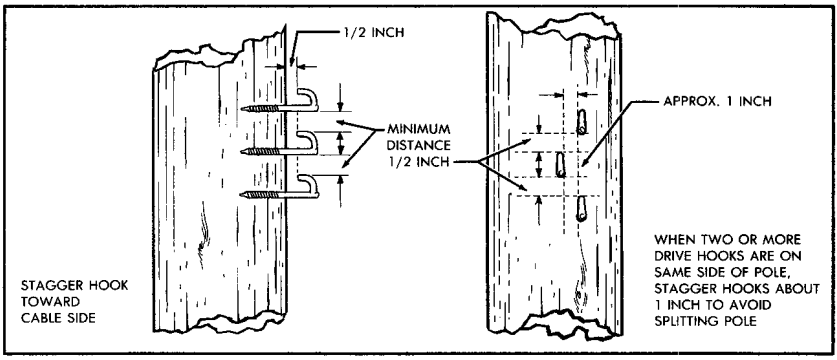


FIGURE 8. Positioning Several Drive Hooks On Same Side Of Pole

7.03 If the diameter of the pole is 5 inches or less, drill a 5/16-inch lead hole for the drive hook, about 3 inches deep. This is to protect the pole from splitting. If drive hooks are placed near the top of a pole and on both sides, a vertical separation of approximately 3 inches should be provided between drive hooks.

7.04 Table A shows the maximum number of drop wires which may be attached to one drive hook where the drop wire is dead-ended at both ends of the span.

8. RUNNING PAST TERMINALS

8.01 When a terminal assignment requires running past a cable terminal, try to obtain a reassignment to the proper terminal. Before placing more than a total of 2 spans of drop wire along a lead carrying cable, check with your supervisor.

8.02 Where a disconnected drop wire which has been run past a cable terminal is to be reconnected, obtain an assignment to the proper terminal.

9. POLE-TO-BUILDING SPANS

9.01 It is desirable to run drop wires under obstructions, such as trees or foreign wires, provided the required clearance can be obtained. Avoid running drop wire over obstructions where contact may result due to the stretching of the drop wire.

10. ATTACHING DROP WIRES TO METAL POLES

10.01 Avoid attachment to metal poles whenever possible. When it is necessary to attach to metal poles, approval shall be obtained from the supervisor. Use a sign bracket, depending on the size of the pole, and attach as shown in Figure 9. For the bracket sizes and ordering information, refer to the Continental Telephone System General Supplies Catalog under "BRACKETS, SIGNS".

TABLE A. Number of Drop Wires to be Attached to One Drive Hook

	If Number of Drop Wires Attached Pole-To-Pole or From Span Clamp is:			
	0	1	2	3
Maximum Drop Wires Crossing Street	3	2	1	0
Maximum Drop Wires Not Crossing Street	4	3	2	0
Maximum Total Drop Wires	7	6	5	3

NOTE: Combinations of drop wires crossing and not crossing street must pull as near as possible to 180 degrees to equalize the strain on the drive hook. Use separate drive hooks when strain of combinations of drop wire span tends to be in one direction.

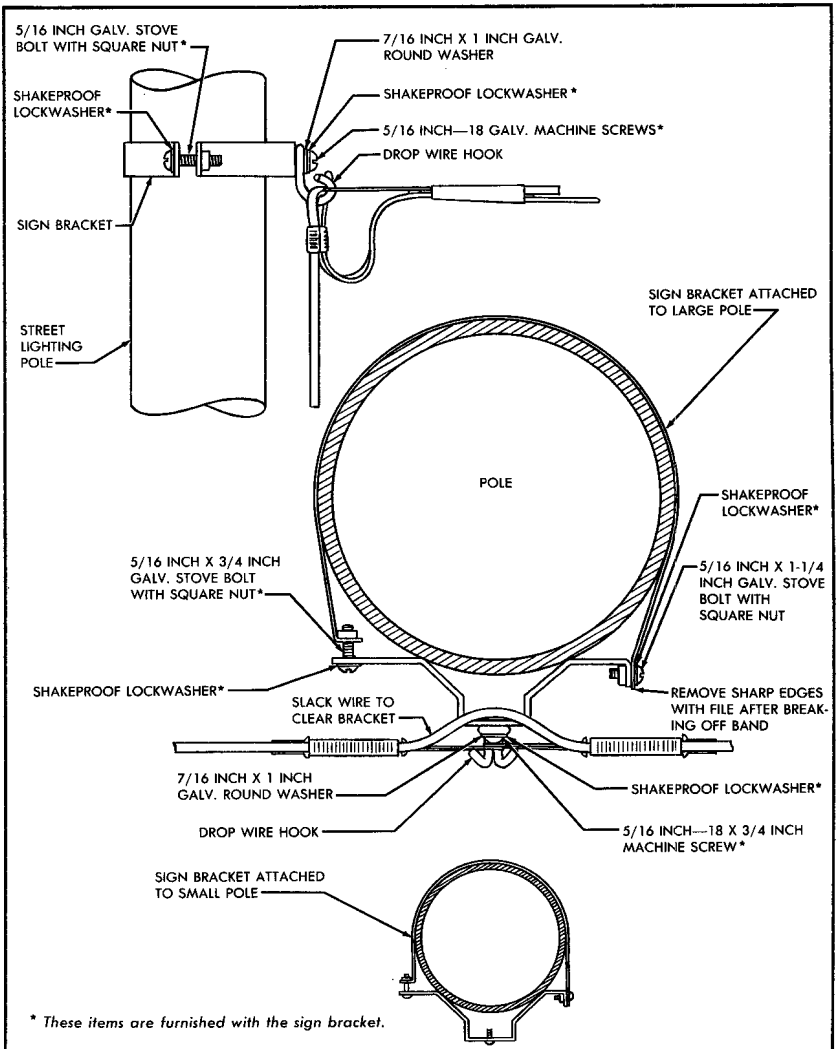


FIGURE 9. Metal Pole Attachment

DROP WIRING

PLACING DROP WIRE
POWER EXPOSURE UP TO 300 VOLTS

CONTENTS

1. GENERAL

1.01 This practice provides procedures for the one-man method of placing drop wire over and under power wires or power cables operating at 300 volts or less, or where there is no exposure to power.

1.02 This practice replaces in its entirety CTSP 475-300-400, all copies of which should be removed from the file and destroyed.

1.03 Refer to CTSP 475-301-410 for the method of placing drop wire over power wires or power cables operating at **300 volts or more.** The methods of raising or lowering drop wire, and replacing drop wire are covered in CTSP 475-301-605 and CTSP 475-301-610.

1.04 This practice covers the installation of drop wire with the use of a handline to avoid accidents when tensioning the drop wire from a position on a pole or ladder.

1.05 Drop wire shall not be placed over secondary electric service wires if other means of installing the wire are possible.

1.06 Under certain circumstances it may be desirable to attach the drop wire to the pole first and then raise it at the building. In such cases, raise the drop wire as instructed in paragraph 6.

1.07 At the time of installation, drop wire should be twisted one complete turn for every ten feet of span length to reduce vibration and dancing.

1.08 Refer to CTSP 490-060-001 for measuring clearances and separations in aerial plant and to CTSP 475-300-403 for stringing sags and span limits.

2. PRECAUTIONS

NOTE: All precautions in CTSPs 490-050-104, 490-050-105, and 490-050-106 must be taken before climbing.

2.01 If traffic, trees, or other conditions create a safety hazard for the one-man method, assistance shall be obtained before placing drop wire over streets, highways, etc.

2.02 High voltage insulating gloves shall be worn by all employees when performing any operation where the handline or the drop wire may come in contact with power wires or power cables.

2.03 The handline used for raising drop wire shall be free from metallic strands and shall be dry. However, if it is not possible to keep the handline dry due to weather conditions, a wet handline may be used for placing drop wire over secondary electric wires operating at **less than 300 volts.**

2.04 Two 3/8-inch handlines, one 50 feet and one 100 feet in length, are required for the operations in this practice. The handlines shall be served at the ends to prevent unraveling.

2.05 When it is necessary to carry a handline up a pole or ladder, use a handline carrier (CTS #74-56-031-0) or double the end of the handline back on itself for a distance of approximately 1 foot. Place this loop under the side or back of the body belt so that it will be released readily if placed under tension.

2.06 Do not work from a ladder placed against a building with the side rails crossing a wire run, or in any other position where movement of the wire, due

to loosening of the attachments, could cause an accident.

2.07 When a drop wire is to be attached to a span clamp, place the foot of an extension ladder on the field side of the suspension strand so the ladder is not in the street or highway. If there is no street or highway adjacent to the span clamp, place the ladder against the opposite side of the strand from the drop wire run to the building.

2.08 If conditions could cause the handline or the drop wire to which it is attached to become disengaged from a drive hook, crossarm, or to slide along the strand or guard arm while the work is being done, enclose the handline or drop wire with a temporary guide loop. This loop consists of a short length of wire or rope placed over the handline or drop wire, with the ends of the guide securely tied in the following manner (Figure 1):

a. Guard Arm: Tie the ends to the guard arm on each side of the handline or drop wire.

b. Drive Hook: Tie one end to the vertical portion of the drive hook and lash the other end to the pole.

c. Crossarm: Tie the ends to adjacent pins or insulators.

d. Strand: Tie the ends across 2 span clamps.

3. OVER STREET OR HIGHWAY—NOT CROSSING OVER POWER WIRES/CABLES—NO TREE INTERFERENCE

3.01 Where a drop wire to be placed over a street or highway will not cross over power wires or power cables and there is no tree interference, place the wire as follows:

CAUTION: Before proceeding with the following operations, fasten the inner end of the coil of drop wire securely to one of the springless spokes of the drop wire reel; then tighten the reel drag brake so the reel does not spin freely.

a. Install the first building attachment; secure the drop wire to this support; then complete the building run. Keep the drop wire reel on the ground near the building to avoid accidents resulting from vehicles striking the wire, or pedestrians tripping on it. See Figure 2.

b. Place a handline over the strand, guard arm, drive hook, or crossarm so that both ends reach the ground, with no excess length in that portion of the handline toward the building. If practicable, the handline may be formed into a coil at one end and thrown over the strand.

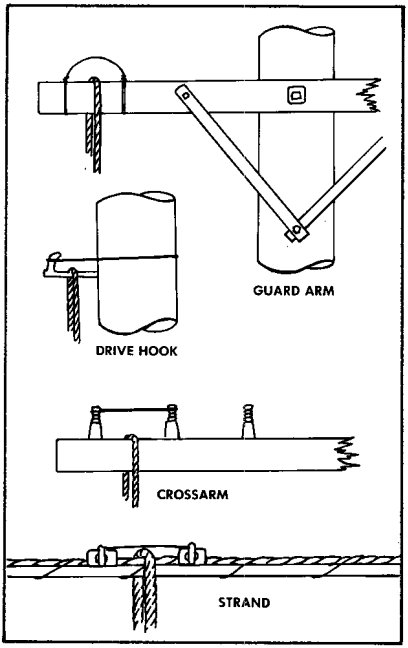


FIGURE 1. Temporary Guide Loop—Pole

After the handline has been placed, tie it to the base of the pole or the lower rungs of the ladder to avoid interference with pedestrians or vehicles. If it is necessary to climb the pole or ladder to place the handline, install any drop wire support that is needed.

c. Roll or carry the drop wire reel from the building to the building side of the street or highway. Pay out the wire along the ground with sufficient slack to ensure that the wire rests flat on the ground.

d. When no traffic is approaching, roll or carry the drop wire reel across the street or highway to the previously placed handline, paying out the wire so that it rests flat on the ground. If a metal or hard rubber-tired vehicle passes over the wire, carry the drop wire reel back to the building side of the highway and pull the wire from the highway. Inspect the wire for possible damage.

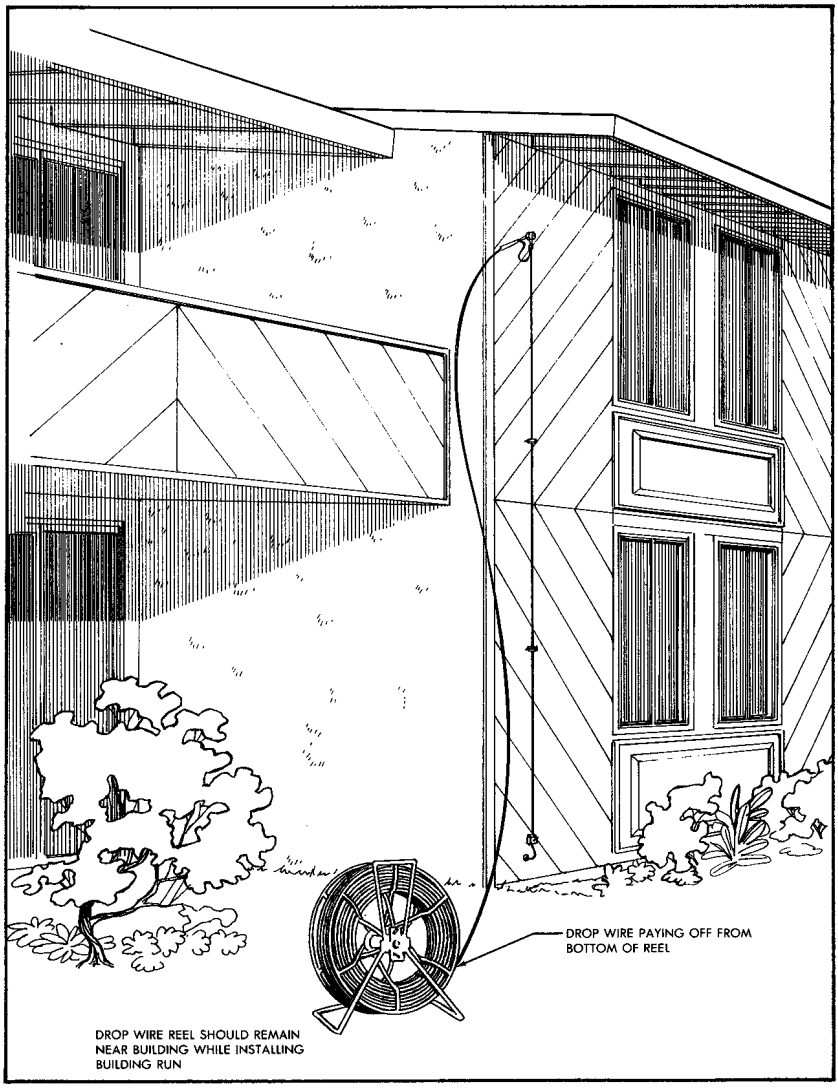


FIGURE 2. Drop Wire Attached to Building

e. Release the handline from the base of the pole or ladder, and tie a bowline knot in the end of the handline toward the building and around the drop wire at the reel. See Figure 3. Be careful not to raise the wire above the highway. Wind any excess length of drop wire on the reel.

f. Set the brake of the drop wire reel so that when the wire is raised by the handline there

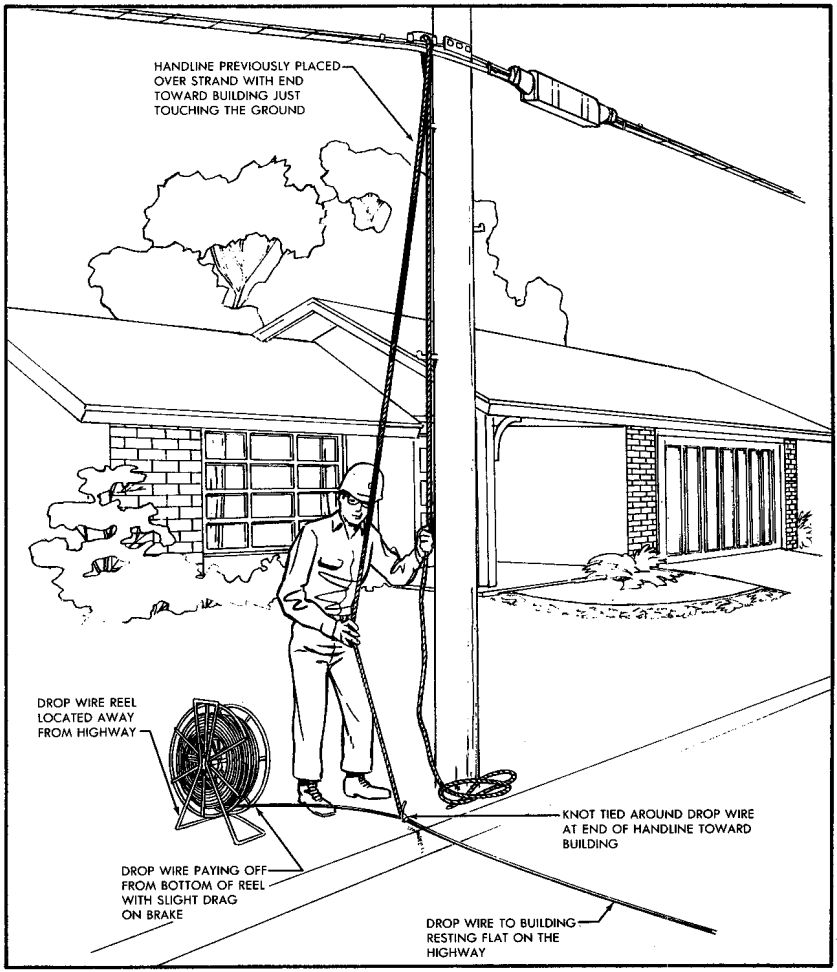


FIGURE 3. Preparing to Raise the Drop Wire

will be sufficient tension on the wire for it to be pulled up to the required height in the span over the street or highway.

g. After checking to make sure that the drop wire reel is in a stable position and that its brake is properly set, grasp the free end of the handline. When no vehicles or pedestrians are approaching, raise the drop wire as shown in Figure 4. If it is necessary to remove excess slack from the wire span as it is being raised, pull the wire at the reel end to obtain the desired slack and wind the excess length of wire on the reel.

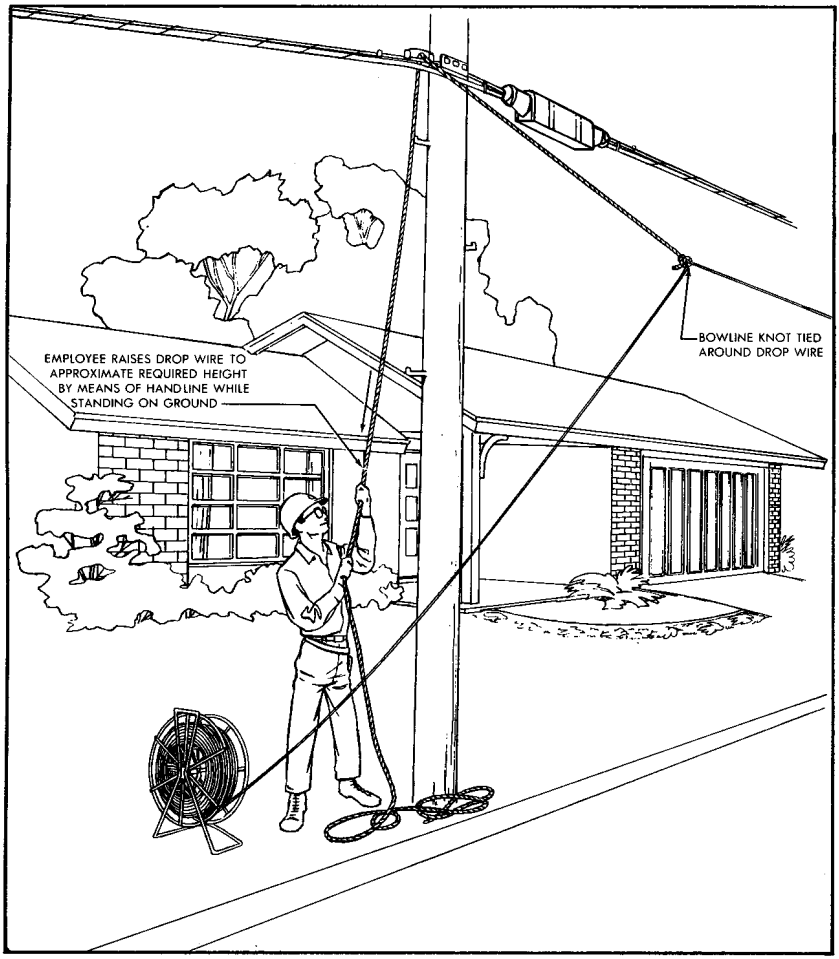


FIGURE 4. Raising the Drop Wire

h. After the drop wire has been raised to the required height, lash the handline with a clove hitch near the base of the pole or at a span clamp to the lower rungs of the ladder. See Figure 5.

i. Climb the pole or the ladder (if at a span clamp) and attach the drop wire to the pole or strand without removing the handline from the drop wire. When attaching the drop wire to a span clamp, keep in mind that the strand is

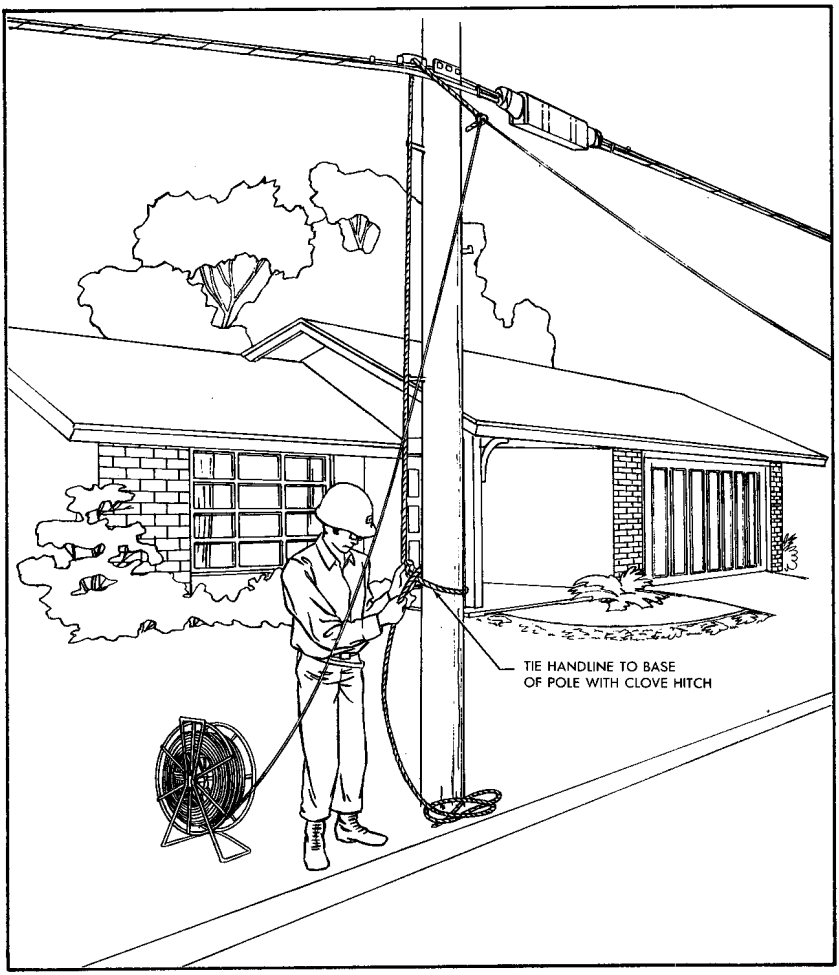


FIGURE 5. Drop Wire Raised to Approximate Height

forced out of line by the ladder resting against it. When working from the ladder, make any adjustments necessary to avoid excessive tension in the wire span to ensure proper sag and clearance after the ladder is removed.

j. Remove the handline from the drop wire. Cut the wire, leaving a sufficient length to reach the terminating point; then complete the connection.

k. Attach the handline and remaining drop wire under the body belt as instructed in paragraph 2.05, and carry them down the pole. **DO NOT DROP THEM TO THE GROUND.**

4. OVER STREET OR HIGHWAY—NOT CROSSING OVER POWER WIRES/CABLES—TREE INTERFERENCE

4.01 Placing drop wire through trees shall be avoided whenever possible. However, if trees cannot be avoided, the method in paragraph 3.01 shall be modified as follows:

CAUTION: Before proceeding with the following operations, fasten the inner end of the coil of drop wire securely to one of the springless spokes of the drop wire reel and set the brake.

a. Where a tree is located on the same side of the street or highway as the building:

(1) Place the drop wire reel on the side of the tree toward the pole line. If the tree overhangs the street, the reel shall not be placed in the street unless it is properly guarded by means of a Telephone Company truck or another object equivalent in size.

(2) Place the handline among the branches of the tree in the desired location for the drop wire, and pull the wire into position among the branches. A wire raising tool may be used to facilitate this operation.

CAUTION: The handline and drop wire shall not overhang the street unless properly guarded. If practicable, park the Telephone Company truck so that it will shield the handline and the drop wire.

(3) Attach the drop wire to the building as instructed in paragraph 3.01 a., making sure that the wire rests flat on the ground between the tree and the building.

(4) Complete the wire run to the pole or to the span clamp as instructed in paragraph 3.01 b.

b. Where a tree is located in the immediate vicinity of the pole or span clamp:

(1) When placing the handline over the strand, guard arm, drive hook, or crossarm, locate it among the branches of the tree (Figure 6) so the drop wire may be raised to the proper position. A wire raising tool may be used to facilitate this operation. After the handline has been placed, tie it to the base of the pole or the lower rungs of the ladder to avoid interference with pedestrians or vehicles.

CAUTION: The handline shall not overhang the street unless it is properly guarded. If practicable, park the Telephone Company truck so that it will shield the handline.

(2) Proceed as instructed in paragraph 3.01 or paragraphs 4.01 a., (1), (2), (4), depending on the conditions, except that the wire shall be raised at the pole or strand end of the span as follows:

(a) With the drop wire crossing the street and resting flat on the ground, remove sufficient wire from the drop wire reel to reach the terminating point and cut the wire.

(b) Tie the end of the drop wire to the handline (Figure 6) at a point in that portion of the handline toward the building which will permit access to both ends of the handline from a position on the ground during the entire raising operation.

NOTE: If the handline has been placed over a drive hook or other support on which a square knot would sag, fasten the wire to the handline as shown in Figure 7.

c. When no vehicles or pedestrians are approaching, raise the drop wire by pulling that portion of the handline on the opposite side of the strand from the building. The portion of the handline toward the building should pass through employee's hand (Figure 8) so the employee can pull the handline in either direction to work the drop wire among the branches of the tree, or to pull the wire to the ground quickly, if necessary.

d. After the drop wire has been raised to the required height, tie the handline to the base of the pole or, if at a span clamp, to the lower

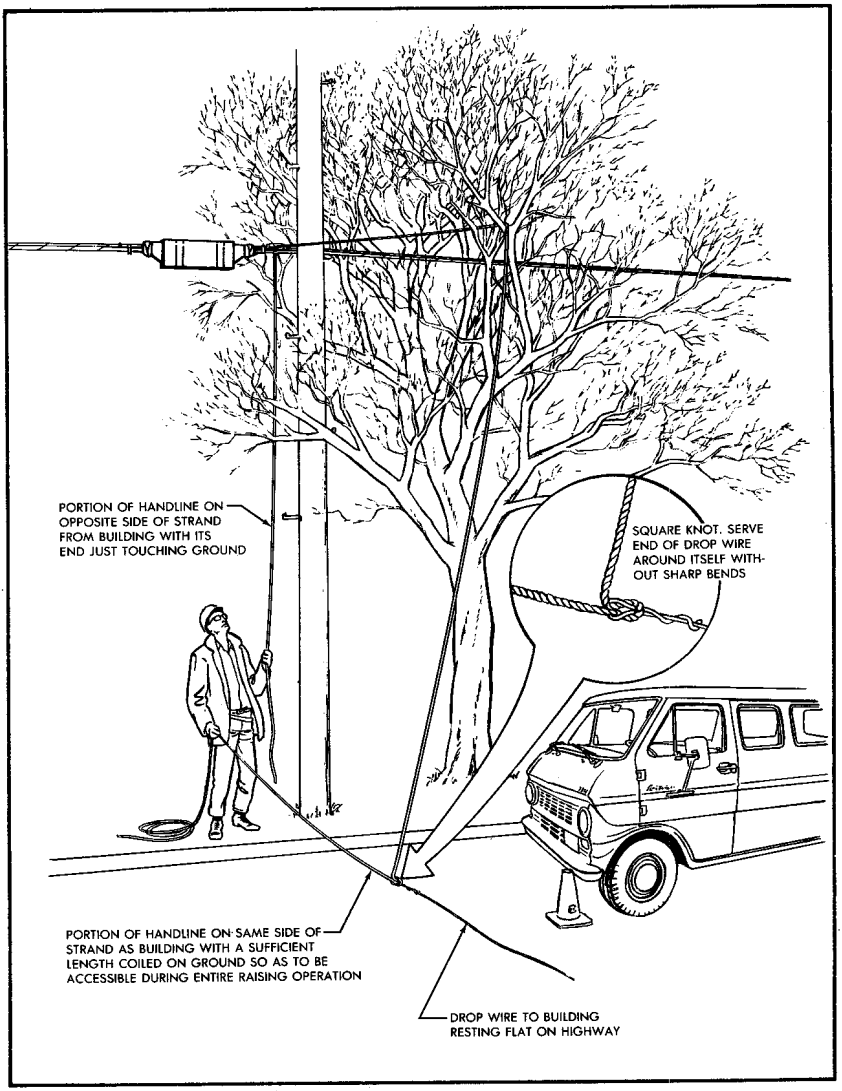


FIGURE 6. Drop Wire Tied to Handline

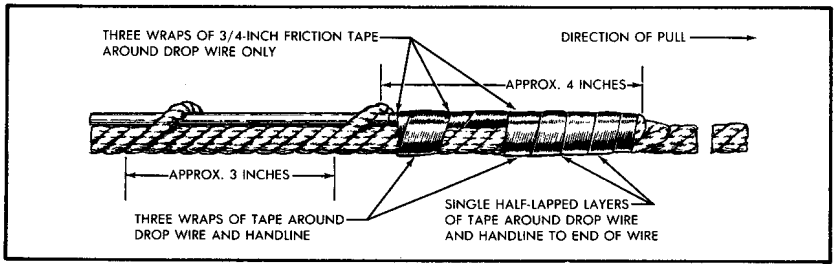


FIGURE 7. Alternate Tie to Prevent Sagging

rungs of the ladder, and proceed as instructed in paragraphs 3.01 i. and j.

5. OTHER THAN OVER STREET OR HIGHWAY—NOT CROSSING OVER POWER WIRES/CABLES

5.01 When placing a drop wire other than over a street or highway, and not crossing over power wires or cables, place the wire as follows:

CAUTION: Before proceeding with the following operations, fasten the inner end of the coil of drop wire securely to one of the springless spokes of the drop wire reel and set the brake.

a. Install the first building attachment and complete the wire run on the building, keeping the drop wire reel near the building to prevent accidents resulting from vehicles striking the wire, or pedestrians tripping on it.

NOTE: If obstructions are encountered between the building and the pole or span clamp, locate the drop wire on the pole line side of the obstructions, place the wire over or through the obstruction, and attach the wire to the building, making sure that the wire rests flat on the ground between the obstruction and the building.

b. Roll or carry the drop wire reel from the building to the pole or span clamp location, paying out the wire so that it rests flat on the ground.

c. Tie a bowline knot in one end of the handline around the drop wire at the reel. The length of the handline shall be greater than the distance from the ground to the drop wire attachment point.

d. Set the brake of the drop wire reel so that when the wire is raised by the handline there will be sufficient tension in the wire for it to be pulled to the required height in the span.

e. Loop the other end of the handline under the body belt as instructed in paragraph 2.05, and climb the pole or the ladder (if at a span clamp).

f. Place the handline over the strand, guard arm, drive hook, or crossarm from the side toward the building. Return to the ground.

g. Raise the drop wire to the required height by pulling the handline over the strand or other support, and lash the handline to the pole or strand. Climb the pole.

h. Attach the drop wire to the pole or strand without removing the handline. When attaching the drop wire to a span clamp, keep in mind that the suspension strand is forced out of line by the ladder resting against it. Make any adjustments necessary to avoid excessive tension in the wire span when working from the ladder, and to ensure proper sag and clearances after removal of the ladder.

i. Remove the handline from the drop wire. Cut the wire, leaving a sufficient length to reach the terminating point, and complete the connection.

6. OTHER THAN OVER STREET OR HIGHWAY—CROSSING OVER POWER WIRES/CABLES—POWER EXPOSURE UP TO 300 VOLTS

6.01 Place the drop wire over power wires or power cables up to 300 volts as follows:

a. Install the first building attachment; or the pole attachment if the drop wire is to be attached to a pole on the building side of the power wires or power cables.

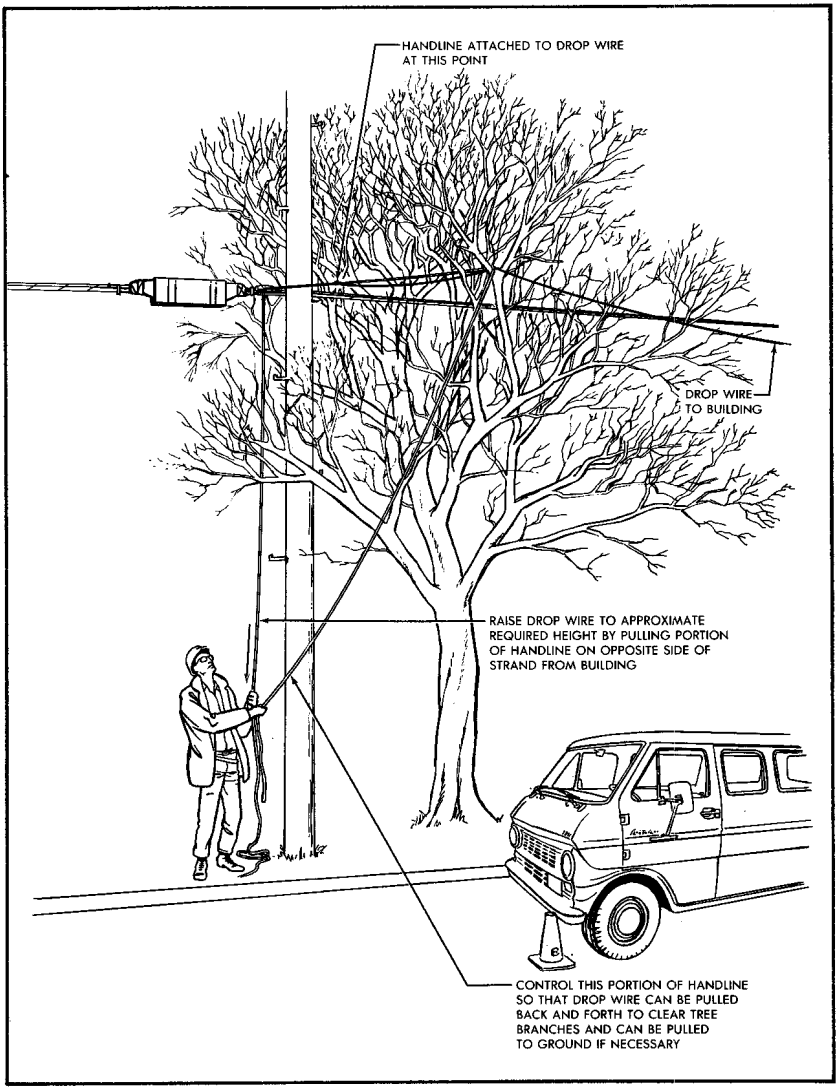


FIGURE 8. Raising Drop Wire

b. Attach a temporary guide loop to the attachment to prevent the drop wire from becoming accidentally disengaged during the placing operation. See Figures 1 and 9.

c. Place the drop wire reel, equipped with a coil of new wire, in a stable position near the foot of the ladder at the building, on the side away from the wire span.

CAUTION: Fasten the inner end of the coil of drop wire securely to one of the spokes of the drop wire reel.

d. Set the brake of the drop wire reel so that when the wire is pulled by the handline there will be sufficient tension in the wire to prevent it from sagging onto the power wires or power cables.

e. With the wire paying off from the bottom of the reel, pass the wire over the first building attachment and through the temporary guide loop until the end of the wire reaches the ground.

f. Go to the pole. Lash one end of a handline to the base of the pole. The handline shall be of a sufficient length to extend vertically from the ground to the strand or pole attachment, and horizontally at least 25 feet beyond the power wires or power cables.

g. Place the free end of the handline over the strand, guard arm, drive hook, or crossarm. If practicable, the handline may be formed into a coil at one end and thrown over the strand.

h. Standing on the ground, throw the free end of the handline over the power wires or power cables. Tie this end of the handline to the end of the drop wire by means of a square knot, serving the end of the wire around itself without sharp bends. If the handline has been placed over a drive hook or other support on which the square knot would snag, fasten the handline to the wire as shown in Figure 7.

NOTE: If a tree is involved, place the handline among the branches of the tree in the desired location for the drop wire. A wire raising tool may be used to facilitate this operation.

i. Go to the building. Reel up all slack in the handline and drop wire onto the drop wire reel, thereby raising the handline clear of the power wires or power cables. Make sure the drop wire reel is in a stable position and that its brake is properly set.

j. Return to the pole end of the handline and pull the handline and drop wire, being careful not to sag into the power wires or cable. After a sufficient length of drop wire has been pulled over the strand, guard arm, drive hook, or crossarm, the handline shall be lashed to the base of the pole.

k. Go to the building and fasten the drop wire to the first building attachment with a drop wire clamp, and then remove the temporary guide loop.

l. Climb the pole, fasten the drop wire and remove the handline.

7. OVER STREET OR HIGHWAY—CROSSING OVER POWER WIRES/CABLES—POWER EXPOSURE UP TO 750 VOLTS

7.01 Follow the procedures in CTSP 475-301-410, paragraph 2, when it is necessary to place drop wire over power wires or cables and where the drop wire crosses over a street or highway.

8. FROM BUILDING TO BUILDING

8.01 Place a drop wire between two buildings in the same manner as for a pole-to-building run, providing as much sag as practicable in the wire span. A temporary guide loop (Figure 9) should be installed on the first building attachment at which the wire span is to be raised; this will prevent accidental disengagement of the handline from the building attachment. Support the tension in the wire by lashing the handline (which was used in raising the wire) to a secure support near the base of the building, and install the second drop wire clamp on the span.

8.02 All safety precautions contained in this practice must also be observed when placing wire from building to building.

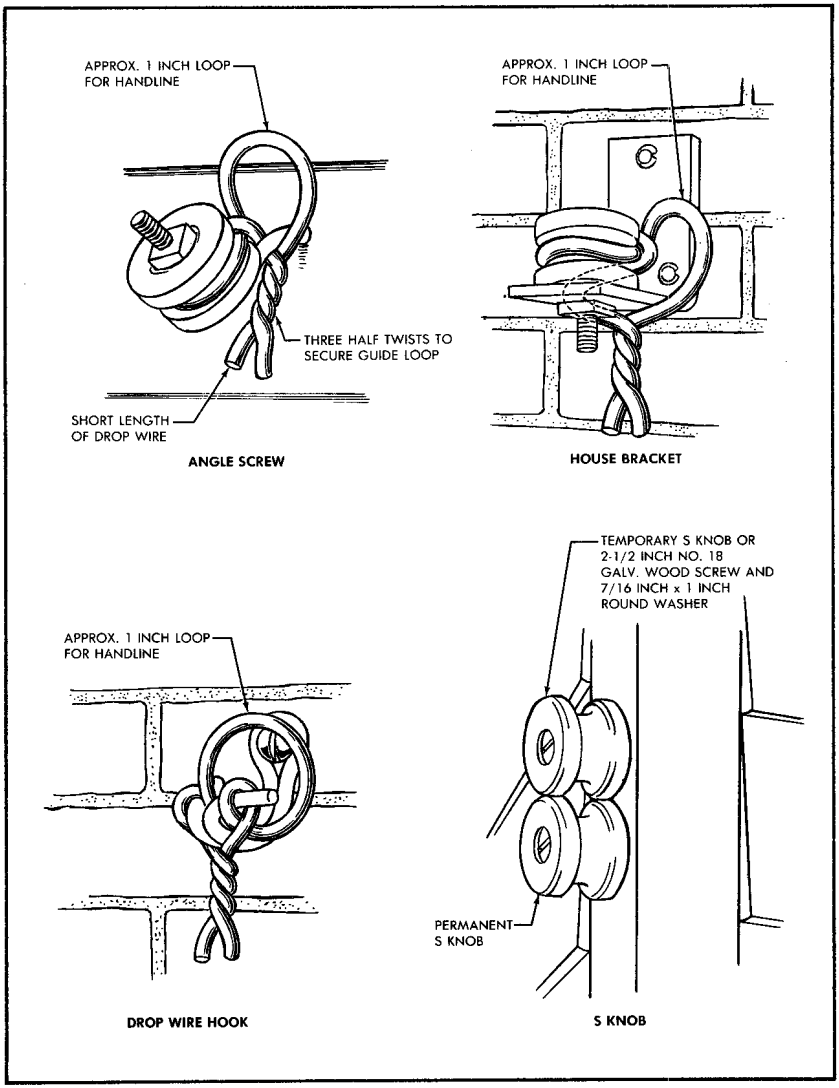


FIGURE 9. Temporary Guide Loop—Building

DROP WIRING

PLACING DROP WIRE POWER EXPOSURE UP TO 750 VOLTS

CONTENTS

1. GENERAL

1.01 This practice provides procedures for the two-man method of placing drop wire over power wires or power cables operating at 300 to 750 volts. It also provides the procedures for placing drop wire over power wire or power cables where the exposure is up to 750 volts and where a street or highway is crossed.

NOTE: Under no condition shall a drop wire be placed over power wires or power cables operating at more than 750 volts. Such cases shall be referred to your supervisor for disposition.

1.02 Drop wire shall not be placed over power cables operating up to 750 volts if other means of installing the wire are practicable.

1.03 This method provides for the drop wire to be attached first to the building and then placed over the power wires or power cables by means of a handline. During this operation, employees remain on the ground and perform the work so that the drop wire does not come in contact with the power circuits during the entire placing operation. This method is also intended to avoid the possibility of accidents caused by tensioning the wire from a ladder at the building, or vehicles striking the wire or the handline as it is being raised from the ground.

1.04 Drop wire shall not be attached to a span clamp under the conditions covered in this practice unless the span clamp is accessible from the pole.

1.05 Refer to CTSP 475-301-405 for the methods of placing a drop wire over power wires or power cables where the exposure is **300 volts or less** or where there is no exposure to power. The methods of lowering a drop wire, raising a lowered drop wire, and replacing a drop wire are covered in CTSP 475-301-605 and CTSP 475-301-610.

1.06 Drop wire should be twisted one complete turn for each ten feet of span length at the time of installation to reduce vibration and dancing.

1.07 See CTSP 490-060-001 for measuring clearances and separations in outside plant; CTSP 475-300-403 for stringing sags and span limits.

2. PRECAUTIONS

NOTE: All precautions in CTSPs 490-050-104, 490-050-105, and 490-050-106 must be taken before climbing.

2.01 Two employees shall perform the work when raising a drop wire over power wires or power cables operating at 300 to 750 volts. Obtain additional assistance before raising a drop wire over streets, highways, or elsewhere if traffic, trees, or other conditions create a safety hazard.

2.02 Insulating gloves shall be worn when placing a drop wire over power wires or power cables, and until the drop wire has been attached at both ends of the crossing span.

2.03 The handline used for raising a drop wire under the conditions described in this practice shall be free from metallic strands and shall be dry. A wet handline must not be used in the vicinity of power circuits operating at 300 volts or more.

NOTE: When it is necessary to maintain service or establish emergency service during rainstorms, a wet handline may be used over contact wires and other power circuits operating at 300 to 750 volts, PROVIDED THAT INSULATING GLOVES, RUBBER BOOTS, AND RUBBER RAINCOATS ARE WORN.

2.04 When it is necessary to carry a handline up a pole or ladder, use a handline carrier (CTS #74-56-031-0), or double the end of the handline back on itself for a distance of approximately 1 foot. Place this loop under the right or left side or back of the body belt, or in such other position that the handline will be released readily if it is placed under tension while the employee is climbing the pole or ladder.

2.05 Never release the drop wire supports from the wire span while working inside the angle formed by the wire.

2.06 Do not work from a ladder placed against a building with the side rails crossing a wire run or in any other position where movement of the wire, due to loosening of the attachments, would cause an accident.

2.07 If conditions could cause the handline, or the drop wire to which it is attached, to become

disengaged from a drive hook or crossarm, or to slide along the strand or guard arm while work is being done, the handline or drop wire shall be enclosed with a temporary guide loop. This loop shall consist of a short length of wire or rope placed over the handline or drop wire, with the ends of the guide securely tied as follows (Figure 1):

a. Guard Arm: Tie the ends to the guard arm on each side of the handline or drop wire.

b. Drive Hooks: Tie one end to the vertical portion of the drive hook and lash the other end to the pole.

c. Crossarm: Tie the ends to adjacent pins or insulators.

d. Strand: Tie the ends across 2 span clamps.

3. PLACING WIRE OVER POWER WIRES OR POWER CABLES CROSSING A STREET OR HIGHWAY

CAUTION: When it is necessary to place a drop wire over power wires or power cables, the crossing span shall be placed independently of any additional spans of wire that may be required to establish service. Place one drop at a time.

3.01 Place drop wire over power wires or power cables as follows:

a. Employee No. 1 installs the first building attachment; or the pole attachment if the drop

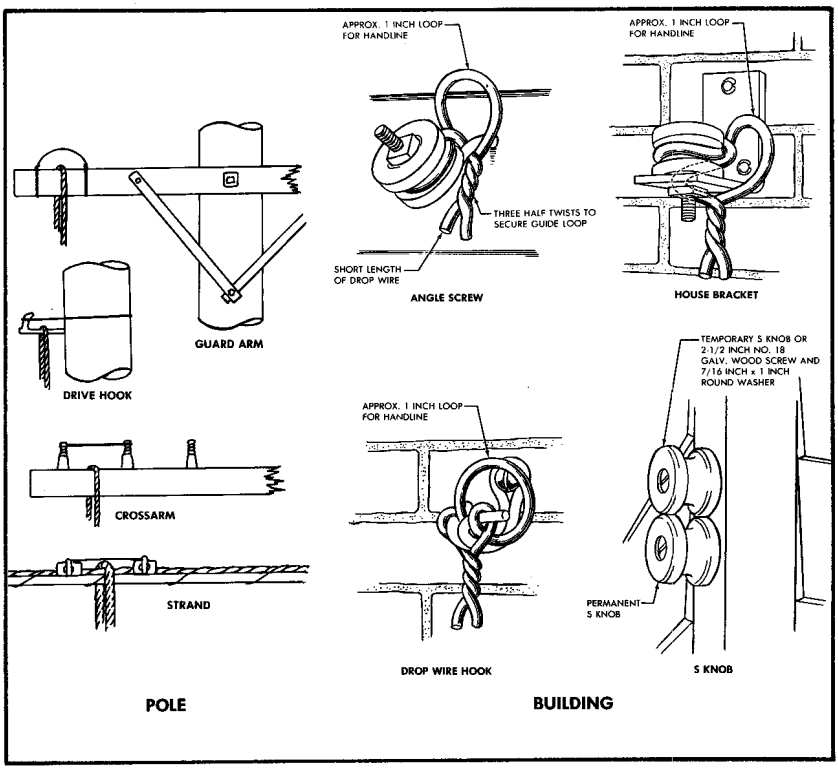


FIGURE 1. Temporary Guide Loops

wire is to be attached to a pole on the building side of the power wires or power cables.

b. Employee No. 1 attaches a temporary guide loop to the first building attachment (Figure 1) to prevent the drop wire from becoming accidentally disengaged from the building attachment during the placing operation.

NOTE: If the drop wire is to be attached to a pole between the power wires or power cables and the building, place the temporary guide loop on the pole attachment instead of at the building.

c. Employee No. 1 places the drop wire reel, equipped with a coil of new wire, in a stable position near the foot of the ladder on the side away from the wire span.

CAUTION: Fasten the inner end of the coil of drop wire securely to one of the spokes of the drop wire reel.

d. Employee No. 1 sets the brake of the drop wire reel so that when the wire is pulled by the handline there will be sufficient tension in the wire to prevent it from sagging onto the power wires or power cables.

e. With the wire paying off from the bottom of the reel, pass the wire over the first building attachment and through the temporary guide loop until the end of the wire reaches the ground.

f. Employee No. 2 lashes one end of a handline to the base of the pole. The handline shall be of a sufficient length to extend vertically from the ground to the strand or pole attachment, and horizontally at least 25 feet beyond the power wires or power cables.

g. Employee No. 1 goes into the street or highway to control traffic. (He may require the assistance of the police.)

h. Employee No. 2 places the free end of the handline over the strand, guard arm, drive hook, or crossarm. If practicable, the handline may be formed into a coil at one end and thrown over the strand.

i. Standing on the ground, **Employee No. 2** now throws the free end of the handline over the power wires or power cables. Tie this end of the handline to the end of the drop wire by means of a square knot, serving the end of the wire around itself without sharp bends. If the handline has been placed over a drive hook or other support on which the square knot would snag, fasten the handline to the wire as shown in Figure 2.

NOTE: If a tree is involved, place the handline among the branches of the tree in the desired location for the drop wire. A wire raising tool may be used to facilitate this operation.

j. Employee No. 2 reels up all slack in the handline and drop wire onto the drop wire reel, thereby raising the handline clear of the power wires or power cables. If the end of the drop wire attached to the handline would be pulled back through the temporary guide loop at the first building attachment during this operation, stop reeling up slack; make sure the drop wire reel is in a stable position and that its brake is properly set. The employee returns to the pole end of the handline, and pulls the remaining slack out of the handline and wire span so that the handline is clear of the power circuits. The handline is then retied to the pole and the employee returns to the drop wire reel.

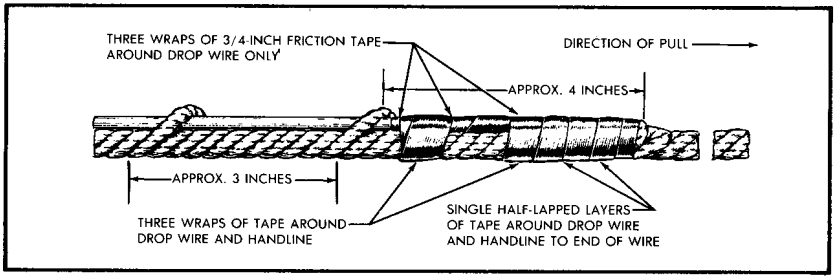


FIGURE 2. Alternate Tie to Prevent Snagging

k. **Employee No. 1** who has been in the street or highway directing traffic during operations (steps h. through j.), goes to the pole and pulls the handline, observing carefully that there is sufficient tension in the wire paying off the drop wire reel to prevent the wire from sagging onto the power circuits. **Employee No. 2** controls the action of the drop wire reel to ensure that there is adequate tension in the wire as it is pulled from the reel.

l. After **Employee No. 1** has pulled a sufficient length of drop wire over the strand, guard arm, drive hook, or crossarm for terminating or splicing purposes, the handline shall be lashed to the base of the pole.

NOTE: If the handline or drop wire catches while it is being pulled over the strand, guard arm, drive hook, or crossarm, Employee No. 2 remains at the drop wire reel and keeps the wire under sufficient tension to prevent it from sagging onto the power circuits. Employee No. 1 lashes the handline to the base of the pole and proceeds to free the handline or drop wire.

m. **Employee No. 1** crosses the highway to the building and, while **Employee No. 2** maintains tension in the wire span, **Employee No. 1** fastens the drop wire to the first building attachment with a drop wire clamp, and then removes the temporary guide loop.

NOTE: While Employee No. 1 is fastening the drop wire to the first building attachment, Employee No. 2 shall not attempt to maintain any more tension in the wire than is necessary to prevent it from sagging onto the power wires or power cables. The proper tensioning of the drop wire shall be done from the pole attachment side of the power circuits.

n. Both employees now go to the pole and, while **Employee No. 1** maintains the proper tension in the handline, **Employee No. 2** climbs the pole, fastens the drop wire, and removes the handline.

DROP WIRING

LOWERING AND REPLACING DROP WIRE POWER EXPOSURE UP TO 300 VOLTS

CONTENTS

1. GENERAL

1.01 This practice provides procedures for the one-man method of lowering a drop wire, raising a lowered drop wire, and replacing a drop wire by pulling the new wire into the span as the old wire is pulled out of the span.

1.02 The procedures in this practice apply specifically to drop wire that crosses over power wires or power cables operating at 300 volts or less, or where there is no exposure to power.

1.03 These methods provide for the drop wire to be lowered, raised or replaced by means of a handline while the employee remains on the ground where he can observe traffic, control the wire to prevent its striking persons or damaging property, and remove the wire from a street or highway quickly. An exception is made in certain cases where a wire, which does not cross a street or highway, may be dropped from a pole. The methods are also intended to avoid the possibility of accidents caused by releasing wire under tension from a building or strand attachment while working from a ladder, or as the result of vehicles striking the wire as it is being lowered to the ground.

1.04 Refer to CTSP 475-301-610 for the methods of lowering or replacing a drop wire which crosses over power wires or power cables operating at 300 volts or more. The methods of placing drop wires are covered in CTSP 475-301-405 and CTSP 475-301-410.

1.05 Drop wire should be twisted one complete turn for each ten feet of span length to avoid vibration and dancing.

1.06 See CTSP 490-060-001 for measuring clearances and separations in aerial plant; CTSP 475-300-403 for stringing sags and span limits.

2. PRECAUTIONS

NOTE: All precautions in CTSPs 490-050-104, 490-050-105, and 490-050-106 must be taken before climbing.

2.01 If traffic, trees, or other conditions create a safety hazard for one employee, obtain additional assistance before lowering a drop wire, raising a lowered drop wire, or replacing a drop wire over streets, highways, etc.

2.02 Insulating gloves shall be worn by all employees when performing all operations in which the handline or the drop wire may come in contact with power wires or power cables.

2.03 Under the conditions described in this practice, the handline used for lowering, raising, or replacing a drop wire shall be free from metallic strands and shall be dry. However, if it is impracticable to keep the handline dry due to weather conditions, a wet handline may be used for lowering, raising, or replacing a drop wire over secondary electric service wires operating at less than 300 volts.

2.04 One 50-foot and one 100-foot 3/8-inch handline will be needed for the operations in this practice. The handlines should be served at the ends to prevent unraveling.

2.05 When it is necessary to carry an extended handline up a pole or ladder, use a handline carrier (CTS #74-56-031-0), or double the end of the handline back on itself for a distance of approximately 1 foot. Place this loop under the right or

left side or back of the body belt, or in such other position that the handline will be released readily if it is placed under tension while the employee is climbing the pole or ladder.

2.06 Never release the drop wire supports from a wire span while working inside the angle formed by the wire.

2.07 Avoid working from a ladder placed against a building with the side rails crossing a wire run or in any other position where movement of the wire, due to loosening of the attachments, would cause an accident.

2.08 When a drop wire attached to a span clamp is to be lowered or replaced, place the foot of the extension ladder on the field side of the suspension strand so it is not in the street or highway. If there is no street or highway adjacent to the span clamp, place the ladder preferably against the opposite side of the strand from the drop wire run to the building.

2.09 If conditions could cause the handline, or the drop wire to which it is attached, to become disengaged from a drive hook or crossarm, or may slide along the strand or guard arm while doing the work, the handline or drop wire shall be enclosed with a temporary guide loop. This loop shall consist of a short length of wire or rope placed over the handline or drop wire, with the ends of the guide securely tied as follows (Figure 1):

a. Guard Arm: Tie the ends to the guard arm on each side of the handline or drop wire.

b. Drive Hook: Tie one end to the vertical portion of the drive hook and lash the other end to the pole.

c. Crossarm: Tie the ends to adjacent pins or insulators.

d. Strand: Tie the ends across 2 span clamps.

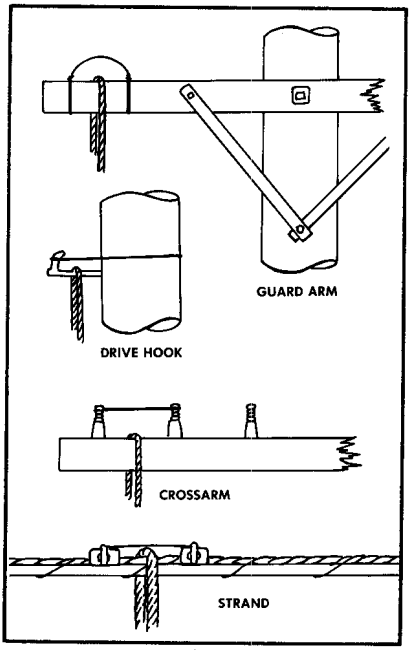


FIGURE 1. Temporary Guide Loop—Pole

3. LOWERING WIRE WHICH CROSSES A STREET OR HIGHWAY—WIRE ATTACHED TO POLE

CAUTION: The lowering of a taut drop wire span requires that special precautions be taken to ensure that the wire is lowered safely. These special precautions are covered in paragraph 6.

3.01 Handline Lowering Method: Lower the drop wire from its position on the pole (drive hook, guard arm, or crossarm) as follows:

a. Lash a handline securely to the base of the pole at a point on the handline which will leave a sufficient length on the ground so that this end will be accessible from the ground until the wire has been lowered to the street.

b. Place the other end of the handline over the strand, guard arm, drive hook, or crossarm so that this end is toward the building and reaches the ground. If practicable, the handline may be formed into a coil at one end and thrown over the strand. If the drop wire passes through a tree in the immediate vicinity of the pole attachment, place the handline so that it follows the route of the wire through the tree. A wire raising tool may be used to facilitate this operation. After the handline has been placed, tie it to the base of the pole to avoid interference with pedestrians or vehicles.

CAUTION: The handline shall not overhang the street unless it is properly guarded. If practicable, park the Telephone Company truck so that it will shield the handline.

c. Disconnect the drop wire from the terminal and remove the free end from the wiring rings on the pole.

d. Place a temporary drop wire clamp on the wire to be lowered, about one foot out in the span. Seat the clamp firmly on the wire.

e. Tie a loop of the bight of the handline to the bail of the temporary drop wire clamp so that the lashed end of the handline is sufficiently taut to remove tension from the original drop wire clamp.

f. Remove the original drop wire clamp from the wire span, leaving the wire supported by the temporary drop wire clamp and the lashed handline.

g. Return to the ground. Untie the handline from the base of the pole and, when no vehicles or pedestrians are approaching, lower the drop wire to the ground by pulling that portion of the handline toward the building. The portion of the handline on the opposite side of the strand should pass through the employee's hand, as shown in Figure 2, so that the handline can be pulled in either direction to work the drop wire among the branches of a tree, or to raise the wire quickly if necessary.

h. After the wire has been lowered to the street or highway, remove the temporary drop wire clamp from the wire, tie the handline to the base of the pole, and remove the wire from the street or highway.

4. DROPPING WIRE WHICH DOES NOT CROSS A STREET OR HIGHWAY—WIRE ATTACHED TO POLE

CAUTION: The lowering of a taut drop wire span requires that special precautions be taken to ensure that the wire is lowered safely. These special precautions are covered in paragraph 6.

4.01 A wire span may be dropped from a pole if:

a. The wire span does not cross a street or highway, or over power wires or power cables.

b. A taut wire span is not involved.

c. The wire will not be struck by a passing vehicle.

d. The wire will not fall on pedestrians or cause damage to property as a result of being dropped to the ground.

4.02 If any of the above conditions exist, the span shall be lowered by the handline method (paragraph 3).

5. LOWERING WIRE ATTACHED TO A SPAN CLAMP

CAUTION: The lowering of a taut drop wire span requires that special precautions be taken to ensure that the wire is lowered safely. These special precautions are covered in paragraph 6.

5.01 The lowering method covered in this paragraph applies to all drop wire spans attached to span clamps.

5.02 Precautions: The following precautions shall be observed when lowering a drop wire attached to a span clamp:

a. Place the extension ladder at the location of the span clamp as instructed in paragraph 2.08.

b. When climbing the extension ladder to work at a span clamp, the strand is forced out of line. The distance the strand is deflected depends on the tension in the strand, the weight of the cable, and the combined weight of the employee and ladder. Therefore, while climbing the ladder it is important to observe the effect of the strand deflection on all drop wires attached to the section of strand on which the employee is working. The principal conditions to be observed are:

(1) Where drop wire crosses a street or highway, avoid placing additional sag in a drop wire span which would create a traffic hazard, unless traffic is properly controlled.

(2) Where drop wire does not cross a street or highway, avoid placing excess tension in a drop wire span which may pull out the first building attachment, thereby causing property damage and sudden movement of the strand while the employee is climbing the ladder. See paragraph 6.04 for the method of releasing excess tension in a drop wire span.

5.03 Lower the wire from the span clamp as follows:

a. Detach the drop wire first from the pole and lower this end of the wire run to the ground. Take necessary precautions if this span crosses a street or highway.

b. Coil the drop wire and place it on the ground near the ladder to avoid accidents resulting from vehicles striking it or pedestrians tripping on it.

c. Place a handline over the strand and lower the drop wire as instructed in paragraph 3, except that the handline shall be lashed to the

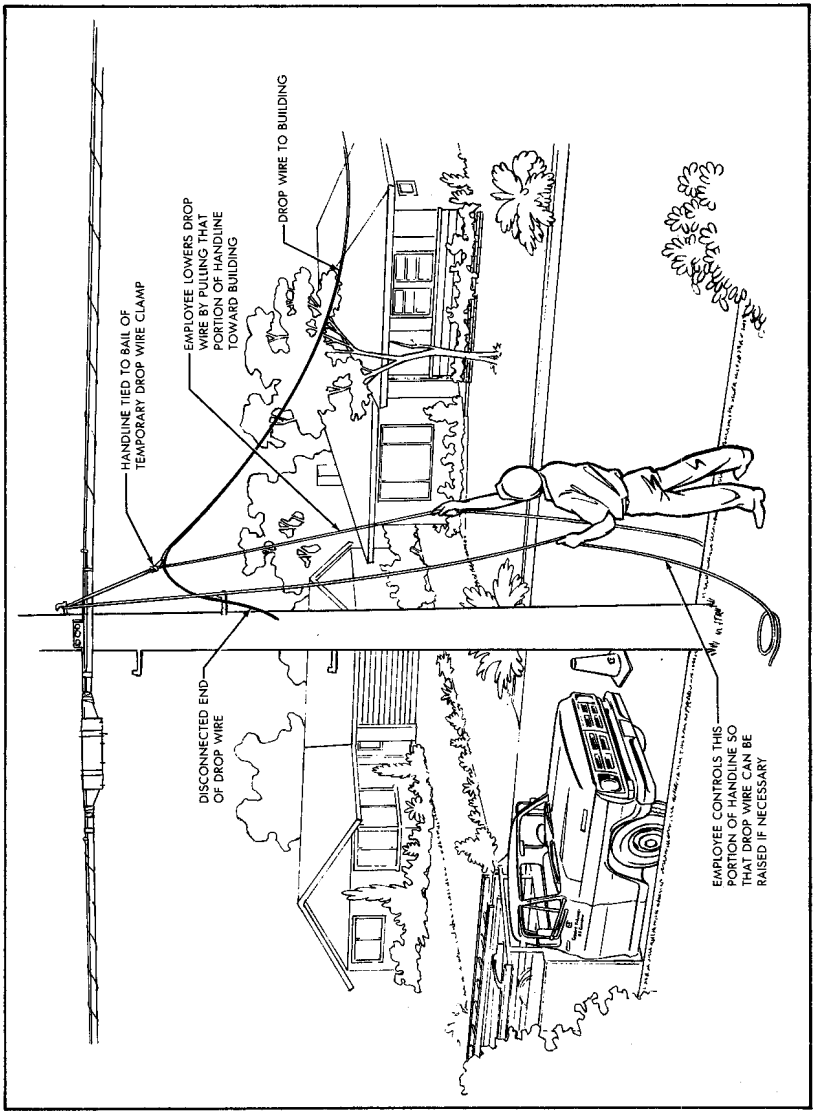


FIGURE 2. Lowering Drop Wire

lower rungs of the extension ladder if it cannot be fastened to a nearby pole or tree.

6. LOWERING TAUT WIRE

6.01 The method described in the following paragraphs covers the special precautions which shall be taken when lowering a taut drop wire span. It applies to the lowering of all taut wire spans whether or not they cross streets or highways.

6.02 Taut Span From Pole: When it is necessary to lower a taut drop wire span from a pole, proceed as follows:

a. Place a handline over the strand, guard arm, drive hook, or crossarm so that the end of the handline toward the building just reaches the ground.

b. Disconnect the drop wire from the terminal, and remove the free end from the wiring rings on the pole.

c. Place a temporary drop wire clamp on the wire to be lowered, about one foot out in the span. Seat the clamp firmly on the wire.

d. Tie a loop of the bight of the handline securely to the bail of the temporary drop wire clamp.

e. Return to the ground. Pull the long end of the handline sufficiently taut to remove tension from the original drop wire clamp, and lash the handline securely to the base of the pole. The taut wire span will be supported by the temporary drop wire clamp and the lashed handline.

CAUTION: Exercise care to avoid placing more tension in the drop wire span than is necessary to remove tension from the bail of the original drop wire clamp.

f. Climb the pole and check to ensure that the tension in the drop wire span has been removed from the bail of the original drop wire clamp.

g. Cut the bail of the original drop wire clamp with pliers.

h. Return to the ground. Untie the handline and slowly ease off the long end of the handline, thereby releasing excess tension in the taut drop wire span. When no vehicles or pedestrians are approaching, lower the wire span to the ground by pulling the short end of the handline. The long end of the handline should pass through the employee's hand. The wire can be raised quickly if necessary.

6.03 Taut Span From Span Clamp: The procedure in paragraph 5 also applies to the lowering of a taut drop wire attached to a span clamp, except that the excess tension in the drop wire span shall first be released.

6.04 Release the excess tension in the drop wire from the building end of the span as follows:

a. Remove the C knob or the D wire clip and the associated loop of drop wire from the first building attachment. Do not remove the drop wire clamp which supports the wire span.

b. Attach a temporary guide loop to the first building attachment to prevent the handline used in releasing the excess tension from becoming accidentally disengaged from the building attachment.

c. Place a temporary drop wire clamp on the wire to be lowered, about one foot out in the span. Seat the clamp firmly on the wire.

d. Place a handline over the first building attachment and through the temporary guide loop. Tie the handline securely to the bail of the temporary drop wire clamp.

e. Return to the ground. Pull the handline sufficiently taut to remove tension from the original drop wire clamp, and lash the handline to a secure support near the base of the building.

CAUTION: Take care to avoid placing more tension in the drop wire span than is necessary to remove tension from the bail of the original drop wire clamp.

f. At the first attachment, check to ensure that the tension in the drop wire span has been removed from the bail of the original drop wire clamp.

g. Cut the bail of the original drop wire clamp with pliers.

h. Return to the ground. Untie the handline and slowly ease off the handline, thereby releasing excess tension in the taut drop wire span. Retie the handline to a secure support near the base of the building.

NOTE: If the amount of slack introduced into the drop wire span is not sufficient to release the excess tension, remove the wire from one or more of the building attachments beyond the first attachment and, if necessary, cut the wire in the building run.

i. Proceed as instructed in paragraph 5 for lowering a normal wire span from a span clamp.

7. LOWERING WIRE ATTACHED TO TWO BUILDINGS

7.01 To lower a drop wire span attached to two buildings:

a. Select the end of the drop wire span at which the operations can be performed.

b. Lower the drop wire run on the building up to the first attachment from which the wire span is to be lowered. Remove the C knob or the D wire clip and the associated loop of drop wire from this attachment. Do not remove the drop wire clamp which supports the wire span.

c. Place a handline over the first building attachment so the end of the handline toward the wire span just reaches the ground. Attach a temporary guide loop to the first building attachment around the handline (Figure 3) to prevent the handline from becoming accidentally disengaged from the building attachment during the lowering operation.

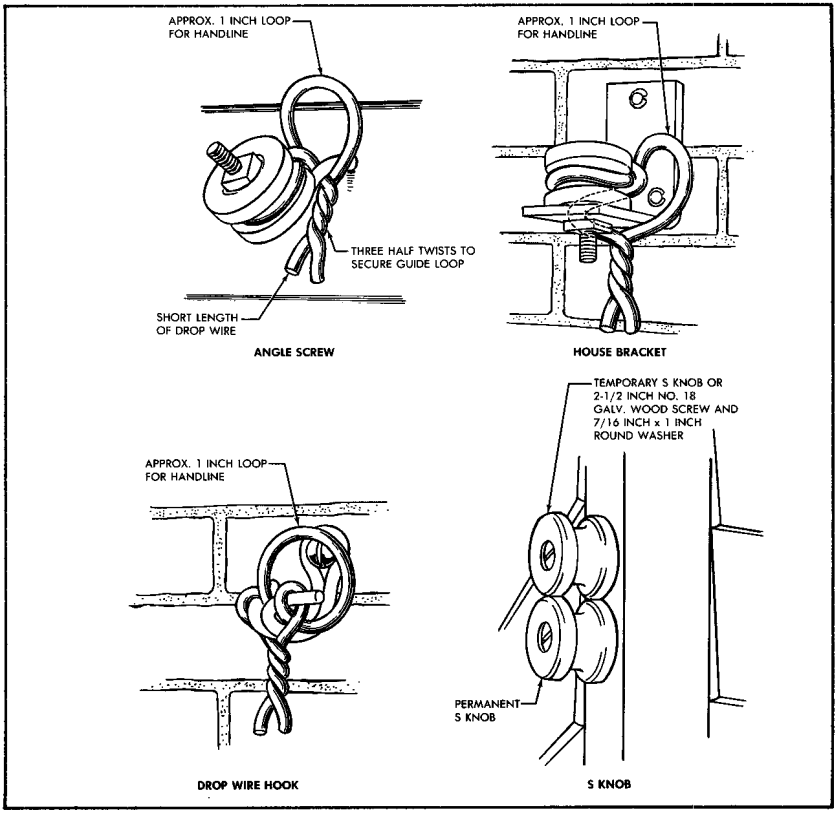


FIGURE 3. Temporary Guide Loop—Building

d. Place a temporary drop wire clamp on the wire to be lowered, about one foot out in the span. Seat the clamp firmly on the wire.

e. Tie a loop of the handline securely to the bail of the temporary drop wire clamp.

f. Return to the ground. Pull the long end of the handline sufficiently taut to remove tension from the original drop wire clamp. Lash the handline to a secure support near the base of the building. The wire span will be supported by the temporary drop wire clamp and the lashed handline.

g. Remove the original drop wire clamp from the building attachment.

h. Return to the ground. Untie the long end of the handline and lower the wire span by pulling the short end of the handline.

8. RAISING WIRE LOWERED BY HANDLINE METHOD

8.01 Where the entire original wire span is to be raised:

a. After the wire has been repaired, lay it along the ground between the building and the building side of the highway, and coil the remaining length of wire.

b. When no traffic is approaching, carry the coil across the street or highway to the previously placed handline, paying out the wire so that it rests flat on the ground. If a metal or hard rubber-tired vehicle passes over the wire, pull the wire back to the building side of the highway. Inspect the wire for possible injury and replace any portions that are damaged.

c. Tie the end of the drop wire to the handline at a point in that portion of the handline toward the building which will permit the employee to have access to both ends of the handline from the ground during the entire raising operation. See Figure 4.

NOTE: If the handline has been placed over a drive hook or other support on which the square knot would snag, fasten the wire to the handline as shown in Figure 5.

d. When no vehicles or pedestrians are approaching, raise the drop wire by pulling that portion of the handline on the opposite side of the strand from the building. The portion of the handline toward the building should pass through the employee's hand so the wire may be pulled to the ground quickly if necessary.

e. After the drop wire has been raised to the required height, tie the handline to the base of the pole or, if at a span clamp, to the lower rungs of the ladder.

f. Climb the pole or ladder (if at a span clamp), and attach the drop wire to the pole or strand without removing the handline from the drop wire. When attaching the drop wire to a span clamp, keep in mind that the strand is forced out of line by the ladder resting against it; make any adjustments necessary to avoid excessive tension in the wire span when the employee is working from the ladder, and also to ensure proper sag and clearance after removal of the ladder.

g. Remove the handline from the drop wire and complete the connection.

8.02 Where the entire original wire span or the end toward the pole or strand is to be replaced, proceed as though raising a new drop wire over a street or highway. See CTSP 475-301-405.

8.03 When raising a drop wire between two buildings, provide as much sag as practicable in the wire span, and support the tension in the wire by means of a lashed handline before placing the second drop wire clamp.

9. RAISING WIRE LOWERED BY DROPPING METHOD

9.01 Where the entire original wire span of a drop wire that was lowered by the dropping method (paragraph 4) is to be raised:

a. After the wire has been repaired, lay it along the ground between the building and the pole or span clamp location.

b. Attach one end of the handline to the bail of the drop wire clamp. The length of the handline shall be greater than the distance from the ground to the drop wire attachment point.

c. Loop the other end of the handline under the body belt or use a handline carrier as instructed in paragraph 2.05, and climb the pole or, if at a span clamp, the ladder.

d. Place the handline over the strand, guard arm, drive hook, or crossarm from the side toward the building.

e. Raise the drop wire to the required height by pulling the handline over the strand or other support; then lash the handline to the pole or strand.

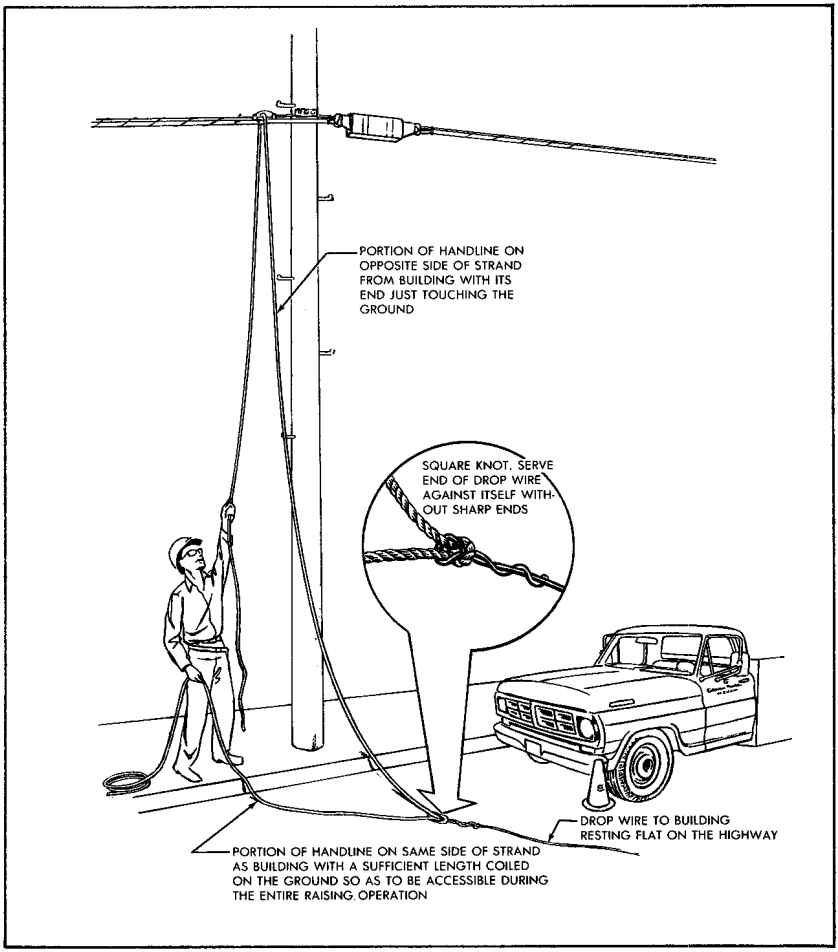


FIGURE 4. Raising the Drop Wire

f. Attach the drop wire to the pole or strand; then remove the handline. When attaching the drop wire to a span clamp, keep in mind that the strand is forced out of line by the ladder resting against it. Make any adjustments necessary to avoid excessive tension in the wire span when the employee is working from the ladder, and also to ensure proper sag and clearance after removal of the ladder.

9.02 Where the entire original wire span or the end toward the pole or strand is to be replaced, proceed

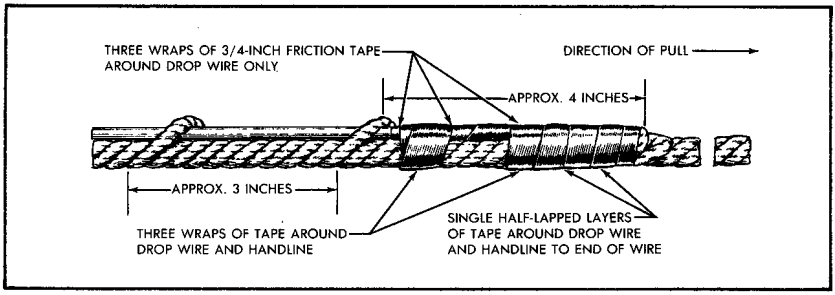


FIGURE 5. Fastening Handline to Prevent Snagging

as though raising a new drop wire at a location **OTHER** than over a street or highway. See CTSP 475-301-405.

10. REPLACING WIRE NOT LOWERED FOR INSPECTION

10.01 If it is obvious that an entire drop wire span requires replacement, and conditions indicate that it would be advantageous to pull the new wire into the span as the old wire is pulled out of the span, proceed as instructed in paragraph 10.02, provided that:

a. The existing drop wire span has at least the minimum required clearance over streets or highways, or over secondary electric service wires operating at less than 300 volts.

b. Specific approval to use this method has been obtained from the supervisor.

c. The operation of the drop wire reel can be observed from the handline location.

d. The drop wire reel can be located in a stable position so that when the tension in the wire span is transferred to the reel, it will not slide along the ground or fall over.

e. The existing drop wire span is not taut.

f. The existing wire does not cross over power wires or power cables operating at 300 volts or more.

CAUTION: If all of the above conditions are not met, the employee shall follow the standard method for lowering an existing drop wire span and raising a new drop wire span.

10.02 If conditions permit pulling the new drop wire into place as the old wire is pulled out, proceed as follows:

a. Remove the C knob or the D wire clip and the associated loop of drop wire from the first building attachment. Do not remove the drop wire clamp which suppports the wire span.

b. Attach a temporary guide loop to the first building attachment (Figure 3) to prevent the replacing drop wire from becoming accidentally disengaged from the building attachment.

c. Place the drop wire reel in a stable position near the foot of the ladder on the side away from the wire span.

CAUTION: Fasten the inner end of the coil of drop wire securely to one of the springless spokes of the drop wire reel.

d. Set the brake of the reel so that it will hold the tension in the wire span after it is transferred to the reel.

e. With the drop wire paying off from the bottom of the reel, pass the end of the wire over the first building attachment and through the temporary guide loop at this attachment.

f. Place a temporary drop wire clamp on the wire to be replaced, about one foot out in the span. Seat the clamp firmly on the wire. Tape the front end of the temporary clamp so that it will not foul on the strand, guard arm, or crossarm.

NOTE: If the drop wire is to be pulled over a drive hook or other support on which the temporary clamp would snag, securely fasten the end of the wire from the drop wire reel to the wire in the span, as shown in Figure 4.

g. Securely tie the end of the wire from the drop wire reel to the bail of the temporary drop wire clamp.

h. Reel up all slack between the drop wire reel and the temporary drop wire clamp so that tension is removed from the original drop wire clamp.

i. Go to the other end of the drop wire span and lash one end of the handline to the base of the pole or, if at a span clamp, to the lower rungs of the ladder or to a nearby pole or tree.

j. Loop the other end of the handline under the body belt or use a handline carrier as instructed in paragraph 2.05, and climb the pole or ladder.

k. Disconnect the drop wire from the terminal and remove the free end from the wiring rings on the pole.

l. Place a temporary drop wire clamp on the free end of the drop wire (not in the span) to be replaced. This arrangement eliminates the necessity of pulling the temporary drop wire clamp over the strand, guard arm, drive hook, or crossarm on which it may become fouled.

m. Tie a loop of the handline to the bail of the temporary drop wire clamp so that the lashed end of the handline is sufficiently taut to remove tension from the original drop wire clamp.

n. Remove the original drop wire clamp from the drop wire at the pole or span clamp, leaving the wire supported by means of the temporary drop wire clamp and the lashed handline.

o. Return to building; check to ensure that tension has been removed from the original drop wire clamp, and cut the wire to be replaced behind the temporary drop wire clamp with pliers.

p. Return to the pole or span clamp location; untie the handline and, while standing on the ground, pull the new wire into the span. Observe the drop wire as it feeds from the drop wire reel to make sure that the brake maintains sufficient tension to prevent the wire from sagging excessively.

q. When a sufficient length of new wire has been pulled over the strand, guard arm, drive hook, or crossarm, lash the old wire to the base of the pole, or to the lower rungs of the ladder. The wire in the crossing span shall be reasonably slack so there will not be undue tension in the span when placing the drop wire clamp at the first building attachment.

r. Fasten the new wire span to the first building attachment with a drop wire clamp, and remove the temporary guide loop.

s. Fasten the new wire span to the pole or strand attachment without removing the old wire which was used as the pulling line. When attaching the drop wire to a span clamp, keep in mind that the strand is forced out of line by the ladder resting against it; make any adjustments necessary to avoid excessive tension in the wire span when the employee is working from the ladder, and also to ensure proper sag and clearance after removal of the ladder.

t. Detach the old wire from the new wire and complete the connection.

DROP WIRING

LOWERING AND REPLACING DROP WIRE POWER EXPOSURE UP TO 750 VOLTS

CONTENTS	PARAGRAPH
GENERAL	1
PRECAUTIONS	2
LOWERING WIRE OVER POWER WIRES OR POWER CABLES	3
REPLACING WIRE OVER POWER WIRES OR POWER CABLES	4

1. GENERAL

1.01 This practice provides procedures for the two-man method of lowering and replacing drop wire over power wires or power cables operating at **300 to 750 volts.**

NOTE: If for any reason it is necessary to lower or replace a drop wire crossing over any power wires or power cables operating at more than 750 volts, refer the matter to your supervisor for specific instructions.

1.02 The methods in this practice provide for drop wire to be lowered by means of a handline while employees remain on the ground, and to perform the work so that the drop wire does not come in contact with the power wires or power cables during the entire lowering operation. These methods are also intended to avoid the possibility of accidents caused by releasing tensions from a building or strand attachment while working from a ladder, or as the result of vehicles striking the wire or the handline as it is being lowered to the ground.

1.03 Refer to CTSP 475-301-605 for the methods of lowering or replacing a drop wire over power wires or power cables operating at **300 volts** or less or where there is no exposure to power. The methods of placing drop wire are covered in CTSP 475-301-405 and CTSP 475-301-410.

1.04 Drop wire should be twisted one complete turn for each ten feet of span length to reduce vibration and dancing when replacing.

1.05 See CTSP 490-060-001 for measuring clearances and separations in aerial plant; CTSP 475-300-405 for stringing sags and span limits.

2. PRECAUTIONS

NOTE: All precautions in CTSPs 490-050-104, 490-050-105, and 490-050-106 must be taken before climbing.

2.01 Two employees shall perform the work when lowering or replacing a drop wire over power wires or power cables operating at 300 to 750 volts. Obtain additional assistance before lowering or replacing a drop wire over streets, highways, or elsewhere if traffic, trees, or other conditions create a safety hazard.

2.02 Insulating gloves shall be worn by all employees when lowering or replacing a drop wire over power wires or power cables, until the crossing span has been completely removed or replaced.

2.03 The handline used for lowering or replacing a drop wire under the conditions described in this practice shall be free from metallic strands and shall be dry. A wet handline must not be used in the vicinity of power circuits operating at 300 volts or more.

NOTE: When it is necessary to maintain service or establish emergency service during rainstorms, a wet handline may be used over power circuits operating at 300 to 750 volts PROVIDED THAT INSULATING GLOVES, RUBBER BOOTS, AND RUBBER RAINCOATS ARE WORN.

2.04 When it is necessary to carry a handline up a pole or ladder, use a handline carrier (CTS #74-56-031-0), or double the end of the handline back on itself for a distance of approximately 1 foot. Place this loop under the right or left side or back of the body belt, or in such other position that the handline will be released readily if it is placed under tension while the employee is climbing the pole or ladder.

2.05 Never release the drop wire supports from a wire span while working inside the angle formed by the wire.

2.06 Avoid working from a ladder placed against a building with the side rails crossing a wire run, or in any other position where movement of the wire, due to loosening of the attachments, could cause an accident.

2.07 When a drop wire attached to a span clamp is to be lowered or replaced, place the foot of the extension ladder on the field side of the suspension strand and not in the street or highway. If there is no street or highway adjacent to the span clamp, place

the ladder against the opposite side of the strand from the drop wire run to the building.

2.08 If conditions could cause the handline, or the drop wire to which it is attached, to become disengaged from a drive hook or crossarm, or to slide along the strand or guard arm while performing the operations, the handline or drop wire shall be enclosed with a temporary guide loop. This loop shall consist of a short length of wire or rope placed over the handline or drop wire, with the ends of the guide securely tied as follows (Figure 1):

a. Guard Arm: Tie the ends to the guard arm on each side of the handline or drop wire.

b. Drive Hook: Tie one end to the vertical portion of the drive hook and lash the other end to the pole.

c. Crossarm: Tie the ends to adjacent pins or insulators.

d. Strand: Tie the ends across 2 span clamps.

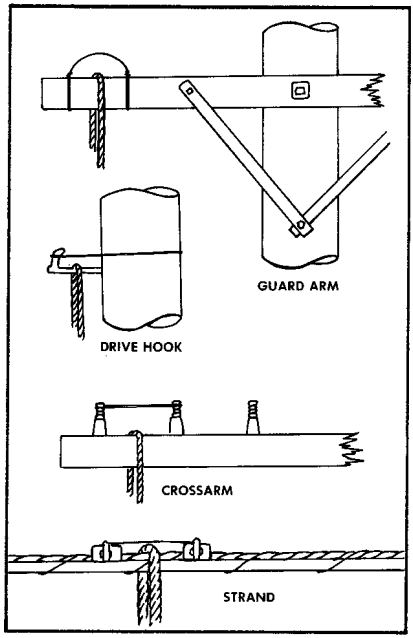


FIGURE 1. Temporary Guide Loop—Pole

3. LOWERING WIRE OVER POWER WIRES OR POWER CABLES

3.01 The procedure described below shall be followed when the drop wire span is to be permanently removed from plant, or lowered for inspection, repair, or replacement. Lower one wire span only at a time. Do not pull in new drop wire with old wire as it is pulled out.

a. Employee No. 1 loops one end of the handline under the body belt as instructed in paragraph 2.04 and climbs the pole or, if at a span clamp, the ladder. The handline shall be of a sufficient length to reach from the ground to the strand, guard arm, drive hook, or crossarm; then horizontally to about 25 feet beyond the power wires or power cables to ensure that the end of the drop wire can be pulled at least 10 feet beyond the power circuits.

CAUTION: IF A SPAN CLAMP IS INVOLVED, KEEP IN MIND THAT THE STRAND IS FORCED OUT OF LINE BY THE LADDER RESTING AGAINST IT; TAKE ANY STEPS NECESSARY TO PREVENT THE DROP WIRE FROM SAGGING ONTO THE POWER WIRES OR POWER CABLES WHILE CLIMBING AND WORKING ON THE LADDER. CARE SHOULD ALSO BE TAKEN TO ENSURE THAT THERE WILL BE ADEQUATE CLEARANCE BETWEEN THE EMPLOYEE AND POWER WIRES OR CABLES WHEN THE STRAND IS DEFLECTED BY THE WEIGHT OF THE EMPLOYEE ON THE LADDER.

b. Employee No. 1 places a temporary drop wire clamp on the wire to be lowered, about 1 foot out in the span, and seats the clamp firmly on the wire.

c. Employee No. 1 places the handline over the strand, guard arm, drive hook, or crossarm, and ties the end securely to the bail of the temporary drop wire clamp.

d. Employee No. 2, standing on the ground, grasps the free end of the handline and pulls it sufficiently taut to remove the tension from the original drop wire clamp. The handline is then lashed securely to the base of the pole or, if at a span clamp, to the lower rungs of the ladder (see Note). **Employee No. 1,** on the pole or ladder, cuts the drop wire approximately 6 inches behind the temporary drop wire clamp, leaving the drop wire span supported by means of the temporary clamp and the lashed handline.

NOTE: If a taut drop wire span is involved, Employee No. 2 on the ground grasps the free end of the handline and pulls it sufficiently taut to support the wire span, snubbing the handline if necessary. Employee No. 1 cuts the bail of the original drop wire clamp with pliers. Employee No. 2 slowly eases off the handline, thereby releasing excess tension in the taut wire span; then lashes the handline to the base of the pole or the lower rungs of the ladder.

e. Both employees go to the opposite or building end of the drop wire span.

f. Employee No. 1 cuts the drop wire in the building run at a point where the end of the wire can be reached from the ground; then frees the wire from all intermediate attachments between the cut end of the wire and first building attachment.

g. Employee No. 2 removes the C knob or the D wire clip at the first building attachment. A temporary guide loop is then placed at the first attachment around the drop wire, as shown in Figure 2, to prevent the wire from becoming accidentally disengaged from the building

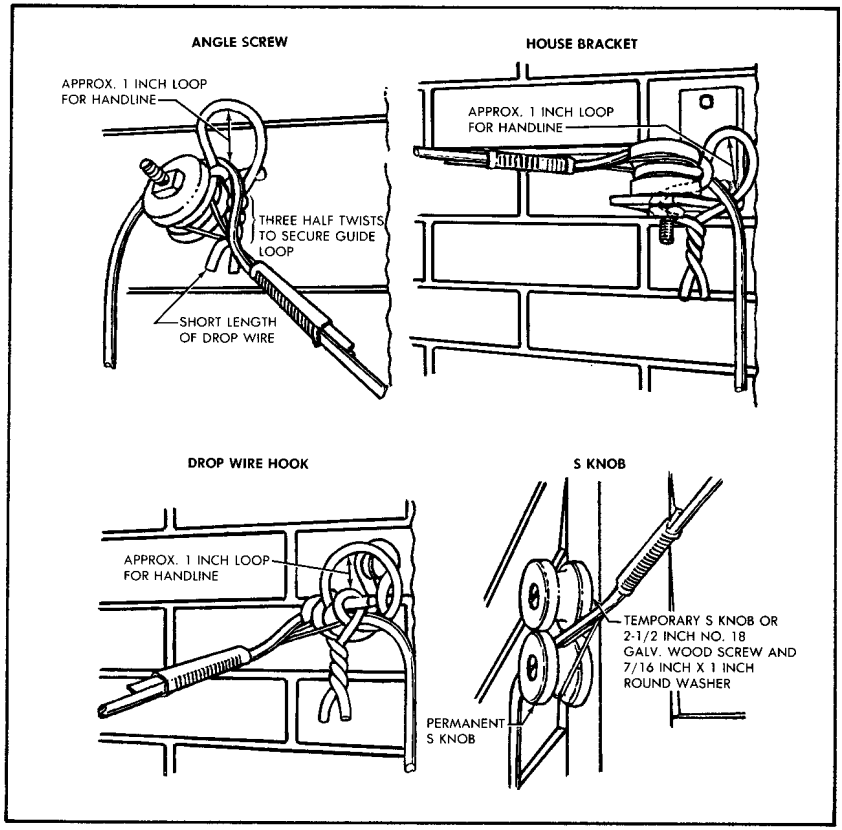


FIGURE 2. Temporary Guide Loop—Building

attachment as it is being pulled over the power circuits.

h. Employee No. 1, on the ground, holds tension in the drop wire while **Employee No. 2** removes the original drop wire clamp from the first building attachment. **Employee No. 1** continues to hold tension in the wire span to prevent it from coming in contact with the power wires or power cables.

i. Employee No. 2 returns to the other end of the wire span, unties the handline, and keeps the drop wire taut while feeding it to **Employee No. 1** who pulls it over the power circuits and coils the drop wire as it is pulled out of the span.

j. When the end of the drop wire has been pulled at least 10 feet beyond the power wires or power cables, and no traffic is approaching, **Employee No. 2** carefully releases the handline, allowing it to fall on the power circuits, and immediately goes into the street or highway to control traffic.

k. Employee No. 1 pulls the remainder of the drop wire and the handline to the building end of the span and away from the street or highway.

4. REPLACING WIRE OVER POWER WIRES OR POWER CABLES

4.01 When a drop wire crossing over power wires or power cables operating at 300 to 750 volts is lowered for inspection, repair, or replacement, it shall not be reused in the crossing span. Place new wire in the crossing span in accordance with the instructions in CTSP 475-301-410.

DROP WIRING

DROP WIRE RUNS TO BUILDINGS FASTENING AND EQUIPPING FIRST ATTACHMENTS

CONTENTS

1. GENERAL

1.01 This practice provides the rules to be followed for planning drop wire runs to buildings, and the methods of fastening and equipping first attachments. The fastener to be used on various type surfaces is also covered.

1.02 This practice replaces CTSP 475-300-401 and CTSP 475-300-415, all copies of which should be removed from the file and destroyed. For information on intermediate and last attachments of drop wire runs on buildings, see CTSP 475-302-405.

1.03 The attachments to be used in any installation depend on a number of factors, such as:

a. Loading areas.

b. Number of drops to be placed.

c. Angle at which drop approaches building.

d. Insulated or noninsulated attachments.

1.04 See CTSP 475-500-402, Station Protector Selection—Application, for information on the use of insulated or noninsulated attachments.

1.05 When galvanized attachments are fastened on buildings with aluminum siding in highly corrosive areas (industrial or marine), apply "C" rubber cement (CSS #66-52-003-7) to the siding at the point of contact.

CAUTION: It is possible for foreign voltage to be present on buildings covered with metal siding. Test siding with B voltage tester before starting any work.

2. PRECAUTIONS

NOTE: All precautions in CTSPs 490-050-104, 490-050-105, and 490-050-106 must be taken before climbing.

2.01 When planning an attachment to a customer owned clearance fixture, observe the following precautions:

a. Avoid climbing on roofs of customer premises.

b. Before making attachment, inspect fixtures, but do not make an attachment if there is any doubt as to the strength or firmness of the fixture.

c. On joint use fixtures, observe location of the power service drops to avoid body contact. **Wear insulating gloves when making attachment to the fixture.** Obtain a separation of at least 1 foot between telephone and power wires.

3. RULES

3.01 The following rules will be observed when planning drop wire runs to buildings:

a. Locate the first building attachment where the drop wire span will have the required clearance from light or power wires, other foreign wires, and metallic objects.

b. Locate the first building attachment where tree interference (including future growth of existing trees) will be avoided. It is preferable to make a longer wire run on the building if the trees can be cleared.

c. Locate the first building attachment so the drop wire span can be placed with adequate sag.

d. If possible, locate the first building attachment at the same point when two or more drop wires to a building are involved. The location of the initial and subsequent attachments should provide satisfactory wire runs in the span and on the building.

e. If possible, locate the first building attachment so the drop wire will make a direct vertical run to the last attachment, provided the drop wire in the span would have adequate clearance from trees; would not be objectionable to concerned parties if it crosses adjacent property; or would not cross portions

of vacant lots on which buildings are likely to be erected.

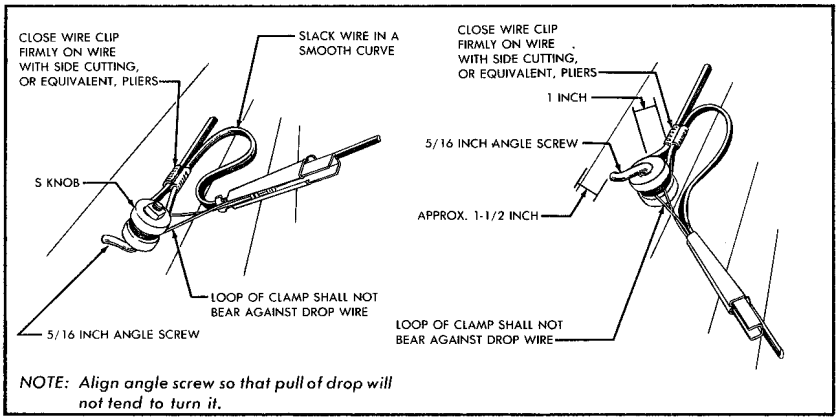
f. If possible, locate the first building attachment so ice and snow falling from the roof will not strike the drop wire. If the drop wire in the span must pass under the sloping part of a roof, make the first attachment as near the eaves as possible.

g. The first attachment should be located so the anchors will not be placed less than 10 inches to a corner or top of a wall, except in turning corners.

4. TYPICAL FIRST ATTACHMENTS TO BUILDINGS AND STEEL STRUCTURES (Figures 1 through 9)

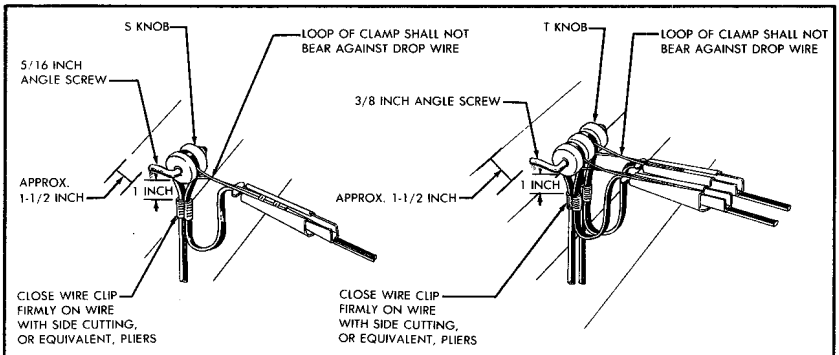
4.01 Tables A, B, C and D list anchoring devices of first attachments used on various surfaces.

4.02 Table E lists equipping information for first attachments.



NOTE: Align angle screw so that pull of drop will not tend to turn it.

FIGURE 1. First Attachment, Angle Screw (Drop Wire Run in Horizontal Direction On Building)



NOTE: Align angle screw so that pull of drop will not tend to turn it.

FIGURE 2. First Attachment, Angle Screw (Drop Wire Run in Vertical Direction On Building)

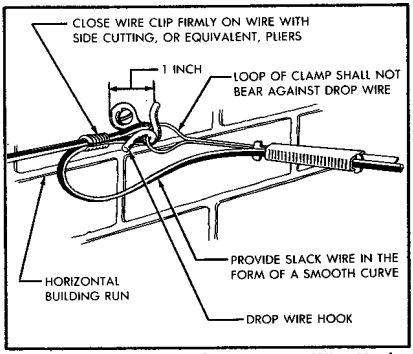


FIGURE 3. First Attachment, Drop Wire Hook

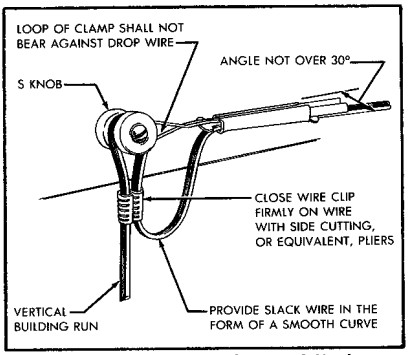


FIGURE 4. First Attachment, S Knob

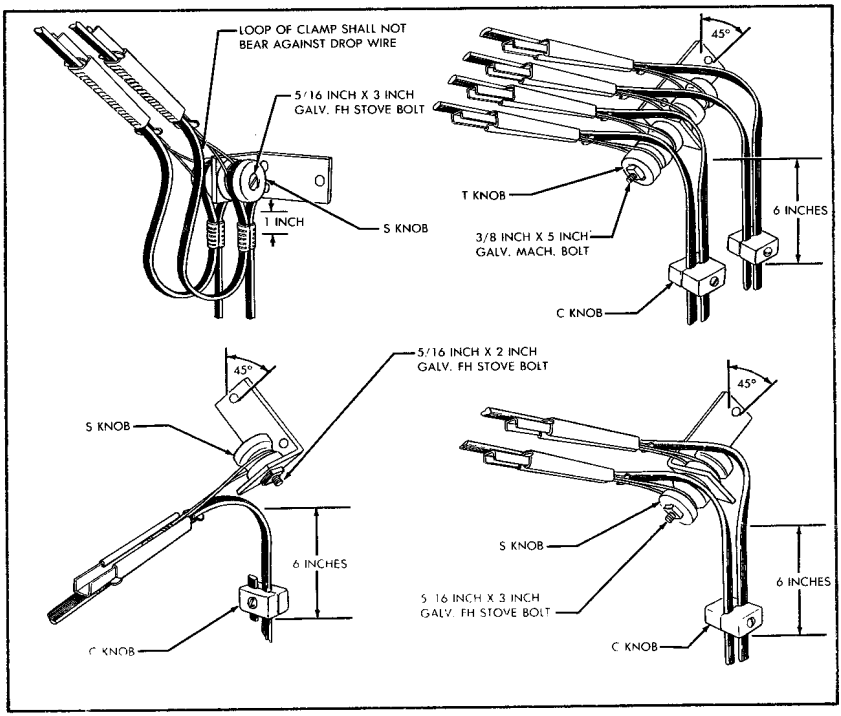


FIGURE 5. First Attachment, House Bracket (Drop Wire Run in Vertical Direction On Building)

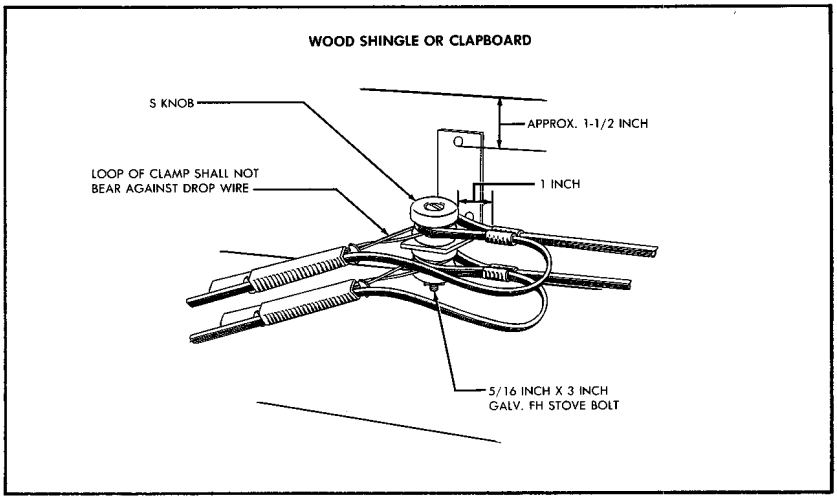


FIGURE 6. First Attachment, House Bracket (Drop Wire Run in Horizontal Direction On Building)

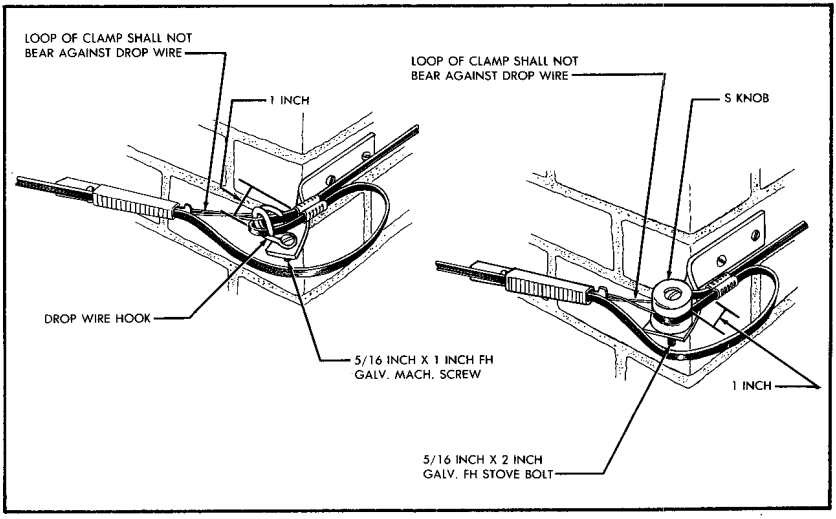
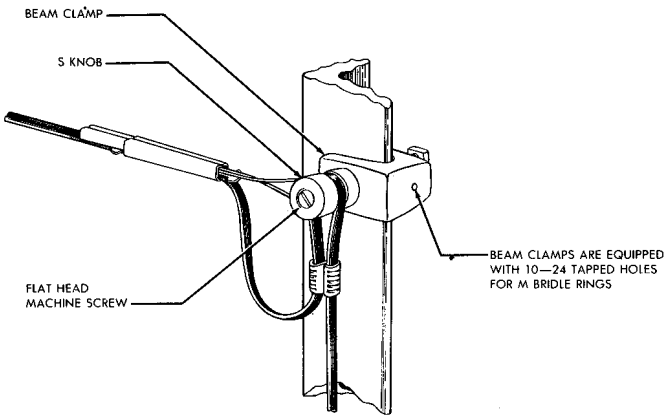
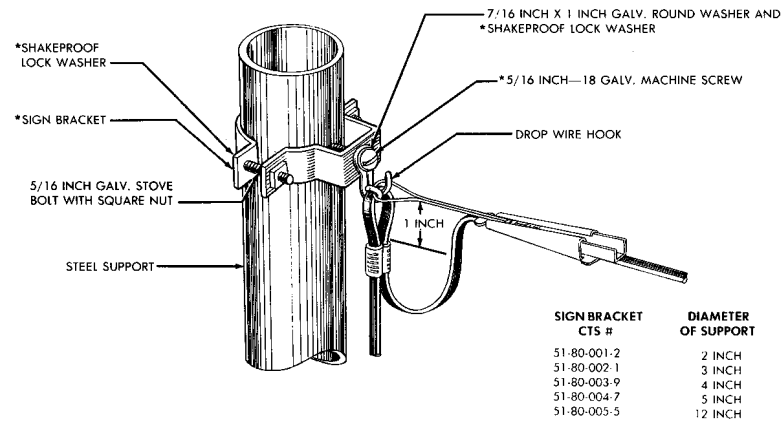


FIGURE 7. First Attachment, Corner Bracket



NOTE: Pull of drop wire must not tend to remove clamp from structure.

FIGURE 8. First Attachment, Beam Clamp



SIGN BRACKET CTS #	DIAMETER OF SUPPORT
51-80-001-2	2 INCH
51-80-002-1	3 INCH
51-80-003-9	4 INCH
51-80-004-7	5 INCH
51-80-005-5	12 INCH

**These items are furnished with sign bracket.*

FIGURE 9. First Attachment, Sign Bracket

TABLE A. Fasteners For Drop Wire Hook

WALL TYPE	FASTENERS		REMARKS
	QUANTITY	TYPE	
Wood Siding	1	2-in. No. 18 RH galvanized wood screw	Place screw in studding.
Stucco on Wood	1	2-in. No. 18 RH galvanized wood screw	Place screw in studding.
Rigid Composition Shingles	1	2-in. No. 18 RH galvanized wood screw	Drill Clearance hole to avoid splitting shingle.
Masonry or Substantial Brick Veneer*	1	5/16-in. by 1-3/4-in. drive anchor	Locate anchor in center of brick. Second drop wire hook should be located in separate brick.
Thin Wall Brick Veneer (Less Than 3-3/4 Inch Thickness)	1	6-in. No. 18 RH galvanized wood screw	Pass screw through the seam between bricks. Penetrate wood backing approximately 1 inch.
Hollow Tile	1	5/16-in. by 5-in. RH galvanized toggle bolt	Place 7/16 in. by 2-in. galvanized square washer between wall and drop wire hook.

**Do not use corner or top row of bricks.*

TABLE B. Fasteners For S and T Knobs

WALL TYPE	ATTACHMENT KNOB	FASTENERS		REMARKS	
		QUANTITY	TYPE		
Wood Siding	S	1	2-1/2 in. No. 18 FH galvanized wood screw	Place screw in studding.	
	T	1	3-1/2 in. No. 18 FH galvanized wood screw		
Stucco on Wood	S	1	3-in. No. 18 FH galvanized wood screw	Use 3-1/2 in.	If necessary to penetrate studding.
	T	1	3-1/2 in. No. 18 FH galvanized wood screw	Use 4-1/2 in.	
Rigid Composition Shingles	S	1	3-1/2 in. No. 18 FH galvanized wood screw	Drill clearance hole to avoid splitting shingle.	
	T	1	4-1/2 in. No. 18 FH galvanized wood screw		

TABLE B. Fasteners for S and T Knobs (Continued)

WALL TYPE	ATTACH-MENT KNOB	FASTENERS		REMARKS
		QUANTITY	TYPE	
Thin Wall Brick Veneer (Less Than 3-3/4 Inch Thickness)	S	1	7-in. No. 18 FH galvanized wood screw	Pass screw through the seam between bricks. Penetrate wood backing approximately 1 inch.
	T	1	7-in. No. 18 FH galvanized wood screw	
Hollow Wall	S	1	5/16 in. by 5 in. RH galvanized toggle bolt	Place flat side of S knob against bolt head.
	T	1	5/16 in. by 6 in. FH galvanized toggle bolt	

TABLE C. Fasteners For House Brackets

WALL TYPE	FASTENERS		REMARKS
	QUANTITY	TYPE	
Wood Siding	3	2-in. No. 14 RH galvanized wood screws	Place screw in studding.
Stucco on Wood	3	2-1/2 in. No. 14 RH galvanized wood screws	Place screw in studding
Rigid Composition Shingles	3	3-in. No. 14 RH galvanized wood screws	Drill clearance hole to avoid splitting shingle.
Masonry or Substantial Brick Veneer	2	5/16 in. by 1-1/4 in. B drive anchor	
Thin Wall Brick Veneer (Less Than 3-3/4 Inch Thickness)	2	6-in. No. 14 RH galvanized wood screws	Pass screw through the seam between bricks. Penetrate wood backing approximately 1 inch.
Hollow Wall	2	1/4 in. by 3 in. or 4 in. RH galvanized toggle bolt	

TABLE D. Fasteners For Corner Brackets

WALL TYPE	FASTENERS		REMARKS
	QUANTITY	TYPE	
Wood Siding	2	2-in. No. 14 RH galvanized wood screws	Place screw in studding.
Stucco on Wood	2	2-1/2 in. No. 14 RH galvanized wood screws	Place screw in studding.
Rigid Composition Shingles	2	3-In. No. 14 RH galvanized wood screws	Drill clearance hole to avoid splitting shingle.
Masonry or Substantial Brick Veneer	2	5/16 in. by 1-1/4 in. drive anchor	
Thin Wall Brick Veneer (Less Than 3-3/4 Inch Thickness)	2	6-in. No. 14 RH galvanized wood screws	Pass screw through the seam between bricks. Penetrate wood backing approximately 1 inch.
Hollow Wall	2	1/4 in. by 3 in. or 4 in. RH galvanized toggle bolt	

TABLE E. Equipping Drop Wire Attachments With S Knob, T Knob, Or Drop Wire Hook

ATTACHMENTS		EQUIPPED WITH			HARDWARE	REMARKS
		S KNOB	T KNOB	DROP WIRE HOOK		
Angle Screw	5/16 in.	1			Nut furnished	Place flat side of knob against beveled side of nut.
	3/8 in.		1			
House Bracket		1			5/16 in. by 2 in. FH galvanized stove bolt	Place flat side of first knob against house bracket.
		2*			5/16 in. by 3 in. FH galvanized stove bolt	Place flat side of second knob against beveled side of nut.
			1		3/8 in. by 3 in. galvanized stove bolt	Place flat side of first knob against bolt head.
			2*		3/8 in. by 5 in. galvanized machine bolt	Place flat side of second knob against nut.
				1	5/16 in. by 1 in. FH galvanized machine screw (obtain locally)	

TABLE E. Equipping Drop Wire Attachments With S Knob, T Knob, or Drop Wire Hook (Continued)

ATTACHMENTS		EQUIPPED WITH			HARDWARE	REMARKS
		S KNOB	T KNOB	DROP WIRE HOOK		
Corner Bracket		1			5/16 in. by 2 in. FH galvanized stove bolt	Place flat side of knob against corner bracket.
		2*			5/16 in. by 3 in. FH galvanized stove bolt	Place flat side of top knob against bolt head and place nut against flat side of lower knob.
			1		3/8 in. by 3 in. galvanized machine bolt	Place flat side of knob against bolt head.
				1	5/16 in. by 1 in. FH galvanized machine screw (obtain locally)	
Beam Clamps	D	1			5/16 in. by 2 in. FH galvanized stove bolt	Place flat side of knob against beveled side of nut.
	C		1		3/8 in. by 3 in. galvanized machine bolt	
	D			1	5/16 in. by 1 in. FH galvanized machine screw (obtain locally)	
	C					
Sign Bracket				1	5/16 in. by 3/4 in. RH galvanized machine screw	Machine screw and lock washers furnished. Obtain 7/16 in. by 1 in. galvanized round washer locally.

* *Locate one knob above and one knob below bracket.*

5. FIRST ATTACHMENTS ON LOW BUILDINGS

5.01 Paragraphs 4, 5 and 6 provide information on typical first attachments on low buildings using house fixtures provided by customers to obtain necessary ground clearance for drop wire.

5.02 Where house clearance fixtures are required but have not been provided, or where joint use of a fixture is impracticable, refer the matter to your supervisor.

5.03 Where clearance fixtures are provided but the required minimum ground clearance for drops cannot be obtained, refer the matter to your supervisor.

6. CLEARANCE FIXTURES AND METHODS OF ATTACHMENT

6.01 Figures 10 through 12 show typical clearance fixtures commonly provided by customers, and the recommended methods of making drop wire attachment. Where other types of fixtures are provided and different methods of making drop wire attachments are required, local instructions should be issued.

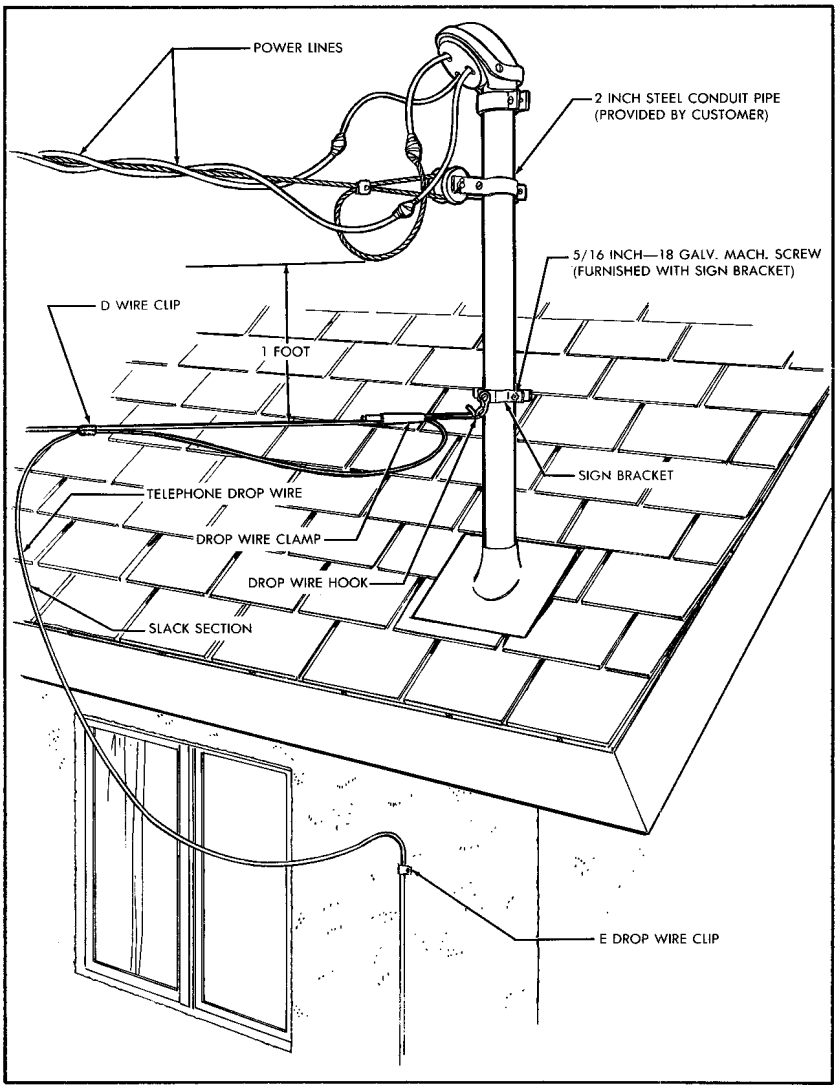


FIGURE 10. Drop Wire Attached To Power Fixture

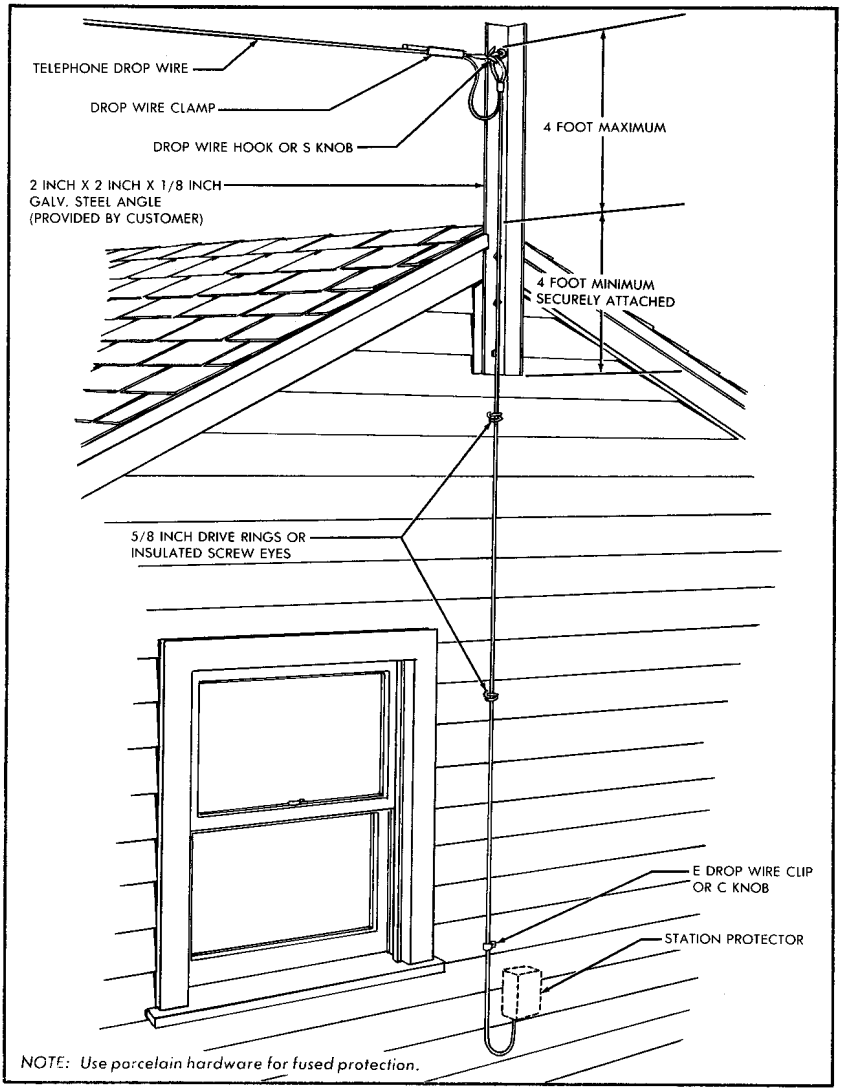


FIGURE 11. Drop Wire Attached To A 2-Inch Angle Iron

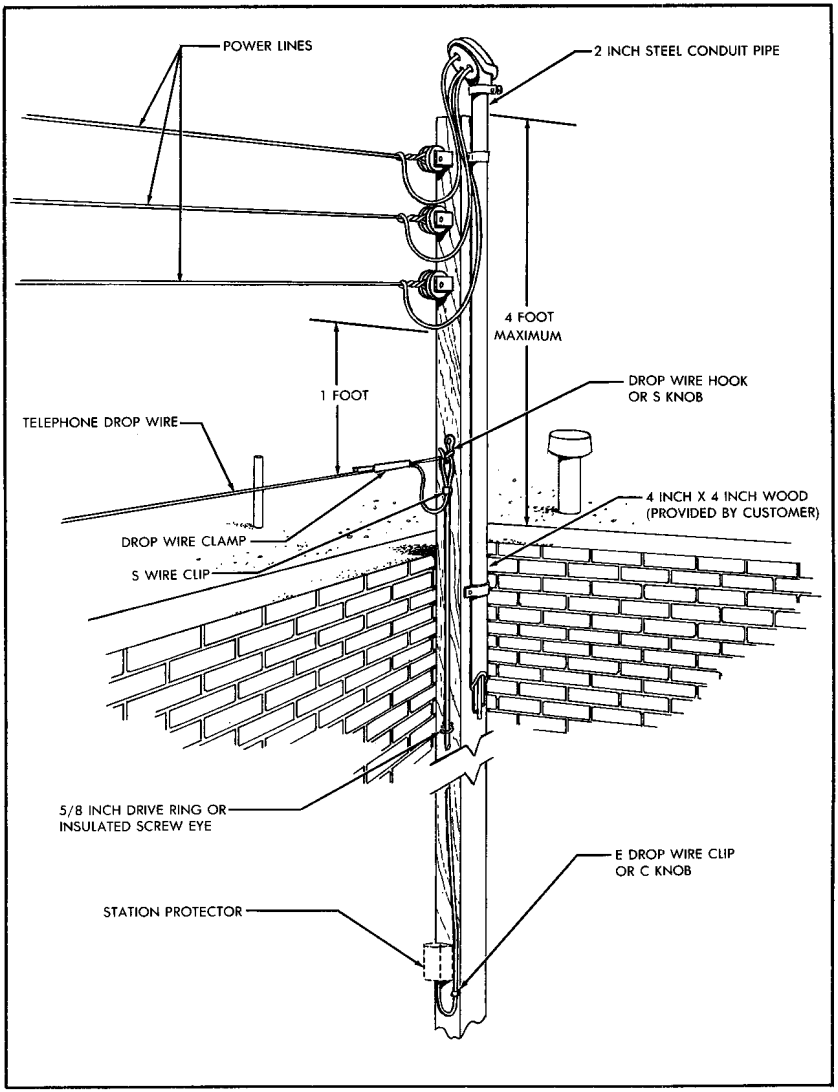


FIGURE 12. Drop Wire Attached To 1-Inch By 4-Inch Wood Beam

DROP WIRING

DROP WIRE RUNS ON AND INSIDE BUILDINGS FASTENING AND EQUIPPING INTERMEDIATE AND LAST ATTACHMENTS

CONTENTS

1. GENERAL

1.01 This practice provides information on material to be used and the rules to be followed for planning drop wire runs on buildings; the methods of fastening and equipping intermediate and last attachments; the methods of running drop wire on building walls and structures; and the methods of running drop wire inside buildings.

1.02 This practice replaces CTSP 475-300-401 and CTSP 475-300-415, all copies of which should be removed from the file and destroyed. See CTSP 475-302-401 for information on first attachments of drop wire runs.

1.03 The attachments to be used in any installation depend on a number of factors, such as:

a. Loading areas.

b. Number of drops to be placed.

c. Type of surface to be attached to.

d. Insulated or noninsulated attachments, etc.

1.04 The use of insulated or noninsulated attachments is covered in CTSP 475-500-402.

1.05 Where station protectors are required, plan the wire run so that the location of the point of entrance and the location of the station protectors conform to the methods covered in CTSP 475-500-405.

CAUTION: It is possible for foreign voltage to be present on buildings covered with metal siding. Test siding with B voltage tester before starting any work.

2. RULES

2.01 When planning drop wire runs on buildings, observe the following instructions:

a. Locate the drop wire run on the building giving consideration to permanency, accessibility, and appearance.

b. Locate runs preferably on the rear and side walls of a building.

c. Locate the run to require the minimum length of wire and as few turns as practicable. Keep runs horizontal or vertical.

d. Locate horizontal runs above the reach of the public.

e. If it would not appreciably increase the length of the run, locate vertical runs preferably in the angle formed by intersecting walls.

f. Locate the run to avoid light and power wires and so that it will encounter a minimum number of other obstructions.

g. Avoid runs on tin, sheet metal, or other materials requiring frequent repairs or renewals.

h. Avoid locating runs on walls which are likely to be added to, or on intermediate structures of a deteriorated or temporary construction. Select alternate routes.

i. Avoid vertical runs within 2 feet of a downspout where ice conditions are severe.

j. Do not make attachments to chimneys.

k. On building walls finished with stucco, rigid composition shingles, thin-wall brick veneer, and similar materials, locate attachments on wood trim if practicable and if the trim is sufficiently substantial to provide adequate support for the drop wire.

l. Maintain clearances from foreign wires. See CTSP 475-300-407.

2.02 Reuse an existing drop wire at a reinstallation wherever practicable. Inspect the wire carefully and, if necessary:

a. Tighten all loose rings and replace missing rings.

b. Replace spliced drop wire.

c. Where necessary, place mechanical protection around building projection, electrical conduits, and other obstructions.

d. If the insulation is weatherworn, replace the wire.

e. Remove strings or other foreign matter which may detract from wire run appearance.

3. SPACING OF ATTACHMENTS

3.01 Space drop wire attachments 6 feet apart or less on horizontal and vertical runs. For example, a 7-foot run would have attachments spaced 3 feet 6 inches apart.

3.02 Locate attachments so that fasteners will be placed no closer than 10 inches to the corner or top of a wall, except in turning corners.

3.03 Place additional attachments as required to keep exposed wires terminated at fused-type protectors from touching flammable surfaces.

3.04 When establishing a wire run on a building wall where cable has been placed, the wire run should parallel the cable run.

3.05 When paralleling cable is attached to building wall by cable clamps, place rings in every third cable clamp where clamps are 17 inches apart, and in every other cable clamp where clamps are 26 inches apart.

4. WIRE CARRYING CAPACITIES OF DRIVE RING, WIRE LOOPS, BRIDLE RINGS, AND INSULATED SCREW EYES

4.01 Table A shows the fastener to be used on drop wire attachments on various types of walls.

4.02 Table B shows the drop wire capacity of wire loops, drive rings, bridle rings, and insulated screw eyes.

5. INTERMEDIATE ATTACHMENTS ON BUILDINGS

5.01 Make all vertical or horizontal attachments on a straight line. For best results, fashion a plumb bob and hang from the first attachment. Use this as a guide.

TABLE A. Fasteners for Intermediate Attachments on Drop Wire

ATTACHMENT		FASTENER QTY	FASTENER TYPE		TYPE OF CONSTRUCTION		REMARKS
Wire Loops	No. 5/8 No. 1-1/4	1	Wire Loop Fastener	3/4 in. 1 in. 1-1/4 in.	Concrete Mortar Cinder Cement	Block	Fasteners for hand-type drive tools
Drive Rings	1/2 in.	1	3/16 in. x 5/8 in. Drive Anchor CTS # 68-21-001-9		Masonry or substantial brick veneer		
	5/8 in. and 7/8 in.	1	1/4 in. x 1 in. Drive Anchor CTS # 68-21-002-7				
	5/8 in. L* 7/8 in. L* 1-1/4 in. 1-1/4 in. L*	1	1/4 in. x 1 in. Drive Anchor CTS # 68-21-003-5				
C Bridle Rings	7/8 in.	1	No. 12 Plastic Anchor CTS # 68-21-034-5		Masonry or substantial brick veneer		
	1-1/4 in. 1-5/8 in.	1	No. 16 Plastic Anchor CTS # 68-21-034-5				
	3 in.						

** The L type is equipped with longer shank.*

TABLE A. Fasteners for Intermediate Attachments on Drop Wire (Continued)

ATTACHMENT	FASTENER QTY	FASTENER TYPE	TYPE OF CONSTRUCTION	REMARKS
B or M Bridle Rings	1	Utility Clip	Angle Irons, I beams, etc.	
C Knob (used only where fused protectors are required)	1	2-1/2 in. No. 10 RH galvanized wood screw	Exposed woodwork (outdoors)	Locate screw approximately 1 inch above bottom shingle or clapboard.
	1	2 in. No. 8 RH blued wood screw	Exposed woodwork (indoors)	
	1	3 in. No. 10 RH galvanized wood screw	Stucco on wood	
E Drop Wire Clamp	1	Headed Drive Pins 3/4 in.	Concrete	Fasteners for hand-type drive tools
		Headed Drive Pins 1 in.	Mortar	
		Headed Drive Pins 1-1/4 in.	Cinder Block / Cement Block	
	1	3/16 in. x 1 in. Plastic Anchor	Brick	
	1	1 in. No. 8 RH galvanized wood screw	Wood siding or shingle and metallic siding on wood	Locate screw approximately 1 inch above bottom shingle or clapboard.
	1	3/16 in. x 3 in. toggle bolt	Hollow wall	

* *The L type is equipped with longer shank.*

TABLE B. Attachment Capacity

TYPE OF RING OR INSULATED SCREW EYE	SIZE	MAXIMUM NUMBER OF WIRES	
		DROP WIRE	STATION WIRE
Drive Rings	1/2	2	3
	5/8 and 5/8 L*	6	9
	7/8 and 7/8 L*	16	22
	1-1/4 and 1-1/4 L*	30	40
Wire Loops†	No. 5/8	6	9
	No. 1-1/4	30	40
Bridle Rings	7/8	6	9
	1-1/4	16	22
	1-5/8	30	40
	3	100	140
A or M Bridle Rings	1-1/4	16	22
Insulated Screw Eyes	5/8 and L*	4	
	1 S and L*	10	

* *L represents longer shank.*
† *Install with suitable wire loop fastener.*

5.02 Drop wires extended with **fuseless protection** should be supported with the following attachments:

a. Drive rings on wood frame building.

b. Wire loops and a suitable wire loop fastener on masonry surfaces.

c. Toggle bridle rings on hollow surfaces.

d. Bridle rings as a substitute for drive rings when:

(1) Drive rings are likely to split woodwork.

(2) An intermediate support is needed for greater wire carrying capacity.

5.03 Drive rings equipped with a drive anchor, or bridle rings equipped with a plastic anchor may be used on masonry surfaces if they can be used to better advantage than wire loops.

5.04 Drop wire runs that require **fused protection** and that are to be attached to a flammable surface should be supported with porcelain hardware such as:

a. Insulated screw eyes.

b. A "C" knob may be used if not more than two wires are to be placed.

NOTE: Place drop wire in C knob so that tension is in a clockwise direction on C knob when only one drop wire is used.

5.05 Figures 1 through 8 illustrate spacing of typical wire runs using a variety of attachments.

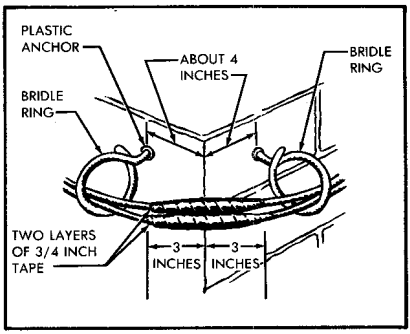


FIGURE 1. Bridle Ring

6. INTERMEDIATE ATTACHMENTS INSIDE BUILDINGS

6.01 Drop wire runs between the point of entrance and the station protector should be kept as short as practicable.

6.02 Exposed runs that require fused protection and attach to flammable surfaces should be supported with insulated attachments.

6.03 Space attachments 16 inches apart on runs between the point of entrance and the protector or connecting block. Spacing will vary at corners with type of attachment used. See Figure 5.

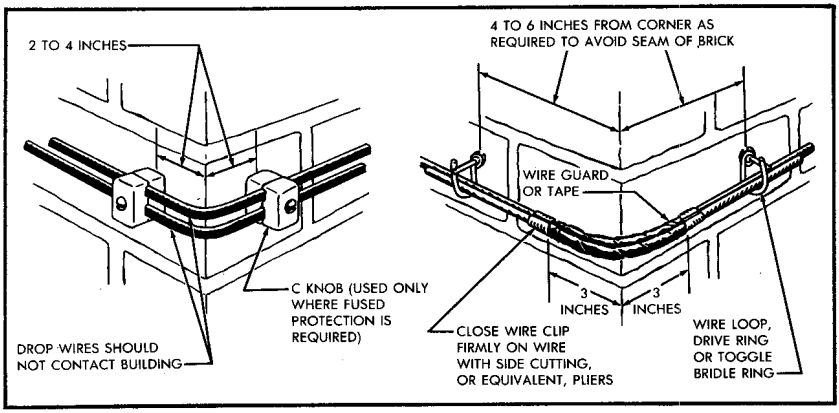


FIGURE 2. Intermediate Building Attachment at Outside Corner

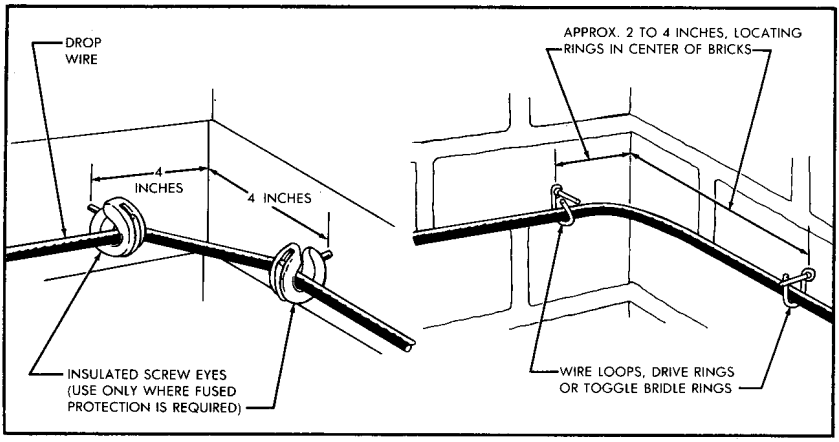


FIGURE 3. Intermediate Building Attachments at Inside Corners

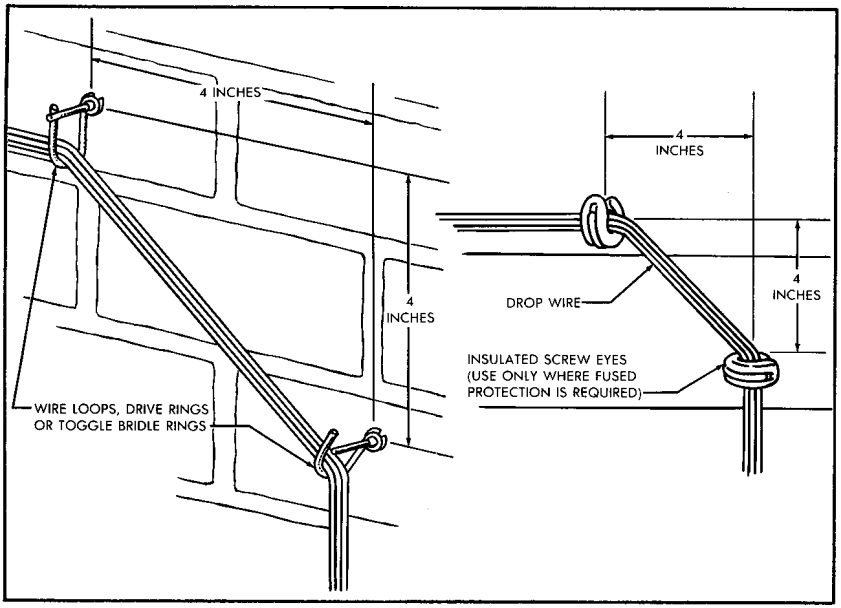


FIGURE 4. Intermediate Building Attachments to Change Direction of Wire Run

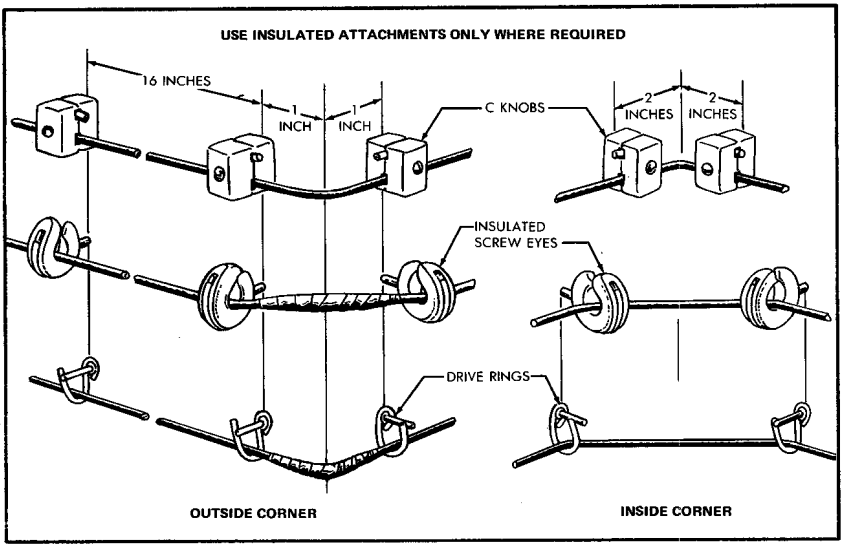


FIGURE 5. Attachments Inside of Building

6.04 Where drop wires are extended from unexposed plant, or from the station side of a fuseless protector, the method of fastening between the point of entrance and the connecting block or subscriber set is the same as for fastening station wire.

7. PARALLELING CABLE RUN

7.01 When establishing a wire run on a building wall where cable has been placed, attach the wire run as follows (Figure 6):

a. Place a drive ring or a C bridle ring in every third cable clamp where clamps are 17 inches apart.

b. Place the drive ring or C bridle ring in every other clamp where the clamps are 26 inches apart.

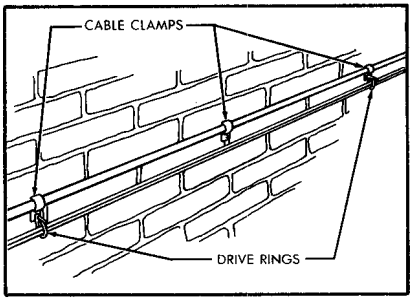


FIGURE 6. Drive Ring or Bridle Ring Run Paralleling Cable Attached with Cable Clamps

8. ATTACHING TO STEEL STRUCTURES

8.01 Manufacturing buildings, warehouses, piers, etc., require special means of attaching. Methods of attaching which have proven practicable are:

a. The utility clip (Figure 7), equipped with either a drive ring or the A or M bridle ring, is used to support wire runs on I beams, angle irons, etc., on beam thickness of 1/8 to 1/2 inch.

b. Beam clamps equipped with C or T knobs or bridle rings can be used in various applications to attach to I beams, angle irons, etc. See Figure 8.

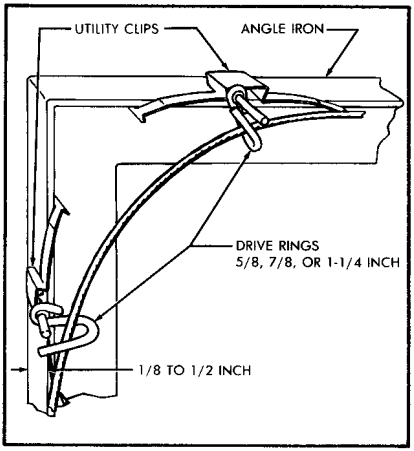


FIGURE 7. Utility Clips

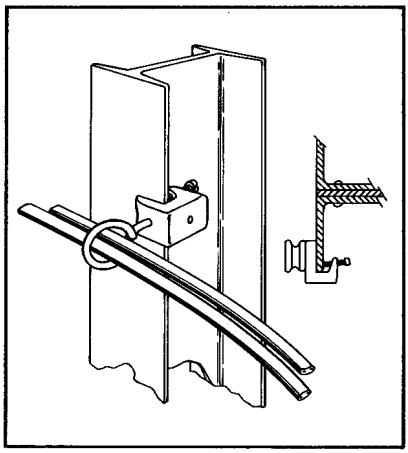


FIGURE 8. Beam Clamp and Bridle Ring

9. PARTY LINE TAPS

9.01 Party line taps should be avoided. When it is necessary to make a tap, use a wire terminal. In making a party line connection, a bridge may be made at the most accessible point in an existing wire run, provided this point is 50 feet or more away from the terminal, or if there is no space available on the binding posts for terminating the new party. If the most convenient point for bridging in the run is within 50 feet of the terminal, run the wire to the terminal, provided there is space available on the binding posts.

10. LAST ATTACHMENTS

10.01 The last attachment should be located within 18 inches of the building entrance hole.

10.02 Where fused protection is used, use a C knob or an S or T knob with a D Clip. The E drop wire clamp is used with fuseless protection.

10.03 Place drop wire in C knob so that tension is in a clockwise direction on C knob when only one drop wire is used.

10.04 See Figure 9 for typical arrangements for last attachments.

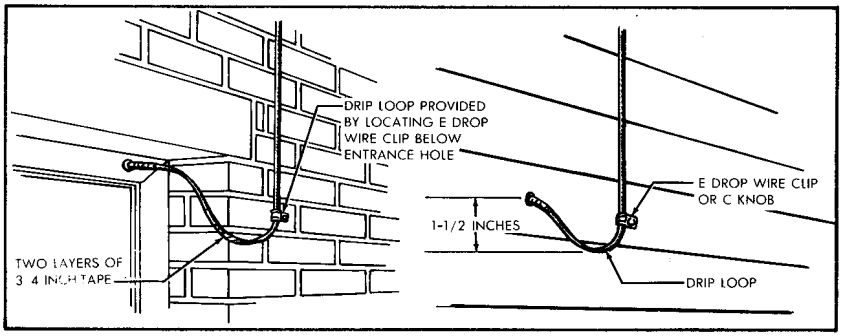


FIGURE 9. Last Attachment, Building Entrance Hole

11. BUILDING ENTRANCE HOLES FOR DROP WIRES

11.01 Use plastic tubes at building entrance holes for drop wire where fused protection is required and the wire passes through a flammable surface. Place tube as shown in Figure 10. Cut plastic tubes with a hacksaw or diagonal pliers. Do not use split tubes at entrance holes.

11.02 When drilling building entrance holes, consider the following:

a. Drill holes away from side where appearance is most important.

b. Slope holes upward from outside.

c. Use seams when drilling through masonry.

d. Take care to avoid splintering wood or cracking masonry or brick.

e. Drill clearance hole on all types of shingle siding.

11.03 Sizes of building entrance holes for wires and plastic tubes are shown in Table C.

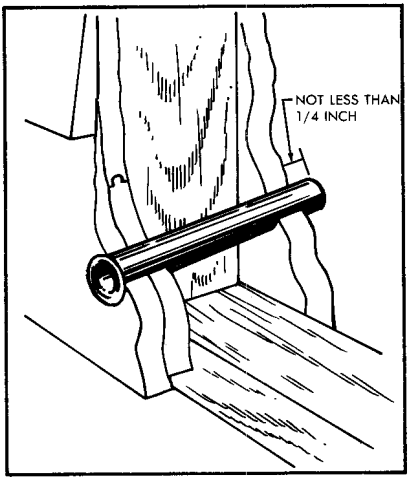


FIGURE 10. Placing Tube

TABLE C. Sizes of Building Entrance Holes for Drop Wires and Plastic Tubes

NUMBER OF DROP WIRES	1	2	3	1	2	3	4
	Plastic Tube Required			Tube Not Required			
Tube Size, Inch	3/8	1/2	5/8				
Entrance Hole Size, Inch	1/2	5/8	3/4	3/8	1/2	5/8	3/4

SELECTION OF ROUTE FOR STATION WIRE AND CABLE

CONTENTS

1. GENERAL

1.01 This practice provides recommended guidelines for routing and installing station wiring and cable.

1.02 This practice is issued to provide:

a. All telephone employees with the same information that the building industry consulting service gives to developers, architects, contractors, and building owners.

b. More detailed information and requirements pertaining to the use of false ceilings for concealing telephone plant.

c. Requirements for concealing wires and cables in walls.

d. Revised procedures to follow for advance wiring.

1.03 In addition to the conditions outlined in this practice, certain local building codes may add further restrictions to the placement of cables in buildings. If the local building codes exceed the requirements of telephone company standards the building codes will apply. If telephone company standards exceed the requirements of the local building codes, the telephone company standards will apply.

NOTE: Know the requirements of local building codes. Be sure concealed cabling satisfies fire codes.

2. UNUSUAL BUILDING ENTRANCES

2.01 Entrances at Metal Frame Windows and Doors:

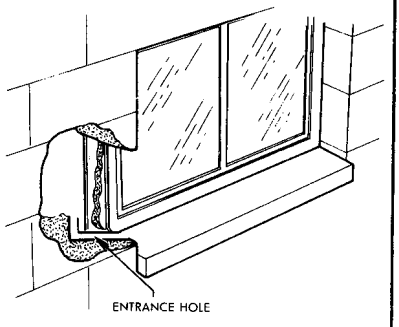
a. Do not make entrance through metal door frames.

b. When a metal window frame is set in masonry or bricks, enter as shown in Figure 1.

c. Bore hole in mortar joint as shown in Figure 2. Be sure slot is deep enough so wire is cleared when shutter or screen is operated.

NOTE: Wires or cables should ***not*** *be placed in conduits or raceways which contain electric wires not properly separated by partitions from the space provided for telephone wires or cables.*

d. Locate hole as shown in Figure 3 to avoid drilling through two shingles.



NOTE: Bore hole from both sides to pass around frame.

FIGURE 1. Entrance at Metal Window

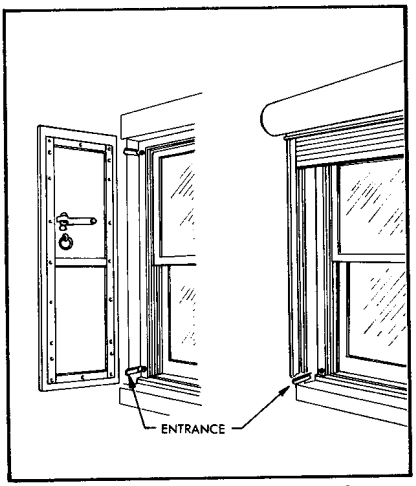


FIGURE 2. Entrance at Shutter or Fire Screen

3. GENERAL INSTALLATION REQUIREMENTS

3.01 General Notes Pertaining to Telephone Facilities Installation:

a. Seal all conduit ducts at each end between underground terminals or utility poles and the customer's premises. A weatherhead may be used if the conduit terminates above ground.

b. **Inside wire runs and outlets:** A telephone outlet consists of a convenience outlet or plaster ring with a telephone cover plate and a suitable wiring channel.

(1) Conduit should be used where inside wire runs have turns or go through a plastered ceiling, such as in a garage. Conduit is normally provided by customer.

(2) Pull wires may be used instead of conduit where a run is short and is vertical to an unfinished readily accessible area, such as a basement, garage, etc. Pull wires should be No. 14 single A.W.G. or the equivalent.

(3) Avoid attic runs wherever possible.

c. Interior wiring in buildings to provide telephone service to the occupants will be furnished, installed, and maintained by the telephone company.

d. Advance wiring may be provided in the following instances:

(1) In unfinished buildings, such as apartment houses, multi-unit dwellings or other living quarters.

(2) When service orders have been issued in advance, pending the availability of facilities to connect service.

3.02 Figure 4 and Table A show various points which should be considered when selecting routes for wire and cable.

3.03 Facilities to Look For:

a. Existing conduits or raceways.

b. Existing wiring or cable.

3.04 Placement of Wiring or Cable:

a. Run wire or cable horizontally or vertically in a straight line.

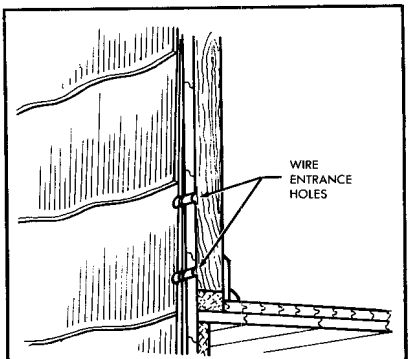
b. Use baseboards or other trim where conduit is not provided.

c. Make use of wooden surfaces in preference to others where possible.

d. Keep runs short as possible.

3.05 After location of first attachment has been determined, consider the following:

a. Locate the station wire run on the building



NOTE: Avoid drilling holes through 2 shingles.

FIGURE 3. Entrance Through Composition Shingles

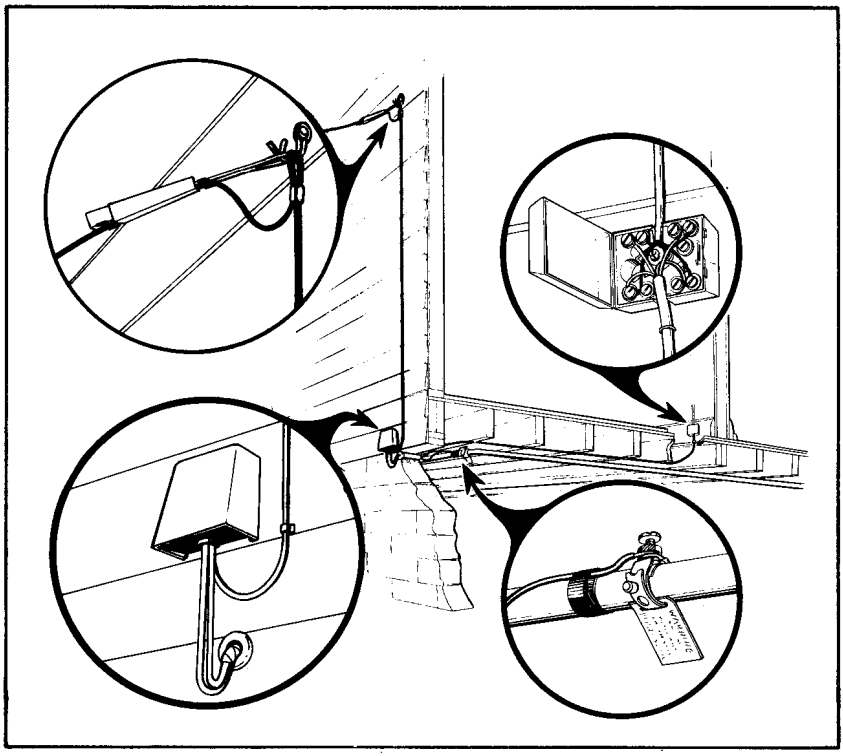


FIGURE 4. Typical Wiring Routes

with a view to permanency, and accessibility.

b. On building walls finished with stucco, rigid composition shingles, brick veneer, and similar materials, locate attachments on wood where practicable.

c. Locate preferably on the rear and side walls of a building.

d. Place horizontal run above the reach of the public.

e. Do not run wires in front of signs, doors, windows, fire escapes, awnings, etc.

f. Do not place wire runs on walls which are likely to be built against.

g. Avoid locating on intermediate structures of a deteriorated or temporary construction; select alternate route.

h. When making a wire run on a building wall near cable, proceed with one of the following methods:

(1) Use rings installed with cable clamps.

(2) Remove nails or screws that hold cable clamps and replace with drive rings.

(3) Install separate wire run paralleling cable.

TABLE A.
IF NO ENTRANCE CONDUIT

TYPE OF CONSTRUCTION	POINT OF ENTRANCE				
	WOODEN WINDOW FRAME	WOODEN DOOR FRAME	FOUNDATION SILL	OUTSIDE WALL*	METAL WINDOW FRAME
Masonry or Brick	•	•			•
Wood or Stucco on Wood (basement ceiling unplastered)	•	•	•	•	
Wood or Stucco on Wood (basement ceiling plastered)	•	•		•	

*To wire direct to set or connecting block.

3.06 Avoid the following locations when placing wire or cable:

a. Damp locations.

b. Locked storerooms, etc.

c. Temporary structures.

d. Runs that provide support for foreign objects.

e. Excessively hot locations, steam pipes, etc., run wires over rather than under pipes.

f. Locations where wires and cables will be subjected to abrasion.

3.07 In explosive atmospheres, locate and install wiring as instructed in accordance with the equipment being installed.

a. In explosive areas, all telephone lines must run through conduit and be sealed up on completion.

b. Explosive type telephone set must be used.

3.08 Requirements for Ground Wire Runs: (See CTSP's 475-500-405, 475-500-410 and 475-300-407).

a. Make runs as short as possible.

b. Locate wire where it is least likely to be disturbed.

c. Run protector ground wire exposed, except where conduit has been provided.

d. Do not place protector ground wire in ring runs.

e. Signal ground wire may be placed in ring runs.

f. When existing protector ground wire has become enclosed by a ceiling or partition, reuse if continuity can be checked and ground clamp is accessible.

g. Avoid sharp corners.

h. Do not place any coils in ground wire.

i. Use proper size.

4. MAKING USE OF WIRE DISTRIBUTION SYSTEMS

4.01 Distributing Systems in Office Buildings:

a. Office buildings are generally provided with an exchange cable terminated in a main terminal on the ground floor and distributed to each floor through a building or house cable, or the exchange cable may be distributed directly to each floor.

b. For information regarding the building conduit system, consult the plan at the main terminal or contact the building superintendent.

4.02 Distributing Systems in Apartment Houses, Hotels, and Hospitals:

a. Generally, these buildings provide a main terminal location in the basement or ground floor and a wall conduit system to each apartment or room.

b. In large buildings, there may be house cable from the main terminal to each floor with a terminal on each floor and conduits to the various apartments or rooms from the floor terminal.

5. SELECTION OF EXPOSED WIRING ROUTE

5.01 Generally, an exposed wire route should be used only where no concealing facilities are available.

5.02 Wiring in Finished Rooms and Offices:

a. Run wires along baseboards, on top of moldings, or on door or window casings, so that they will be as inconspicuous as possible. See Figures 5 and 6.

b. Where trim cannot be followed, run wires horizontally or vertically but not diagonally.

5.03 Wiring in Cellars, Factories, Storerooms:

a. Place wire and cable where they will be least likely to be broken or detached. Provide mechanical protection if necessary.

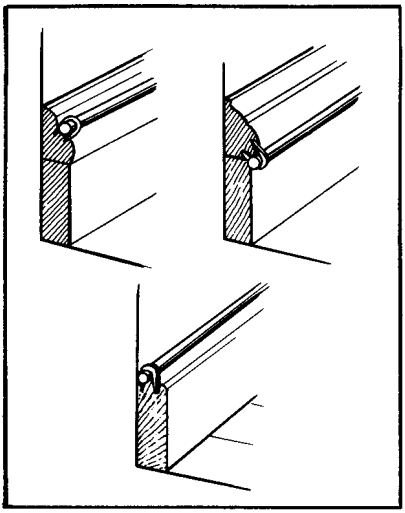


FIGURE 5. Wiring to Baseboards

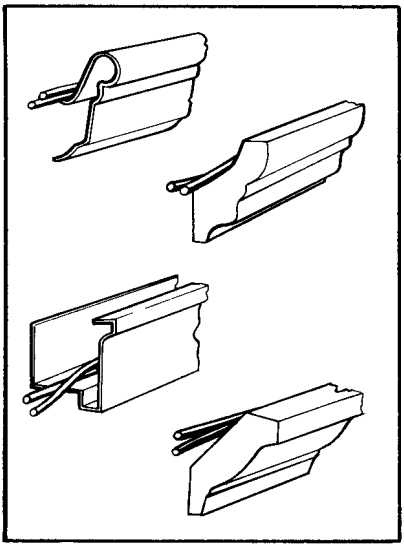


FIGURE 6. Wiring in Picture Moldings

b. Consider the shortest, most direct right-angle route unless otherwise specified.

c. Select a wire route which will be safe and accessible.

d. Follow the ceiling line rather than baseboard in heavily traveled passageways.

e. If necessary to follow chair rails, use the underside.

f. When possible, follow joists.

g. If necessary to span joists, run wiring not more than 3 inches from wall. See Figure 7.

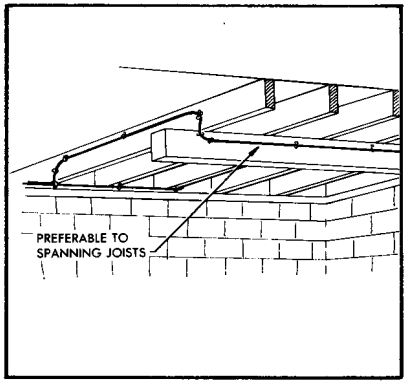


FIGURE 7. Spanning Joist

6. USING CONCEALED AND OVERFLOOR CONDUITS

6.01 Consider the following factors when using conduits:

a. Conduit should be used whenever it is provided for telephone wires and meets the prescribed specifications.

b. Check to be sure conduit does not contain electrical wires not associated with telephone equipment.

c. Consult the building people before extending wiring beyond the provided system.

d. When necessary to provide wiring through concrete floors or similar construction from floor to floor and conduit is not provided, inspect premises for pipes through floor which may be provided for such use.

7. PLACING STATION WIRE AND CABLE IN BUILDING RISER SHAFTS

7.01 Building riser shafts are usually of two types:

a. Closed riser shafts consist of a series of closets, aligned vertically one above the other, usually beginning in the basement and extending throughout the height of the building. The closets are interconnected by a cable slot or pipe sleeves through the floors.

(1) Polyethylene sheath cable may be placed if fire stops are placed in the slots or floor ducts at each floor. Fire stops should consist of a packing of asbestos or fiber glass with a thin topping of water plug cement or equivalent.

(2) If lead sheath cable or polyvinyl chloride (PVC) jacketed station wire and inside wiring cable is placed, fire stops are not required.

b. Open riser shafts usually extend from the basement to the roof of the building with no floor separations. They are similar in construction to elevator shafts.

(1) The use of polyethylene sheath cable is restricted unless it is enclosed in a noncombustible conduit.

(2) Lead sheath cable and PVC jacketed station wire and inside wiring cable may be placed with no restrictions.

NOTE: PVC jacketed wire and cable shall not be placed in ventilator or return air ducts unless in conduit.

8. USE OF AREA ABOVE SUSPENDED CEILINGS

8.01 It is not recommended to use the area above a suspended ceiling for concealing telephone plant. Avoid it whenever possible because of the following disadvantages:

a. The necessity of working on ladders over desks or other objects creates a safety hazard.

b. The employees of the tenant lose working time while the telephone employee works over their desks to install, maintain, rearrange, and remove telephone plant.

c. Expenses are incurred by the owner and the tenant when opening and closing ceilings for access by telephone employees.

d. The telephone employee loses time while waiting for the ceiling to be opened.

e. It is difficult to avoid low beams, air ducts, power conduits, etc., when placing telephone plant after the ceiling has been installed.

f. There is a possibility of damaging or soiling ceilings.

g. There is a possibility of telephone cables picking up interference from induction and causing noise in working circuits.

h. There is a possibility of having to rearrange telephone cables due to the addition or rearrangement of air conditioning ducts or other services.

i. Some fire codes prohibit using the area above suspended ceilings.

8.02 A ceiling distribution system is considered a last choice. An adequate underfloor raceway or conduit system is preferable. When it cannot be avoided, use the area above the suspended ceiling if the following conditions are agreed on by Telephone Company and builder/owner.

a. The area above a suspended ceiling is to be used only for telephone service on the same floor so that the **occupants** of one floor are not disturbed by telephone work for the **occupants** of another floor.

b. Whenever access is required, the ceiling shall be opened and closed by the building owner or customer.

c. Building entrance cables and house feeder or distribution cables require conduit.

d. Areas with solid or interlocking suspended ceilings require conduit.

e. Clear working space for placing wires and cables must be available and not blocked by vent ducts, pipes, supports, or other equipment.

f. Opening of fire walls to permit the passage of telephone wire and cable shall be completed by the building owner or the customer.

g. Telephone terminals properly sized and spaced to keep wire or cable runs to a maximum of 150 feet are required.

h. Suitable supporting structures of the type(s) outlined in paragraph 9 must be provided to support inside wires and station cables. Such supporting structures shall be placed by the building owner or customer.

i. No deviations from the preceding conditions shall be made without prior review by your local Engineering Department.

8.03 Whenever possible, avoid disturbing other tenants on the same floor where telephone service is being installed.

9. SUPPORTING STRUCTURES ABOVE FALSE CEILINGS

9.01 Make every attempt to secure the following type(s) of supporting structure(s) when placing inside wires or station cables above suspended ceilings:

a. Conduit.

b. Cable trays.

c. J-hooks.

d. Wire loops.

9.02 If none of these types of supporting structures can be obtained, inside wires or station cables can be placed directly on the main runners and/or cross runners (T-bars) of the false ceiling hardware, provided the conditions in paragraphs 9.03 through 9.05 are adhered to.

9.03 Inside wires and station cables that do not exceed a total of 500 pairs within a 4-foot section of the ceiling may be placed directly on the ceiling runners if the supporting structure(s) outlined in paragraph 9.01 cannot be obtained. Cable runs supported on the ceiling hardware should be placed as close as possible to the hangar wires.

9.04 Major runs of inside wires and station cables should be placed in the type(s) of supporting structures mentioned in paragraph 9.01 in **new buildings** or sections of existing buildings that have been **completely renovated.**

NOTE: A major run is a run that could ultimately exceed any combination of 500 total pairs.

9.05 In existing buildings, additional cables should not be added to any run supported on the ceiling runners if the combination of new and existing wires and cables will exceed 500 pairs within a 4-foot section of the ceiling. If the combination of new and existing wires and cables exceeds this limit, a route along another row of hangar wires should be selected.

a. Exercise care when working in false ceiling spaces to avoid distorting or damaging the ceiling.

b. Avoid blocking access tile in "limited access" type ceiling. Also avoid placing cables on or against any light fixtures.

10. TELEPHONE ZONES

10.01 The floor area to be served shall be divided into telephone zones consisting of not more than 400 to 600 square feet (between four adjacent columns).

a. To feed the telephone zone, the building will usually have a continuous length of 2-inch conduit in the ceiling space, properly supported to permit the pulling-in of cables. This conduit should extend from the nearest telephone terminal or apparatus closet and left open-ended at the midpoint of each telephone zone as illustrated in Figure 8.

b. For floor areas where the 2-inch conduit to the telephone zones is not available and where a number of inside wiring cables are to be placed loosely in the ceiling, adequate open-top cable supports (J-hooks) are required. These cable supports should be located on 5-foot centers and must be provided by the building owner to avoid damage to the ceilings because of cable weight.

11. USE OF WALLS OR PARTITIONS

11.01 The following conditions apply if hollow core walls or partitions are used for concealing telephone wire and cables:

a. The hollow core walls or partitions must be clear and unobstructed.

b. Opening of walls and partitions and the installation of outlet boxes are the responsibility of the building owner or customer.

c. A pull wire is required from all outlet boxes to the approved supporting structure above the suspended ceiling.

d. Use only vertical pull wire runs. If bends or horizontal runs are necessary, conduit is required.

NOTE: Fulfilling the above items shall be the responsibility of the customer.

11.02 If fire blocks, sound deadening materials, or insulation is used in the construction of walls or partitions, conduit must be run from the outlet to the approved supporting structures above the suspended ceiling.

11.03 Telephone employees shall not fish walls or partitions in commercial buildings.

11.04 Where it is planned to use walls or partitions to conceal inside wiring cables down from ceilings, a minimum of 1-1/2 inches in diameter is required to permit the connector end of the cable to pass from the top of the wall to the outlet box above floor. The following are recommended:

a. 1-1/2 inch conduit in wall or partition to outlet box. See Figure 9.

b. 1-1/2 inch square clear space between partition sections with snap-in panel or cover. See Figure 10.

c. Smaller conduit is suitable when no amphenol type of connector is on the cable.

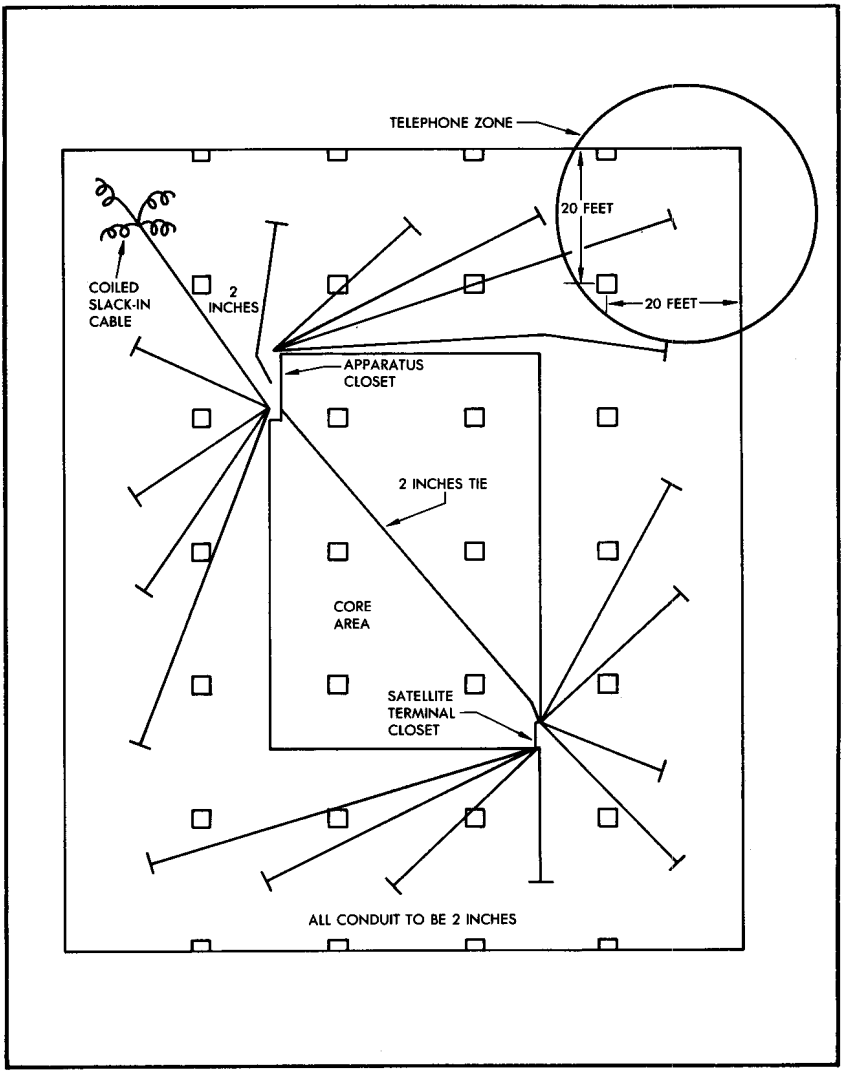


FIGURE 8. Typical Ceiling Distribution System Using Conduit to Telephone Zones

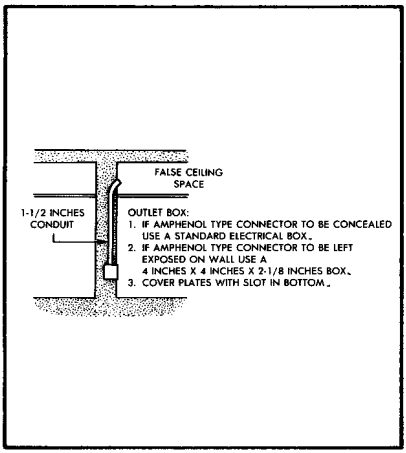


FIGURE 9. Conduit in Wall

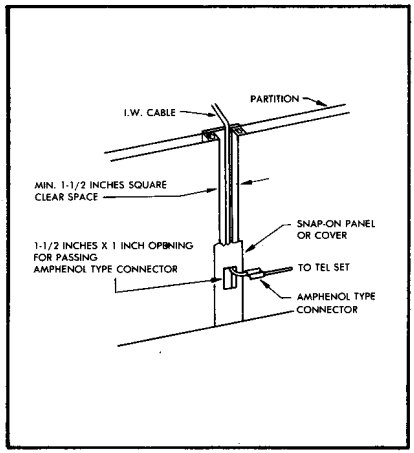


FIGURE 10. Partition Design

CONCEALING WIRE AND CABLE WITHOUT CONDUITS OR RACEWAYS

1. GENERAL

1.01 This practice outlines the procedures to follow in concealing wire and cable without conduits or raceways.

2. FISHING WIRE AND CABLE IN WALLS

2.01 Consider making runs on the outside of the building rather than fishing walls. Fish wire and cable only where appearance will not permit exposed runs, in accordance with local instructions.

a. Consider runs through closets, cupboards, etc., rather than fish.

b. Do not place plastic cable in shafts without baffles, because of fire hazards.

c. Where customer will not permit an exposed run and excessive time is required to conceal the run, consult your supervisor.

2.02 Fishing from Upper Floor to Basement:

a. When fishing from the upper floor to the basement, consider the type of construction used in the building.

b. Consider the location of obstructions.

c. Never fish between two studdings when electric light wiring is present. Presence of electric wiring is generally indicated by light switches, fixtures, or outlets.

d. In order to drill through obstructions between floors, the molding at baseboard and floor should be loosened. Consider the following procedure in loosening and replacing molding:

(1) Place a wood chisel under or in back of the molding and pry up or out gently.

(2) Then place a screw driver between molding and baseboard. See Figure 1.

(3) Pry carefully with chisel and screw driver to loosen nails which have been driven diagonally.

(4) Move tools forward as the molding is loosened and keep tools as near nail locations as possible.

(5) Loosen molding only as far as necessary to provide room for boring.

(6) Withdraw nails from molding by pulling the head through to the underside with diagonal pliers.

(7) Removing nails this way leaves the paint and putty undisturbed on the face of the molding.

(8) When replacing the molding, remove all dirt and chips from behind the molding and press the molding back into position, starting at the unloosened end.

(9) Fasten molding with thin wire finishing nails.

e. In general, no obstructions will be found in fishing brick or ballon (no obstructions between studs) frame houses. See Figure 2.

f. When fishing walls with obstructions, proceed as follows: See Figure 3.

(1) Loosen molding above baseboard on upper floor and drill hole downward through wall and plates above joist.

(2) Loosen molding at baseboard on upper floor and drill hole downward through floor and plates below joist.

(3) Loosen molding above baseboard on first floor and bore downward through wall and plates.

(4) On upper floor, pass fishing chain with twine attached through hole above baseboard, and with a piece of wire, hook chain through hole at baseboard and pass it through plates.

(5) On first floor, find fishing chain through hole above baseboard and pass it through plates.

(6) If basement has a ceiling, drill hole upward at location of chain and fish it out into basement.

(7) Tie on wire and pull it up to upper floor by use of twine.

g. When location of set, connecting block, etc., is some distance above baseboard, drill hole at location and fish from there down, proceeding as outlined in paragraph 2.02.

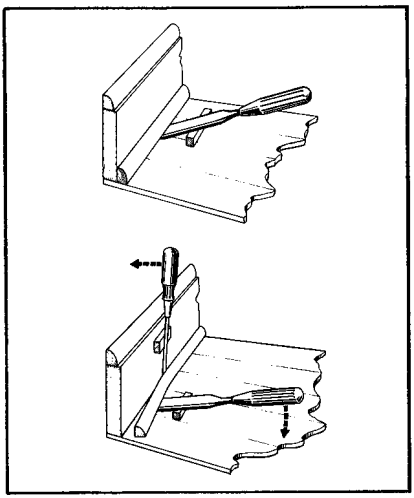


FIGURE 1. Procedure for Removing Molding

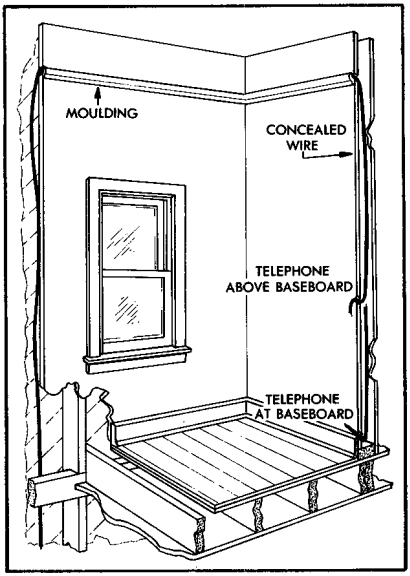


FIGURE 2. Locating on Inside Wall

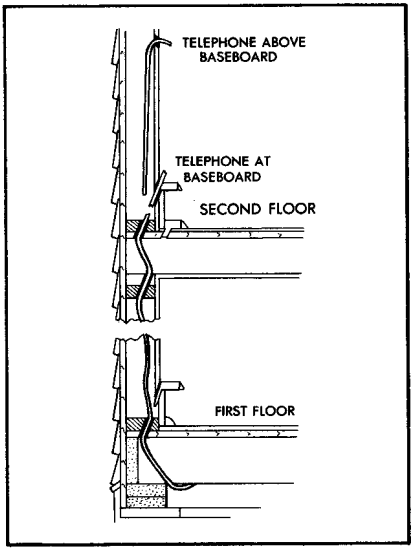


FIGURE 3. Fishing Outside Walls

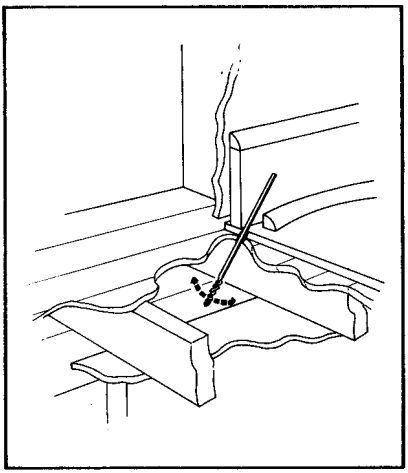


FIGURE 4. Locating Plates

(1) When drilling plates, locate them by feeling with the bit to determine proper position for drilling as shown in Figure 4.

(2) In locating the telephone connecting block, etc., on an inside wall, proceed as shown in Figure 2.

(3) Some of the obstructions which may be encountered are shown in Figure 5.

NOTE: If locations of obstructions are not known or cannot be determined readily, bore hole with search bit to locate them. Use caution when searching for obstructions. Avoid using search bit unless absolutely necessary.

2.03 Fishing Walls on the Same Floor:

a. Make runs on baseboards or around door and window frames where permissible.

b. Sound out walls or partitions by tapping lightly before attempting to fish.

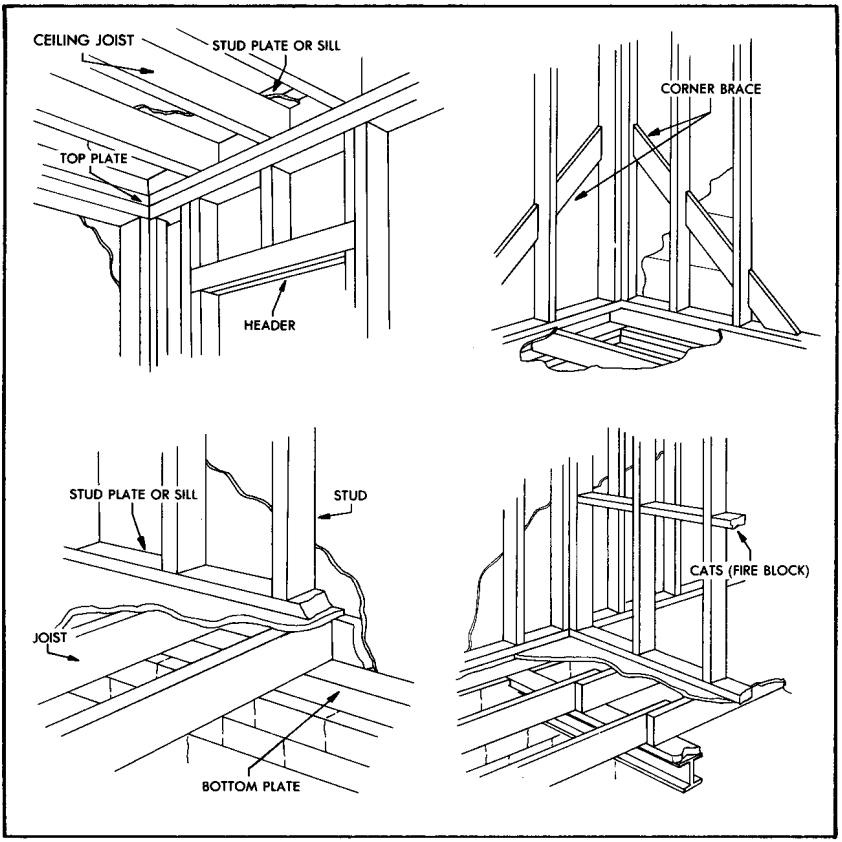


FIGURE 5. Wall Obstructions

DROP AND STATION WIRING
ATTACHMENTS ON ALUMINUM, STEEL, AND VINYL SIDING

1. GENERAL

1.01 This practice provides procedures for mounting drop wire, station protectors, station wiring and associated attachments on aluminum, steel and vinyl sided homes.

1.02 Prior to beginning any work, contact the customer and obtain permission to attach the required equipment. Be sure the customer is aware of the necessity to drill a limited number of holes to mount equipment. If permission cannot be obtained and no other means of giving the customer service is available (other than direct attachment), contact your supervisor.

2. MATERIAL

2.01 This paragraph lists the material covered in this practice. CTS numbers are listed if available.

a. E Drop Wire Clip	CTS #68-11-017-1
b. Angle Screw	CTS #68-21-105-8
c. S Knob	CTS #68-34-002-8
d. Metal Siding Clip (Horizontal)	CTS #68-21-189-9
e. Metal Siding Clip (Vertical)	CTS #68-21-190-2
f. C Porcelain Knob	CTS #68-34-001-1
g. Protector 2100 H	CTS #70-75-053-0
h. 350 Type Protector	CTS #70-75-056-4
i. Drop Wire Hook	CTS #68-21-063-9

3. SAFETY PRECAUTIONS

3.01 After customer's permission has been obtained to make required attachments, check aluminum or steel siding for foreign voltage using the B Voltage Tester (CTSP 490-050-106). Choose an inconspicuous location such as below the last panel to make this test. Be sure metal toothed disc penetrates the enamel.

3.02 If using an electrical drill, be sure that all requirements for grounding this tool are followed. Refer to CTSP 405-705-320.

4. GENERAL PRECAUTIONS

4.01 When working on aluminum or steel siding and a ladder is required, care should be taken not to dent or mar the siding. Attempt to place ladder as close as possible under a lap joint so as to avoid undue pressure on the panel.

4.02 When working on vinyl siding, every effort should be made to avoid placing a ladder against this siding. If this is not possible, follow the procedures in paragraph 4.01.

NOTE: Extreme cold weather affects vinyl siding and may cause it to crack or shatter if undue pressure is applied. If unsure as to type of siding on house, contact the customer.

4.03 When drilling holes in aluminum or steel siding for mounting protectors, knobs, clamps, etc., make a small circle on the siding using a sharp pointed tool such as the side of a screwdriver blade. Circle should not be larger than 1/4-inch in diameter. Scribe a cross within the circle. This will prevent enamel from chipping. See Figure 1.

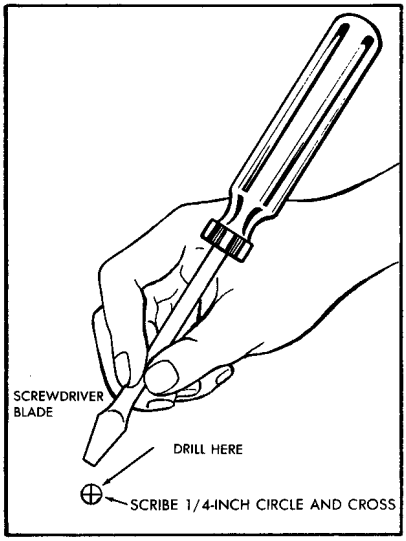


FIGURE 1.

4.04 Always use a sharp bit in a hand type push drill. Use short light strokes. **DO NOT** use a sharp tool such as an awl or ice pick. This will indent the panel, or in the case of vinyl siding, perhaps crack or shatter the panel.

4.05 When placing self-tapping screws in aluminum or steel siding, tighten screws only until they are snug. **DO NOT** exert extra pressure after screw has become snug as this will raise the aluminum or steel siding at the point of contact.

4.06 When placing attachments on vinyl siding, first determine the type of backing under the siding. (In new home construction, this is normally a composition material.) This will determine the type of fastener or attachment to use.

5. INSTALLATION OF DROP WIRE, PROTECTOR, STATION WIRE AND ATTACHMENTS

5.01 Drop Wire: After determining where drop wire will contact the house, locate a wall stud or other solid location to mount the angle screw and knob or drop wire hook. It is very important to locate a solid location, otherwise the weight of the drop may pull the attachment loose and tear the siding. Attach drop wire and drop wire clamp, and form drip loop. When fused type protection is used on flammable or conducting building walls, procelain knobs shall be used to the point of connection with the station protector.

5.02 Protector: Hold protector against siding and mark location using a pencil or marker. (Locate protector as close as possible to lap joint.) Follow procedures for drilling mounting holes as outlined in paragraphs 4.03 and 4.04. Use a spacer of nonrusting type material to get adequate clearance for cover if necessary. When using fused type protection, use the upper two mounting holes in the mounting bracket. See Figure 2.

5.03 Station Wiring: Wherever possible, use the plastic, metal siding clip (see Figure 3) for all horizontal and vertical station wire and ground wire runs. This will eliminate the need for metal clamps and screws. Vertical clips should be used at each panel lap joint. Horizontal clips should be placed at 12 to 15 inch intervals. See Figure 4. To install either the horizontal or vertical siding clip, use the following procedures:

a. To install the horizontal clip:

(1) Place the wire in the hooked portion of the clip so that the flat side will be against the siding for the Pittsburg interlock or the flat side up for the stacking type.

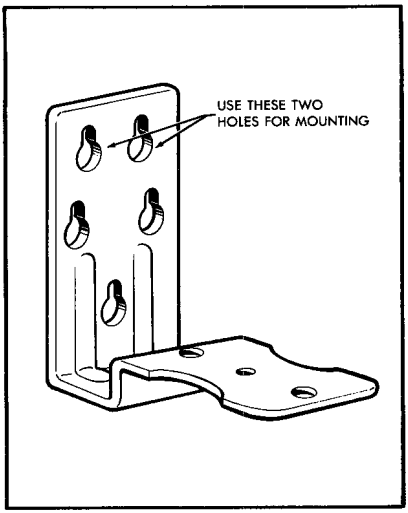


FIGURE 2. 2000 Type Protector Mounting Bracket

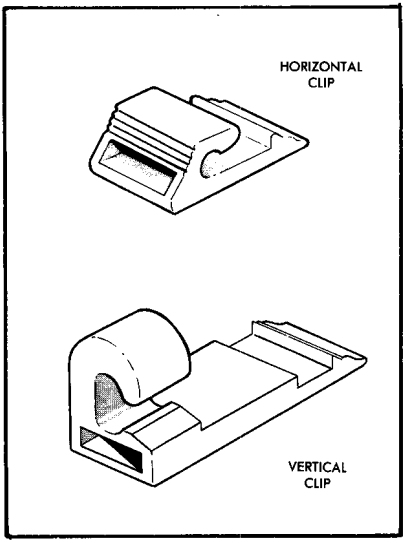


FIGURE 3.

(2) Place the tapered end of the clip (with the wire still in the clip) in the horizontal joint of the siding.

(3) Hold the clip in place with the 4-inch screwdriver by placing the blade in the notch in the bottom of the clip provided for this purpose. While holding the screwdriver with one hand, bump the end of the handle with the heel of the other hand.

NOTE: Use only enough force to properly seat the clip.

(4) Remove any slack from the wire, dress the wire against the siding, and proceed with the next clip. Place the clips 12 to 15 inches apart. See Figure 5.

b. To install the vertical clip:

(1) Place the tapered end of the clip in the horizontal joint of the siding.

(2) Hold the clip in place with the 4-inch screwdriver by placing the blade in the notch in the bottom of the clip provided for this purpose. See Figure 6.

(3) While holding the screwdriver with one hand, bump the end of the handle with the heel of the other hand.

NOTE: Use only enough force to properly seat the clip.

(4) Place the wire into the notch provided and remove any slack in the wire. Place the V clips into every horizontal joint up or down to entrance hole. See Figure 7.

c. When more than one wire is run in the same direction, place each wire in a different lap joint for horizontal runs, and place separate vertical clips for each wire.

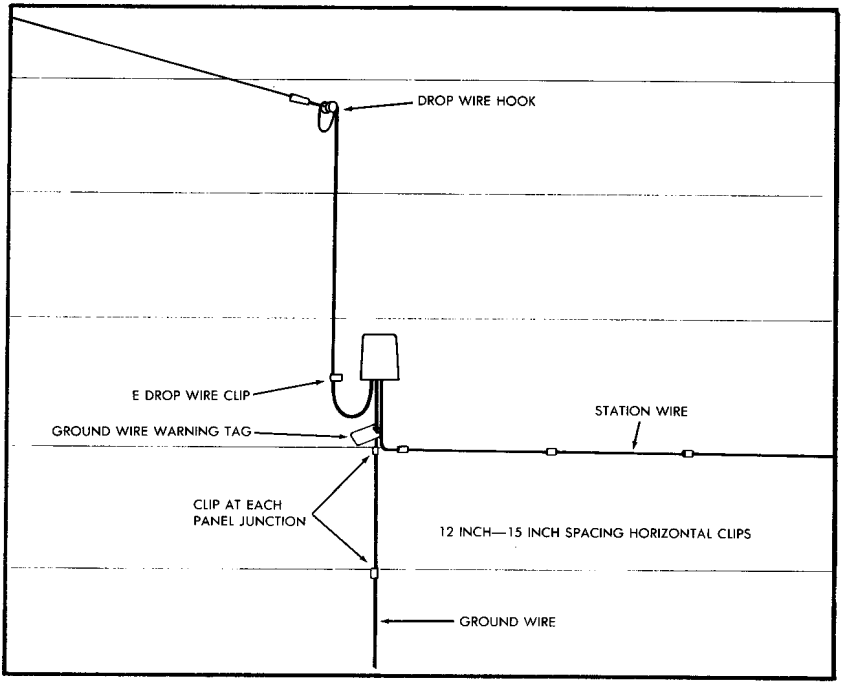


FIGURE 4. Fuseless Protection on Aluminum or Vinyl Siding

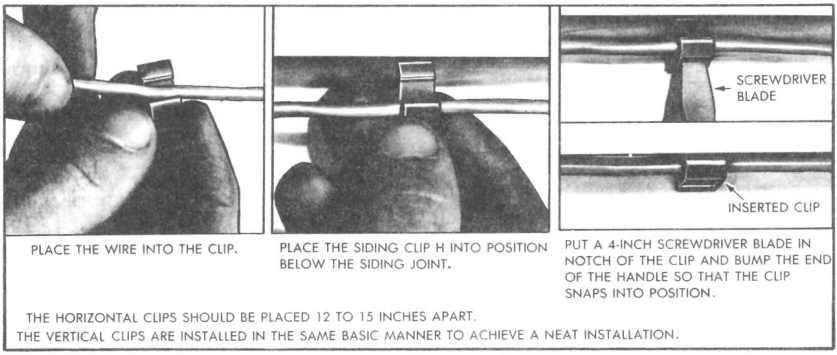


FIGURE 5. Installing Horizontal Clip

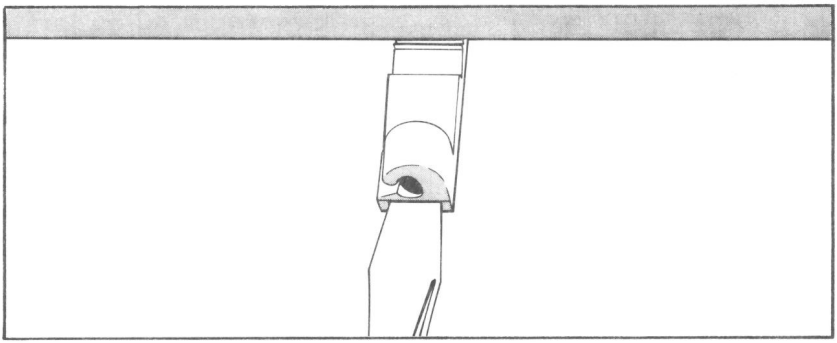


FIGURE 6. Installing the Vertical Clip

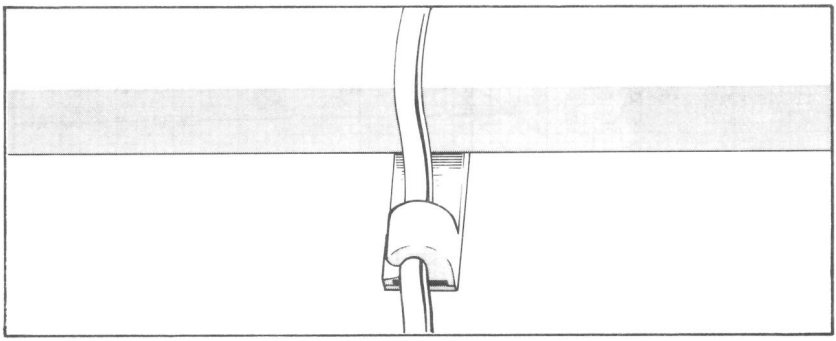


FIGURE 7. Installed Vertical Clip

PORTABLE TELEPHONE INSTALLATION

1. GENERAL

1.01 This addendum is to correct descriptive and installation information when working with portable telephones.

1.02 With red pencil or ink make the changes as shown in paragraph 2 of this addendum. Under the subject figures and in the margin of subject paragraph, write "See Addendum".

1.03 File this addendum directly in front of CTSP 475-400-401, Issue 2, 1971.

2. CHANGES

2.01 Correct Figure 1 B (left view) by crossing out "BN" and indicating that this should be "GN" (green).

2.02 Correct Figure 5 as follows:

a.. Line out words "Neoprene Gasket" and replace with "Outlet Plate".

b. Line out words "Outlet Plate" and replace with "Neoprene Jacket".

2.03 Change paragraph 3.02 a., (1) to read:

(1) Connect station wire to terminals in accordance with the color code markings shown in Figure 1 B. Position the 404B jack so that the cord of the plug is to the bottom when inserted into the jack.

PORTABLE TELEPHONE INSTALLATION

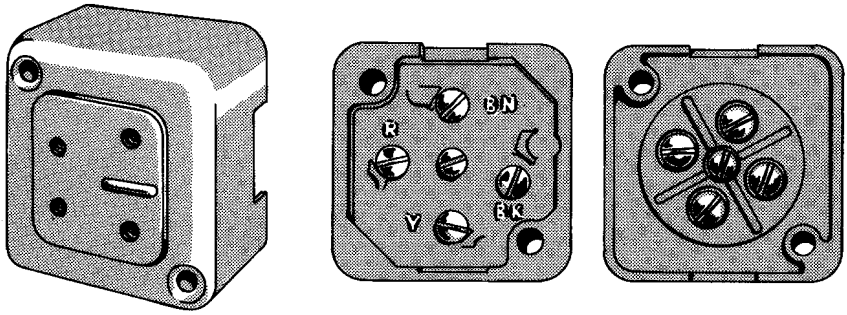
1. GENERAL

1.01 This practice provides the description of and installation procedures for plugs and jacks used with portable telephones. This practice is being reissued to update information on the 505A plug which replaces the 283B portable phone plug.

1.02 The installer should be consistent in positioning portable telephone jacks so that the customer can easily remember how to insert the plug in each jack.

2. DESCRIPTION

2.01 The various types of jacks are divided into two categories, surface mounted jacks and flush mounted jacks. The surface mounted jacks are the 404B indoor jack (see Figure 1) and the 16151 outdoor jack (see Figure 2). The flush mounted jacks are the 548A indoor jack, with various outlet plates and mounting brackets (see Figures 3 and 4), and the 16152 outdoor jack (see Figure 5).



1A. Front

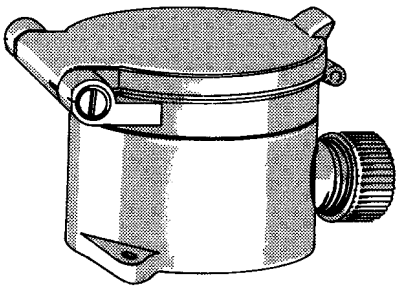
1B. Rear (Different Manufacturers)

FIGURE 1. Surface Mounted Indoor Installation (404B Jack)

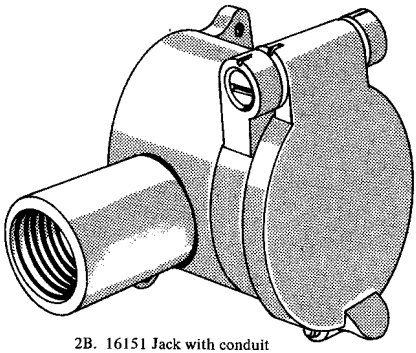
2.02 *Surface Mounted Jacks:*

a. The 404B indoor jack shown in Figure 1 is principally intended for use where exposed wire is run along the baseboard or floor. Two wood screws are supplied with the jack for mounting on a wood surface. The jack accepts a 505A plug.

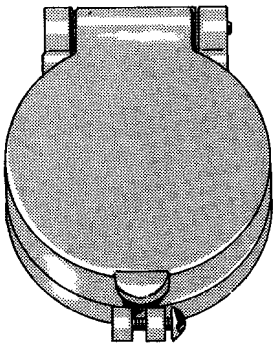
b. The 16151 outdoor jack shown in Figure 2 houses a modified 493A jack which accepts a 505A plug. This jack is designed for service at outdoor locations such as breezeways, patios and terraces where there is an exposed wire run. The jack may be installed with or without conduit.



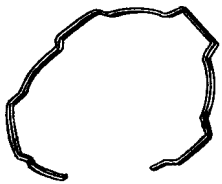
2A. 16151 Jack without conduit



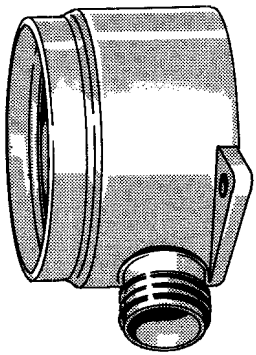
2B. 16151 Jack with conduit

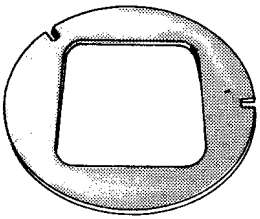


Cover Assembly

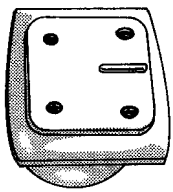


Retainer Spring

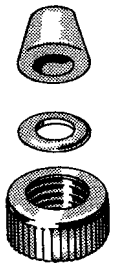




Retainer Ring



Jack Front
Modified 493A Jack



Housing

2C. Assembly of 16151 Outdoor Jack

FIGURE 2. Surface Mounted Outdoor Installation

2.03 *Flush Mounted Jacks:*

a. The 548A indoor jack may be used in conjunction with a customer installed conduit outlet box as shown in Figure 3, or for prewiring in association with a type 60A mounting ring as shown in Figure 4. The jack accepts a 505A plug.

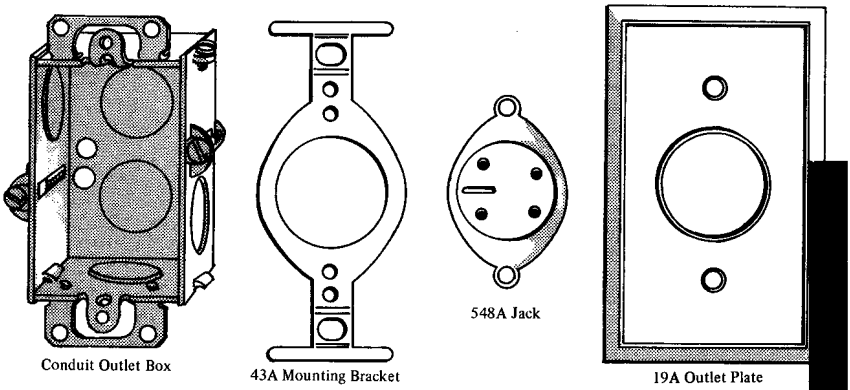


FIGURE 3. Installation Using Customer Installed Conduit Box (548A Jack)

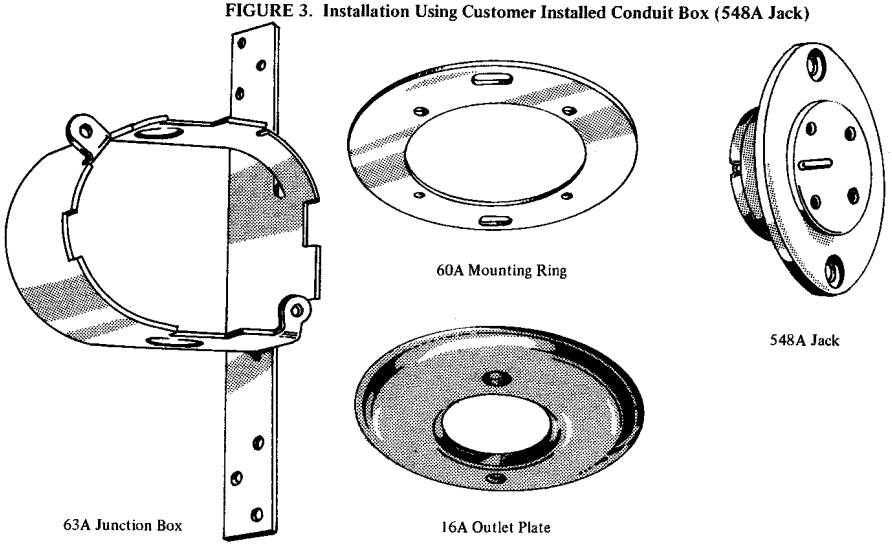
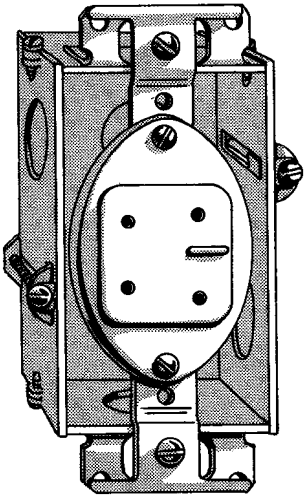
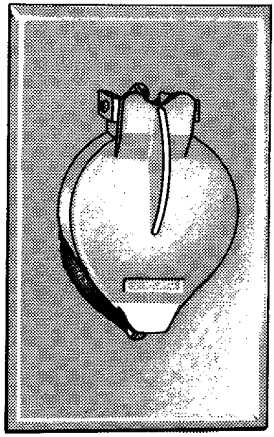


FIGURE 4. Flush Mounted Indoor Installation for Prewiring (548A Jack)

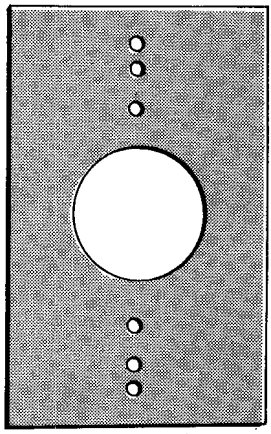
b. The 16152 outdoor jack houses a 493A jack and may be used for prewiring at outdoor locations. The conduit outlet box supplied with the assembly (see Figure 5) is used. When the outdoor jack is to be installed in conjunction with a customer installed conduit outlet box, the conduit outlet box supplied with the unit is not used. The jack accepts a 505A plug.



Conduit Outlet Box with Portable Jack Assembly Installed



Outlet Plate



Neoprene Gasket

FIGURE 5. Flush Mounted Outdoor Installations (16152 Jack)

2.04 *505A Plug:* The 505A plug fits 404B and 548A jacks, as well as associated 498A and 550A jack assemblies. It consists of an insulating block with four push-in spade terminals and a removable cap (see Figure 6). The 505A plug replaces the 283B plug (see Figure 7).

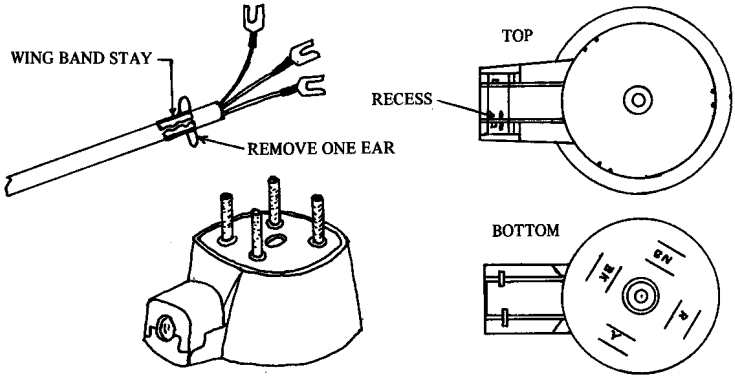


FIGURE 6. 505A Portable Phone Plug

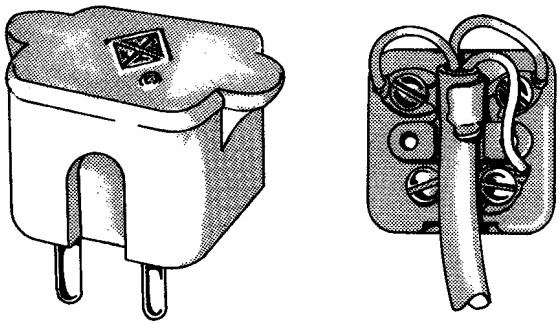


FIGURE 7. 283B Portable Phone Plug

3. INSTALLATION

3.01 The following paragraphs cover the procedures for installing the various combinations of jacks. It is assumed that conduit outlet boxes (where used) will have been installed in buildings already constructed and the installer will be responsible for prewiring installations.

3.02 *Surface Mounted Jacks:*

a. To install station wire to 404B indoor jacks (see Figure 1), proceed as follows:

(1) Connect station wire to terminals in accordance with the color code markings shown in Figure 1B. Position the 404B jack so that the cord entry hole is situated on the side.

(2) If necessary, coil excess station wire around the outside of the circular molded case.

(3) Mount the 404B indoor jack using the two 1-1/2-inch wood screws supplied with the jack.

NOTE: If the 404B indoor jack is to be mounted to a masonry wall (or any similar hard surface), use appropriate standard mounting hardware.

b. The 16151 outdoor jack may be installed with or without conduit. If installed without conduit, the wire entrance fitting should always be at the bottom, with the cover hinge of the assembly at the top, as shown in Figure 2A. The jack should be fastened to wood or masonry (or similar hard surfaces) with appropriate standard mounting hardware. To install station wire to the 16151 outdoor jack, proceed as follows:

(1) Remove the retainer spring, retainer ring and 493A jack.

(2) Loosen the gland nut.

(3) Run station wire through the gland nut friction washer, grommet and into the housing.

(4) Connect the station wire to terminals marked R, Y, G, and B on the rear of the 493A jack. If excess cord is left, it may be coiled around the outside of the circular molded case.

(5) Pull excess station wire back through the grommet while inserting the 493A jack in place.

NOTE: Arrange the 493A jack inside the housing so that the ridge on the face of the jack is at the side. This is to ensure that the cord entry hole on the 505A plug will be situated at the side when connected.

(6) Place a friction washer over the grommet and tighten the gland nut.

(7) Insert the retainer ring over the 493A jack.

(8) Insert the retainer spring.

c. The 16151 outdoor jack may be coupled directly to 1/2-inch conduit (see Figure 2B). When attached in this manner, the cover assembly (see Figure 2C) can be rotated (by loosening the cover lock screw) to position the cover hinge at the top. To connect station wire to the 493A jack, pull the station wire through the conduit and proceed as follows:

(1) Remove the gland nut, friction washer and grommet from the entry hole (these items are not necessary when connecting the 16151 jack to conduit).

(2) Remove the retainer spring, retainer ring and 493A jack.

(3) Connect the housing to conduit (using 1/2-inch conduit fitting) and secure to the mounting surface (wood, masonry, or similar hard surface) with appropriate standard mounting hardware.

(4) Bring the station wire out through the housing and connect to the 493A jack according to the color code marked on the rear of the jack.

(5) Wrap any excess cord around the outside of the circular molded case.

(6) Insert the 493A jack into the housing.

(7) Replace the retainer ring and retainer spring.

3.03 *Flush Mounted Jacks:*

a. For an installation where a conduit outlet box is used, pull the station wire through the conduit box and proceed as follows:

(1) Secure the 43A mounting bracket to the front of the conduit outlet box with the two 1-inch flathead machine screws provided.

(2) Bring the station wire out through the conduit outlet box and the 43A mounting bracket and connect to the rear of the 548A jack in accordance with the color code markings. Wrap any excess cord around the outside of the circular molded case.

(3) Insert the 548A jack into the 43A mounting bracket and secure with the two 6-32 x 5/16-inch flathead screws supplied with the 548A jack. When installed in a conduit outlet box, the face of a flush type jack should be aligned with the supporting surface and brought forward a sufficient distance so that the outlet plate will not interfere with insertion of the plug. In order to secure a flush fit, it may be necessary to remove tabs as shown in Figure 3, or to place washers between the mounting bracket and conduit outlet box.

(4) Attach the 19A outlet plate to the 43A mounting bracket with the two 6-32 x 3/8-inch ovalhead machine screws supplied with the outlet plate.

b. To install the 16152 outdoor jack in conjunction with a customer installed conduit outlet box, pull the station wire through the conduit and proceed as follows:

(1) Mount the 43A mounting bracket to the conduit outlet box with the screws provided.

(2) Bring the station wire out through the 43A mounting bracket and connect to the 493A jack in accordance with color code markings. Wrap any excess cord around the outside of the circular molded case.

(3) Mount the 493A jack to the 43A mounting bracket with the screws provided.

(4) Secure the neoprene gasket and outlet plate to the 43A mounting bracket with the screws provided.

c. Prewired outdoor installations require the use of the conduit box supplied with the 16152 outdoor jack. Prior to installing a conduit box, obtain the permission of the customer. To mount the 16152 outdoor jack, proceed as follows:

(1) Secure the conduit box supplied with the 16152 outdoor jack between suitable studs according to standard procedures.

(2) Repeat steps (1) through (4) of paragraph 3.03 b.

WIRE TERMINAL TYPE 107A2 and 101B INSTALLATION

1. GENERAL

1.01 This practice covers the description and installation of the CAC type 107A2 and 101B wire terminals which are used in making connections between drop or bridle wire and multi-pair distribution wire.

1.02 Either of the above wire terminals can be reused if in satisfactory condition.

1.03 Local instructions should cover whether the 107A2 or 101B wire terminal is to be removed when subscriber service is disconnected. Where the terminal is removed, the insulation on the support wire should be repaired by two half-lapped layers of DR tape and two half-lapped layers of D vinyl tape. The insulation of the conductors should be repaired by cutting the wire and joining the conductors with the appropriate size splice sleeve.

1.04 On all conductors except those of the 24-gauge with a single PVC jacket, remove the insulation before placing on the binding posts of the 107A2. With 24 gauge conductors having a single PVC jacket, such as C urban wire, place the wire under the lower washer and tighten the nut with the appropriate tool. Be careful not to tighten so hard as to break the wire, but be sure that the insulation has crushed enough for a good contact to be made. (See Figure 1.)

2. DESCRIPTION

2.01 The 107A2 wire terminal consists of a pair of molded phenolic terminal blocks with molded-in binding and mounting posts, and a flexible snap-on neoprene cover and two strips of sealing compound. A stainless steel channel washer on the mounting post at the back of the terminal is used to clamp over the support wire. Grooves on each side of the mounting post guide the support wire into place and keep the terminal in proper position (Figure 1).

2.02 The 101B wire terminal is constructed of durable cast aluminum and equipped with a heavy gauge aluminum sliding cover. Two bindings are mounted in a ceramic base, each binding post is equipped with five washers between two hexagonal nuts providing for up to four drop and block wires. The base is provided with a grommet for wire entrance. (See Figure 2)

3. INSTALLATION

3.01 The 107A2 wire terminal is installed by loosening clamping bolts and placing terminal over "C" rural wire with wire in the groove between blocks. Blocks are then squeezed together by tightening bolts, which makes connection to "C" rural wire and holds wire terminal in place. Strips of sealing compound are placed around "C" wire at each end of terminal block in recessed portion of the wire groove. Drop or bridle wire is inserted through the opening in the center of the terminal blocks and connected to the binding posts. The neoprene cover has lips on the inside of the bottom that fits into the grooves on the bottom of the terminal block, locking the cover in place as shown in Figure 1.

3.02 The 101B wire terminal is used to make line connections to "C" rural wire without removing insulation or for connecting bridle wire to "C" rural wire from cable or open wire; also used for connecting subscriber drop wire or line protector to "C" rural wire. (See Figure 2)

4. LOCATING ON INTERMEDIATE POLES

4.01 The first wire terminal at a pole can be installed as shown in Figures 3 through 6.

4.02 A maximum of three wire terminals can be mounted on each side of the wire bracket. The method of installation for each is similar to that in paragraph 4.01. A complete installation is shown in Figure 8, although individual terminals are added only as needed. The order of installation would depend on the direction of feed for the drop wires.

5. LOCATING ON DEAD-END POLES

5.01 Multiple line wires can have up to two wire terminals at dead-end poles as shown in Figure 9.

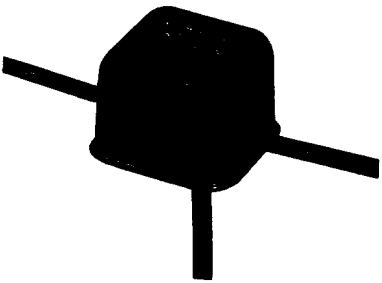
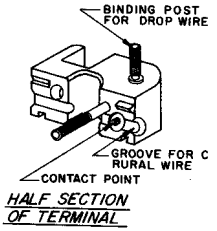
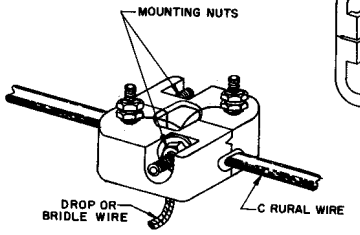


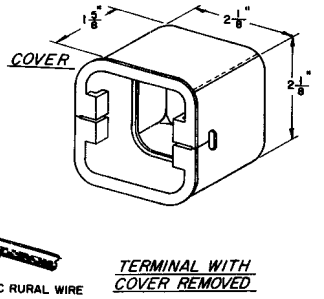
Figure 1: Type 107A2 Wire Terminal used to make line connections to "C" Rural Wire without removing insulation. For connecting bridle wire to "C" Rural Wire from cable, or open wire.

Also used for connecting subscriber drop wire or line protector to "C" Rural Wire.

Type 107A2 Wire Terminal consists of a pair of molded phenolic terminal blocks each equipped with a binding post having insulation piercing contact points. Wire Terminal provided complete with flexible neoprene cover and two strips of sealing compound.







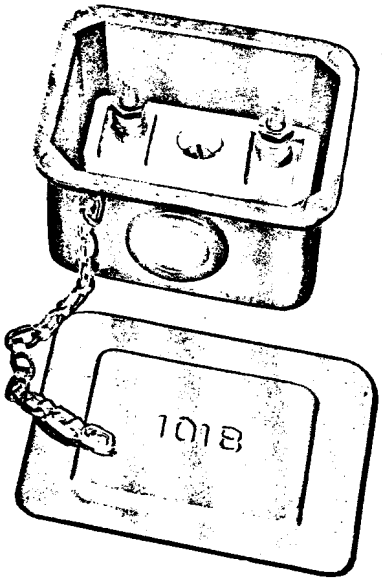


Figure 2

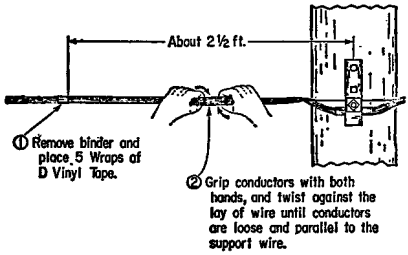


Figure 3

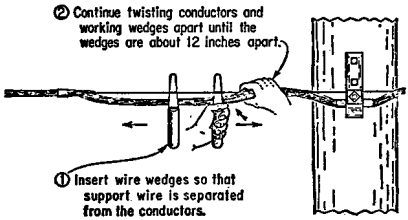


Figure 4

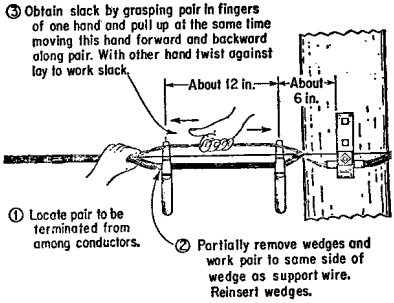


Figure 5

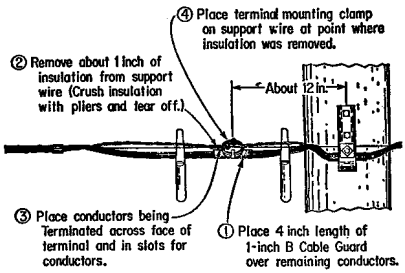


Figure 6

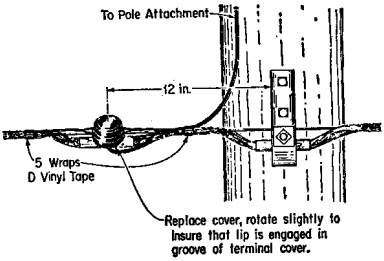


Figure 7

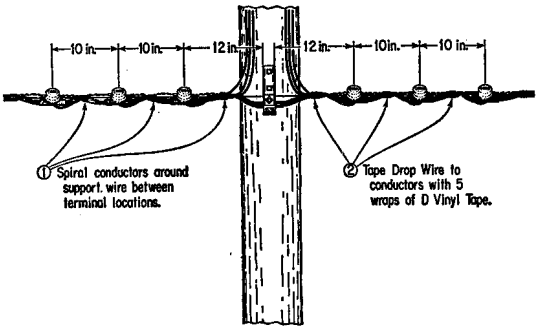


Figure 8

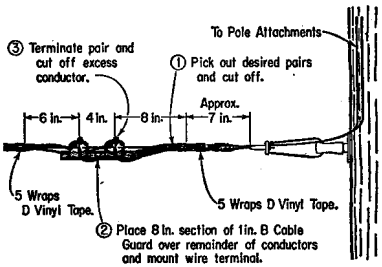


Figure 9

PART IV
PROTECTION AND GROUNDING

STATION PROTECTORS
FUSELESS, FUSED AND GAS TUBE

1. GENERAL

1.01 This addendum is issued to inform field forces that the Reliable 350/351 type fuseless gas tube protector and 1304 GF gas tube arrester will no longer be used.

1.02 It is the decision of the Standards Committee to discontinue use of all two-element gas tube protectors. Three-element gas tube protectors will be used. The T.I.I. 300 type protector is currently the only three-element gas tube protector approved for use in the Continental Telephone System.

1.03 Make the changes as shown in paragraph 2 of this addendum.

1.04 File this addendum directly in front of CTSP 475-500-400, Issue 2, 1973.

2. CHANGES

2.01 With red pencil or pen, cross out all references to the Reliable 350/351 gas tube protector as they appear in CTSP 475-500-400, Issue 2, 1973.

a. Paragraph 2.01, o.

b. Table A, reference to arrester for 350/351 (last reference in Table A).

c. All of paragraph 6.03, a. and b.

d. Figure 12.

INSTALLATION
FUSED AND FUSELESS STATION PROTECTORS

1. GENERAL

1.01 This practice contains instructions for selecting a location and installing fused and fuseless station protectors.

1.02 Fused protectors (Figure 1) consist of a molded body; binding posts for drop, station and ground wires; two fuse holders; two nominal 0.004 inch discharge blocks (color code white); and two plain carbon blocks. They are approved by the Underwriters Laboratories.

1.03 The fuses are 7 ampere power rated (blow at 10.5 ampere), non-repairable, and are UL approved (Figure 2).

1.04 Fuseless protectors (see Figure 3) are Underwriters Laboratories approved and consist of a molded plastic base, two binding posts for terminating line and station wires, a binding post for the ground wire, and two protector units. Covers are neoprene or plastic.

1.05 The protector units to be used with fuseless station protectors are identified by a white mark on the metal cap. No protector unit marked with a color other than white is to be used for station protection.

NOTE: Protected terminals are equipped with the above protector units when used for station protection.

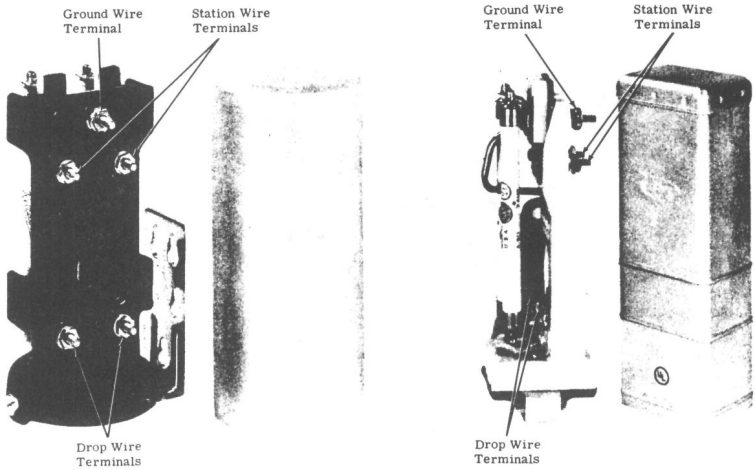


Figure 1 Fused Protectors

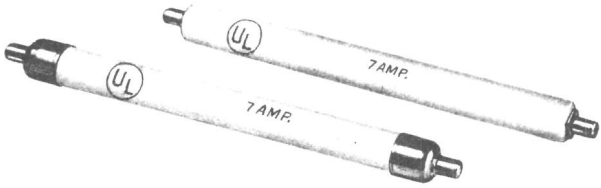


Figure 2 Fuses for Fused Protectors

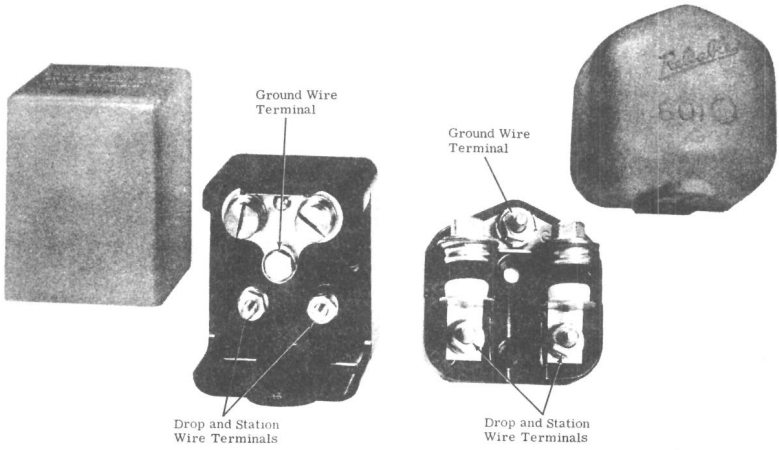


Figure 3 Fuseless Protectors

2. SELECTION OF PROTECTOR LOCATION

2.01 The selection of a location (indoor or outdoor) for fused or fuseless protectors depends on the location of entrance points for drop wires, location of an approved ground, telephone location, and the mounting surface available. Ground wire runs should not exceed 50 feet of No. 14 AWG or 75 feet of No. 6 AWG wire; indoor drop wire runs should not exceed 5 feet from point of entrance to the protector.

2.02 In addition to wire length restrictions, the protector location should be in accordance with the following:

a. Locate where the protector will be accessible for inspection and maintenance and where it will not expose an inspector to contact with power wires, moving machinery, etc.

b. Avoid flammable materials and areas where the atmosphere may be combustible.

c. Locate six inches or more away from window curtains.

d. Avoid excessively damp locations.

e. Avoid locations where the protector would be subject to tampering and where material might be piled against it.

f. Locate at least one foot from electric light or power lines, meters, accessories; water and gas meters except as described in g.

g. Telephone protectors, apparatus, and wiring may be located in a common cabinet with power apparatus and wiring if the telephone and power compartments are separated by a rigid mechanical divider.

h. Avoid locations where the appearance of the protector would be objectionable to the customer.

2.03 Outside protector location is restricted to building attachment. Station protectors should never be pole mounted. For exceptions see paragraph 2.04.

2.04 Telephones installed in boats, for plug-in dockside service, or on docks may have their protectors located at the nearest land or any nearer location where a proper ground is available. If power service is being furnished, install the protector and telephone ground at the power service ground location—where requirements for station grounding can be met.

2.05 The number of protectors that can be connected to various size copper insulated ground wires is as follows:

Wire	Number of Protectors
No. 14 AWG	1
No. 6 AWG	any number

3. INSTALLATION

3.01 At the time of installation or replacement, all protectors and associated wiring should be inspected and any component or wire that appears to be defective should be replaced.

3.02 Protectors mounted side by side shall be placed on not less than five-inch centers. Maintain enough vertical separation or stagger the protectors horizontally so that covers can be removed. If the protector location is a stucco or masonry surface and two or more protectors are required, mount the protectors on a locally fabricated backboard. Where protection for multiple services is required, it is recommended that a protected building terminal (see Figure 4) be installed in place of station protectors.

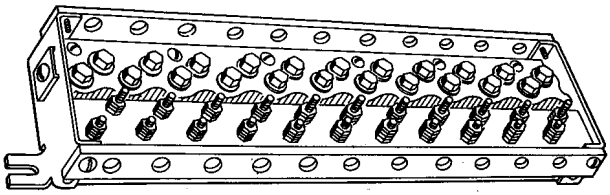


Figure 4 Protected Building Terminal

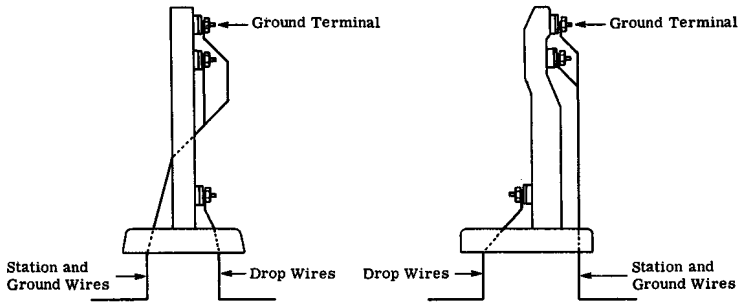


Figure 5 Wiring for Fused Protectors

NOTE: Do not cross station wires and drop wires. Where station and drop wires do not approach protector from the directions shown in these illustrations, rotate the protector 180° on its base.

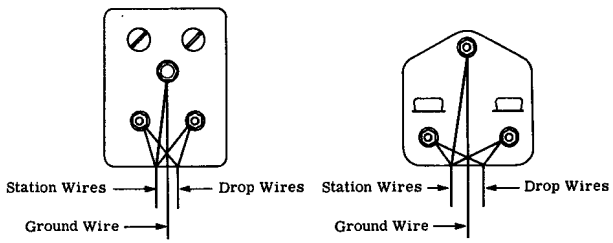


Figure 6 Wiring for Fuseless Protectors

3.03 For mounting, attach the protector to the mounting surface with the proper fastening device. A fused protector must be mounted so that drop and station wires do not cross at the point of entry to the protector (see Figures 5 and 6). Note the direction from which drop and station wires approach the protector location, and mount the protector accordingly. When the protector is mounted on a vertical surface it must be in a vertical position (base at the bottom).

3.04 Wire termination instructions are as follows (see Figures 5 and 6):

a. Make the last drop wire attachment within four inches of the protector.

b. Thread the ground, drop, and station wires through the entrance in the base of the protector.

NOTE: For the fuseless protector with a neoprene cover, the wire entrance is in the bottom of the cover. Approximately six inches of slack must be allowed in the wires and the wires threaded through the cover before termination.

c. Terminate the drop wires on the "L" binding posts.

d. Terminate the station wires on the "I" binding posts.

NOTE: Steps (3) and (4) apply to fused protectors. On fuseless protectors the drop and station wires are terminated on common binding posts.

e. Terminate the ground wire on the "G" binding post.

f. Extend the ground wire to an appropriate ground.

g. If a fused protector has been installed, check the fuses by attaching the leads of a hand test telephone to the station terminals of the protector. When the operator answers (manual exchange line) or dial tone is heard, tap each fuse with a screwdriver blade. If the fuse contains a loose fuse wire, you will hear line cutout in the receiver and the fuse must be replaced.

STATION PROTECTION
SELECTION AND APPLICATION

1. GENERAL

1.01 This addendum is being reissued to correct and add information to CTSP 475-500-402, Issue 2, 1973, Station Protection Selection and Application.

1.02 With red pencil or ink, make the corrections and additions on CTSP 475-500-402 as indicated in paragraphs 2.01, 2.02 and 2.03 of this addendum.

1.03 File this addendum directly in front of CTSP 475-500-402, Issue 2, 1973, and remove and destroy all copies of addendum 475-500-402, Issue 1, 1974 from your files.

2. CORRECTIONS AND ADDITIONS

2.01 Correct paragraph 2.01, a., to read:

a. Red Bridle Wire, CTS #90-07-003-8.

2.02 Change paragraph 2.01, c., to read:

c. 201 Grounding Lug, CTS #68-11-018-9.

2.03 Add paragraph 3.04:

3.04 Do not use grounding mediums (such as ground rods) with fuseless protectors, other than those described in paragraph 3.01, b.

STATION PROTECTION SELECTION AND APPLICATION

CONTENTS

1. GENERAL

1.01 This practice is reissued to update information on when fuseless (carbon or gas) and fused protectors can be used to satisfy the requirements of the National Electrical Code. All copies of CTSP 475-500-402, Issue 1, should be removed from the file and destroyed.

1.02 Fuseless station protectors are preferred over fused station protectors and should be used, provided the requirements listed in paragraph 3 are met. These requirements are for protecting customer stations, including coin telephones at indoor or outdoor locations, and general requirements for protecting PBX circuits.

NOTE: Gas tube protectors or protector units should be installed **only at locations specified on detailed plans or other written instructions.** *They should* **not** *be used to replace conventional carbon block protectors in all cases.*

1.03 Station protectors ensure safety to customers and telephone company personnel and prevent damage to station equipment from abnormally high voltage and current.

1.04 Isolated sections of aerial cable are considered open wire, unless the cable is effectively grounded to a multigrounded power neutral (MGN) or to an extensive water (metallic pipe) system.

1.05 Cable, wire, strand, etc., that are subject to disturbances by lightning or possible contact or induction from electric circuits in excess of 300 volts are called **exposed** cable, wire, or circuits.

1.06 Cable, wire, strand, etc., that are not subject to disturbances by lightning or electric circuits in excess of 300 volts are called **unexposed** cable, wire, or circuits.

1.07 In nonlightning prone areas, the exposure status of cable or wire is based only on power exposure. The protection specified in the station protection practices is primarily for protection against the effects of power contacts. In lightning areas, protection is required regardless of power exposure except when the plant is effectively shielded by buildings or other structures.

1.08 Ground rods encountered on reinstalls and reconnects shall not be used if a better grounding electrode is available.

1.09 Noninsulated building attachments should be used with fuseless protectors or with fused protectors that have been converted to fuseless operation. Insulated building attachments must be used on flammable surfaces when fused protectors are connected to open or exposed line wire.

2. MATERIAL

2.01 This paragraph lists the material covered in this practice. For convenience, CTS catalog numbers are listed if available.

a. 20 Gauge Bridle Wire, CTS #90-07-001-0.

b. UR Cable Conductor Connectors, CTS #66-14-032-3.

c. 201 Grounding Lug.

d. Sneak Current Fuse 60D, CTS #70-75-033-5.

3. FUSELESS STATION PROTECTION AND REQUIREMENTS (AERIAL CABLE)

3.01 Fuseless protectors should be used at all stations provided **one** of the three fusible link requirements listed in paragraph a. is met, and **one** of the grounding requirements in paragraph b. is met.

a. Fusible Link Requirement:

(1) The station is served by 24 gauge (or smaller) cable.

(2) The station is served by cable that has a fusible link, such as a 24 gauge terminal stub, a minimum of 8 inches in length.

(3) Single pair drop wire is served by open or multiple wire and has a fusible link of 24 or 26 gauge copper block wire, or 20 gauge copper steel red bridle wire with 30% conductivity.

NOTE: The bridling between drop wire and open wire (rural wire) must consist of at least 30 inches of 20 gauge copper steel red bridle wire with 30% conductivity.

b. Proper ground medium requirements in order of preference. If a preferred ground is available, it should be used. See CTSP 475-500-410.

(1) A metallic cold water pipe bonded to an MGN system.

(2) A metallic cold water pipe bonded to the power ground.

(3) A metallic cold water pipe (at least 10 feet of this pipe must be buried in moist soil).

(4) Metallic service entrance conduit (except aluminum) bonded to the service entrance box of an MGN system.

(5) Service ground of an MGN power system.

(6) Another effective ground is a recent development known as a **concrete encased electrode.** It consists of not less than 50 feet of 3/8 inch reinforcing steel bar or 20 feet of No. 4 bare copper wire, embedded below grade in a concrete foundation or footing. The bar or conductor is stubbed up into an accessible location for grounding connections. In the absence of an acceptable water pipe or an MGN system, it should be considered as a first choice ground.

NOTE: If one of these grounds is not available, a fused type protector must be used.

3.02 A fuseless protector must not be used with multiple drop wire when the stations are served by open or multiple wire.

NOTE: A fuseless protector can be used with multiple drop wire when the stations are served by a grounded metal sheath or shielded cable.

3.03 Drop wire from an unexposed cable terminal into an exposed area exposes both the customer station and the distribution cable. Fuseless protectors are required at both ends of the drop. When the drop is to be joined to a cable pair, a fusible link is required.

4. FUSED STATION PROTECTION AND REQUIREMENTS

4.01 When the ground requirements or bridling requirements described in paragraph 3 cannot be met, a fused type protector must be used.

5. STATION PROTECTION AND REQUIREMENTS (BURIED AND UNDERGROUND)

5.01 Fuseless station protectors may be used with buried distribution cable connected to exposed cable when 24 or 26 gauge cable is located so that it will serve as a fusible link.

5.02 Fuseless station protectors may not be used when the buried distribution cable is 19 or 22 gauge and no fuse cable has been placed. Fuseless protectors may be used **only** if 24 or 26 gauge copper cable conductors, a minimum of 8 inches in length, are placed at the junction point to serve as a fusible link between the service wire and the buried cable.

NOTE: Use UR cable conductor connectors to join the fine gauge (24 or 26 gauge) conductors, used as a fusible link, to the service wire and buried distribution cable. Use 24 gauge wire as a fusible link for 19 gauge cable conductors. Use 24 or 26 gauge wire as a fusible link for 22 gauge conductors.

5.03 When the requirement specified in paragraphs 5.01 and 5.02 cannot be met, fused type protectors must be used.

5.04 For any length of buried wire, bond the aluminum shield or armored wire to the ground terminal of the protector and cable terminal by means of a 201 grounding lug. See CTSP 475-500-405, paragraph 6.

5.05 Service drops joined to exposed underground cable pairs require the same type of protectors as drop wire joined to exposed aerial cable pairs.

6. PBX STATION PROTECTION (CENTRAL OFFICE TRUNKS, TIE TRUNKS, OFF PREMISES EXTENSIONS, RINGING FEEDERS, AND BATTERY FEEDER CIRCUITS)

6.01 When PBX systems are served by exposed cables, the following protection is required:

a. The sheath or shield of the cable must be grounded.

b. A fuse cable must be spliced between the entrance cable and the terminating facilities if the conductors are larger than 24 gauge.

c. The terminating facilities shall be equipped with heat coils and carbon blocks or sneak current fuses and a station protector.

6.02 When drop or multiple drop wire is extended from exposed cables, fuseless protectors should be used. When drop wire is to be joined to a cable pair, a fusible link is required as instructed in paragraphs 3 and 5.02.

6.03 Fuseless protectors may be used with open or multiple wire when the requirements specified in paragraphs 3.01, a., (3) and 3.01, (b) are observed. Otherwise, fused protectors must be used.

6.04 Battery feeder circuits extended from exposed cables require the following protection:

a. As specified in paragraph 6.01.

b. Where a single battery feeder is extended from a grounded metal shielded cable with a fusible link, as specified in paragraph 3.01, a., a protected terminal or a fuseless type protector meeting the requirements specified in paragraph 3.01, b., is all the protection required.

c. Where two or more cable pairs are used in a multiple and these pairs are extended by a single drop wire, the arrangement may be considered as a single pair and protection provided as described in paragraph 6.05, b.

d. When two or more cable pairs are used in multiple and these pairs are extended by two or more drop wires, fused type protectors must be used.

e. When multiple drop wire is extended from a cable terminal (with a fusible link) on a protected distribution terminal, no other protection is required for a single pair battery feeder circuit.

f. When two or more battery feeder pairs are extended from protected terminals (with a fusible link), no other protection is required.

6.05 Battery feeder circuits extended from open or multiple wire, require the following protection:

a. When the wire has a fusible link as specified in paragraph 3.01, a., (3) and the protector can be grounded as specified in paragraph 3.01, b., a fuseless protector may be used with a single battery feeder pair. Otherwise, a fused protector must be used.

b. A fused protector must be used with two or more pairs.

6.06 Exposed PBX lines (central office trunks, tie trunks, off premises extensions, and ringing feeder circuits) extended from metal sheath cables must be protected with sneak current fuses. Sneak current fuses are not required when pairs are extended from a protector frame equipped with heat coils and carbon blocks.

6.07 Exposed PBX lines (central office trunks, tie trunks, off premises extensions, and ringing feeder circuits) extended from open or multiple wire must be protected with sneak current fuses. Protection can be provided as follows:

a. Fuseless protectors equipped with sneak current fuses may be used with a single drop when the grounding requirements specified in paragraph 3.01, b., can be met. Otherwise, a fused protector equipped with sneak current fuses must be used.

b. When two or more drops are terminated at the same location, fused protectors equipped with sneak current fuses must be provided for each drop.

7. STATIONS REQUIRING SPECIAL PROTECTIVE MEASURES

7.01 Special protective measures are usually required for stations located in the following areas:

a. At power substations or generating stations.

b. In atmospheres containing explosive gas, vapor, or dust.

c. Where privately owned circuits are in conflict or joint use with power circuits not suitable for general joint use.

d. Where facilities are leased for the operation of FOREIGN signaling circuits which might impress excessive voltage or current on the system's facilities.

7.02 Outdoor stations served by exposed conductors usually require only fuseless or fused protectors.

7.03 There are some stations where protectors and special grounding arrangements are necessary, such as:

a. Coin Telephones: If the drop or line wire is exposed between the cable terminal and telephone, protectors are required as specified in paragraph 3.03.

b. Stations on Wooden Poles: If possible, install the stations on a pole that has a vertical ground wire connected to a multigrounded neutral. When a multigrounded neutral is not available and the station is served from a metal shielded cable, the protector is grounded to a ground rod. If the station is served from open or multiple wire, ground the protector to a ground rod in accordance with local procedures.

CAUTION: Do not install a station on a pole that has a power vertical ground wire for lightning protection unless the ground wire is connected to a multigrounded neutral.

c. Stations on Metal Poles:

CAUTION: Do not install stations on metal poles that support power circuits (open wire or in conduit) of 300 volts or more unless the pole is grounded to a multigrounded neutral or a metallic cold water pipe.

(1) Fuseless protectors are required on metal poles supporting power circuits of 300 volts or more.

(2) When the conductors are exposed and the power circuits on the metal pole are 300 volts or less and the pole is bonded to a multigrounded neutral or low impedance ground, such as a metallic cold water pipe, a fuseless protector is required.

(3) When the conductors are exposed and the power circuits on an ungrounded metal pole are 300 volts or less, a fused protector is required.

(4) When the conductors are unexposed and the power circuits on the metal pole are 300 volts or less, no protection is required.

STATION PROTECTORS
INSTALLATION AND INSPECTION

1. GENERAL

1.01 This addendum is to provide additional information when the common clamping method is used and also to specify the type of buried service wire referred to.

1.02 With red pencil or ink, make the changes as shown in paragraph 2 of this addendum. In the margin of subject paragraph and below the subject figures, write the words "See Addendum".

1.03 File this practice directly in front of CTSP 475-500-405.

2. CHANGES

2.01 Change paragraph 4.02 to read:

> 4.02 Where possible, use a common clamp for wiring at the protector. The common clamp method is used to retain station and ground wires or buried drop and ground wires. Drop and station wires may use the common clamp method, provided requirements in CTSP 475-300-407, Table C are met.

2.02 Change paragraph 6.02 to read:

> 6.02 The 201 grounding lug will be used to bond aluminum shielded buried service wire only. Armored buried service wire will be bonded with a grounding harness. See CTSP 490-800-300.

2.03 Change paragraph 6.03 to read:

> 6.03 To install the 201 grounding lug, proceed as follows: Install the protector on the wall. Mark the location of the 201 grounding lug on the service wire. Cut around the outer jacket with a knife.

2.04 Change Figures 22, 24, 25 and 26 as shown in Figures 1 and 2 of this addendum.

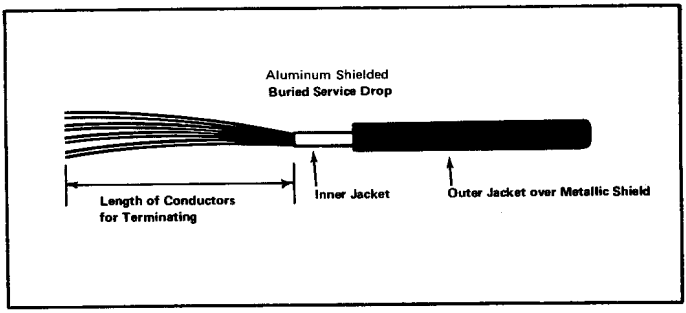


FIGURE 22.

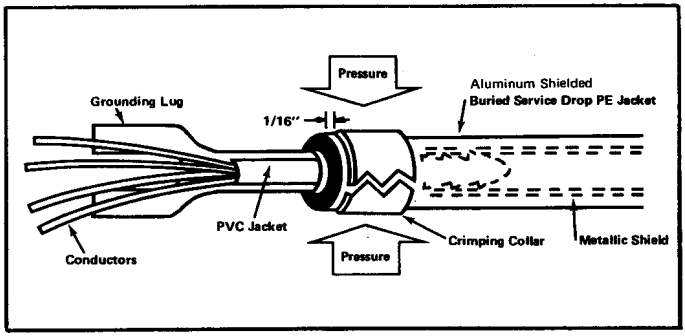


FIGURE 24.

FIGURE 1.

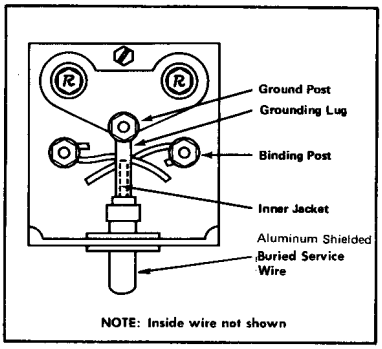


FIGURE 25.

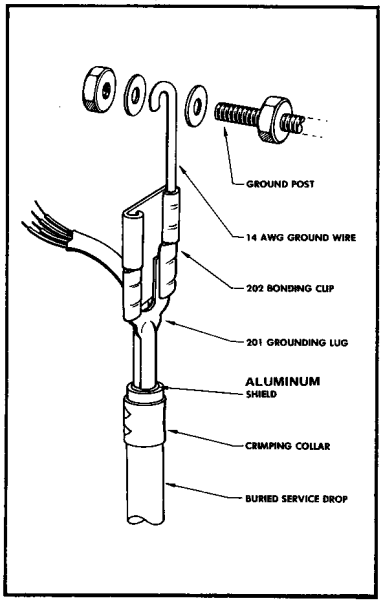


FIGURE 26.

FIGURE 2.

STATION PROTECTORS
INSTALLATION AND INSPECTION

1. GENERAL

1.01 This practice provides information for installing station protectors used at stations served by grounded metal shielded cable and open or multiple line wire. See CTSP 475-500-402 and 475-500-403 for information on protector selection and application and ground selection.

1.02 Station protectors minimize danger to people and damage to station equipment from abnormally high voltage or currents.

1.03 Insulated building attachments must be used on flammable surfaces when fused type of protectors are used.

1.04 Building attachments may be of the noninsulated type when fuseless protectors or converted fused protectors are used.

1.05 If possible, use a 72A bracket and station ground clamp attached directly to a water pipe when installing a fuseless 123 type protector indoors. Where accessibility to the protector for maintenance presents a problem, do not install any protector indoors.

1.06 Fused protectors must be used when it is necessary to run more than one drop or cross-connect wire to furnish battery for a telephone system. A maximum of three drop or cross-connect wires furnishing battery for a system may be terminated on one fused protector and should be bridged on the line side of the protector.

1.07 Sneak current fuses are not required with protectors associated with residence systems, wiring plans, or key equipment. However, they shall be provided on special services and leased lines when specified by local instructions.

1.08 No other protection is required at locations where circuits terminate on main frame type protectors equipped with heat coils and carbon blocks.

2. TEST EQUIPMENT AND MATERIAL

2.01 This paragraph lists the test equipment and material covered in this practice. For convenience, CTS catalog numbers are listed if available.

a. Test Equipment:

(1) B. Voltage Tester, CTS #74-94-310-3.

b. Material:

(1) 72A Bracket, CTS #70-75-104-8.

(2) 123 Type Protector, CTS #70-75-052-0.

(3) Ground Wire Warning Tag, CTS #51-77-016-4.

(4) 350 Type Fuseless Protector, CTS #70-75-056-4.

(5) 300 Type Gas Tube Protector, CTS #70-75-079-3.

(6) 590 Type Fused Protector, CTS #70-75-054-8.

(7) Busbar Adapter, CTS #70-75-001-7.

(8) 2100H Type Fused Protector, CTS #70-75-053-0.

(9) 502A1 Type Fuseless Multiple Protector, CTS #70-75-062-9.

(10) 492 Protector Modules, CTS #70-75-041-6.

(11) 400 Type Fuseless Gas Tube Multiple Protector, CTS #70-75-077-7.

(12) 405 Gas Tube Two-Pair Mounting Block, CTS #70-75-106-4.

(13) U Type Fused Multiple Protector, CTS #70-75-090-4.

(14) 201 Grounding Lug, CTS #68-11-018-9.

(15) 202 Bonding Clip, CTS #68-11-018-9.

(16) 1094A Type Sneak Current Protector, CTS #70-75-059-9.

3. LOCATION OF PROTECTORS

3.01 Before installing protectors, the following should be taken into consideration:

a. Fuseless Protector: The line conductors remain grounded for the duration of a power contact and the voltage on the wire cannot rise sufficiently to create a hazard. To ensure this safety feature, the length of ground wire from the protector should be as short as possible (50 feet maximum for 14 and 10 AWG; 75 feet maximum for 6 AWG) to provide a low resistance path to ground. A ground wire run from the foundation of a building to an exterior ground should be buried at least 12 inches deep. Increase the depth to 18 inches where earth is likely to be disturbed. Buried ground wire runs should not exceed approximately 3 feet for No. 14 and No. 10 wire and 15 feet for No. 6 wire.

b. Fused Protector: To reduce the extent of exposure that might exist when fuses open as a result of power contact, the line conductors on the line side of the protector should be as short as possible.

c. Accessibility: Avoid placing protectors where a ladder is necessary for installation or maintenance or where they would be inaccessible. See paragraph 1.05.

d. Location of Telephone and Power Ground: The telephone ground shall be located to simplify common grounding.

e. Appearance: Avoid locations on the front of buildings or in living quarters.

f. When mounted indoors or underneath buildings, select a dry and well ventilated location.

g. Where snow and moisture might create a problem, locate the protector between 3 and 5 feet above grade if exterior mounted.

h. The location of station protectors, station wire, and ground wires should always comply with the practices covering electrical and mechanical protection and separations.

i. Unless absolutely necessary, attachments should not be made to aluminum siding and other such siding. If it is necessary to make an attachment to such materials, the property owner should be notified and permission obtained.

j. In general, station protectors should be located as near as possible to the entrance hole for the station and ground wires.

k. When locating protectors in alleys and on business buildings, etc., where there is commercial or private traffic, it is necessary to select a safe location. This may involve raising or lowering the protector; also, it may be desirable to locate the protector inside the building.

3.02 When it is necessary to multiple fuseless or fused protectors for interior installation, there should be 1 inch separation when mounted horizontally, and 2 inches separation when mounted vertically. On external installations, there should be 1 inch separation horizontally and sufficient separation vertically to allow removal of the cover.

4. INSTALLING PROTECTORS—GENERAL

CAUTION: Before connecting the protector ground wire, test the power company ground rod, wire, cabinet, meter box, etc., using a B voltage tester.

4.01 Whenever possible, use a 72A bracket and 123 type protector to provide a direct connection to the grounding medium. The 123 type protector and the 72A bracket should be used indoors only. See paragraph 1.05.

4.02 Where possible, use a common clamp for wiring at the protector. The common clamp method is used to retain station and ground wires or **buried** drop and ground wires. Drop and station wires should NEVER be in the same clamp. Generally, aerial drop wire will not be affected by this practice.

NOTE: Never place an aerial drop or buried service wire on a building (when station protection is required) unless the station protector can be installed and grounded before the installer leaves the premises.

4.03 The first clamp to be placed on buried service wire should be 4 inches above ground level; the last clamp should be 2 to 4 inches below the protector.

4.04 The intermediate clamps should not exceed 18 inches maximum distance from the first, last, or any other intermediate clamp.

4.05 Terminate line and inside wires on the protector so that the ring conductors (single tracer or red wires) are connected to the right side of the protector.

4.06 All screws and fasteners should be of sufficient length to mount the protector securely.

4.07 Table A lists the ground wire size required for single or multiple installation of protectors.

4.08 The initial protector ground wire installed should be of sufficient gauge to provide protection for any future protectors installed. See Table A.

TABLE A. Ground Wire Capacity

Size	Protectors		
	Fused		Fuseless
No. 14 No. 10 No. 6	1 to 3 4 to 8 any number	Or	1 2 to 6 any number

NOTE: The ground wire between protectors shall be the same size as the ground wire between the protector and the grounding electrode.

4.09 In all cases, a ground wire warning tag shall be placed conspicuously on the ground wire beneath the protector and at all other ground and bond wire terminations. The tag shall be secured on the ground wire as close as possible to the protector and clamps.

5. INSTALLING PROTECTORS—FUSELESS

5.01 Preferably, the 123 type protector should be installed directly on an acceptable metallic cold water pipe by means of a 72A bracket (see Figure 1) and a station ground wire clamp. The 123 type protector is for indoor installation only. See paragraph 1.05.

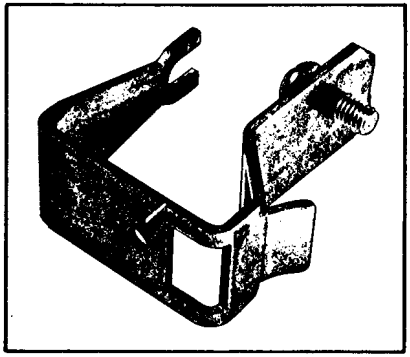


FIGURE T. 72A Bracket

5.02 To install the 72A bracket on the 123 type protector, proceed as follows:

a. Place a station ground wire clamp through the slots in the 72A bracket. See Figures 2 and 3.

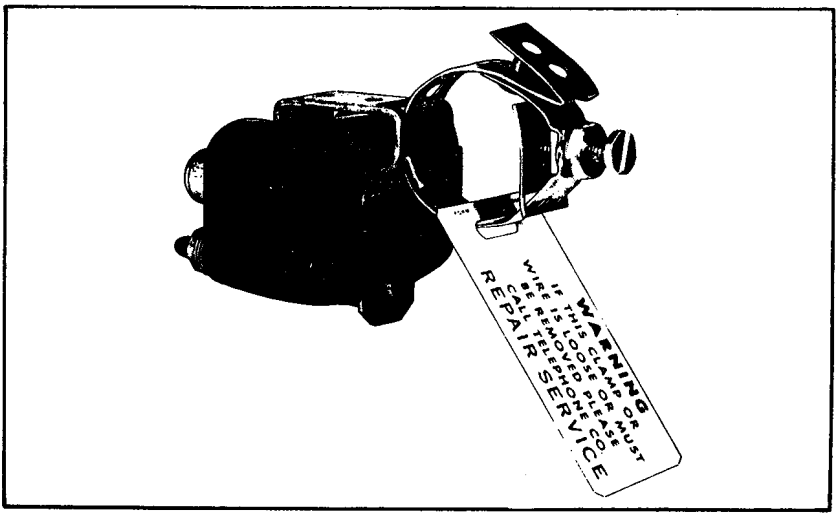


FIGURE 2. Station Ground Wire Clamp Through Slots in 72A Bracket Attached to 123 Type Protector

FIGURE 3. Front View of 123 Type Protector, 72A Bracket and Ground Clamp with Water Pipe Removed

b. Attach the ground wire clamp to an acceptable cold water pipe in the usual manner. Remove the screw from the 72A bracket and slide the protector into place, making sure the notched portion of the bracket is under the pronged washer of the protector ground terminal.

c. Place the mounting screw furnished with the 72A bracket in the bottom mounting hole of the 123 type protector and into the threaded hole of the bracket. Tighten the mounting screw, ground terminal nut, and protector ground terminal nut. See Figure 4.

NOTE: A protector installed in this manner is grounded through the 72A bracket; therefore, a station ground wire is not necessary.

5.03 Figures 5 through 16 show typical installations of single and multiple protectors. Also shown are typical installations of two single protectors at the same location.

a. Figure 5 shows a typical installation when the 123 type protector cannot be installed on a metallic cold water pipe (for indoor use only). See paragraph 1.05.

b. Figures 6, 7, and 8 show typical installations of single fuseless and gas tube protectors.

c. Figure 9 shows a typical multiple installation of fuseless protectors.

d. Figure 10 shows a typical installation of a single fused protector.

e. Figure 11 shows a typical multiple installation of fused protectors.

f. Figure 12 shows a typical installation of a multiple type fuseless protector.

g. Figure 13 shows a typical installation of the multiple type gas tube protector.

h. Figures 14, 15, and 16 show a typical installation of the multiple type fused protector.

5.04 All the measurements shown in Figures 17 through 21 should be followed when locating and wiring station protectors.

6. BURIED INSTALLATION

6.01 The armor of underground wire or the aluminum tape of service wire should always be grounded at the buried closure and at the customer's location. The grounding is required to minimize shock

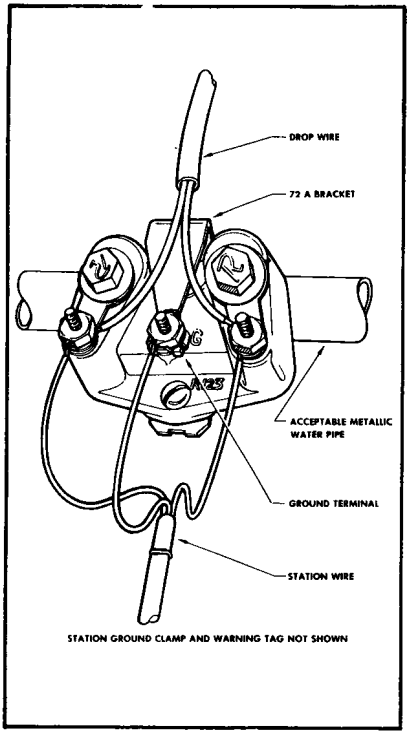


FIGURE 4. 123 Type Protector Installed on a Metallic Water Pipe (for Indoor Use Only)

or fire hazards from sustained power contact at the customer's location.

6.02 The 201 grounding lug will be used to bond the aluminum shield of service wire or the armor of underground wire to the protector.

6.03 Install the protector on the wall. Mark the location of the 201 grounding lug on the service wire. Cut around the outer jacket with a knife.

CAUTION: Do not cut into metallic shield. Bend the service wire at the cut in several directions until the outer jacket and shield break away cleanly. Slide the jacket and shield material off the end, exposing the inner PUC jacket.

6.04 Remove all but approximately 3/8 inch of the inner jacket by cutting around with a knife; then pull off the jacket. See Figure 22.

CAUTION: Do not cut into the conductor insulation.

6.05 Straighten the service drop at the prepared end. Slip the crimping collar (see Figure 23) over the wires and inner jacket and up onto the outer jacket.

6.06 With pliers or fingers, place the grounding lug (see Figure 23) against the inner jacket and push it under the metallic shield until the tapered end is inserted up to the step at the end of the sawtoothed edges. If the lug binds, tap it in lightly.

6.07 Move the crimping collar to within 1/16 inch of the cut end of the outer jacket. Rotate it until the opening in the collar is on the opposite side of the service drop from the grounding lug. Crimp the collar. Ordinary pliers may be used for this operation, with pressure applied as shown in Figure 24 (the crimp will be oval and the teeth of the grounding lug will not close). Apply enough pressure to close the collar, ensuring penetration of the lug teeth into the metallic shield.

6.08 Terminate the grounding lug directly on the ground post of a station protector. See Figure 25.

6.09 Use the lug, 202 bonding clip and wire combination where the ground post will not accept the spade tip of the grounding lug, such as when multiple protectors 400, 502A1, and U-type are used. Place the 202 bonding clip over the lug, securing the clip with two crimps on each of the two edges, using wire cutters. Slip an end of a 14 AWG ground wire into one of the open edges of the bonding clip and make two crimps. Use the other end of the 14 AWG ground wire for terminating on the ground post of the protector. See Figure 26. The same method can be used for terminating the buried service drop in a pedestal or terminal.

7. INSTALLING PROTECTORS—PBX

7.01 No other protection is required at location where PBX circuits terminate on main frame type protectors equipped with heat coils and carbon blocks.

7.02 Where main frame type protectors are not used, sneak current fuses are required. The 1094A type protector equipped with sneak current fuses (60D) will be used with either fuseless or fused protectors. Insert the 1094A type protector between the fuseless or fused protector and the station wire (for indoor mounting only). See Figure 27.

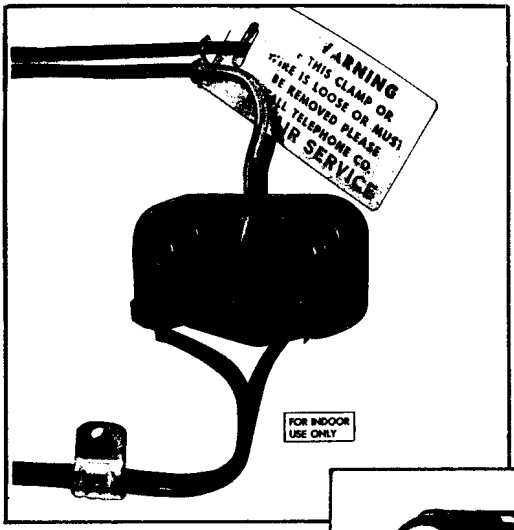


FIGURE 5. 123 Type Protector Mounted on Wall (For Indoor Use Only)

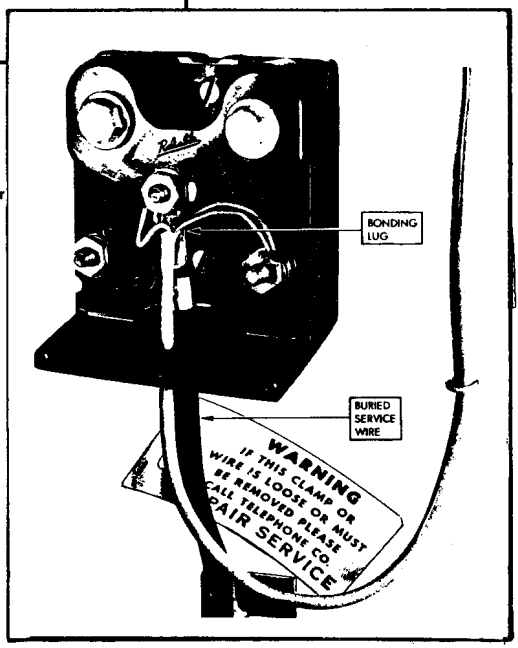


FIGURE 6. 350 Type Fuseless Protector With Buried Service Wire

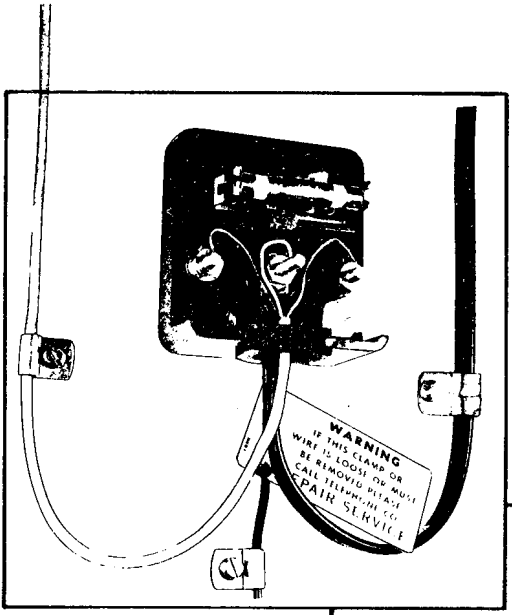


FIGURE 7. 300 Type Gas Tube Protector (Cover Removed)

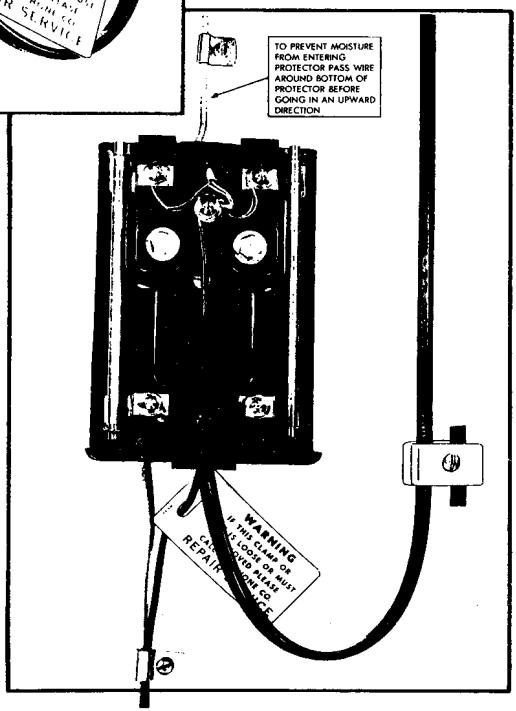


FIGURE 8. 590X Protector—Converted 590 Type Fused Protector to Fuseless Operation With Two Inside Wires Using Busbar Adapters

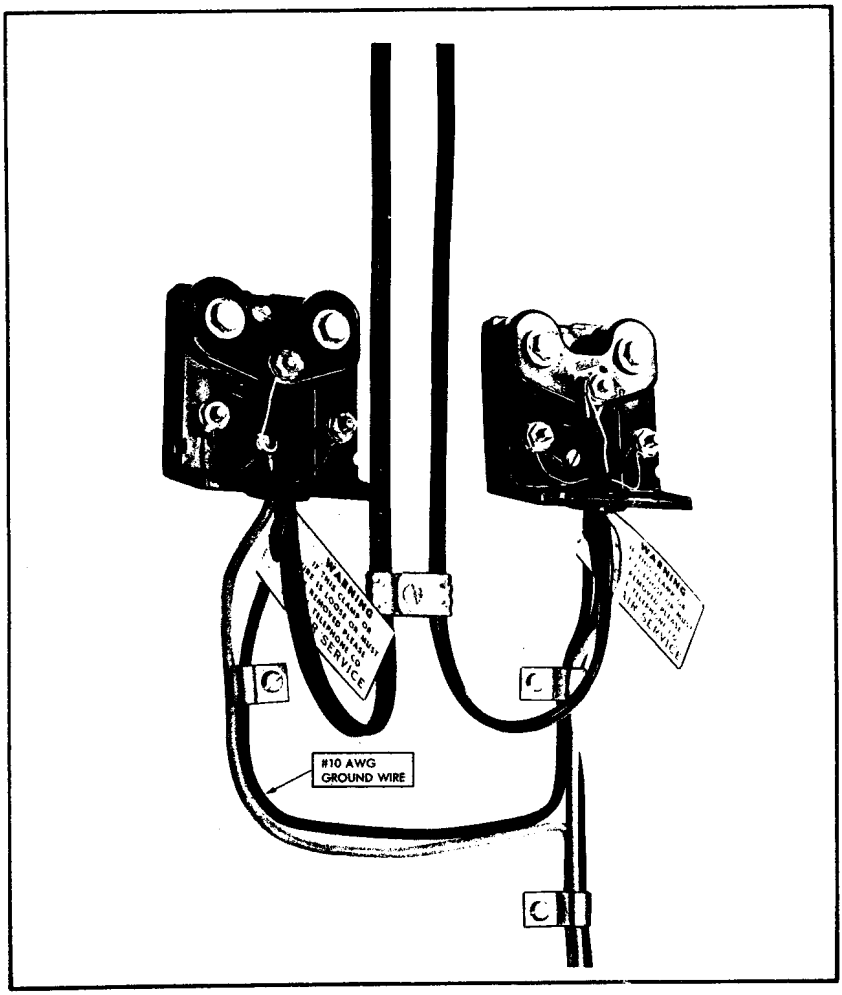


FIGURE 9. Typical Multiple Installation of Fuseless Protectors

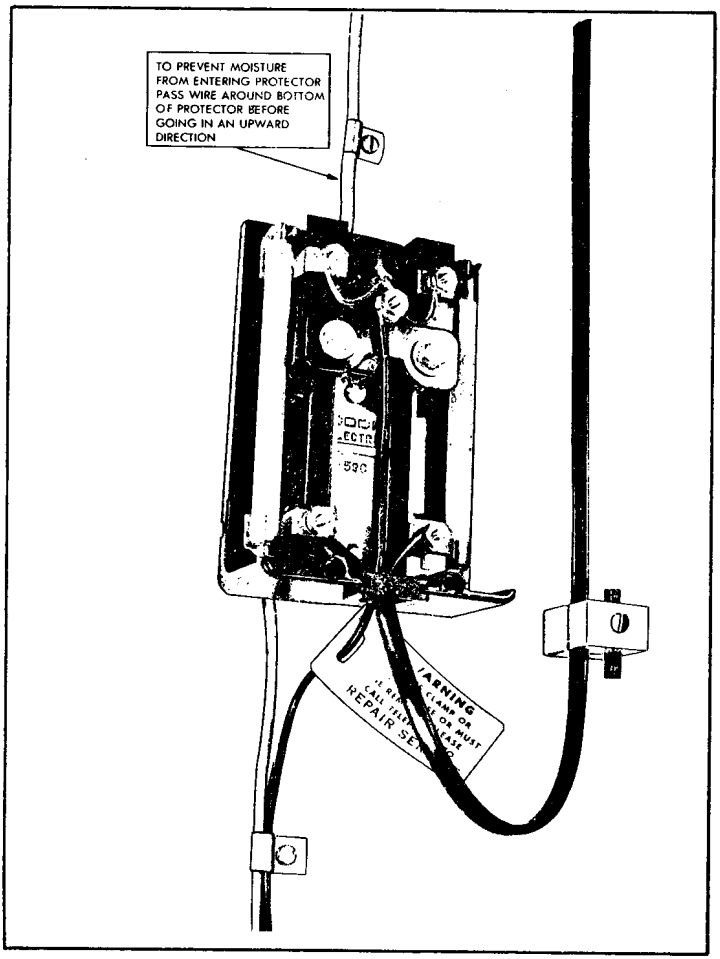


FIGURE 10. 590 Type Fused Protector with Two Inside Wires

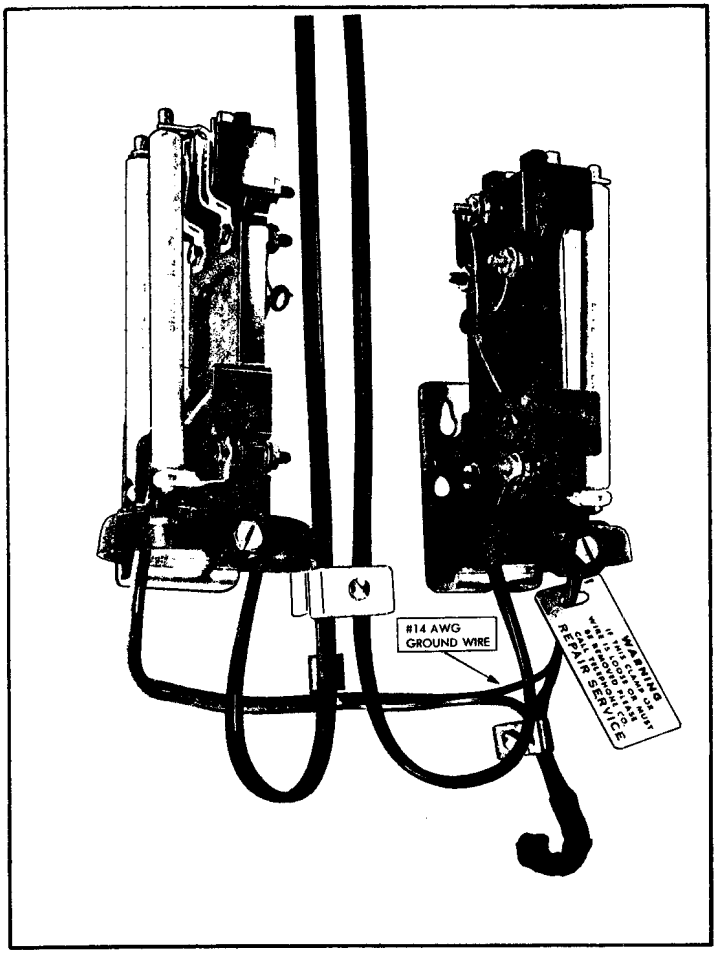


FIGURE 11. Typical Multiple Installation of 2100H Type Fused Protectors (Covers Removed)

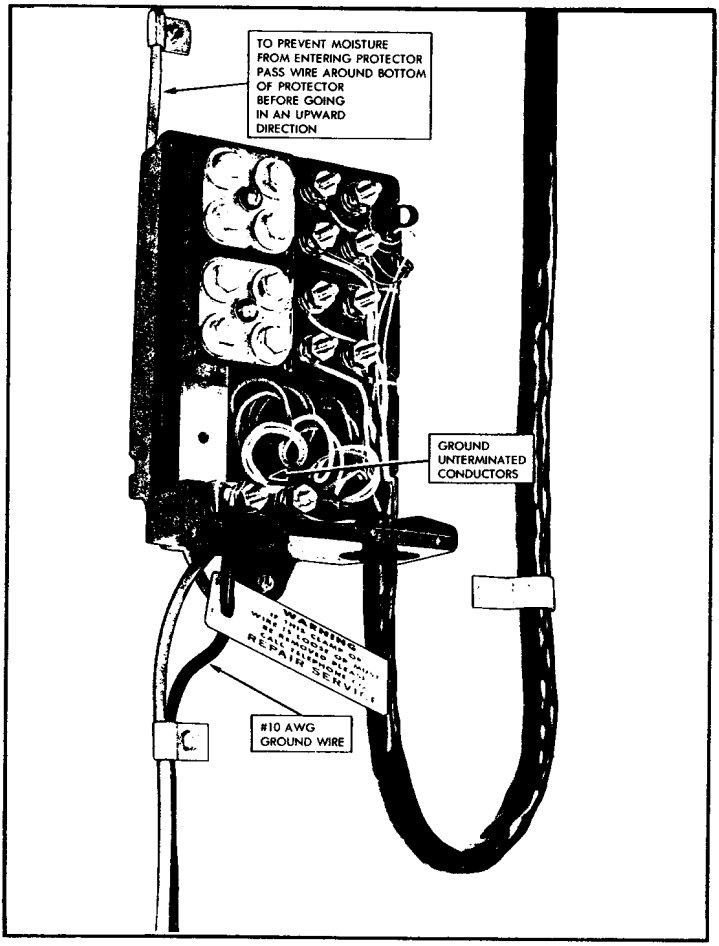


FIGURE 12. Typical Installation of Fuseless Multiple Protector 502A1 Type with Two 492 Protector Modules

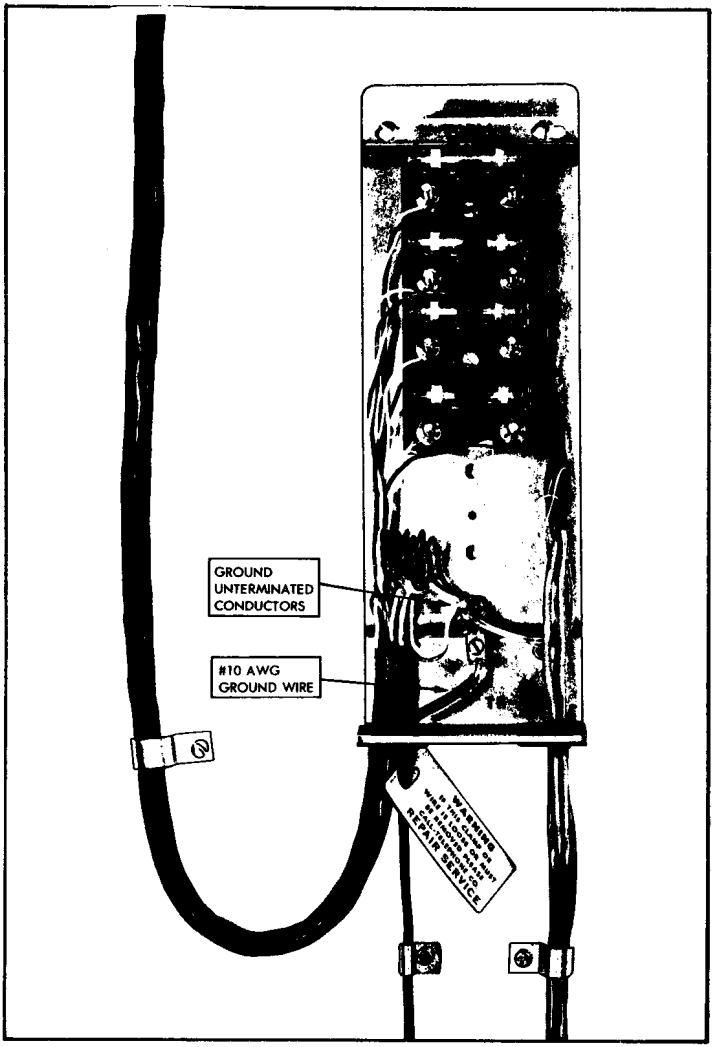


FIGURE 13. Typical Installation of Fuseless Gas Tube Multiple Protector Type 400 with Two 405 Two-Pair Mounting Blocks (Cover Removed)

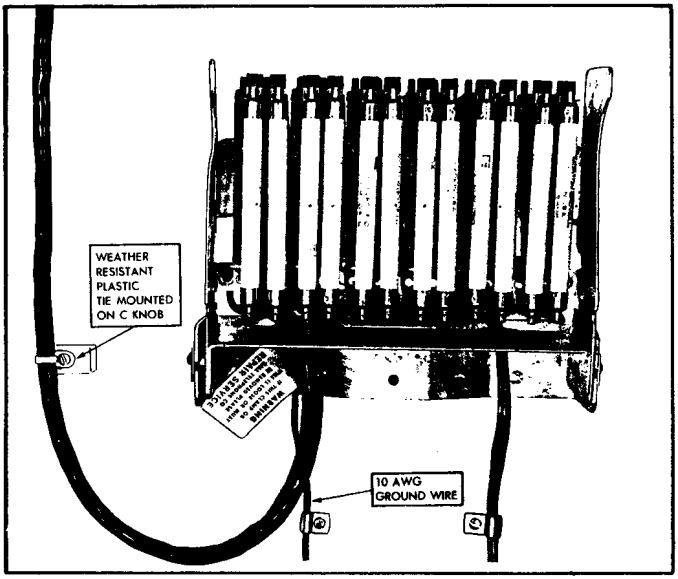


FIGURE 14. Typical Installation of U-Type Multiple Fuse Protector (Cover Removed)

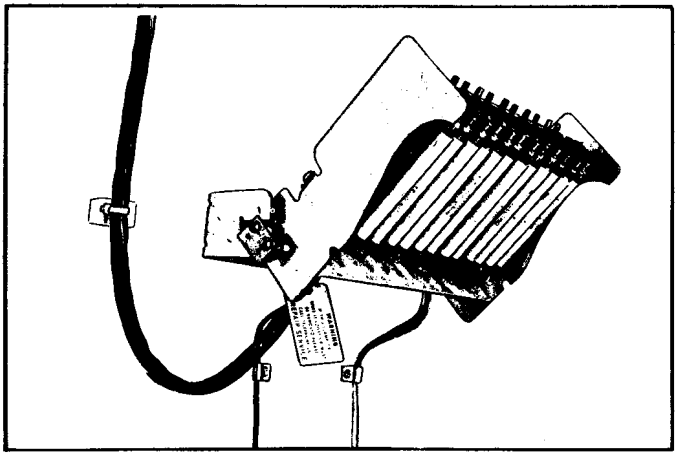


FIGURE 15. U-Type Protector Tipped Forward to Facilitate Attaching Inside Wires

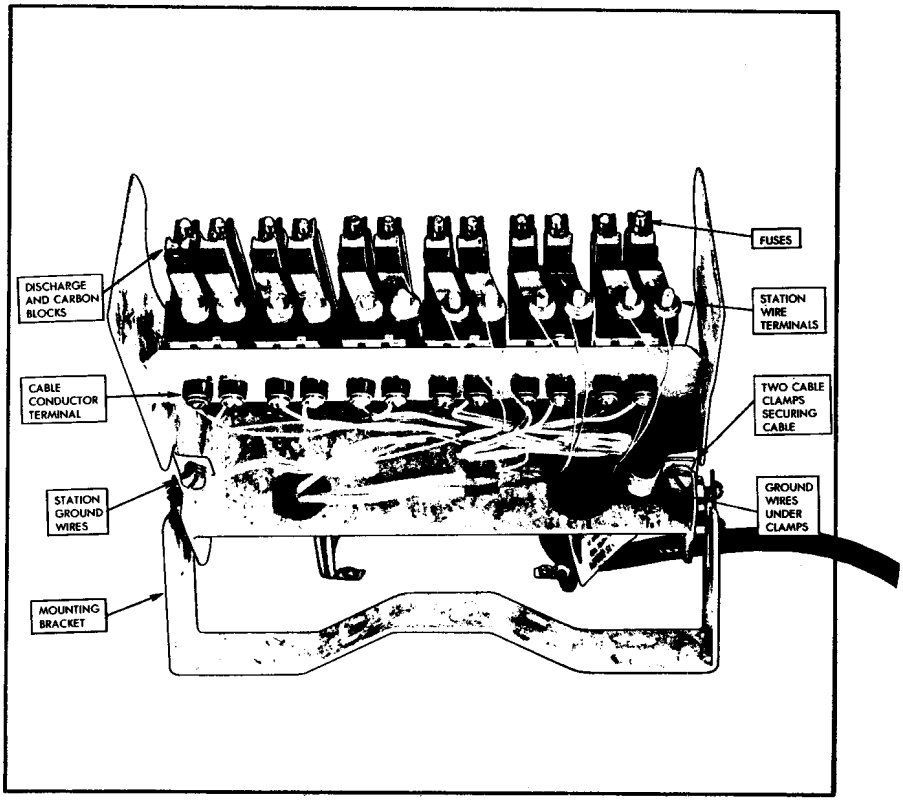


FIGURE 16. U-Type Protector as Viewed from Above with Protector Tipped Forward

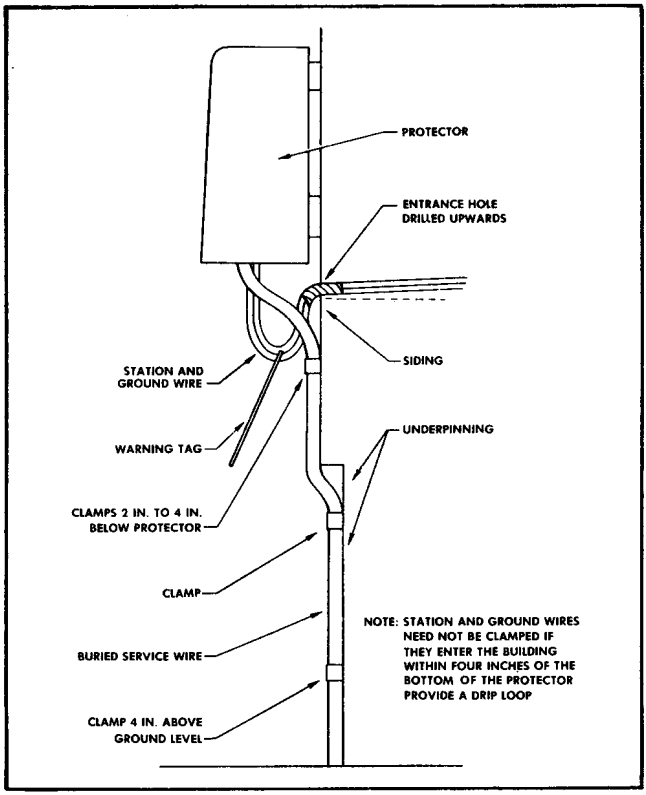

PROTECTOR
ENTRANCE HOLE DRILLED UPWARDS
SIDING
STATION AND GROUND WIRE
WARNING TAG
UNDERPINNING
CLAMPS 2 IN. TO 4 IN. BELOW PROTECTOR
CLAMP
BURIED SERVICE WIRE
CLAMP 4 IN. ABOVE GROUND LEVEL
NOTE: STATION AND GROUND WIRES NEED NOT BE CLAMPED IF THEY ENTER THE BUILDING WITHIN FOUR INCHES OF THE BOTTOM OF THE PROTECTOR PROVIDE A DRIP LOOP

FIGURE 17.

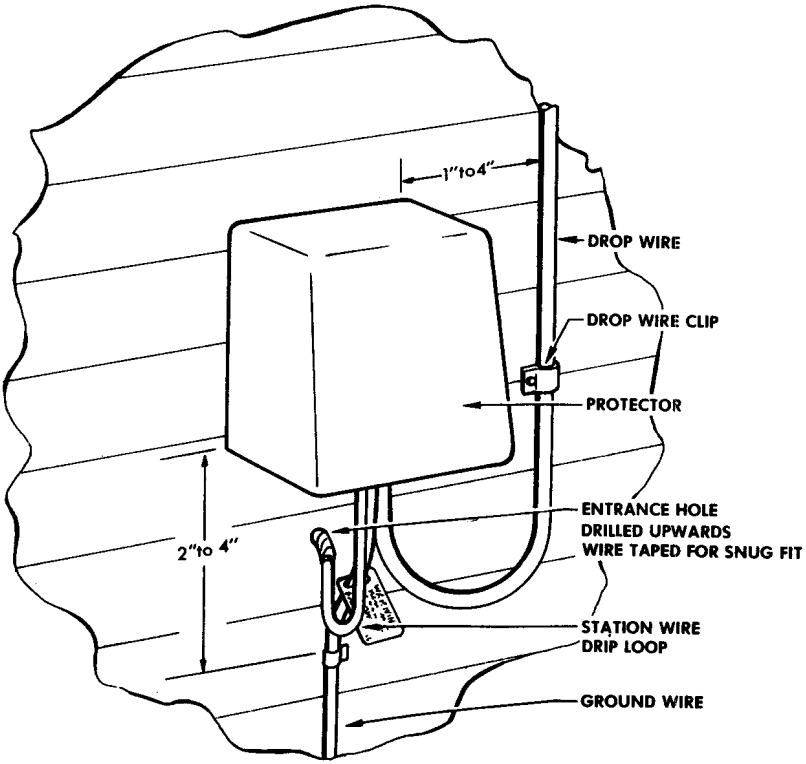

1"to4"
DROP WIRE
DROP WIRE CLIP
PROTECTOR
ENTRANCE HOLE
DRILLED UPWARDS
WIRE TAPED FOR SNUG FIT
2"to 4"
STATION WIRE
DRIP LOOP
GROUND WIRE

FIGURE 18.

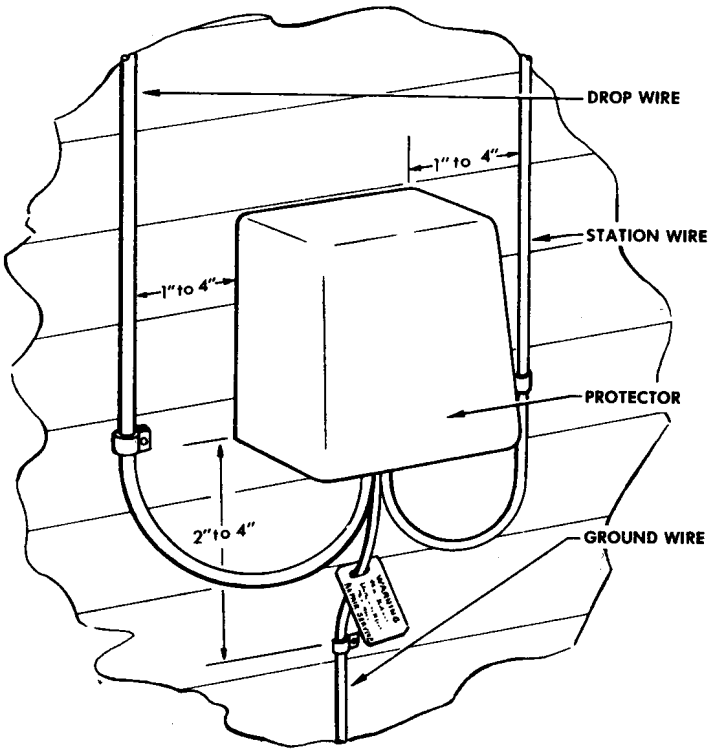

DROP WIRE
1" to 4"
STATION WIRE
1" to 4"
PROTECTOR
2" to 4"
GROUND WIRE

FIGURE 19.

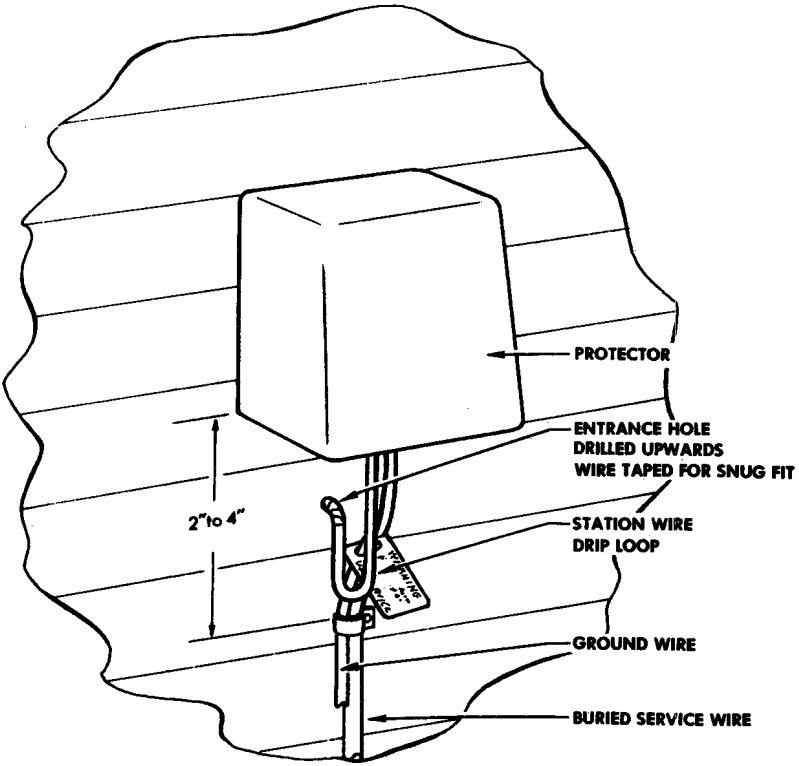

PROTECTOR
ENTRANCE HOLE
DRILLED UPWARDS
WIRE TAPED FOR SNUG FIT
2"to 4"
STATION WIRE
DRIP LOOP
GROUND WIRE
BURIED SERVICE WIRE

FIGURE 20.

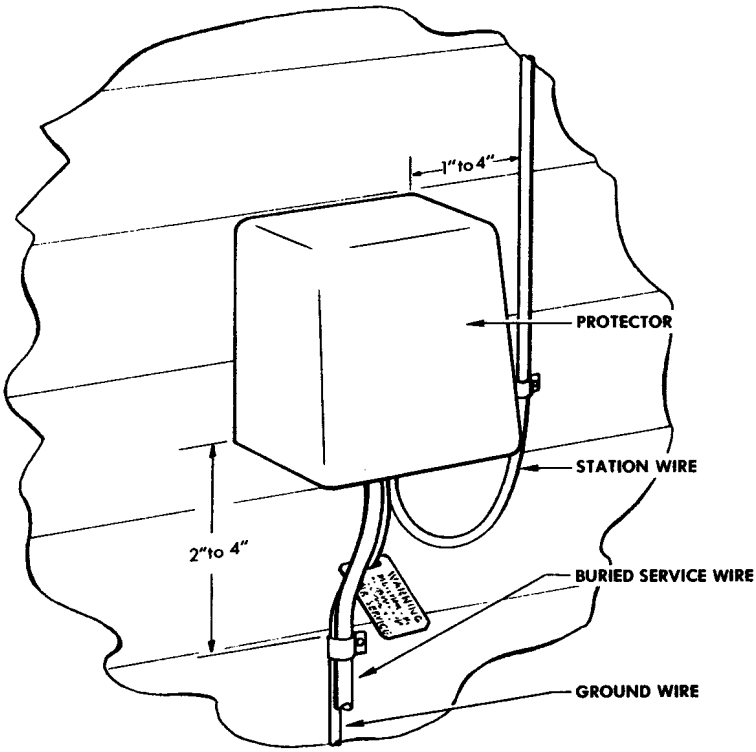

1" to 4"
PROTECTOR
STATION WIRE
2" to 4"
BURIED SERVICE WIRE
GROUND WIRE

FIGURE 21.

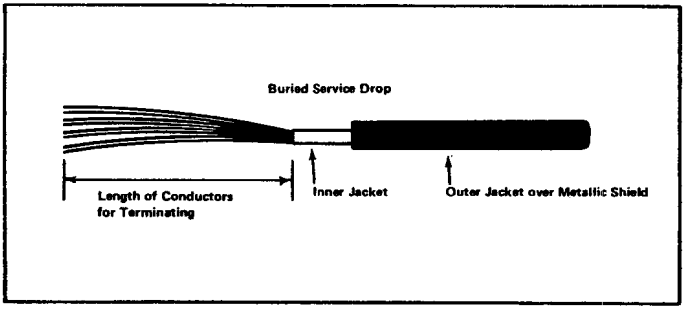


FIGURE 22.

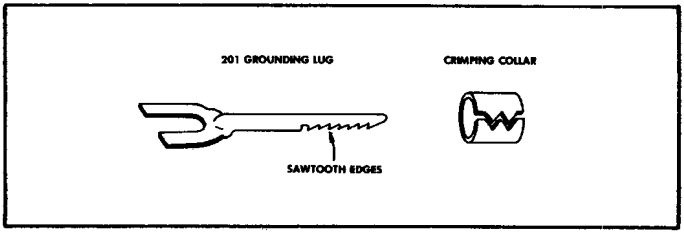


FIGURE 23.

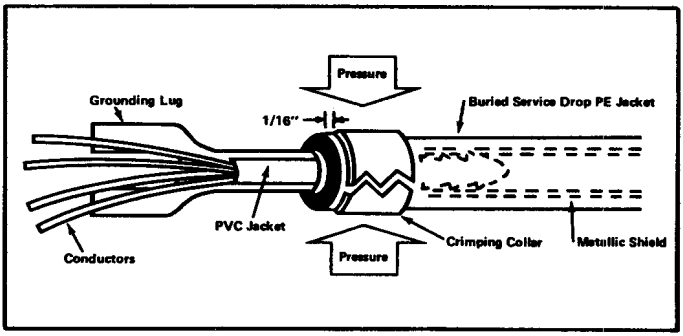


FIGURE 24.

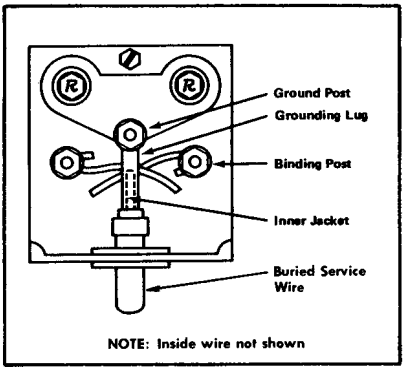


FIGURE 25.

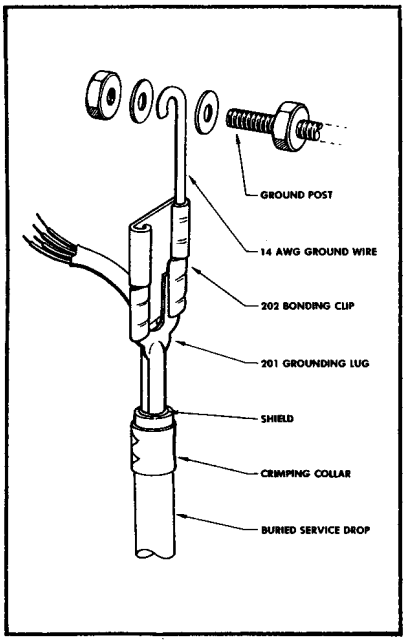


FIGURE 26.

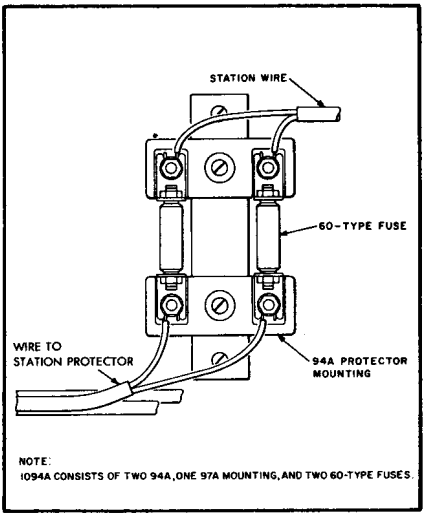


FIGURE 27. 1094A Type Protector with Type 60 Fuses

STATION PROTECTION AND SIGNALING GROUNDS SELECTION AND INSTALLATION

1. GENERAL

1.01 This addendum is to correct and add information on ground clamps and wiring.

1.02 With red pencil or ink make the changes as shown in paragraph 2 of this addendum. In the margin of subject paragraphs and tables write the words "See Addendum".

1.03 File this addendum directly in front of CTSP 475-500-410.

2. CHANGES AND ADDITIONS

2.01 Change paragraph 2.01 b. (6) to read: (6) GC 166SO Ground Clamp, CTS #68-11-061-8.

2.02 Add paragraph 3.08 which shall read: 3.08 Run the ground wire in as straight a line as possible with no sharp bends or kinks.

2.03 Change Table D as follows:

TABLE D. Wire Connectors

WIRE CONNECTOR	POWER CO. GROUND WIRE (MAX. SIZE)	TEL. CO. GROUND WIRE (MIN. SIZE)
No. 6 split bolt	8 solid	14 AWG
No. 4 split bolt	6 solid	14 AWG*
No. 4 split bolt	4 solid	14 AWG*
GC166SO	Larger than 4 solid	14 AWG

* #14 AWG must be doubled to fit into connector.

STATION PROTECTION AND SIGNALING GROUNDS SELECTION AND INSTALLATION

CONTENTS

1. GENERAL

1.01 This practice covers the selection of protector and signaling grounds and the installation of ground connecting equipment. See CTSP 475-500-402 for information on protector selection and application.

1.02 This practice replaces in their entirety CTSP 475-500-401, CTSP 475-500-403, and CTSP 475-500-404, all copies of which should be removed from the file and destroyed.

1.03 Power contacts, power induction, or lightning disturbances may cause abnormal voltages to develop between telephone plant and power services or metallic structures (such as water pipes) in a building. To equalize or limit possible voltage differences between telephone facilities and metallic structures, the station protector ground shall be bonded to the power service ground and the water system. The interconnection of the various metallic systems is known as **common bonding or grounding.**

NOTE: The telephone protector ground and the electrical service ground shall be interconnected. The method of interconnecting these facilities is described in paragraph 6.

1.04 When maintenance or repair work is performed on previously installed stations, the grounding system should be inspected. All systems must meet the current grounding and bonding requirements.

1.05 When available, a public metallic water pipe provides the preferred grounding medium. A private metallic water system with at least 10 feet of buried metallic pipe is an acceptable grounding medium and is preferred to a ground rod. Connect the ground wire to the metallic cold water pipe at a point where normal maintenance of water meters, pumps, or the installation of insulating sections for reducing vibrations will not interrupt the circuit to ground or common bonding to power ground. Figure 1 is an illustration of a preferred effective ground.

1.06 If the interior metallic cold water pipe is insulated from the buried water system by an insulating joint, or if the water system is nonmetallic, the interior metallic water piping is not an acceptable ground and an alternate method (see paragraph 4) must be used. The selected alternate ground shall always be bonded to the interior metallic cold water piping system.

1.07 The MGN (multiground neutral) type power system is an acceptable ground, but it is not in general use in all areas. The power company may have adopted the MGN as the standard on new or rearranged construction and still have a portion of plant operating without a multiground neutral. In all cases, it must be determined through supervisory channels whether the power system is MGN.

1.08 To provide a direct connection to the grounding medium, use a 72A bracket and a 123 type protector whenever possible. See CTSP 475-500-405. If a ground wire is necessary, the run should be short, straight, and continuous. See Figure 2.

NOTE: The 72A bracket and 123 type protector are to be used indoors only. Where accessibility to the protector for maintenance presents a problem, do not install any protector indoors.

1.09 If a fused protector must be used, the length of drop wire indoors should be as short as possible, no longer than five feet. See Figure 3.

2. TEST EQUIPMENT AND MATERIAL

2.01 This paragraph lists the test equipment and material covered in this practice. For convenience, CTS catalog numbers are listed if available.

a. Test Equipment:

(1) B Voltage Tester, CTS #74-94-310-3.

b. Material:

(1) 72A Bracket, CTS #70-75-104-8.

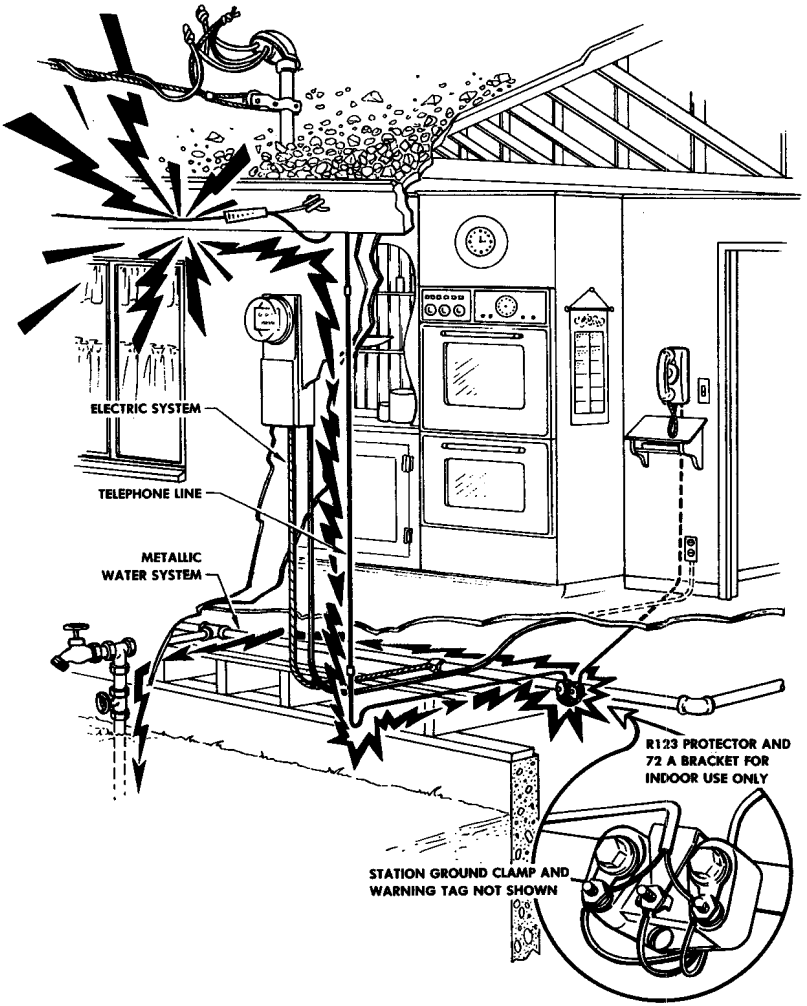


FIGURE 1. Preferred Effective Ground

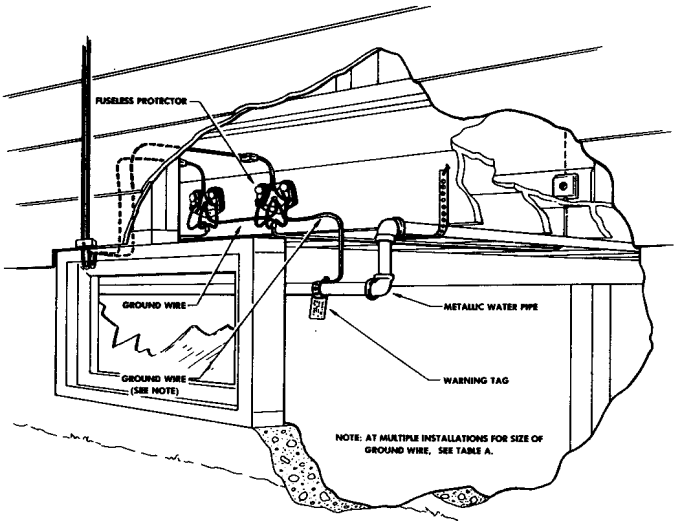


FIGURE 2. Ground Wire Run—Fuseless Protector

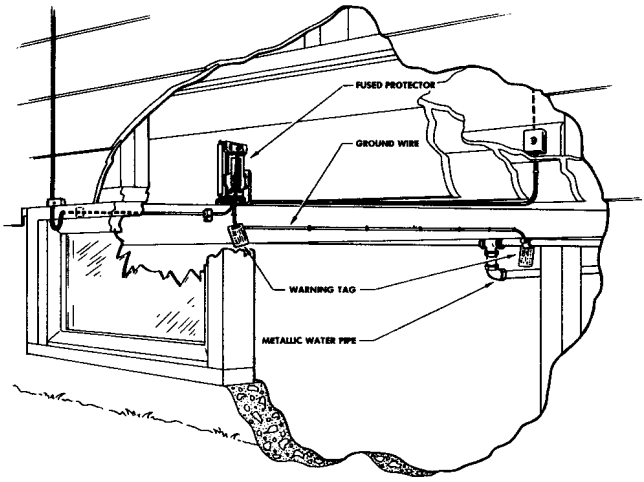


FIGURE 3. Ground Wire Run—Fused Protector

(2) 123 Type Fuseless Protector, CTS #70-75-052-0.

(3) Ground Wire Warning Tag, CTS #51-77-016-4.

(4) 3844 Ground Clamp, CTS #60-17-040-9.

(5) Station Ground Clamp, CTS #68-11-014-6.

(6) GC16650 Ground Clamp, CTS #68-11-061-8.

(7) L Ground Clamp, CTS #60-17-041-7.

(8) No. 4 Split Bolt Connector, CTS #60-17-057-3.

(9) No. 6 Split Bolt Connector, CTS #60-17-058-3.

3. SAFETY PRECAUTIONS

3.01 Before connecting the protector ground wire, test the power company ground rod, ground wire, cabinet, meter box, etc., with a B voltage tester. Make the voltage test as prescribed for vertical power ground wires or metallic conduit. If the grounding mediums are energized, do not proceed with the work. Report the condition to the proper supervision so that the power company or customer-owned power system may be informed of the situation.

3.02 To prevent damage to copper pipe or tubing, place ground clamps on fittings only.

3.03 Do not spiral the ground wire around the pipe.

3.04 Do not attach ground wires to the interior of any service entrance box, fuse box, meter box, etc.

3.05 Do not attach ground wire to power service aluminum ground wire, aluminum conduit, aluminum service boxes, etc., due to corrosive action.

3.06 Do not attach ground wire to gas pipes.

3.07 The ground wire warning tag shall be used as prescribed in paragraphs 5.07, 5.08, and 5.09.

4. SELECTION OF PROTECTOR GROUND

4.01 The gauge of station ground wire used depends on the type and number of protectors. See Table A.

4.02 The selection of the protector ground should be made in accordance with Table B and as shown in Figures 4 through 18. The only exceptions permitted without the approval of the supervisor or as stated in authorized instructions are those covered in paragraphs 4.06 and 4.07.

4.03 The wire directly connected to the metallic cold water pipe or other grounding medium is the grounding conductor of the power system. If this wire is encased in metallic armor or metallic conduit, the armor or conduit may be considered as the grounding conductor.

TABLE A. Ground Wire Capacity

Size	Protectors		
	Fused		Fuseless
No. 14 No. 10 No. 6	1 to 3 4 to 8 any number	Or	1 2 to 6 any number

NOTE: The ground wire between protectors shall be the same size as the ground wire between the protector and the grounding electrode.

4.04 The portion of conduit from the power drop entrance to the service equipment enclosure is the metallic entrance of the power service. The conduit or armoring on the branch circuits in the building must not be used as protector ground.

4.05 Figure 4 shows the 123 type protector attached to a metallic cold water pipe by means of a station ground clamp and a 72A bracket. This arrangement should be the first choice of grounding to an acceptable metallic cold water pipe.

NOTE: The 72A bracket and 123 type protector are to be used indoors only. See paragraph 1.08 note.

4.06 Stations located at power company stations, in an explosive atmosphere, or connected to foreign communication circuits usually require special protection. See the appropriate Continental Telephone System practices.

4.07 At radio or television stations, connect the protector or signaling ground wire to the radio or television station ground.

4.08 Tanks or pipes (public or private) that contain or have contained flammable gases or liquids are prohibited as protector or signaling grounds. Steam and hot water space heating pipes are also prohibited.

4.09 Another effective ground is a recent development known as a **concrete encased electrode.** It consists of not less than 50 continuous feet of 3/8 inch reinforcing steel bar or 20 continuous feet of No. 4 bare copper wire, embedded below grade in a concrete foundation or footing. The bar or conductor is stubbed up into an accessible location for grounding connections. In the absence of an acceptable water pipe or an MGN system, it should be considered as a first choice ground.

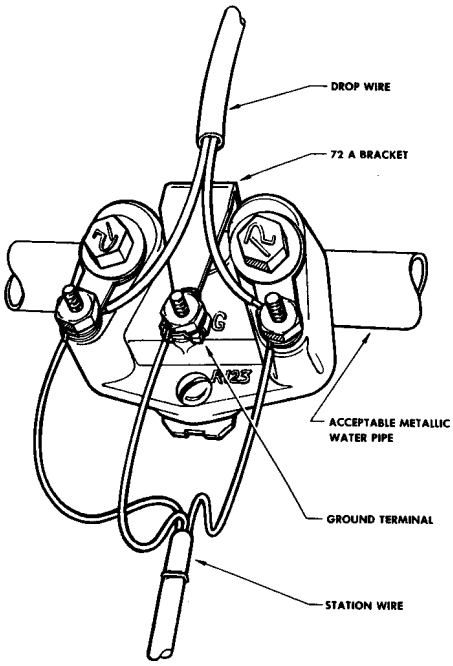


FIGURE 4. Protector Mounting—72A Bracket (For Indoor Use Only) See Paragraph 1.08 Note

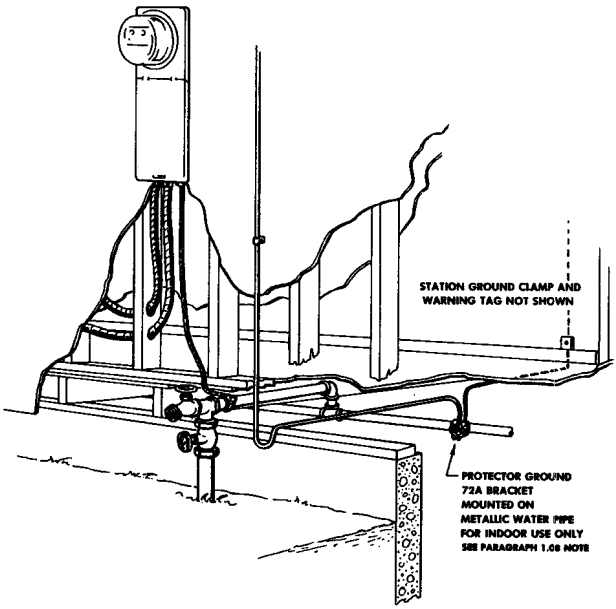


FIGURE 5. Protector Ground—72A Bracket

TABLE B—PROTECTOR GROUNDING

A1—MGN System on acceptable metallic water pipe or concrete encased electrode.
A2—MGN System on ground rod
B1—Non-MGN System on acceptable metallic water pipe or concrete encased electrode.
B2—Non-MGN System on ground rod
C —Power not grounded at premises
D —No power

WATER PIPE	POWER CONDITION	WHAT TO DO FOR PROPER PROTECTOR GROUNDING	FIG.
Acceptable metallic water pipe (at least 10 feet in moist soil)	A1 or B1	Ground protector preferably to metallic water pipe or second choice to power service conduit or third choice power service ground wire. See 4.03.	4, 5, or 6
	A2 or B2	Ground protector to metallic water pipe. Bond power to water pipe with No. 6 ground wire.	7
	C or D	Ground protector to metallic water pipe (if C, refer to 6.03).	8
Metallic interior water piping not acceptable because of plastic entrance, insulating joints, etc.	A2	Ground protector to MGN ground rod. Bond with No. 6 ground wire to metallic water pipe. If ground rod not accessible ground to power service conduit or ground wire.	9 or 10
	B2	Ground protector to best available ground or telephone ground rod. Bond to power ground rod and interior metallic water pipe with No. 6 ground wire. If power ground rod is not accessible bond to power service conduit or ground wire.	11 or 12
	C or D	Ground protector to best available ground or ground rod. Bond to interior metallic water pipe using No. 6 ground wire (if C, refer to 6.03).	13
No metallic water pipe or not possible to connect to metallic water pipe	A1 or B1	Ground protector to power service conduit or power service ground wire or concrete encased electrode.	6
	A2	Ground protector to MGN power ground rod, or, if ground rod is not accessible, ground protector to power service conduit or ground wire.	14 or 15
	B2	Ground protector to telephone ground rod and bond with No. 6 ground wire to power ground rod.	16 or 17
	C or D	Ground protector to best available ground (if C, refer to 6.03).	18

NOTE: Verify existing power and telephone bonding and grounding. If they meet these requirements no further action is required.

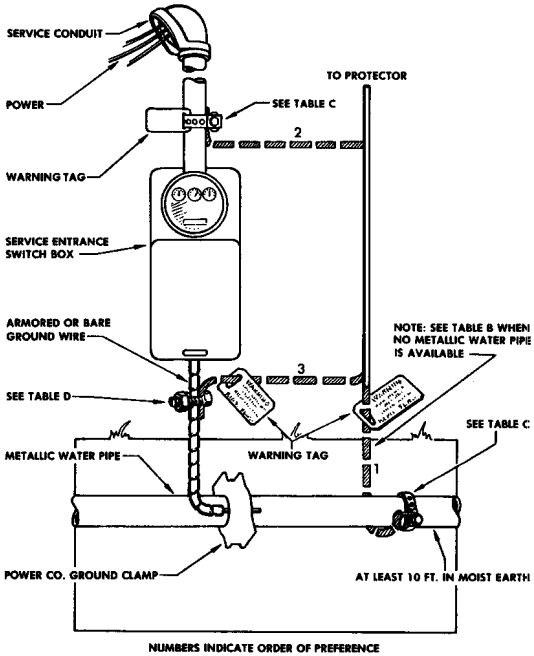


FIGURE 6. Power Grounded to Acceptable Water System

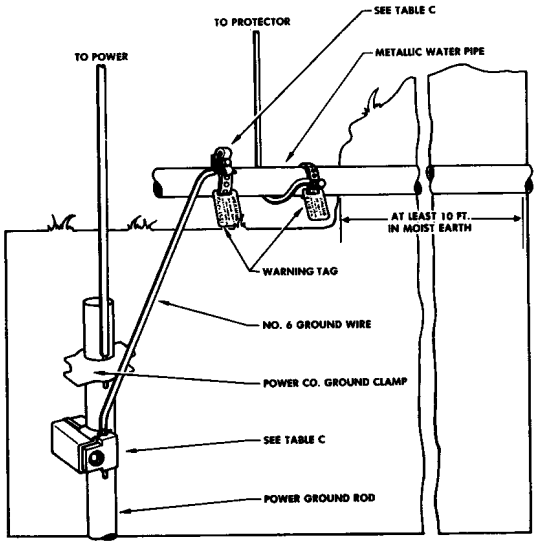


FIGURE 7. Grounding to Metallic Water System—Power on Ground Rod at Premises

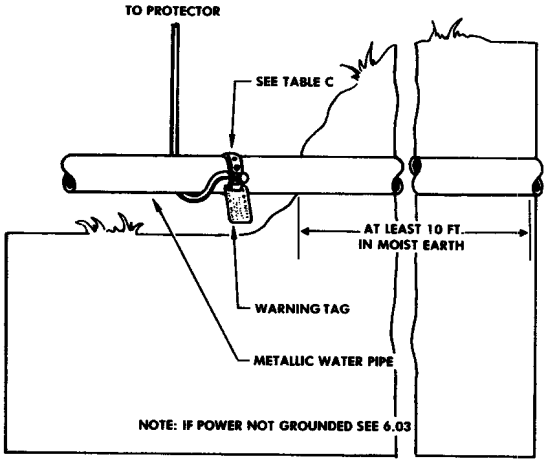


FIGURE 8. Grounding to Metallic Water System—Power (If Any) Not Grounded at Premises

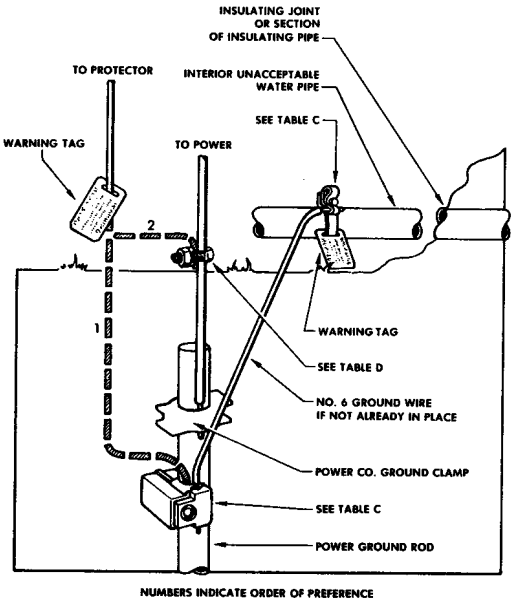


FIGURE 9. MGN Power Grounded to Ground Rod—Unacceptable Interior Water System

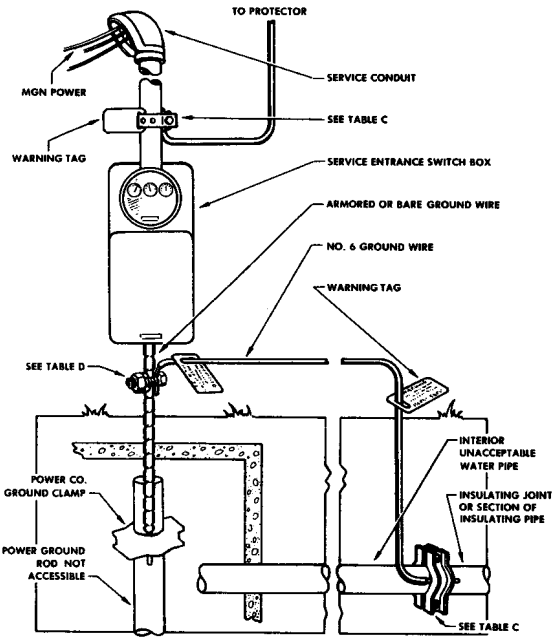


FIGURE 10. MGN Power Grounded to Inaccessible Ground Rod—Unacceptable Interior Water System

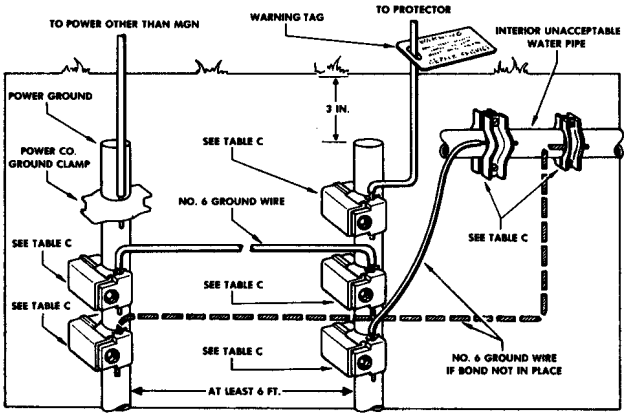


FIGURE 11. Power Other than MGN Grounded to Ground Rod—Unacceptable Interior Water Pipe

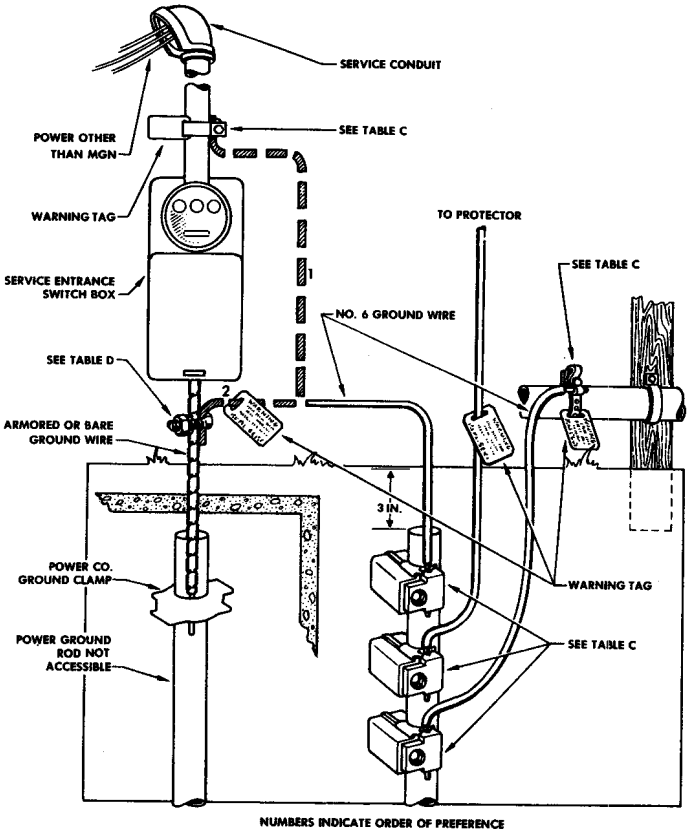


FIGURE 12. Power Other than MGN Grounded to Inaccessible Ground Rod—Unacceptable Interior Water Pipe

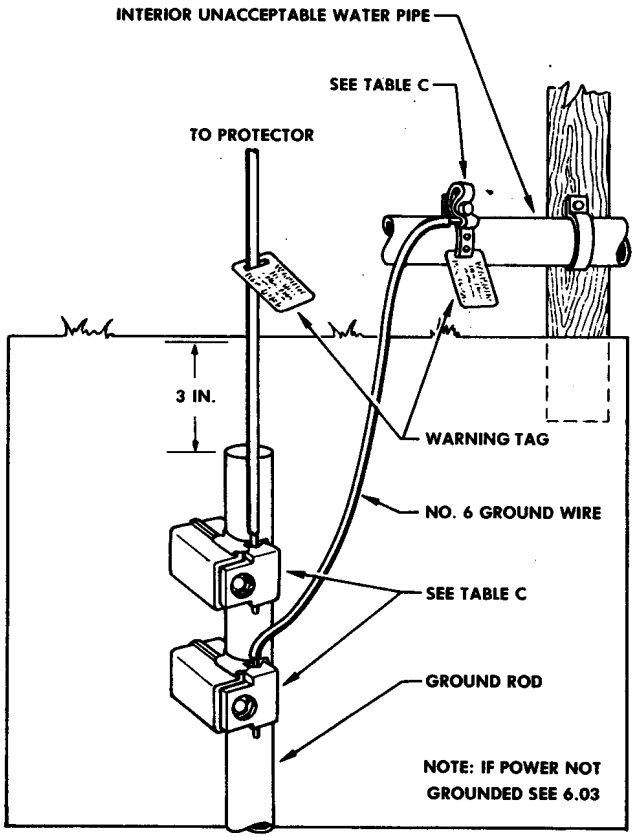


FIGURE 13. Power Not Grounded on Premises—Unacceptable Water Pipe

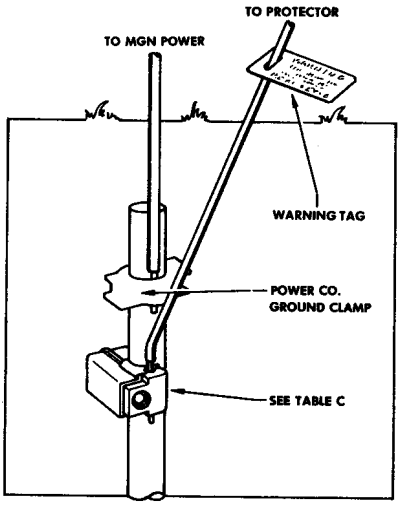


FIGURE 14. MGN Power Grounded to Ground Rod—No Water Pipe—Connection to Pipe Not Possible

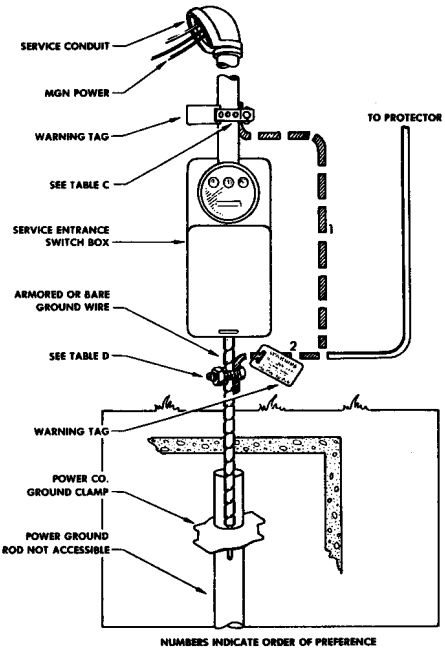


FIGURE 15. MGN Power Grounded to Inaccessible Ground Rod—No Water Pipe—Connection to Pipe Not Possible

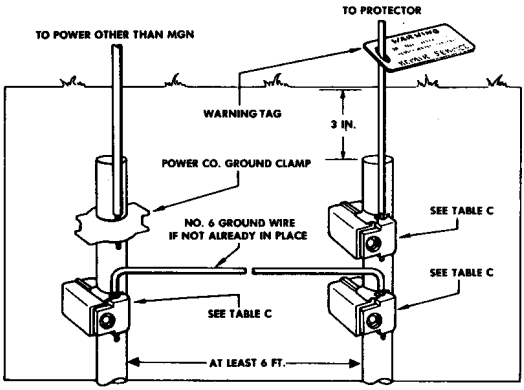


FIGURE 16. Power Other than MGN Grounded to Ground Rod—No Water Pipe

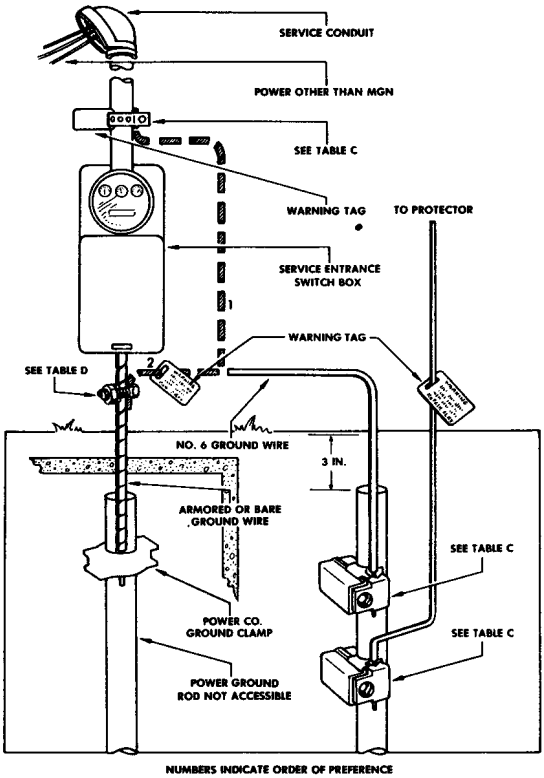


FIGURE 17. Power Other than MGN Grounded to Inaccessible Ground Rod—No Water Pipe

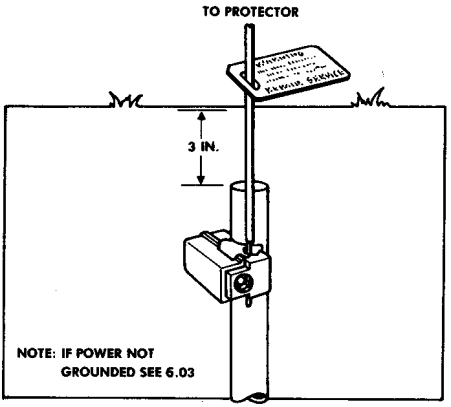


FIGURE 18. Grounding to Telephone Ground Rod—Water Pipe, Power Ground, or Metallic Structure Not Available

5. INSTALLATION OF STATION GROUND CLAMPS

5.01 The hardware used to terminate station ground wire is listed in Tables C and D.

5.02 The station ground clamp, L ground clamp, GC166S0 clamp, 3844 clamp and split bolt connector are shown in Figures 19 through 23.

5.03 The ground clamp should be located at an accessible point where it will not be subject to excessive movement or vibration and where it will least likely be damaged by plumbers or other workmen. If the pipe is insecure or subject to vibrations, tape the ground wire to the pipe in close proximity to the ground clamp. See Figure 24.

5.04 Figures 24 through 28 show correct installations of the station ground clamp and the L ground clamp.

5.05 Where insulating joints are found (usually at meters, pumps, valves, etc.), the ground clamp should be installed at a point where the insulating joint will not break continuity to ground. Where pumps, meters, etc., may be removed for seasonal overhaul, the ground clamp should be installed at a point where the continuity to ground will not be broken.

TABLE C. Ground Clamps

GROUND CLAMPS	CONDUCTOR SIZE	SERVICE PIPE INTERIOR OR ABOVEGROUND SIZE (IN.)	SERVICE PIPE OR GROUND ROD (BURIED) SIZE (IN.)
72A bracket with station ground clamp size 6-3/4		3/8 through 1-1/4	
72A bracket with two station ground clamps		1-7/8 through 3	
3844 ground clamp	No. 6		1/2 through 1 water pipe only
Station ground clamp	No. 14 or 10	3/8 through 1-1/4	3/8 through 1-1/4
Two station ground clamps (Figure 25)	No. 14 or 10	1-7/8 through 3	
Fargo GC166S0	No. 6, 10 or 14		3/8 through 5/8 Ground Rod Only
L ground clamp	Small opening of formed end No. 6 wire. Place No. 10 or No.14 wire under bolt head (Figures 26,27,28)	3/8 through 3	

TABLE D. Wire Connectors

WIRE CONNECTOR	POWER CO. GROUND WIRE (MAX. SIZE)	TEL. CO. GROUND WIRE (MIN. SIZE)
No. 4 split bolt	8 solid	14 AWG
No. 6 split bolt	6 solid	14 AWG*
No. 4 split bolt	4 solid	14 AWG*
GC166S0	Larger than 4 solid	14 AWG

*#14 AWG must be doubled to fit into connector.

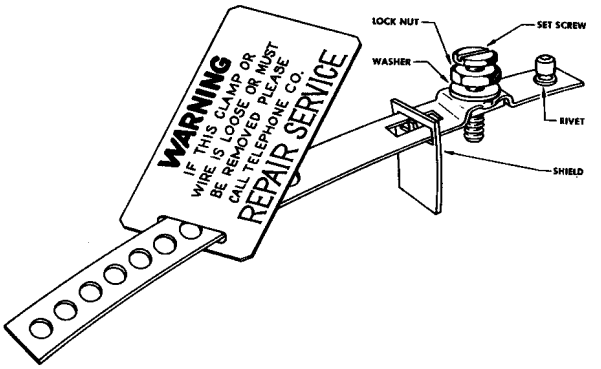


FIGURE 19. Station Ground Clamp

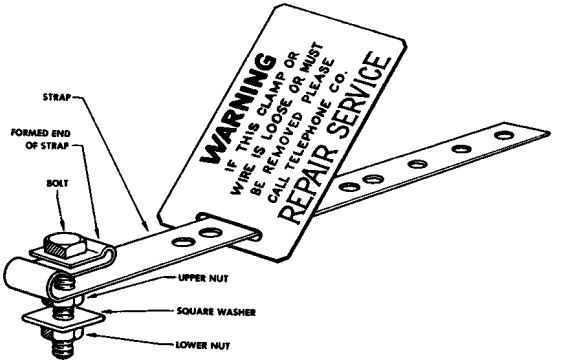


FIGURE 20. L Ground Clamp

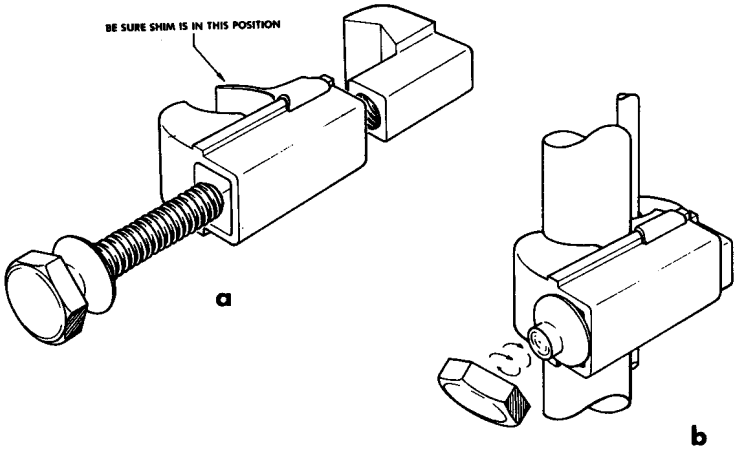


FIGURE 21. GC166S0 Clamp

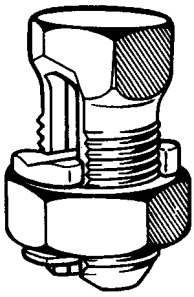


FIGURE 22. Split Bolt Connector

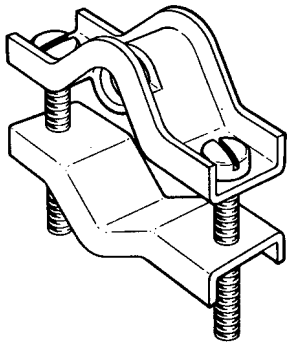


FIGURE 23. 3844 Clamp

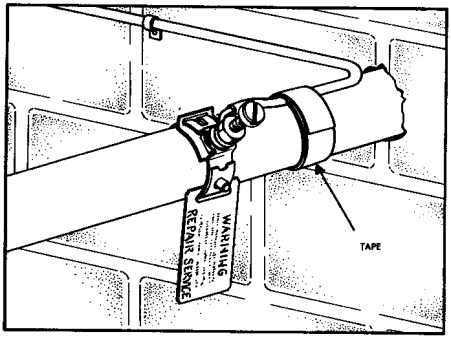


FIGURE 24. Typical Ground Clamp Installation

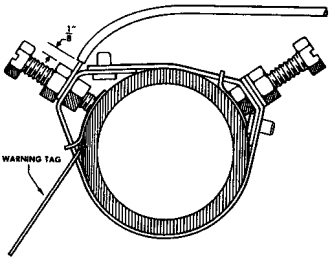


FIGURE 25. Installation on Large Pipes

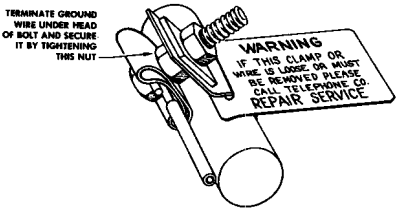


FIGURE 27. Attaching No. 14 or No. 10 ground Wire to L Ground Clamp

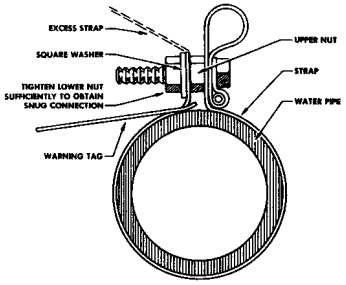


FIGURE 26. Attaching L Ground Clamp to 3-Inch and Smaller Pipe

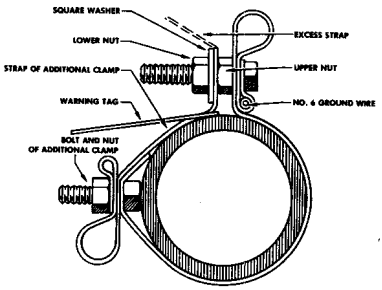


FIGURE 28. Attaching L Ground Clamp to Pipes Larger than 3 Inches

5.06 Make certain that the surface of the metallic pipe to which the ground clamp is being fastened is free of paint, rust, etc.

5.07 The ground wire warning tag shall be placed at all ground wire terminations including the clamp, protector, and bonding terminations.

5.08 The warning tag (see Figure 29) shall be placed at all ground wire terminations to warn people not to disturb the clamp or wire and to notify the telephone company if the clamp or wire is disturbed.

FIGURE 29. Warning Tag

5.09 The preferred method of attaching the warning tag is to insert the station ground clamp through the elongated slot before attaching to a pipe. See Figure 30. An alternate means of attaching the warning tag to the station ground clamp is to place the elongated slot over the hexagonal screw. See Figure 30.

NOTE: After the installation is complete, check the ground clamps to be sure that the ground wire warning tag has been placed.

6. BONDING OF POWER AND TELEPHONE GROUNDS

6.01 The selection of protector grounds listed in Table B and shown in Figures 4 through 18 is intended primarily to provide the best available ground for the telephone protector. It is also intended to accomplish bonding between the power and telephone grounds where there is a choice of acceptable grounds. The necessity for bonding is shown in Figure 31.

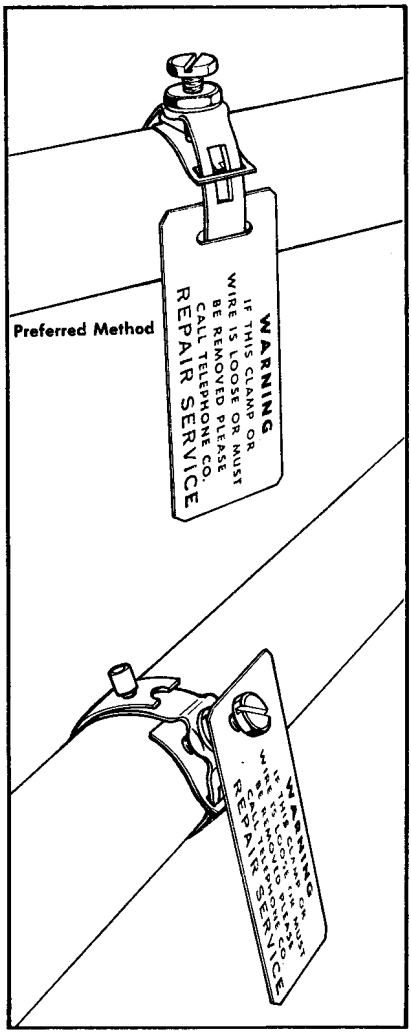


FIGURE 30. Warning Tag Attached to Station Ground Clamp

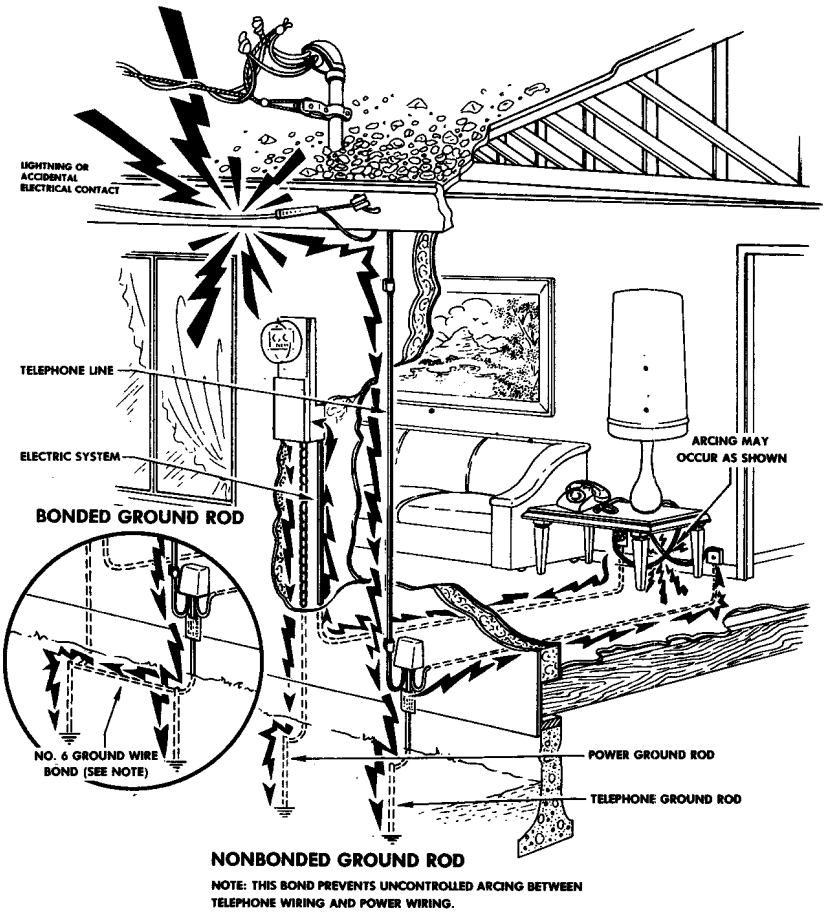


FIGURE 31. Effects of Bonding

6.02 When a situation exists where the power and telephone grounds are not common, the following corrective arrangements should be made:

a. If an acceptable public or private water system is available and the power service is grounded to a ground rod, connect the telephone protector to the metallic water system. In addition; a No. 6 ground wire should be bonded to the interior metallic water pipe and the power ground rod.

b. If the power service and the telephone protector are connected to separate ground rods, bond the two rods together as shown in Figures 11 and 12.

CAUTION: Whenever a bond has been established, it should not be removed. If it becomes necessary to open the bond, as in the case of a rearrangement, a temporary bond should be placed across the location before it is opened.

6.03 The customer's telephone service may be installed where a power ground is not provided. However, the customer should be informed immediately of the need for a power ground and should be requested to notify the telephone company when the ground has been provided. Follow local procedures for notifying the customer. Where telephone service is already being furnished and there is no power ground, the same procedure should be followed. When installing telephones at contractor shacks, trailers, etc., and an acceptable metallic cold water pipe is not available, the telephone protector must be connected to a telephone ground rod. This ground rod must be bonded to a power ground rod as soon as the power ground rod has been installed and connected.

7. SELECTION OF SIGNALING GROUND

7.01 When a signaling ground is required, the protector ground should be used as a first choice. Ground strips connected to ground sheath cables at terminals are suitable for signaling grounds. When commercial power is connected to telephone equipment, the signaling ground shall be bonded to the protector ground at the protector, or by using the same grounding medium. When commercial power is not connected to telephone equipment, it is desirable to bond protector and signaling grounds; however, it is not required.

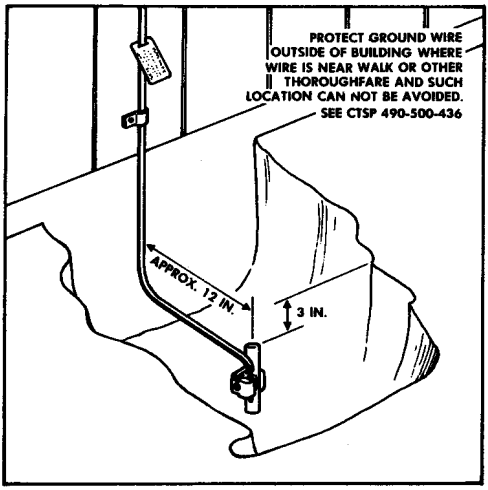


FIGURE 32. Ground Installation Near Wall

8. LOCATING AND INSTALLING GROUND RODS

CAUTION: Avoid personal injury by protecting the eyes and hands when driving ground rods.

8.01 Locate and install ground rods as follows:

a. Where they are least likely to be damaged or tampered with.

b. As near as possible to masonry walls in earth-floor basements.

c. Approximately 12 inches from the outside wall. See Figure 32.

d. Approximately 2 feet from the base of wooden poles or posts, where conditions permit. See Figure 33.

e. At least 6 feet from the power service ground rod.

f. Drive the ground rods until the top of the rod is approximately 3 inches below ground level. See Figures 32 and 33. Increase the depth where damage from digging is possible.

g. If the vertical or horizontal station ground wire run is located so it can be damaged or tampered with and such a location cannot be avoided, protect the ground wire with P.V.C. plastic house and building riser. See CTSP 490-500-436.

8.02 After the ground rod is installed, select the proper size and type of ground clamp from the list in Table C.

8.03 When two or more protectors requiring ground rods are installed at the same location, proceed as follows:

NOTE: Refer to Table A for the proper size of station ground wire to be used.

a. If a power ground rod is not available, install a ground rod for each protector. It is not necessary to place more than 3 ground rods. Place station ground wire from each ground rod as shown in Figure 34.

b. If a power rod is available, one telephone ground rod is sufficient. Bond all protectors together and bond the telephone ground rod to the power ground rod, as shown in Figure 11.

8.04 Multiple type station protectors may be connected to any of the grounds shown in Figures 6 through 18, but they should not be connected to a single telephone ground rod unless the rod is bonded to the power system ground rod. If a power ground rod is not available, a multiple station protector may be connected to an assembly of three telephone ground rods, spaced at least 6 feet apart and bonded together with No. 6 station ground wire. See Figure 34.

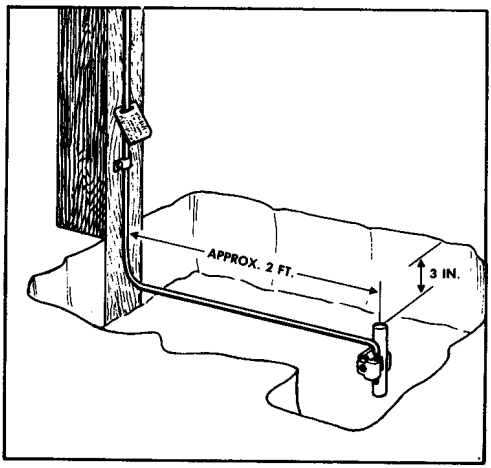


FIGURE 33. Ground Rod Installation Near Pole

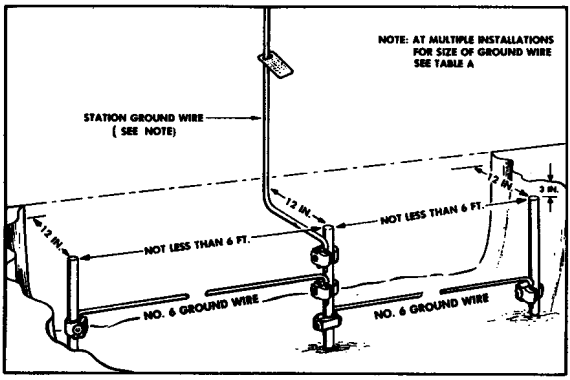


FIGURE 34. Three Ground Rods

STATION PROTECTION AND WIRING
MOBILE HOMES

1. GENERAL

1.01 This addendum is to correct Figures 1, 2, 3 and 4 reference to other figures.

1.02 With red pencil or ink, make the changes shown in paragraph 2 of this addendum. Under the subject figures, write the words "See Addendum".

1.03 File this addendum directly in front of CTSP 475-500-425.

2. CORRECTIONS

2.01 Change the reference in Figures 1, 2, 3 and 4, that presently reads "Buried Service Wire, See Figures 9, 10 and 11" to read, "Buried Service Wire, See Figures 7, 8 and 9". The reference is located at the top of the window of the mobile home in Figures 1, 2, 3 and 4.

STATION PROTECTION AND WIRING
MOBILE HOMES

1. GENERAL

1.01 In many areas of the Continental Telephone System, the electrical hookup to mobile homes is not state regulated. This practice provides information on installation, grounding and bonding procedures for mobile home telephone service.

1.02 For the purpose of this practice, the term **mobile home** includes camp cars, trailer coaches, and travel trailers.

1.03 This practice replaces in its entirety CTSP 475-300-413, Attachments, Trailer Courts and Auto Trailers. All copies of CTSP 475-300-413 should be removed from the file and destroyed.

1.04 Before installation is started, all necessary arrangements should be made with the customer and mobile home park manager or owner. The arrangements may include such facilities as private poles, opening and closing trenches for buried underground wire, and permission to attach wire to mobile homes for proper installation. Where such arrangements have not been made, the installer should refer the Contact Memo to the supervisor.

1.05 Where attachments are made on jointly used poles or posts, standard separations between power and telephone wires shall be provided. All clearance requirements over driveways and/or streets shall be met.

CAUTION: Defects in electrical equipment or wiring in a mobile home could energize the unit and become an electrical hazard to persons in or near it. If it is found that a hazardous condition exists, the installer shall inform the supervisor of the condition and cease all work operations until the condition has been corrected. The occupant or mobile home park manager should also be informed of the hazardous condition.

1.06 Ground wire warning tags should be placed at (or as close as possible to) **all** ground and bond wire terminations including the protector.

2. TEST EQUIPMENT AND MATERIAL

2.01 This paragraph lists the test equipment and material covered in this practice. For convenience, CTS catalog numbers are listed when available.

a. Test equipment

(1) B. Voltage Tester, CTS #74-94-310-3.

b. Material

(1) Ground Wire Warning Tag, CTS #51-77-016-4.

(2) Rubber Gloves; see Gloves, Rubber, Lineman's.

(3) Beam Clamp, CTS #68-11-058-8.

(4) Round Head Machine Screw, 1/4-20 x 3/8 inch.

(5) Station Ground Clamp, CTS #68-11-014-6.

(6) L Ground Clamp, CTS #60-17-041-7.

(7) Ground Rod Clamp, GC166S0, CTS #68-11-061-8.

(8) 201 Grounding Lug and Crimping Collar, CTS #68-11-018-9.

(9) Flat Washer, Zinc or Cadmium Plated, 3/4 inch.

(10) Mobile Home Connecting Block, CTS #70-10-040-3.

3. TESTING FOR HAZARDOUS VOLTAGE

3.01 Before making bodily contact with any metal portion of the mobile home, test for the presence of hazardous voltage on the mobile home body or chassis.

3.02 Use the B Voltage Tester and follow the instructions in CTSP 490-050-106 for verifying the presence of voltage on ground leads on joint use poles. If it is necessary to cut through paint to ensure good contact between the mobile home and the B Voltage Tester, select an inconspicuous location to avoid marring the appearance of the mobile home. **Wear rubber gloves and avoid bodily contact with the mobile home during this operation.**

CAUTION: If the B Voltage Tester indicates that

any part of the mobile home is energized, do not proceed until the supervisor is notified and the condition corrected.

4. INSTALLING SERVICE DROPS

4.01 The distribution plant serving a mobile home park may be any of the following types, depending on the number of lines required:

a. Drop wire, multiple or single.

b. Distribution wire.

c. Aerial cable.

d. Buried cable.

4.02 Service to individual mobile homes may be either an aerial drop wire or a buried wire.

a. For **aerial installations,** the pole should be 4 inches by 4 inches, and extend a minimum of 10 feet above the ground. See Figure 1. The base of the pole (or post) should be set into the ground a minimum of 3 feet, as shown in Figure 1. Do not attach drop wire spans which cross over public thoroughfares to a customer's pole. For instructions on clearances, refer to the CTS 490-060 series of practices.

NOTE: Under no circumstances should two posts, 2 inches by 4 inches, be nailed or wired together in lieu of one post, 4 inches by 4 inches.

b. For **buried installations,** the pole should be 4 inches by 4 inches and extend a minimum of 2 feet above the ground. See Figure 2. The base of the pole (or post) should be set into the ground a minimum of 18 inches, as shown in Figure 2.

NOTE: Under no circumstances should two posts, 2 inches by 4 inches, be nailed or wired together in lieu of one pole, 4 inches by 4 inches.

5. GROUNDING MOBILE HOMES

5.01 See CTSP 475-500-410 for grounding and bonding procedures and preferred ground choice. After installing the protector, connect a No. 14 ground wire from the protector to the grounding medium. See Figures 1 through 4. **It is particularly important to have the power and telephone grounds bonded together. If separate ground rods are used for any reason, bond them together.**

5.02 Place a ground wire warning tag at (or close as possible to) **all** ground wire terminations including the protector.

6. BONDING MOBILE HOMES

CAUTION: The mobile home chassis must be bonded directly to either the power ground or the telephone ground, both of which are bonded together. No additional external bond is necessary where this condition is fulfilled. After making the test for hazardous voltage as instructed in paragraph 3., verify that electrical continuity exists from the mobile home chassis to ground. This bond shall not be removed once installed. If it becomes necessary to temporarily open the bond, a temporary bond should be provided across the location before it is opened.

6.01 Use a suitable size beam clamp to bond the mobile home chassis to the station ground. Attach the clamp to a flange on the structural member of the mobile home chassis (see Figures 1 through 4). Attach the No. 10 ground wire to the beam clamp with a 1/4-20 x 3/8 inch round head machine screw (zinc or cadmium plated) and a suitable size zinc or cadmium plated flat washer. The ground wire should be installed in a manner to provide the best possible mechanical protection.

6.02 Bonding should be completed before any installation work is started on the mobile home.

6.03 Place a ground wire warning tag at (or as close as possible to) **all** bond wire terminations.

7. INSTALLING STATION PROTECTORS AND WIRING

7.01 Mobile home installations vary, depending on the type of facilities provided by the customer.

7.02 The protector should be located on a private post, as near as possible to the mobile home. **Protectors and attachments shall not be mounted on mobile home siding.** See CTSP 475-500-402 for selection of protectors to be used.

7.03 The inside wiring and cabling of mobile homes should be done in the same manner as for permanent structures. In some cases, short lengths of conduit for telephone wiring are provided between the bottom of the mobile home and outlet locations. Where such facilities are not provided, entrance holes should be drilled in the floor, the wire pulled through, taped to protect from the weather, and terminated on a connecting block on the inside wall.

7.04 In all cases, use buried service wire from the service post to the mobile home. Secure the buried service wire, remove the outer jacket; then proceed to wire the mobile home with the buried service wire (outer jacket and shield removed). When the mobile

home is located more than 12 inches from the service post, the buried service wire (along with any other wires) must be placed at least 18 inches in the ground. Be careful not to expose the buried service wire to buried power in the ground. See Figures 5 and 6.

7.05 The metallic shield should be grounded at both ends to keep all conducting material at ground potential. See CTSP 475-500-405, paragraph 6. Attach buried service wire to mobile home chassis using a beam clamp as shown in Figure 7.

7.06 It is not necessary to run all buried service wires directly to the protector. The following method can be used for terminating wires under the mobile home to eliminate the need for running more than one buried service drop to the mobile home from the protector:

a. Attach a mobile home connecting block to the mobile home steel understructure at a convenient location. See Figure 8.

CAUTION: Be sure the securing bolt of the clamp and the undernut of the ground post are tight; together they serve as the bond wire termination when the chassis must be bonded to ground.

b. Use the strain relief clamp to hold all wires terminating on the connecting block.

c. Terminate on the mobile home connecting block:

(1) The No. 10 bond wire on the ground post, if a bond of the chassis to ground is necessary.

(2) The shield of the buried service drop using the 201 grounding lug and crimping collar on the ground post. See Figures 8 and 9 and CTSP 475-500-405, paragraph 6.

(3) The buried service wire and all other station wires on the appropriate wire terminals. See Figures 8 and 9.

(4) Snap cover into place.

7.07 The method used for running inside wire on the underside of the mobile home depends on its construction. In some cases, the wire can be attached to exposed wood. Clamps, rings or staples can be used in such cases. If no wood is found, beam clamps, utility clips and rings, or adhesive inside wire clips should be used to support the wire. **Under no circumstances should any attachment be made to the composition material on the underside of the mobile home.**

NOTE: In areas of high humidity where corrosion is a problem, it may not be desirable to use a mobile home connecting block. In these cases, all of the wires (buried service wires) should terminate at the protector. Be sure to ground both ends of the shield of all buried service wires.

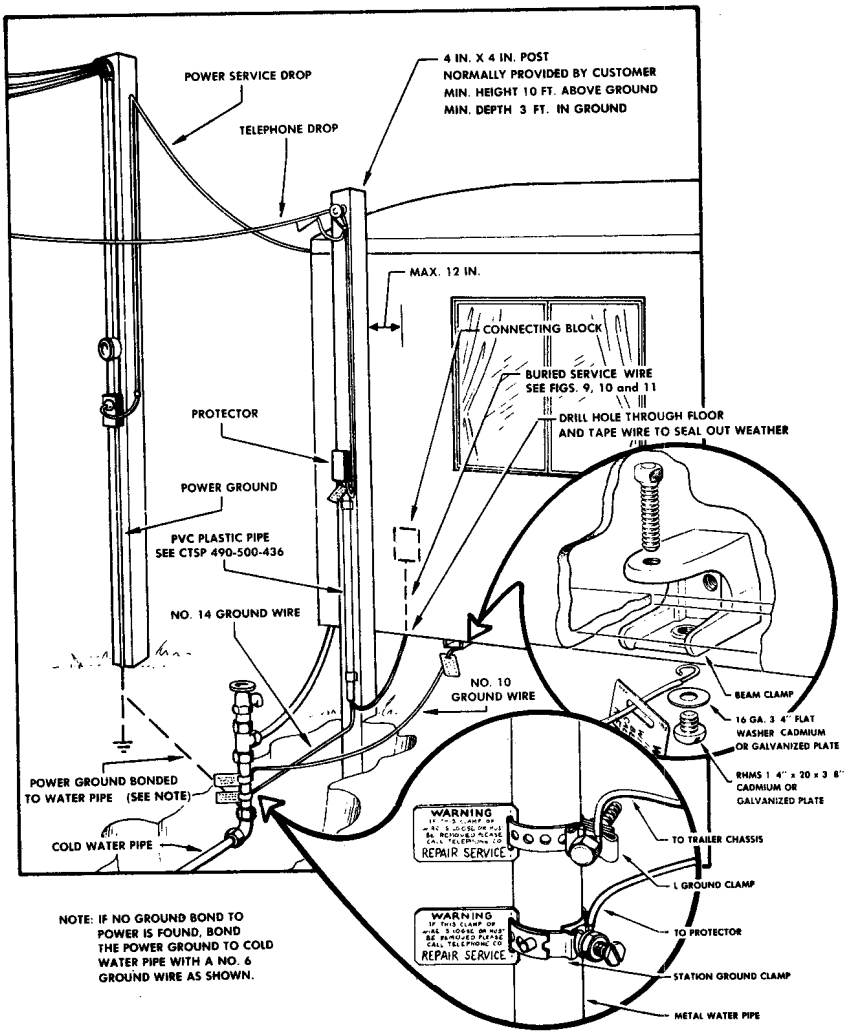


FIGURE 1. Typical Installation—Aerial Distribution Water Pipe Ground

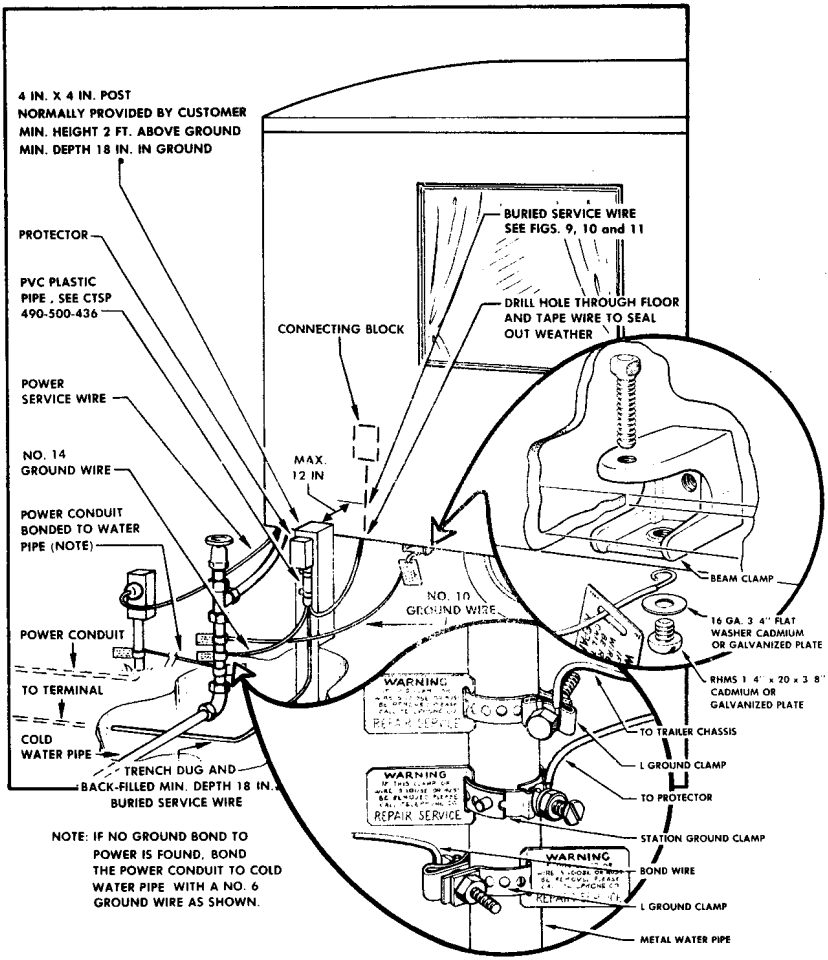


FIGURE 2. Typical Installation – Buried Distribution Water Pipe Ground

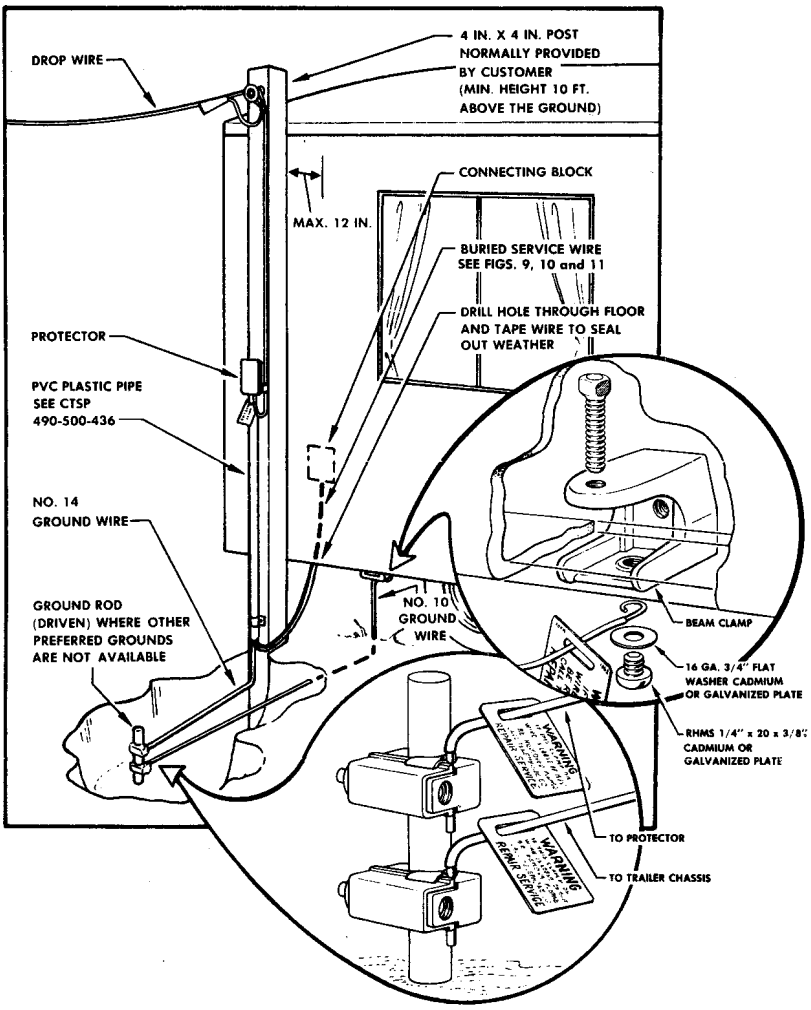


FIGURE 3. Typical Installation—Aerial Distribution, Ground Rod Ground

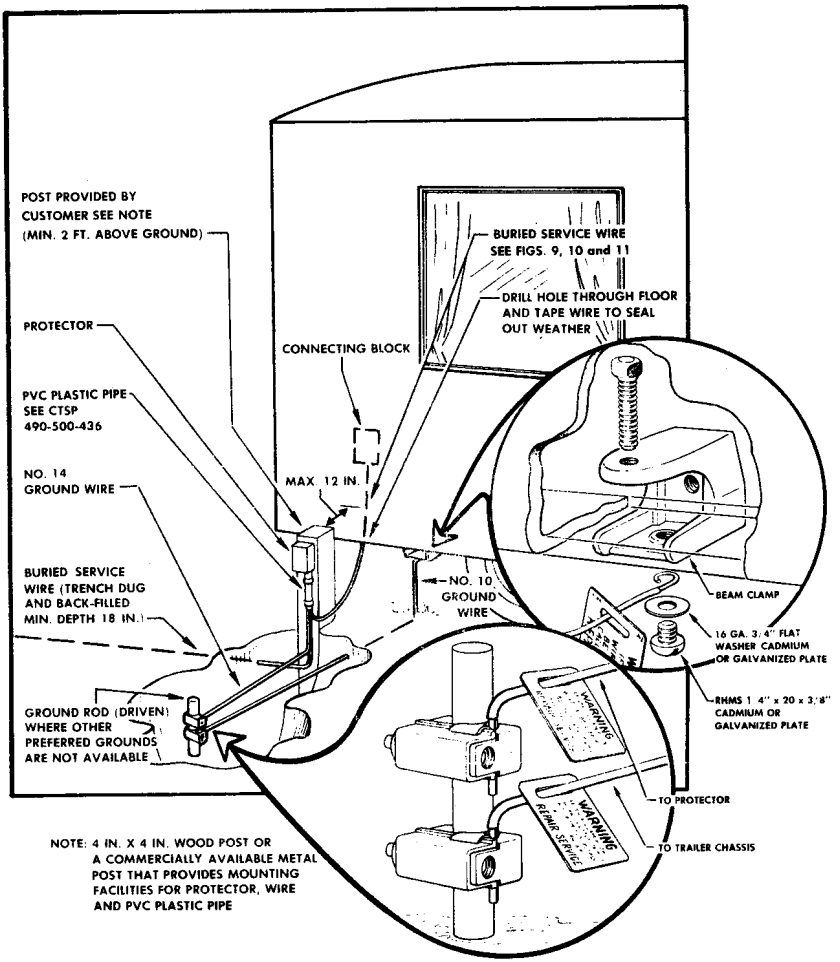
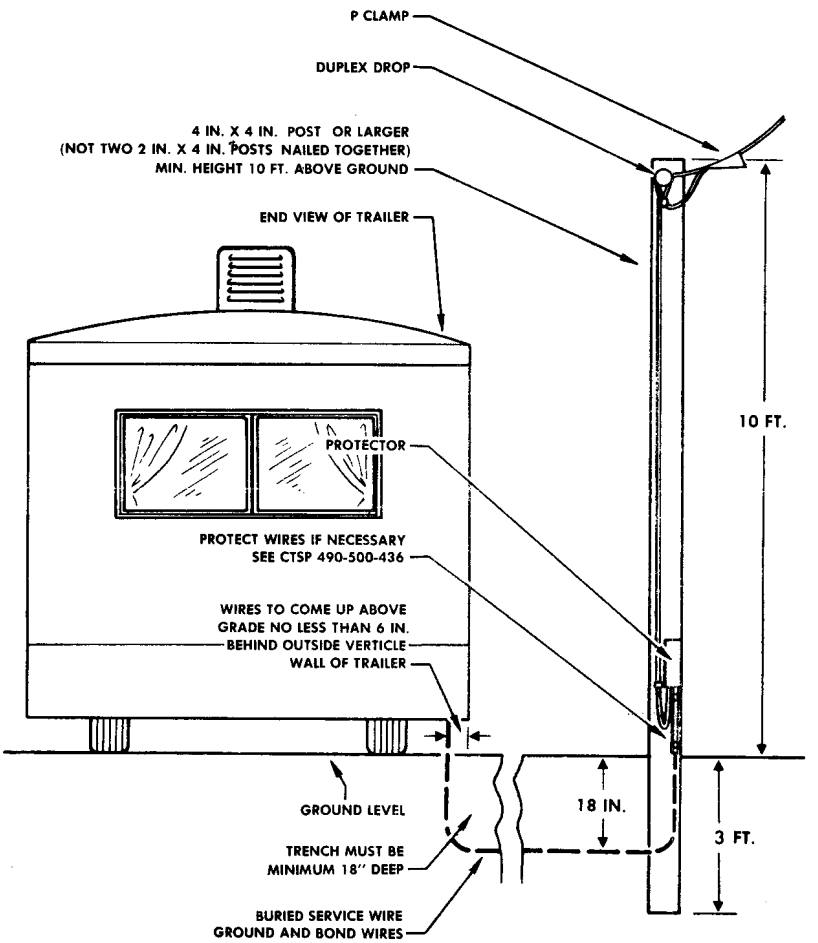


FIGURE 4 Typical Installation—Buried Distribution, Ground Rod Ground



NOTE: POST MAY BE PLACED IN ANY CONVENIENT LOCATION
AROUND TRAILER PROVIDING ABOVE CONDITIONS ARE MET

FIGURE 5. Mobile Home Installation When Service Post Is Not Within 12 Inches - Aerial

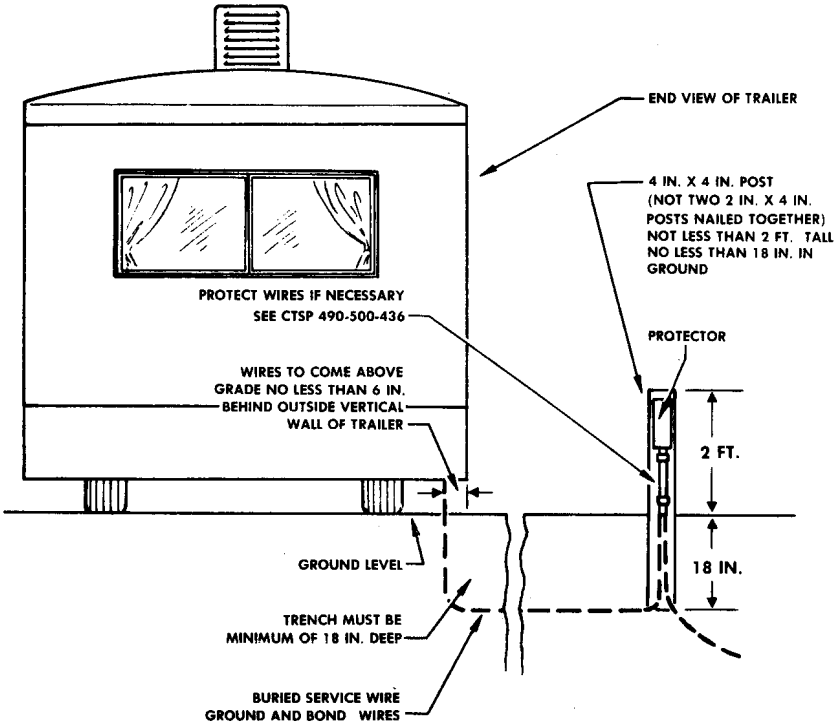


FIGURE 6. Mobile Home Installation When Service Post Is Not Within 12 Inches - Buried

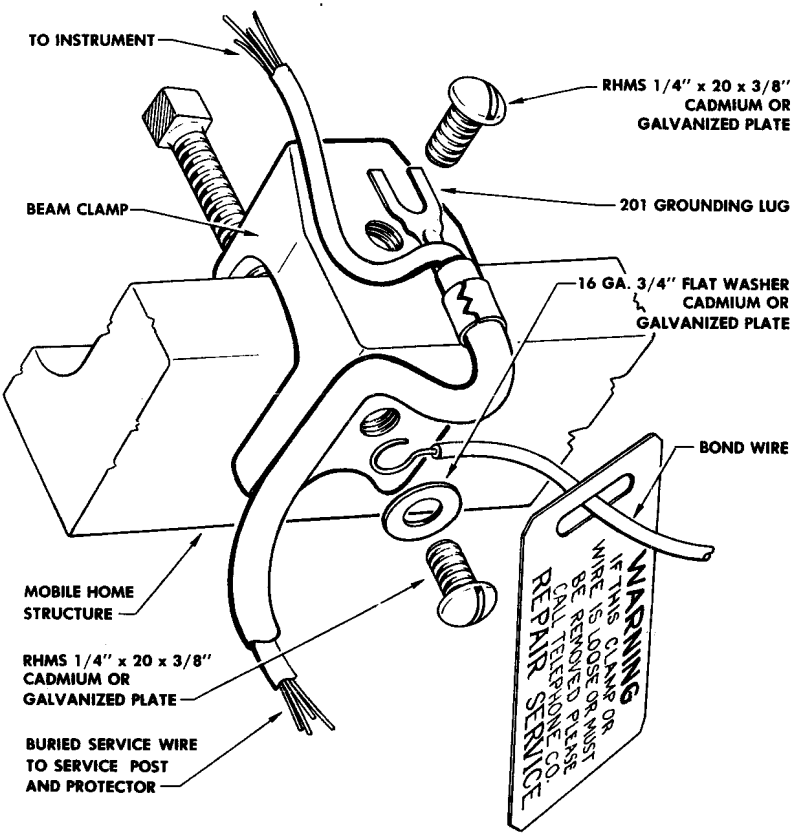


FIGURE 7. Grounding Shield of Buried Service Wire Using Beam Clamp

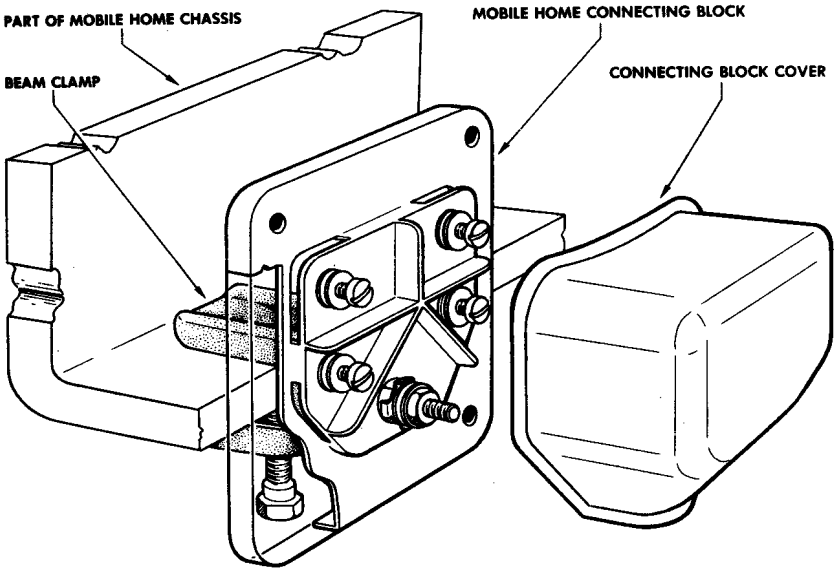


FIGURE 8. Mobile Home Connecting Block

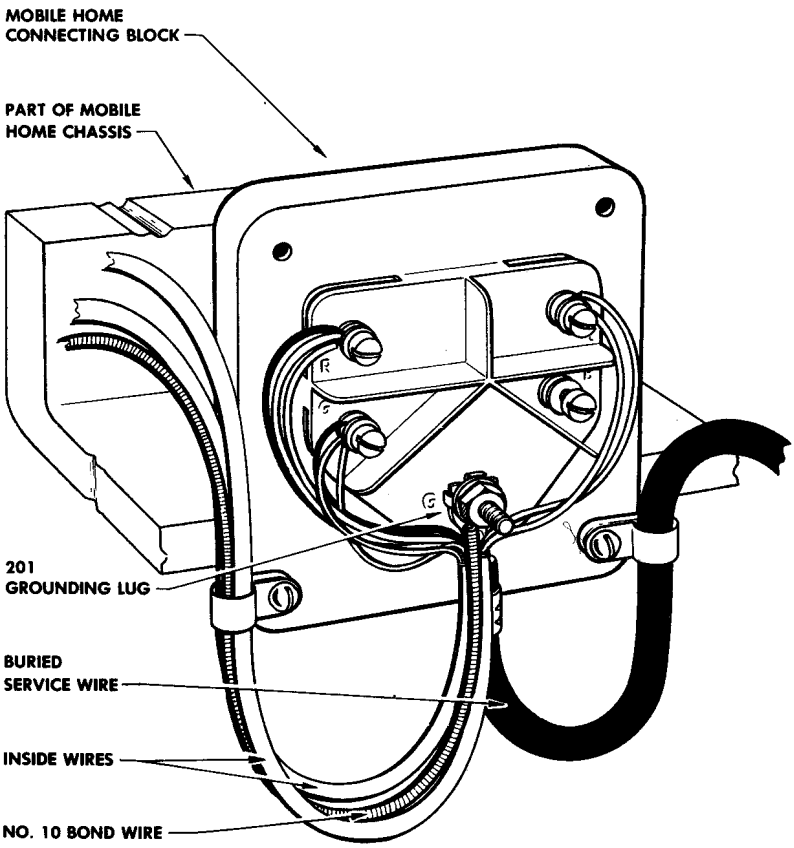


FIGURE 9. Using Mobile Home Connecting Block Under Mobile Home As A Junction Point For Inside Wires And Bond Wire.

PART V
STATION APPARATUS

PRACTICE NUMBER	TITLE
480-101-301	Contempra Telephone Sets Description
480-101-310	Telephone Sets—Trendline (Trim-Line) Description
480-101-401	Telephone Set Contempra Installation and Maintenance
480-101-410	Trendline (Trim-Line)—Installation and Connection
480-105-300	Telephone Set—500 Type Description
480-105-404	Telephone Sets—510-30 and 510-36 Connections
480-105-405	Telephone Set—502-30 Connections
480-105-406	Type 554—Connections
480-105-407	Telephone Set—558-30 Connections
480-105-450	Telephone Sets—2500 **(BA) 33M Connections
480-105-451	Telephone Sets—2502 **(BA) 30M Conections
480-105-452	Telephone Sets—2510 **(BA) 30M Connections
480-105-453	Telephone Sets—Type 2511 Connections
480-105-454	Telephone Sets—2554 **(BA) 30M Connections
480-105-455	Telephone Sets—2558 Connections
480-110-300	700 Series Desk Type Telephones
480-110-401	Telephone Set—Type 701 (LR) 30 Desk Connections
480-110-402	Telephone Set—Type 701 (LR) 37 and 38 Connections
480-110-403	Telephone Set—Type 703 (LR) 30 Desk Connections
480-110-404	Telephone Set—Type 703 (LR) 37 and 38 Connections
480-110-600	Telephone Sets—Types 701, 703 Maintenance
480-110-601	Disassembly and Assembly 700 Type Instrument
480-120-400	Installation and Removal Telephone Set Dial Fingerwheels
480-120-601	Telephone Ringers
480-120-602	Ringers—B Type Maintenance
480-120-603	Ringers—C Type Maintenance
480-120-604	Ringers—D Type Maintenance
480-120-605	Extension Ringer Type 139
480-120-607	F1A Ringer
480-120-700	**Addendum**—Station Apparatus Trouble Locating
480-120-700	Station Apparatus Trouble Locating
480-121-450	Auxiliary Signal—Telehorn 110 DB, 120 VAC HORN Installation
480-122-401	Radio Frequency Demodulation Suppressors For Telephone Sets
480-190-301	**Modular Telephone Apparatus—Description and Installation**

CONTEMPRA TELEPHONE SETS
DESCRIPTION

1. GENERAL

1.01 This practice covers the description of the Northern Electric Contempraphone QSK100AX (rotary dial) and QSK2100AX (digitone dial).

2. DESCRIPTION

2.01 The Contempra Set is a dial-in handset telephone which may be used as a desk or wall set. See Figure 1-a, b, and c.

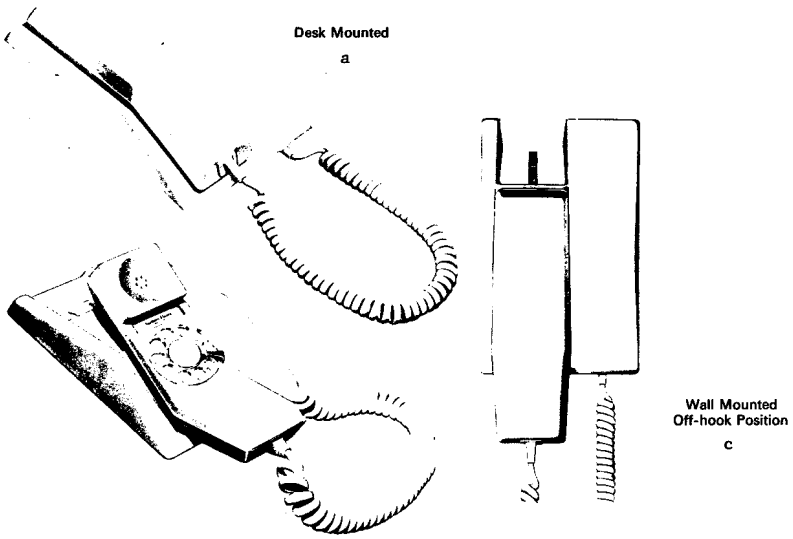


FIGURE 1

2.02 These telephones come in nine decorative colors with a number coding as follows:

Ivory	-50	Mauve	-22
Green	-51	Bright Red	-23
Light Beige	-60	Pale Yellow	-24
Warm White	-20	Deep Blue	-25
Deep Turquoise	-21		

2.03 The set uses a modified NE-D1B ringer which is used in the 600 Series Telephones. This modified ringer (NE-D1QA) uses a volume control wheel which requires a slight relocation of components.

2.04 The T1 and U1 Transmitter and Receiver units are used in conjunction with a repackaged network and are electrically compatible to the standard 500 Series.

2.05 The Contempra Set is equipped with non-skid pads for desk use, and a provision for wall mounting which includes entrance holes for concealed or surface wiring.

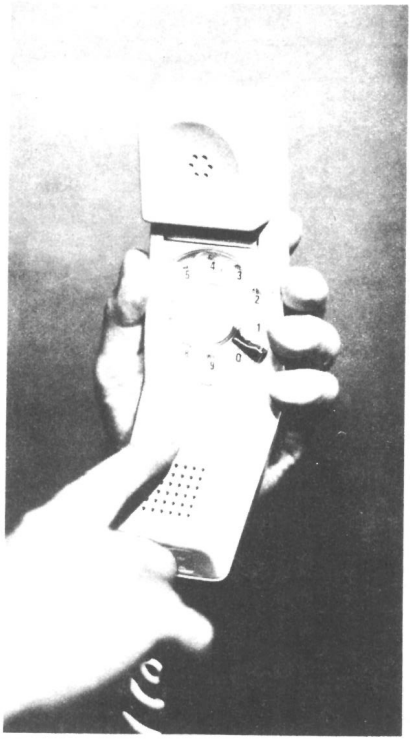
2.06 The dial finger wheel has a smaller diameter than that used in the 500 Sets, but the size of the finger holes has not been reduced proportionally, therefore, the ten finger holes occupy the full 360 degree circumference. The finger stop moves clockwise so that the actual rotational movement is more than 360 degrees. When dialing a selected number, the full rotational follow of the finger stop is required.

2.07 A rectangular recall button is located just below the dial (Figures 2 and 3) so the subscriber can disconnect a call by depressing the button like a switch hook.

2.08 The Contempra Set is designed so that the handset may be placed in an obvious and secure call-waiting position. When used as a desk set, see Figure 4; for wall mounted sets, see Figure 1c.

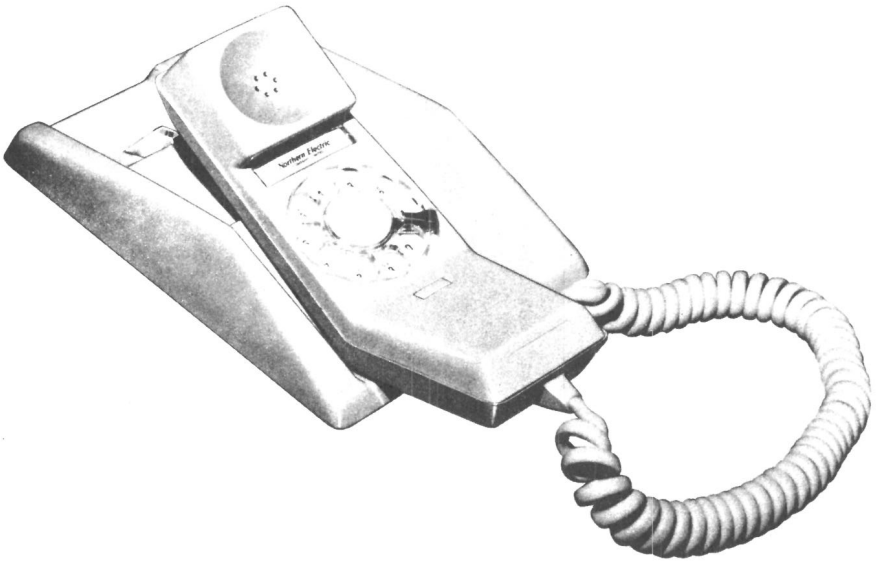
2.09 The ringer volume control wheel is located on the right side of the telephone. A clockwise rotation of the control wheel increases the volume, and a counterclockwise rotation decreases the volume of the ringer. See Figure 5.

2.10 Contempra Sets are authorized for use only in areas or companies approved by the St. Louis corporate office.

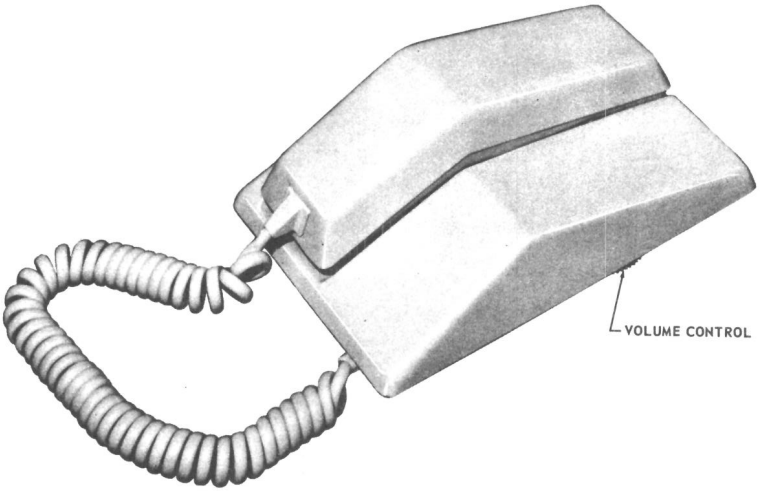


RECALL BUTTON
FIGURE 2

FIGURE 3



DESK MOUNTED CONTEMPRA TELEPHONE IN "OFF-HOOK" POSITION
FIGURE 4



LOCATION OF RINGER VOLUME CONTROL WHEEL
FIGURE 5

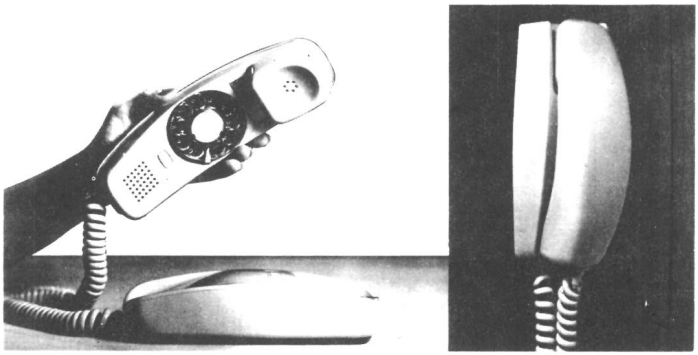
TELEPHONE SETS
TRENDLINE (TRIM-LINE)
DESCRIPTION

1. GENERAL

1.01 This practice covers the description of the Kellogg Trendline K-220C and K-220D.

2. DESCRIPTION

2.01 The Trendline set is a dial-in-handset telephone which may be used as a desk or wall set. The 220C and 220D have different bases but utilize the same type of handset and cord. See Figure 1.



K-220C Handset

K-220D Wall Set

FIGURE 1.

2.02 The handset is equipped with a lamp which illuminates the dial when the phone is off hook. The light is powered by a transformer which is plugged into a nearby electrical outlet.

2.03 Trendline phones are available in six colors with a number code as follows:

a. Green – 05

b. Rose pink – 11

c. Aqua blue – 12

d. Light beige – 13

e. White – 15

f. Turquoise – 30

2.04 The set uses a 152- or 153-type ringer.

a. The 153 (BA) 470 is a straight line biased ringer.

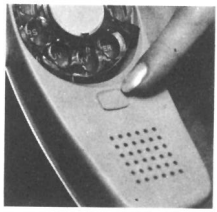
b. The 152 (–) 470 is a frequency selective ringer which includes the matching capacitor. The breakdown is as follows:

Harmonic		Synchromonic		Decimonic	
Code	Frequency	Code	Frequency	Code	Frequency
HA 1	33-1/3 CPS	HB 1	30 CPS	HC 1	20 CPS
HA 2	50 CPS	HB 2	42 CPS	HC 2	60 CPS
HA 3	66-2/3 CPS	HB 3	54 CPS	HC 3	30 CPS
HA 4	16-2/3 CPS	HB 4	66 CPS	HC 4	40 CPS
HA 5	25 CPS	HB 5	16 CPS	HC 5	50 CPS

2.05 The dial fingerwheel has a smaller diameter than that used in the 500 type sets. The size of the finger holes are not reduced proportionately; therefore, the ten finger holes occupy a full 360° circumference. The fingerstop moves clockwise so that the actual rotational movement is more than 360°. When dialing a selected number, the full rotational follow of the fingerstop is required. See Figure 2.

Finger Wheel Stop
FIGURE 2.

2.06 A small recall button is located below the dial (Figure 3) so that the customer can disconnect a call by depressing the button.



Recall Button
FIGURE 3.

2.07 The Trendline wall phone model is designed so that the handset may be placed in an obvious and secure call waiting position. See Figure 4.

Volume Control
Call Waiting Position
FIGURE 4.

2.08 The ringer volume control wheel is located on the bottom of the desk set and on the right side of the wall set.

QSK100 AND 2100 TYPE CONTEMPRA TELEPHONE SET INSTALLATION AND MAINTENANCE

1. GENERAL

1.01 This practice provides the description, installation, and maintenance information for the QSK100 and 2100 Type Contempra telephone sets.

1.02 This practice is reissued to update information on the Contempra sets. Because of the extensive additions, the location of these additions is not noted throughout this practice. **Remove from the file and destroy all copies of CTSP 480-101-401, Issue 1, 1969.**

2. DESCRIPTION

2.01 The Contempra is a two-piece telephone set (Figure 1) consisting of base and handset, and is a combined desk-wall-type telephone. When used as a desk-type telephone, it rests on the feet provided in the base of the set. When used as a wall-type set, it is mounted by using the mounting holes in the baseplate.

2.02 When the Contempra telephone set is used as a desk set, and the handset is in place, it rests in the recess provided in the base of the set. When the Contempra telephone is used as a wall set and the handset is in place, the lower edge of that portion of the handset that houses the receiver unit engages a projection provided as part of the handset recess.

2.03 The transmission circuit is the same as for a 500 type telephone set.

2.04 The QSK100 type telephone sets are equipped with a NE-10QA rotary dial (except QSK100C which has no dial), while the QSK2100 type telephone sets are equipped with a QDC1A Digitone dial.

2.05 The QSK100A and 2100A telephone sets are single-line telephone sets equipped with rotary and Digitone dials respectively (Figures 1 and 2).

2.06 The QSK100B and 2100B are the rotary and Digitone dial versions of the "Message Waiting" telephone sets (Figure 3).

2.07 The QSK100C is the "manual" version of the QSK100A and no dial is required (Figure 4).

2.08 The QSK191A and 219A telephone sets are similar to the QSK100A and 2100A single-line sets except that they are not equipped with a ringer; instead, they have a mounting bracket mounted in place of the ringer, which may be used to mount a frequency selective type ringer.

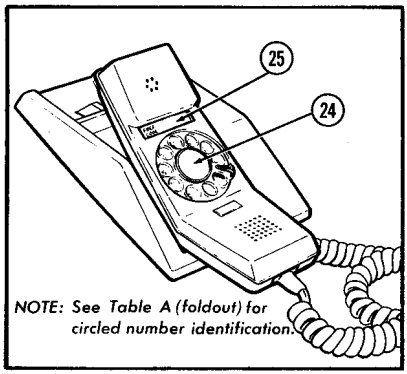


FIGURE 1. Desk Mounted "Off-Hook" Position

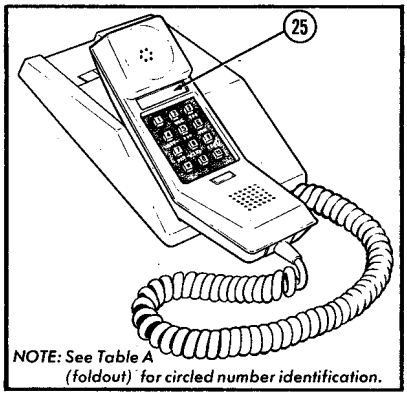


FIGURE 2. Desk Mounted "Off-Hook" Position

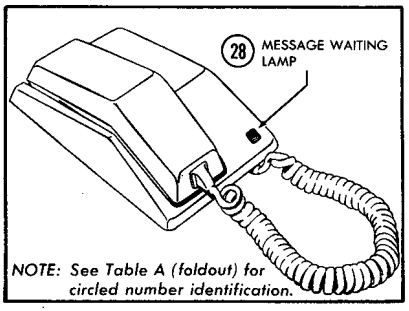


FIGURE 3. QSK100B Message Waiting Telephone

2.09 The QSK110A and 2110A are two-line telephone sets, equipped with a nonlocking press-to-operate key which provides a signaling or grounding feature.

2.10 Telephone sets coded with a letter (A, B, etc.) are for telephone company use only, and have "Telephone Company Property—Not for Sale" marked permanently on the underside of the baseplate.

2.11 A three-conductor cord is supplied with all codes of the Contempra (except the QSK110A and 2110A) which are equipped with a six-conductor cord. Other mounting cords, if required, may be ordered separately.

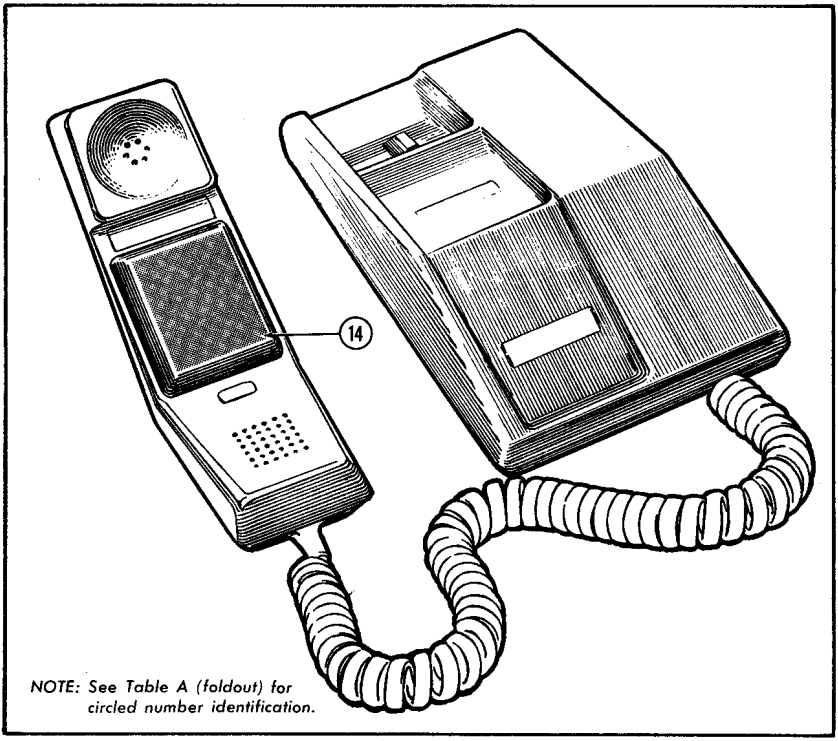


FIGURE 4. QSK100C Manual Telephone

3. IDENTIFICATION

3.01 All single-line Contempra telephone sets are furnished wired for individual service. Wiring changes can be made to allow their use for the following services:

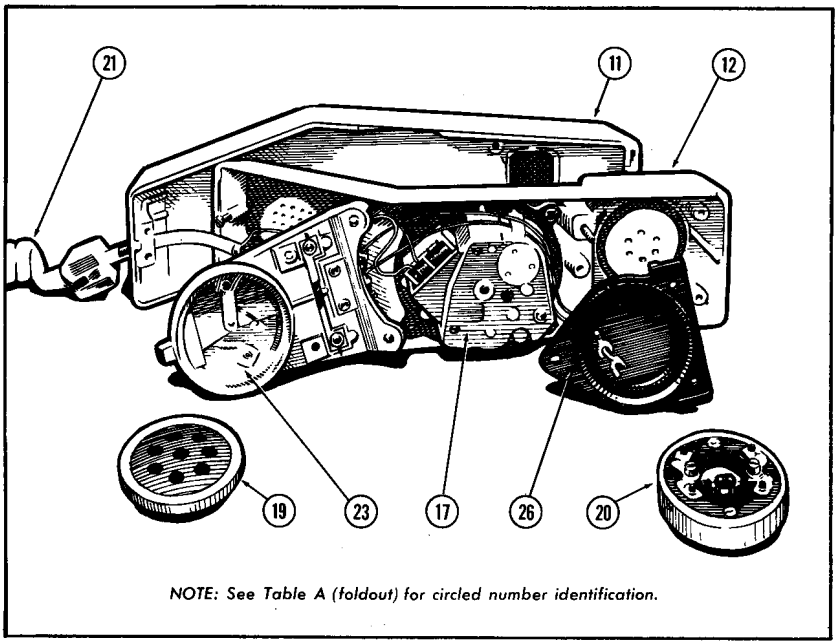
- **a.** Tip party flat rate.
- **b.** Ring party flat rate.
- **c.** 1A1 Key Systems.
- **d.** Tip party dial message rate.
- **e.** Tip party automatic message identification.

3.02 Figures 1 through 8 show component parts of the Contempra. The circled numbers in Figures 1 through 8 are identified in Table A. The wiring options for the QSK110A and 2110A two-line Contempra sets are shown in Tables B and C.

3.03 All Contempra telephone sets are available in the following colors:

- **a.** Warm White—20.
- **b.** Deep Turquoise—21.
- **c.** Mauve—22.
- **d.** Bright Red—23.
- **e.** Pale Yellow—24.
- **f.** Deep Blue—25.
- **g.** Ivory—50.
- **h.** Green—51.
- **i.** Beige—60.

3.04 The QSK110 and 2110 sets are equipped with a dual purpose switch on the right-hand side of the baseplate (Figure 7) in front of the ringer volume control. The switch located closest to the front of the set is a two-position slide switch. The position towards the front of the set is referred to as "Line 1", while the position towards the volume control is referred to as "Line 2". The movement of this switch transfers the



NOTE: See Table A (foldout) for circled number identification.

FIGURE 5. Parts of Handset Assembly NE-H1Q Type

TABLE B. QSK100A Connections Single-Line Telephone, Rotary Dial

CLASS OF SERVICE	CONNECTIONS AT CONNECTING BLOCK DESK TYPE ONLY										CONNECTIONS AT NETWORK & TERM STRIP DESK AND WALL											
	LINE					MTG. CORD					BASE CORD OR STATION WIRE					RINGER LEADS*				SWITCH LEADS		
	Ring	Tip	GND (A1)	A	LK	R	G	Y	BK	W	R	G	Y	BK	W	R	BK	S	S-R	S	S-Y	S-BR
Bridged	R	G	Y	–	–	R	G	G	–	–	L2	L1	G	–	–	L2	L1	K	A	L3	L2	C
Ring Party (See Note 3)	R	G	Y	–	–	R	G	Y	–	–	L2	L1	G	–	–	L2	G	K	A	L3	L2	C
Tip Party Except Dial Message Rate (See Note 3)	R	G	Y	–	–	G	R	Y	–	–	L2 (L1)	L1 (L2)	G	–	–	L2	G	K	A	L3	L2	C
Tip Party Dial Message Rate (See Note 1)	R	G	Y	–	–	G	R	Y	–	–	L2 (L1)	L1 (L2)	G	–	–	K	A	G	L2	L3	L2	C
Tip Party Automatic Number Identification (See Note 1)	R	G	Y	–	–	G	R	Y	–	–	L2 (L1)	L1 (L2)	G	–	–	G	L2	K	A	L3	L2	C
1A1 Key System (See Note 2)	R	G	Y	BK	–	R	G	Y	BK	–	□ C	L1	G	L2	–	C	L1	K	A	L3	G	L2

Circled letters (L1) *indicate terminals on wall set. All other other terminals are common.*

□ *For wall mounted set, connect ring (red) incoming line to Y on terminal strip and strap Y to C of network using an NE-M1W cord.*

NOTE 1: For these connections, the NE-H1QBX Handset and H6QA-cord are necessary for proper operation of recall switch and central office equipment. (See Table C.)

NOTE 2: For 1A1 key systems, the NE-D4QC line cord is necessary.

NOTE 3: To help reduce induced line noise, the red ringer lead may be changed from L2 to L3. This will disconnect the ringer from the line when the handset is off-hook; however, the ringer will not operate when the recall switch is depressed.

* *Ringer not supplied with QSK191C.*

TABLE C. QSK2100A Connections Single-Line Telephone, Digitone Dial

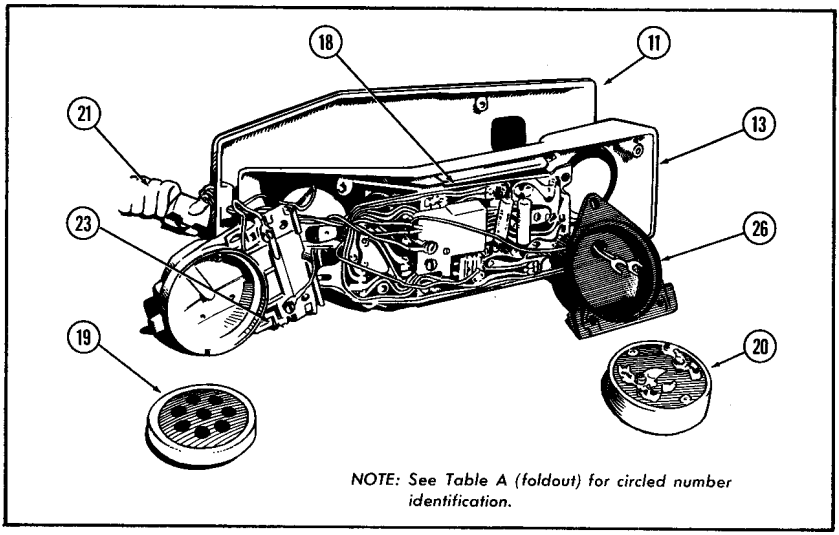
CLASS OF SERVICE	CONNECTIONS AT CONNECTING BLOCK DESK TYPE ONLY										CONNECTIONS AT NETWORK & TERM STRIP DESK AND WALL											
	LINE					MTG. CORD					BASE CORD OR STATION WIRE					RINGER LEADS*				SWITCH LEADS		
	Ring	Tip	GND (A1)	A	LK	R	G	Y	BK	W	R	G	Y	BK	W	R	BK	S	S-R	S	S-Y	S-BR
Bridged	R	G	Y	–	–	R	G	G	–	–	L2	L1	G	–	–	L2	L1	K	A	L3	L2	X
Ring Party (See Note 3)	R	G	Y	–	–	R	G	Y	–	–	L2	L1	G	–	–	L2	G	K	A	L3	L2	X
Tip Party Except Dial Message Rate (See Note 3)	R	G	Y	–	–	R	G	Y	–	–	L2	L1	G	–	–	G	L1	K	A	L3	L2	X
Tip Party Dial Message Rate (See Note 1)	R	G	Y	–	–	R	G	Y	–	–	L2	L1	G	–	–	L1	A	G	K	A	L2	X
Tip Party Automatic Number Identification (See Note 1)	R	G	Y	–	–	R	G	Y	–	–	L2	L1	G	–	–	G	L1	K	A	L3	L2	X
1A1 Key System (See Note 2)	R	G	Y	BK	–	R	G	Y	BK	–	X	L1	G	L2	–	X	L1	K	A	L3	G	L2

NOTE 1: *For these connections, the NE-H2QBX Handset and H6QA-cord are necessary for proper operation of recall switch and central office equipment. (See Table E.)*

NOTE 2: *For 1A1 key system, the NE-D4QC line cord is necessary.*

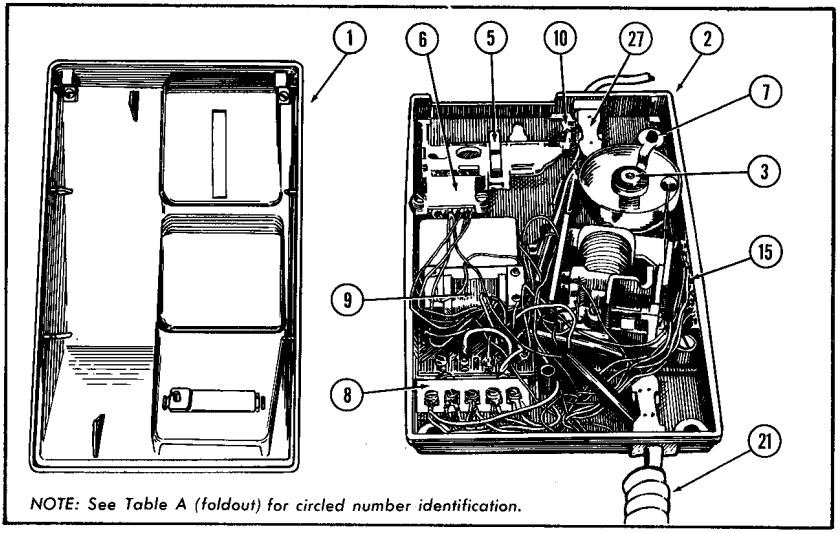
NOTE 3: *To help reduce induced line noise, the red ringer lead may be changed from L2 to L3. This will disconnect the ringer from the line when the handset is off-hook; however, the ringer will not operate when the recall switch is depressed.*

* *Ringer not supplied with QSK2191.*



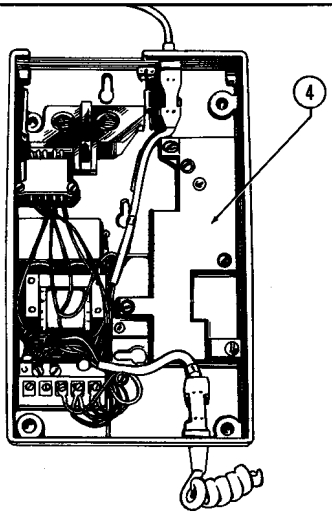
NOTE: See Table A (foldout) for circled number identification.

FIGURE 6. Parts of Handset Assembly NE-H2Q Type



NOTE: See Table A (foldout) for circled number identification.

FIGURE 7. Components of Base Assembly



NOTE: See Table A (foldout) for circled number identification.

FIGURE 8. QSK191 Base Assembly—Showing Ringer Mounting Bracket

talking circuit of the telephone set to either of the two lines. The switch immediately behind the two-line slide switch and nearest to the ringer volume control is a "press-to-operate" switch which may be used as a grounding or signaling switch. The ringer is factory wired across Line 1.

3.05 The Contempra telephone sets contain a printed circuit type network of the QNB18 type, which is equipped with quick connect type terminals. Connections are made by pushing the spade tips into spring clips on either side of the terminal. (Each terminal holds two spade tips.) To avoid damage to the leads, use long-nose pliers to grasp the spade tip and use a **slight** sideways rocking motion while inserting or removing a spade tip. Use caution to ensure that the shank of the clip is not bent.

3.06 A recall button is located on the handset which can be used to disconnect for redialing, thus eliminating the need to operate the switchhook on each call. However, as the ringer is disconnected by the switchhook, incoming calls will not be received unless the receiver is on-hook (sets manufactured before January, 1970). **For sets manufactured after January, 1970, the ringer is not disconnected by switchhook when the receiver is off-hook.**

3.07 To adjust the ringer volume, a wheel that protrudes through the baseplate at the side of the set has been provided. (See Figure 9.) Moving a screw will allow this wheel to completely silence the

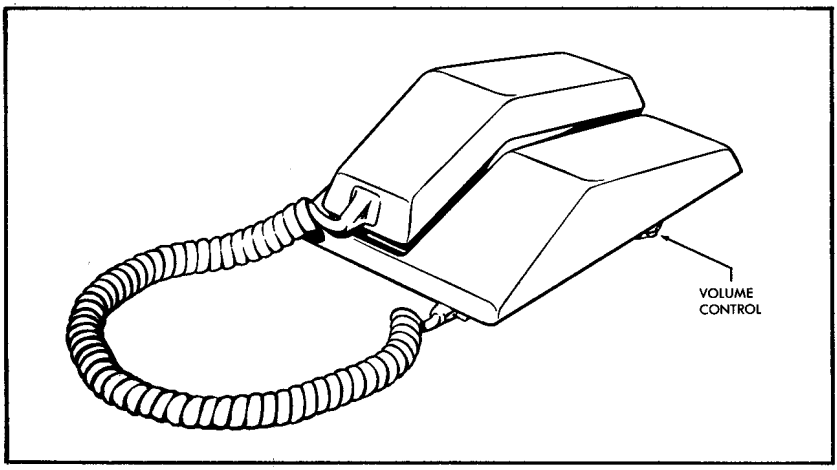


FIGURE 9. Location of Ringer Volume Control Wheel

ringer. However, ringer cut-off must not be provided unless authorized.

4. INSTALLATION

4.01 Disassembly:

a. To remove the molded housing from the base:

(1) Remove card retainer (or window) located near the front of the housing. To remove card retainer, insert the tip of the NS167050 List 3 releaser tool into the small slotted hole at the edge of transparent window. Ensure that the tip does not enter the hole by more than one-eighth of an inch as an underlying screw may hinder the lateral movement of the tool. Apply a slight pressure to the handle of the tool. (See Figure 10.) The housing projection provides a fulcrum. This will bow the window upward so that its edges may be grasped with the fingertips of the other hand to spring it out.

(2) Remove the number card, if present.

(3) Loosen the exposed captive screw sufficiently so that the front of the housing may be lifted free of the base.

(4) Continued lifting of the cover enables the housing latches to disengage and free the cover.

b. To open the handset:

(1) Remove the card retainer and the number card located above the dial.

(2) Remove the handset grommet by holding the handset with the back or smooth section in the palm of the hand. Insert about 1/16-inch of the tip of the NS16750 List 3 releaser tool into the small slot adjacent to the grommet. (See Figure 11.) Press the handle of the tool towards the grommet and push the shank into the slot as far as it will go. Push the handle of the releaser tool away from the grommet to release the returning spring and gently ease the grommet out of the handset shell.

(3) Once the grommet has been withdrawn, two screws are exposed. Loosen these two screws by about 3/16-inch only, as it is not desirable or necessary to remove them.

(4) Free (do not remove) the captive screws in the cord retainer well. Loosen sufficiently to separate the handset sections at the receiver end; then slide the smooth or back half of the handset housing towards the cord grommet to release this section from the slotted screw holes at the grommet.

c. Installation of base mounting cord (NE-D3Q5A):

(1) Enter the spade tipped leads at the grommeted end of the line cord through the square hole in the edge of the base.

(2) Push the grommet through the opening so that the narrow section aligns with the square projections directly in front of the grommet entry.

(3) Push the grommet down firmly to engage between projections.

(4) Press the jacketed portion of the cord into the channel beside the NE-DIQA ringer and between the projections located about midpoint on the base. Dress the leads under the existing wiring; loop them around the right side of the housing screw stud and connect to the terminal block in accordance with Table B or D.

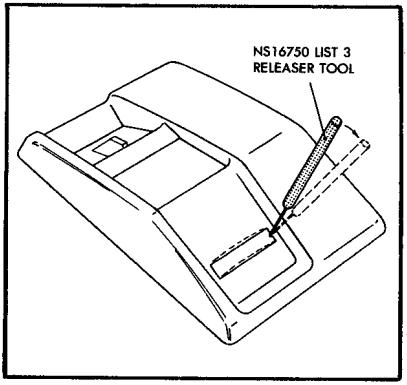


FIGURE 10. Removal of Card Retainer

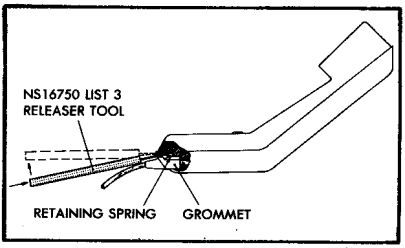


FIGURE 11. Removal of Handset Grommet

TABLE D. Base Cord Connections Single-Line Telephone

COLOR	NE-H5QE-Cord	
	BASE	HANDSET
G	F	GN
Y	RR	Y
BL	GN	BL
BK	B	BK
R	B	R
W*	A*	W*

* *For Tip Party ANI Use NE-H1QBX Handset with NE-H6QA Cord*

4.02 Wall Mounted (Figure 12):

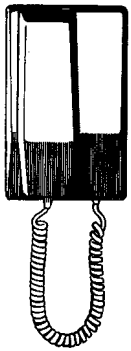
a. Remove line cord. The center key opening in the base is normally used for the entry of the station wiring. The slots at the hookswitch end of the set and the one just below the ringer are used for normal wall mounting. For mounting on an outlet box, the key at the center of the set and the one just below the ringer are used. Additional space may be opened for the entrance of wire from the outlet box, when necessary, by placing the set on a flat surface, placing a screwdriver in the detent adjacent to the center key and giving the screwdriver a sharp knock downward. This action will shear out an additional opening leading into the center key. If a mounting screw fails to hold, knockouts can be made near the handset cord or under the switch plunger, as necessary, for the addition of another screw without having to move the complete installation. These knockouts should not be opened unnecessarily. If it is necessary to bring the station wire up the wall from the baseboard, an opening can be uncovered for wire entry by removing the handset cord grommet from the base, rotating it 180° and replacing it.

b. To provide the ringer cut-off feature (when authorized), change the position of the lever associated with the ringer volume control wheel. With housing of the base off, remove the screw that holds the lever in contact with the wheel, shift the lever to the opposite end of the slot, place the screw in the hole that was under the lever and tighten.

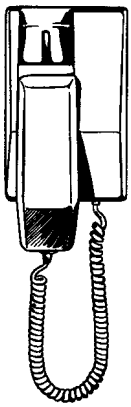
4.03 Reassembly:

a. Base:

(1) Dress line cord leads and other wiring away from the housing retaining screw post on the base of the telephone set.



a. Wall Mounted Telephone "On-Hook"



b. Wall Mounted Telephone "Off-Hook"

FIGURE 12.

(2) Locate housing at an angle to the base as shown in Figure 13.

(3) Press rear of housing down and toward the back of the base to engage the housing latches with the notches in the base.

(4) Push front of housing down, ensuring that latches remain in notches, so that the retaining screw enters the tapped post in the base.

(5) **Carefully tighten the screw snugly, without undue force.**

(6) Insert a station card number and the retainer window in the well in the base.

b. Handset:

(1) Align the jacketed portion of the handset cord which projects beyond the grommet and into the handset, so that it will fit the channel in the transmitter cup assembly.

(2) Dress receiver leads through clip or dial cover wire retainer of rotary dials.

(3) Slide the two handset sections together so that the two slots at the grommet end slide under the heads of the screws in the apparatus section.

(4) Carefully align sections so that the two screws in the number plate slot will engage the tapped post holes in the other section.

(5) Tighten screws; two in the grommet cutout and two in the number plate well. Tighten the screws snugly without undue force.

(6) Slide the grommet into the square hole in the end of the handset housing with the

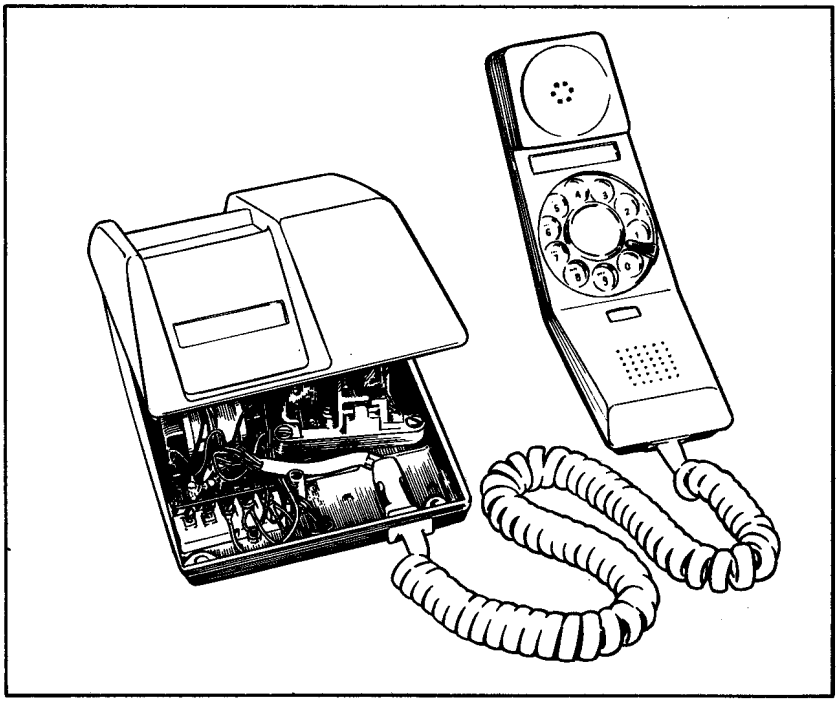


FIGURE 13. Reassembly of Housing

retaining clip facing the instrument section of the handset. Fully seat the grommet so that the clip will engage. The grommet shoulder should be flush with the surface of the housing.

(7) Insert a station number card and card holder window into the well on the handset.

5. MAINTENANCE

5.01 Normal maintenance may involve replacement of the following parts (see Table A, foldout, for identification of parts):

a. Dial.

b. Cords.

c. Transmitter.

d. Receiver.

e. Ringer.

f. Feet.

g. Switchhook.

h. Transmitter Cup.

NOTE: In case of a defective dial, replace; do not attempt repair in the field.

5.02 To replace Digitone dial:

a. See paragraph 4.01 for instructions on opening of the handset.

b. Loosen two screws and remove one screw attaching the circuit board to the transmitter cup.

c. Remove two mounting screws attaching dial and transmitter cup to instrument section.

d. Remove leads from terminal strip on back of dial.

e. Replace dial and assemble two mounting screws.

f. Reconnect lead colors to agree with terminal designations. (See Figure 14 for lead dressing.)

g. See paragraph 4.02 for instructions on reassembly of handset.

5.03 To replace transmitter, Digitone set:

a. Open handset (see paragraph 4.01).

b. Loosen two screws attaching dial and transmitter cup to the instrument section.

c. Lift the dial and transmitter cup as a unit.

d. Replace transmitter.

e. Reassemble screws.

f. Close handset (see paragraph 4.03).

5.04 To replace rotary dial:

a. See paragraph 4.01 for instructions on opening handset.

b. Remove dial leads from terminals located on transmitter cup.

c. Remove four (4) mounting screws.

d. Replace dial.

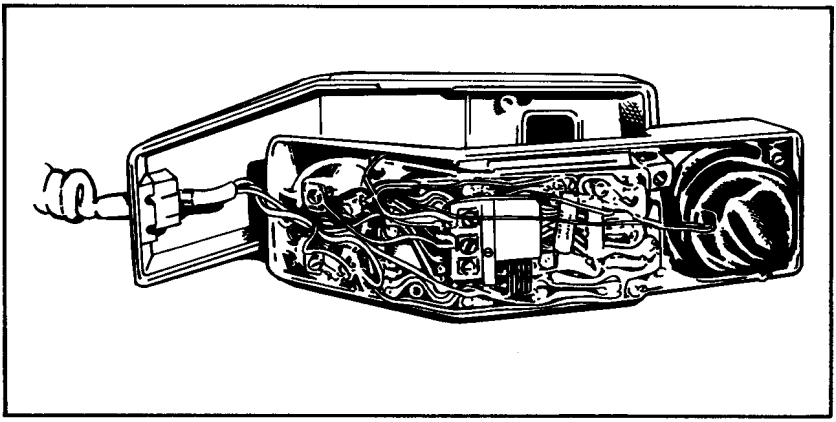


FIGURE 14. Digitone Handset Showing Lead Dressing

e. See paragraph 4.03 for reassembly instructions.

5.05 To replace transmitter, rotary set:

a. Open handset (see paragraph 4.01).

b. Loosen two (2) screws holding transmitter cup.

c. Lift transmitter cup and replace transmitter.

d. Close handset (see paragraph 4.03).

5.06 To replace receiver:

a. Open handset (see paragraph 4.01).

b. Loosen completely the three screws holding the receiver cup and remove the two end screws.

c. Lift slightly by leads so that cup and receiver may be grasped as a unit and move back and upward.

d. Slide cup along leads.

e. Disconnect and replace receiver.

f. Slide cup back along leads.

g. Line up front screw (still in cup) with hole in post and run down.

h. Replace two end screws.

i. Reassemble handset (see paragraph 4.03).

5.07 Handset cord replacement:

a. **Rotary:** See paragraphs 4.01 and 4.03.

b. **Digitone:** The outer sheath of the handset cord must be cut back to within 1 inch of the handset grommet. (See Figures 15 and 16.) See Tables D and E for base and handset connections.

5.08 Rotary Dial Center Disc: Insert the NS16750 L3 releaser tool in the small hole adjacent to the number 5 hole and pry off disc.

5.09 Rotary Dial Fingerwheel: If replacement is necessary, replace complete dial.

5.10 Line cord replacement is covered in paragraphs 4.01 and 4.03.

5.11 Ringer:

a. Open base (see paragraph 4.01).

b. Loosen screw in volume control and mounting screws of ringer.

c. Remove ringer leads.

d. Replace ringer.

e. Close base (see paragraph 4.03).

6. CONNECTIONS

6.01 The connections for single-line sets are shown in Tables B, D and E and Figure 17, 18 and 19 for rotary dial sets. See Tables C, D and E and Figures 20 and 21 for Digitone dial sets.

TABLE E. Digitone Handset Cord Connections

COLOR	NE-H5QE-Cord	
	BASE	HANDSET
G	X	GN
T	C	Y
BL	BN	BL
BK	R	BK
R	B	R
W*	A*	W*

* *For Tip Party ANI Use NE-H2QB Handset with NE-H6QA Cord*

6.02 Connections and options available for the two-line sets QSK110A and QSK2110A are shown in Table F and Figures 22 and 23.

6.03 Typical connections for the type 8A buzzer are shown in Figure 24.

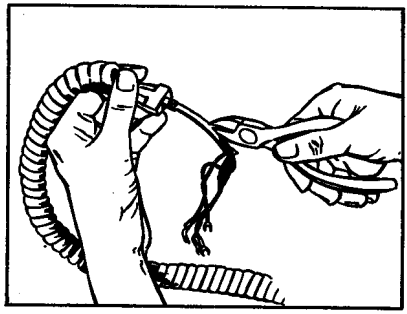


FIGURE 15. Slitting Sheath

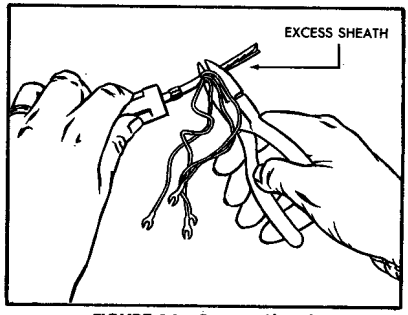


FIGURE 16. Cutting Sheath

TABLE F. Connections for QSK110A and QSK2110A Two-Line Telephones

OPTIONS							SELECTOR SWITCH USED TO CUT OFF:					CONNECTIONS IN TELEPHONE SET																				EXTERNAL CONNECTIONS FOR MOUNTING CORD														
OPTION NUMBER	NO. OF LINES	"A" LEAD CONTROL	3 TYPE SPEAKERPHONE	BUZZER IN SET	SIGNALING	LINE RINGER IN SET	ONE LINE	EXTENSION SET OR EXTENSION RINGER	RINGER IN SET	AUXILIARY RECEIVER	RINGER FROM OPEN LINE	MOUNTING CORD SET END CONNECT TO:						SELECTOR SWITCH LEADS CONNECT TO:						RINGER LEADS CONNECT TO:		LINE SWITCH LEADS CONNECT TO:			BUZZER LEADS CONNECT TO:		LINE 1		LINE 2		SIGNAL			SPEAKER-PHONE			"A" LEAD CONTROL		CUTOFF CIRCUIT	
												R	G	Y	KB	KL	W	S-R	G-Y	W	BK	Y	BL	R	BK	S	S-Y	S-BR	W	W	RING	TIP	RING	TIP	SIGNAL POWER (SP)	GROUND (GRD)	SIGNALS (S)	A1 (GND)	A	LK	A	A1	RING	TIP
1	2				•	•	•		•			L2+	L1+	Y+	X+	G1	G+	L1	L3	G+	X+	Y+	G1	L2+	L1+	L1	L1	C			R	G	Y	BK	BL	W								
2	2				•		•		•			L2+	L1+	Y+	X+	G1	G+	L1	L3	DD	X+	Y+	DD	L3	L1+	L1	L1	C	G+	G1	R	G	Y	BK	BL	W								
3	2					•	•		•			L2+	L1+	Y+	X+	G1	G+	L1	L3	G+	X+	Y+	G1	L1	L3	L1	L1	C			R	G	Y	BK	BL	W								
4	1				•	•	•		•			L2+	L3	DD	X+	G1	G+	L1	L3	X+	L3	Y+	G1	L2+	L1+	L1	L1	C	G+	X+	R	G			BL	W	BK							
5	1					•	•	•				L1	L3	Y+	X+	G1	G+	L1	L3	G+	X+	Y+	G1	L1	L3	DD	L1	C			R	G			BL	W							Y	BK
6	1					•	•	•				L1	L3	Y+	X+	G1	G+	L1	L3	G+	X+	Y+	G1	L2+	L1+	L1	L1	C			R	G			BL	W							Y	BK
7	1					•	•			•		L1	L3	Y+	X+	G1	G+	GN	R	G+	X+	Y+	G1	L1	L3	L1	L1	C			R	G			BL	W							Y	BK
8*	1	•				•	•					C	L3	Y+	DD	G1	G+	L1	L3	G+	X+	L1	G1	C	L3	L1	G+	Y+			R	G			BL	W					Y	W		
9*	1	•		•	•	•	•		•			C*	L3	Y+	X+	G1	G+	L1	L3	X+	L3	Y+*	G1	C	L1+	L1	G+	Y+	G+	X+	R	G			BL	W	BK				Y	W		
10	1	•	•		•	•						C*	L1+	Y+	X+	G1	G+	L1	L3	G+	L1+	L1	G1	C	L1+	X+	G+	Y+			R	G			BL	W		W	Y	BK				
11*	1	•	•	•		•			•			C*	L3	Y+	X+	G1	G+	L1	L3	DD	L3	DD	DD	C	L1+	X+	G+	Y+	G+	X+	R	G						W	Y	BK				

* *For option 8 with QSK2110A Telephone Set—Connect S—R, R and Y selector switch leads to L1.*
For option 9 with QSK2110A Telephone Set—G handset lead and R mounting lead to L2+.
For option 10 with QSK2110A Telephone Set—otherwise connections same as above.
For option 11 with QSK2110A Telephone Set

\+ *Indicates connection to terminal strip.*

DD *Indicates dead dress.*

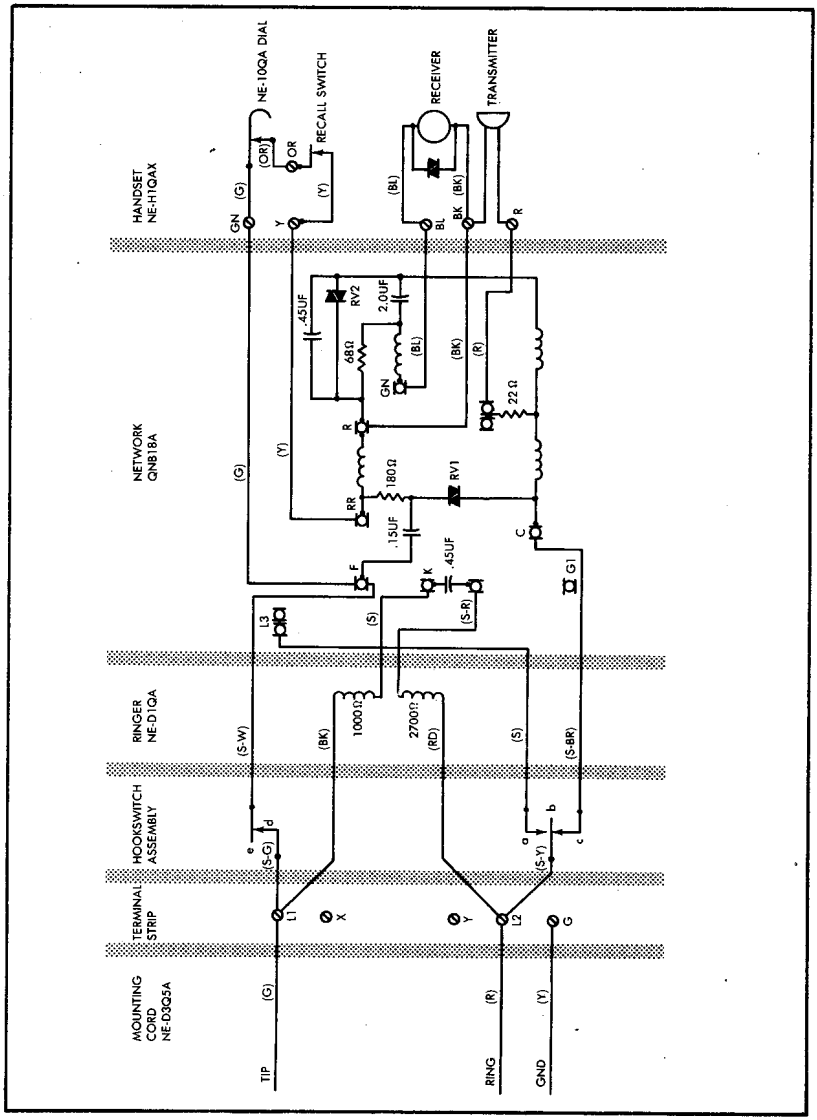


FIGURE 17. QSK100 and QSK191A Telephone Sets—Connections Single Line, Rotary Dial

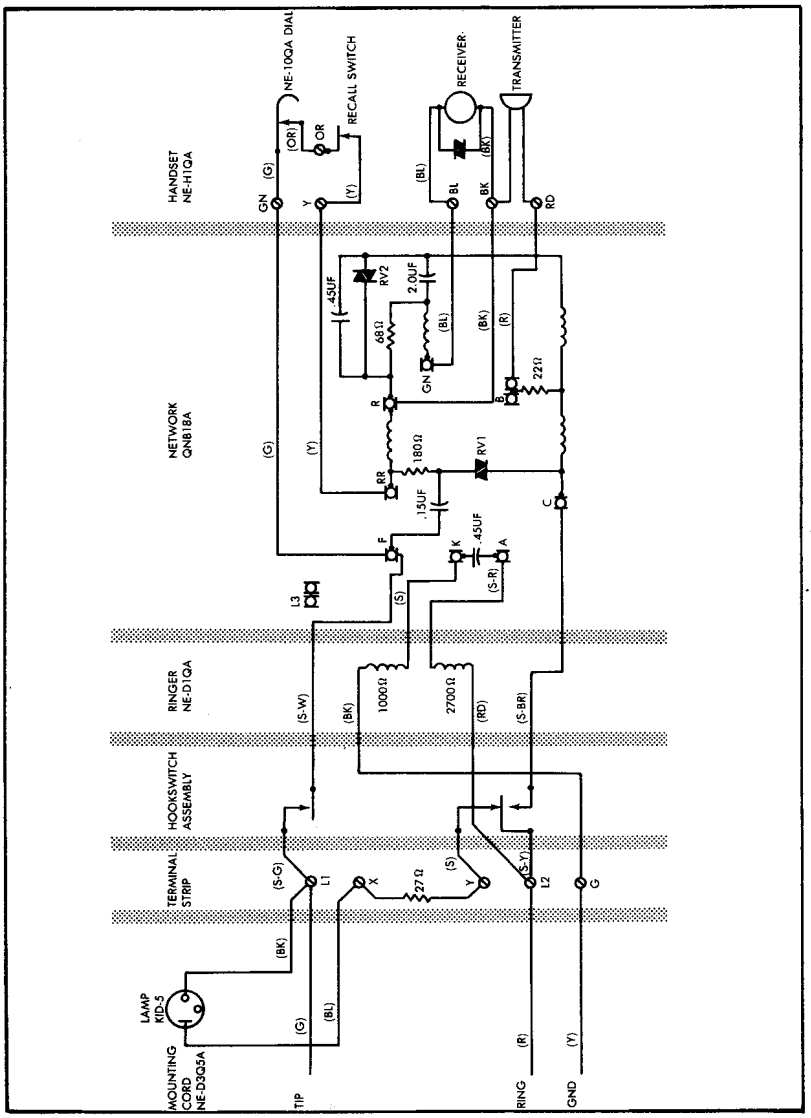


FIGURE 18. QSK1008 Telephone Set—Connections Message Waiting, Single Line, Rotary Dial

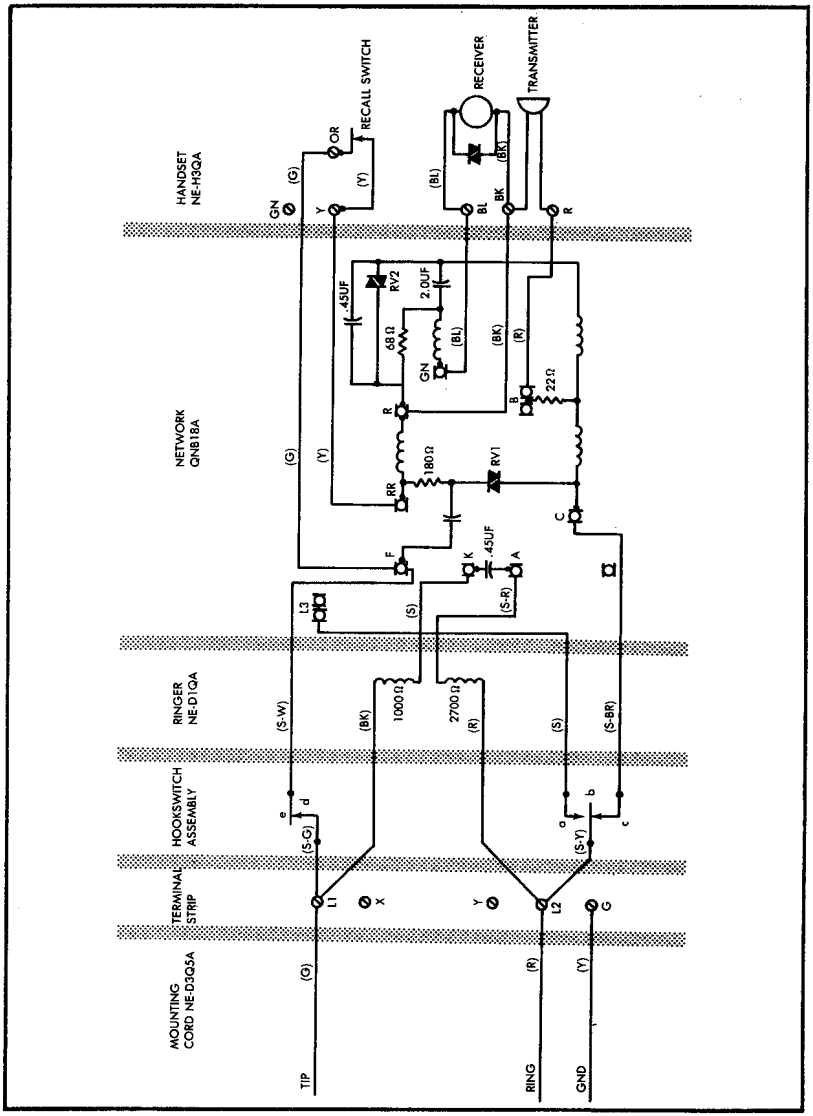


FIGURE 19. QSK100C Telephone Set—Connections Manual, Single Line, Rotary Dial

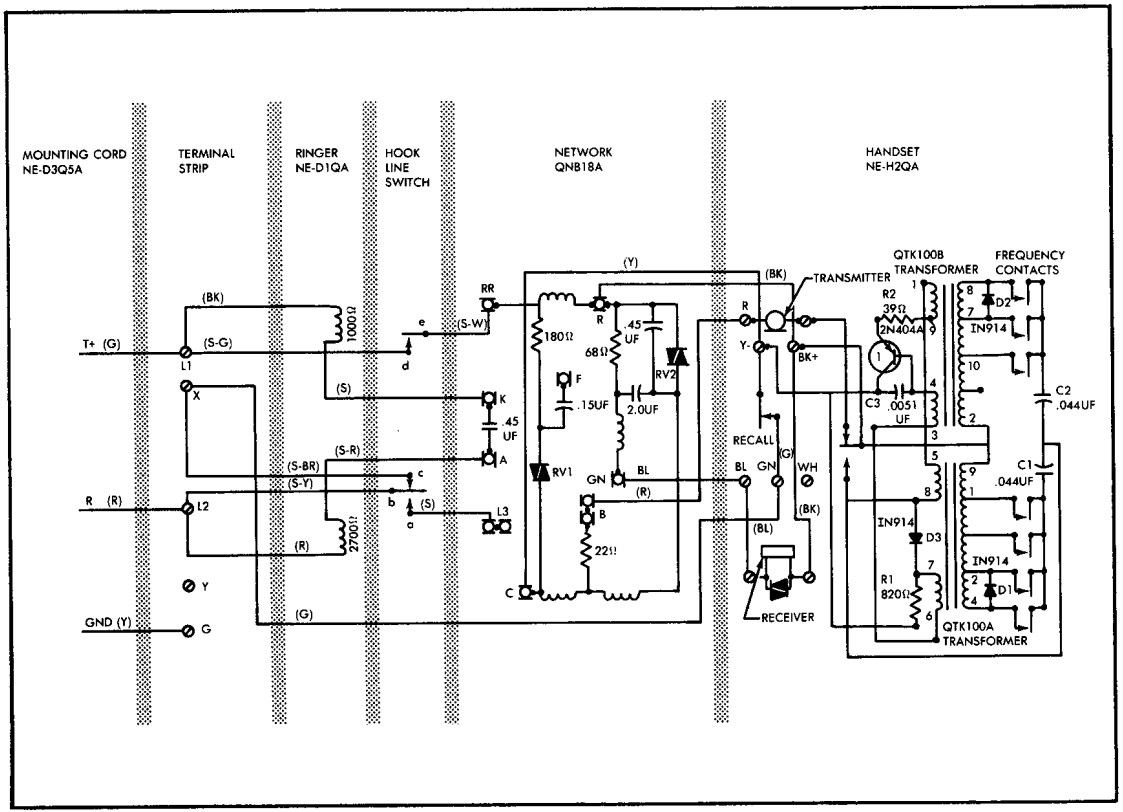


FIGURE 20. QSK2100A and QSK2191A Telephone Set—Connections Single Line, Digitone Dial

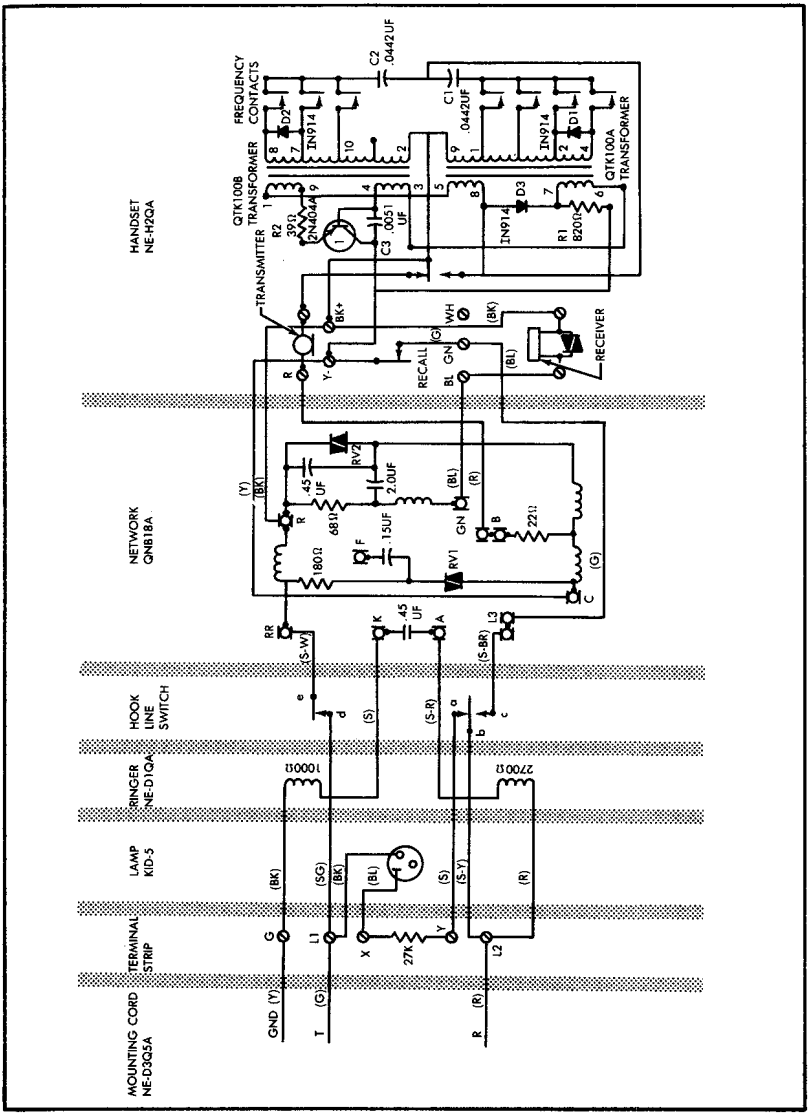


FIGURE 21. QSK2100B Telephone Set—Connections Message Waiting, Single Line, Digitone Dial

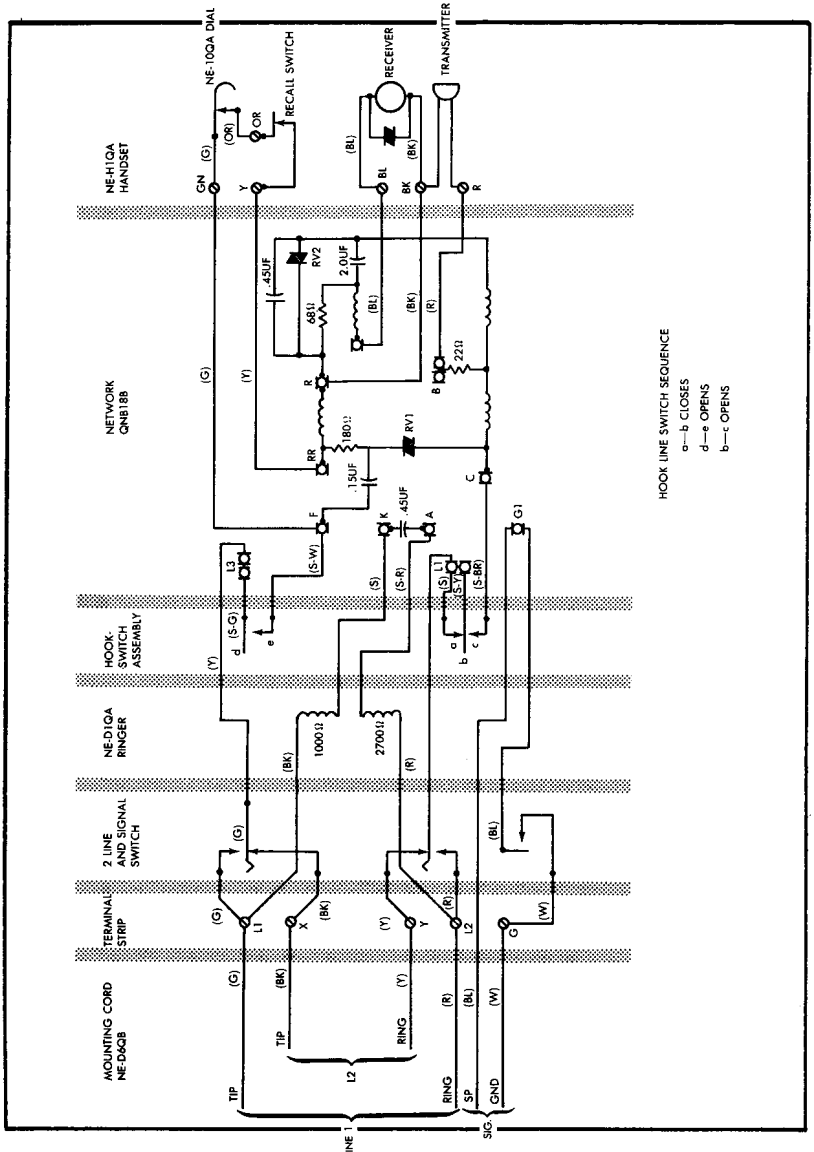


FIGURE 22. QSK110 Telephone Set—Connections Two Line, Rotary Dial

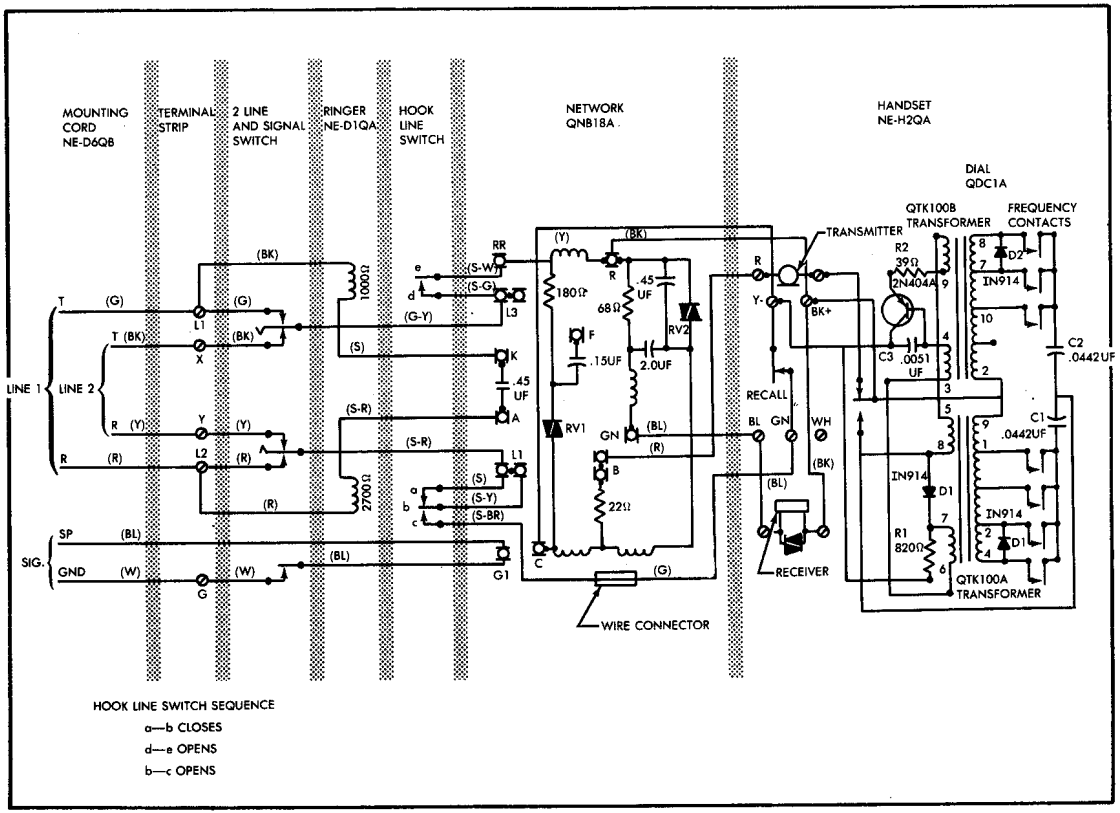


FIGURE 23. QSK2110A Telephone Set—Connections Two Line, Digitone Dial

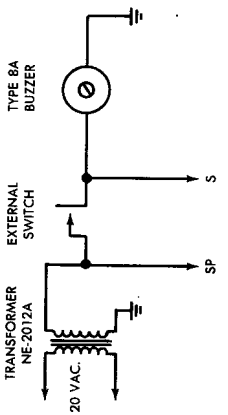


FIGURE 24. Typical Connections for Type 8A Buzzer

TABLE A. Major Components of the QSK100 and QSK2100 Type Telephone Sets

Item Number	Identification	Description	QSK 100A*	QSK 100B*	QSK 100C*	QSK 110A*	QSK 191A*	QSK 2100A*	QSK 2100B*	QSK 2110A*	QSK 2191A*	Shown On
	P096D200-299*	Housing Assembly	1		1		1	1			1	Fig. 7
1	P0891200-299*	(Base)		1					1			Fig. 7
	P0891400-499*	(Base)				1				1		Fig. 7
2	P096D314	Baseplate	1	1	1		1	1	1		1	Fig. 7
	P0897581	Baseplate				1				1		Fig. 7
3	NE-D1QA	Ringer	1	1	1	1		1	1	1		Fig. 7
4	P0897534	Ringer Mounting Bracket					1				1	Fig. 8
5	P096D337	Line Switch Operating Plunger Assy.	1	1	1	1	1	1	1	1	1	Fig. 7
6	P0894971	Line Switch Assy.	1	1	1	1	1	1	1	1	1	Fig. 7
7	P096D326	Foot	4	4	4	4	4	4	4	4	4	Fig. 7
8	P096D303	Terminal Strip Assembly										Fig. 7
9	QNB18A	Network	1	1	1		1	1	1		1	Fig. 7
	QNB18B	Network				1				1		Fig. 7
10	P096D322	Spring	1	1	1	1	1	1	1	1	1	Fig. 7
11	P0892000-099*	Handset Cover Assy.	1	1	1	1	1	1	1	1	1	Fig. 5, 6
12	P0892100-199*	Handset Instrument	1	1		1	1					Fig. 5
13	P0892200-299*	Section Assembly			1			1	1	1	1	Fig. 6
14	P0896855	Inset Assembly			1							Fig. 4
15	P0897585	Switch Assembly				1				1		Fig. 7
17	NE-10QA	Dial (Rotary)	1	1		1	1					Fig. 5
18	QDC1A	Dial (DIGITONE)						1	1	1	1	Fig. 6
19	NE-T1	Transmitter Unit	1	1	1	1	1	1	1	1	1	Fig. 5, 6
20	NE-U1	Receiver Unit	1	1	1	1	1	1	1	1	1	Fig. 5, 6
21	NE-H5QE*	Handset Cord	1	1	1	1	1	1	1	1	1	Fig. 5, 6
22	P096D309	Transmitter Cup	1	1		1	1					Fig. 5
23	P0895021	Assembly			1			1	1	1	1	Fig. 6
24	P096E700-799*	Dial Center Disc	1	1		1	1					Fig. 1
25	P096D313	Card Holder Window	2	2	2	2	2	2	2	2	2	Fig. 1, 2
Not Shown	P0896532	Card Holder Group (Contents of 2—P-96D313)										Fig. 1, 2
26	P096D305	Receiver Cup	1	1	1	1	1	1	1	1	1	Fig. 5, 6
	NE-D3O5A*	5 Ft. 6 In. Cord for Individual and 2-Party Line (Note 1)	1	1	1		1	1	1		1	Fig. 7
27	NE-D40C*	Cord for NE-1A1 Key System (Note 1) (Standard on QSK110 and QSK2110) (Note 1)				1				1		Fig. 7 Fig. 7
28	K1D-5	Lamp—Message Waiting		1					1			Fig. 3

NOTE 1: The NE-D4QC and the NE-D6QB cord is available in the standard 5 foot 6 inch length, while the NE-D4QC is also available in a non-standard 13 foot length by special order. Both cords must be ordered separately except in the case of the QSK110 and QSK2110 which come equipped with an NE-D6QB cord, 5 foot 6 inches long.

** Replace the last two digits of piece part numbered items with color identification code, as listed in paragraph 3.03 e.g., P096D220—Housing Assy, warm white. For coded apparatus add the color identification code after the dash following the apparatus code number, e.g., QSK100A—20.*

TELEPHONE SETS

TRENDLINE (TRIM-LINE) INSTALLATION AND CONNECTION

1. GENERAL

1.01 This practice covers the installation, assembly, disassembly, and connection procedures for the Kellogg Trendline (Trim-Line) telephone set.

1.02 This practice is being reissued to include superimposed ringing information shown in paragraph 5.01 d. and Table C. The circuit modification consists of an addition of a diode (180640).

1.03 The Trendline does not come assembled. The handset, base, and cord are not connected and the ringer is in a separate container.

2. ASSEMBLY

2.01 To assemble the base housing (desk or wall model), proceed as follows:

a. Position the housing carefully on the base, making sure that the housing seats properly on the ears of the base.

b. When positioning the housing on a wall set, avoid damaging the switch hook by holding the plunger up as shown in Figure 1.

c. Tighten the housing screws.

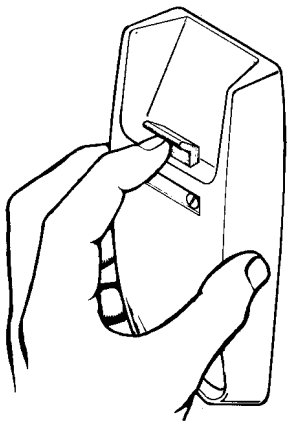


FIGURE 1. Switch Hook Plunger (up)

2.02 To install the name plate, hold the name plate by the outside edges near the center and insert one end in the housing recess. Bend the opposite end into place and release the center hold. See Figure 2.

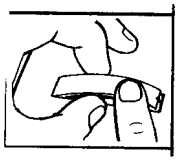


FIGURE 2.

2.03 To assemble the handset, proceed as follows:

a. Hold the plugs of the handset cord side by side. Look at them from the end as shown in Figure 3.

FIGURE 3.

NOTE: Notice that the end of one plug is "T" shaped.

b. Plug the "T" shaped plug into the handset and the rectangular plug into the base until the spring clip clicks into a locked position.

2.04 To assemble the desk stand cord, proceed as follows:

a. Plug the cord in until the spring clip locks into place.

b. Press the cord down into the channel and slide the cord retainer over until it snaps into its detent.

3. DISASSEMBLY

3.01 To remove the housing from the base, proceed as follows:

a. Remove the card retainer (name plate) near the front of the housing by inserting the tip of the releaser tool into the small slotted hole at the edge of the card holder. Do not insert more than 1/8" into the card holder. See Figure 4.

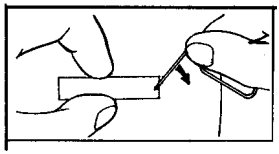


FIGURE 4.

b. Apply slight pressure to the tool. This will bow the window upward so that the edges may be grasped with the free hand. Remove the number card if present.

c. Loosen the two housing screws so that the housing may be lifted free from the base.

3.02 To remove the handset cord, proceed as follows:

a. Insert the releaser tool into the slot provided as shown in Figure 5a. Be sure that the tool is on top of the spring clip.

b. Press the spring clip down and grasp the tool and plug as shown in Figure 5b., and pull out.

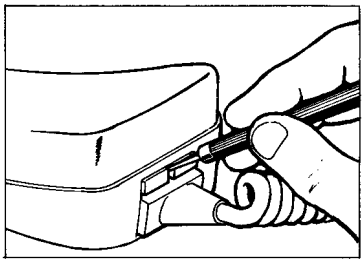


Figure 5A. Depress Spring Clip.

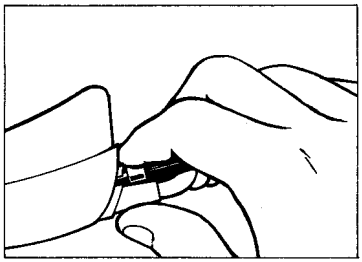


Figure 5B. Unplug Handset Cord.

FIGURE 5. Removal of Handset Cord.

NOTE: If the spring is difficult to depress, push in on the plug to relieve the tension.

3.03 To remove the desk stand cord, proceed as follows:

a. Place the point of the releaser tool on the cord retainer as shown in Figure 6a. Press down lightly to free the retainer from its detent. Then move it to the left until the end clears the cord. Do not move the cord retainer farther than necessary.

b. Pull the cord up and out of its channel. Grasp the cord and wedge the second finger between it and the base. At the same time, use a releaser tool to release the spring clip as shown in Figure 6b.

c. Pull the plug out carefully as shown in Figure 6c.

3.04 To remove the ringer, proceed as follows:

a. Disconnect the ringer leads as follows:

(1) BLACK lead from terminal "G" or "3" as applicable.

(2) RED lead from terminal "K".

(3) BLUE or SLATE lead from terminal "B" if connected. (For TIP party identification only.)

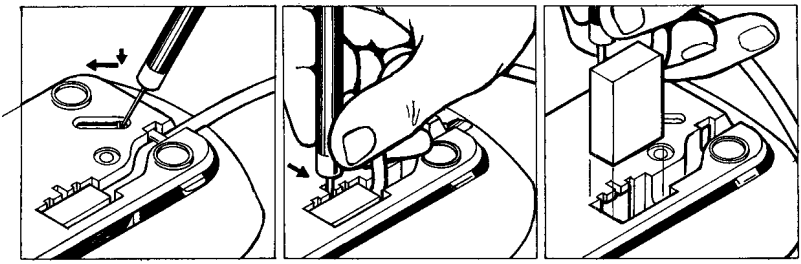


Figure 6A. Release the Cord Retainer. **Figure 6B.** Depress Spring Clip, Grasp Cord. **Figure 6C.** Pull Plug From Base.

FIGURE 6. Removal of Desk Stand Cord.

(4) BLUE, SLATE, and SLATE-RED leads are normally insulated and stored. Pull these from beneath the switchhook bracket and out of the slots in the terminal board.

b. Remove the two terminal board mounting screws and pull the terminal board up.

c. Remove the two ringer mounting screws and remove the ringer.

3.05 When removing the terminal board, observe how the wires are dressed. Remove the two mounting screws and pull the terminal board up carefully.

4. INSTALLATION PROCEDURES

4.01 Trendline telephones are equipped with a dial lamp. If this feature is to be used, a transformer is required–31 ( ) 690 or equivalent. Inside wire (IW) is used to connect the transformer to the telephone or connecting block. The maximum IW allowed is 15 feet; therefore, the phone should be installed conveniently located near a 110 volt AC outlet.

4.02 Installation of the capacitor, terminal board, and ringer are as follows:

a. Place the capacitor (if required) under the terminal board and pull the leads through the slots at "A" and "K". Connect to "A" and "K" terminals. Cut off excess wire length.

NOTE: Allow 1/4" slack in the capacitor leads to permit movement of the capacitor so that it does not interfere with terminal screws.

b. Place the ringer on the mounting bases and secure it with the two screws included with each ringer.

c. Install the terminal board by securing it with two screws. If the leads have been disconnected from the terminal screws, refer to the appropriate circuit table to connect the leads.

d. Dress the ringer leads through a notch in the terminal board. Insulate and store all spare leads by dressing them through notches in the terminal board. On desk models, connect the RED ringer lead to "K" and the BLACK ringer lead to "G".

NOTE: Be sure that the leads do not interfere with operation of the switchhook or ringer.

4.03 When the set is to be used as a desk set, proceed as follows:

a. Connect the desk stand cord as explained in paragraph 2.04. Refer to Figure 7 when installing the telephone.

b. Plug the handset cord into the *base* and *handset* as explained in paragraph 2.03.

4.04 When the set is to be used as a wall phone, the inside wire must be connected within the telephone. The inside wire will normally enter the instrument through the left-hand opening at the bottom of the base plate. Concealed wiring may enter through any suitable hole in the base plate but be sure that the wiring does not interfere with the ringer or switchhook. To install the set, proceed as follows:

a. Remove the housing from the base assembly as explained in paragraph 3.01.

b. Position the base assembly on the wall and center mark the small end of the "keyhole" shaped holes in the base. Remove the base assembly and start the mounting screws. Install the base assembly on the screws and tighten the screws.

c. Connect the inside wire as shown in Figure 8.

d. Install the housing as explained in paragraph 2.01 and Figure 1.

e. Install the handset cord as explained in paragraph 2.03 and Figure 3.

5. WIRING CONNECTIONS

5.01 Wiring changes can be made to provide the following services:

a. Use with 1A1, 1A2, and 6A KTS. See Table A.

b. Two party flat-rate service.

c. Tip party ANI identification.

d. Connections for 4 party full selective or 8 party semiselective ringing (using 180640 diode).

TABLE A. CONVERSION TO 1A1, 1A2, and 6A KTS MOVE LEADS AS FOLLOWS:

LEAD AND COLOR			TERMINAL BOARD	
			From:	To:
LINE SWITCH		BR	C	G
		Y	L2	3
RINGER	AC1	BK	G	C
	AD1	BK	G	C
MTG CORD or IW		R	L2	C
CAPACITOR STRAP		BK	L2	L1 (Note 2)

Notes:

1. Disconnect (Y) lead from B, insulate and store.
2. Capacitor strap connects from A to L1.

5.02 See Figure 9 for a wiring diagram and circuit schematic of the desk type telephone, 220C.

5.03 See Figure 10 for a wiring diagram and circuit schematic of the wall type telephone, 220D.

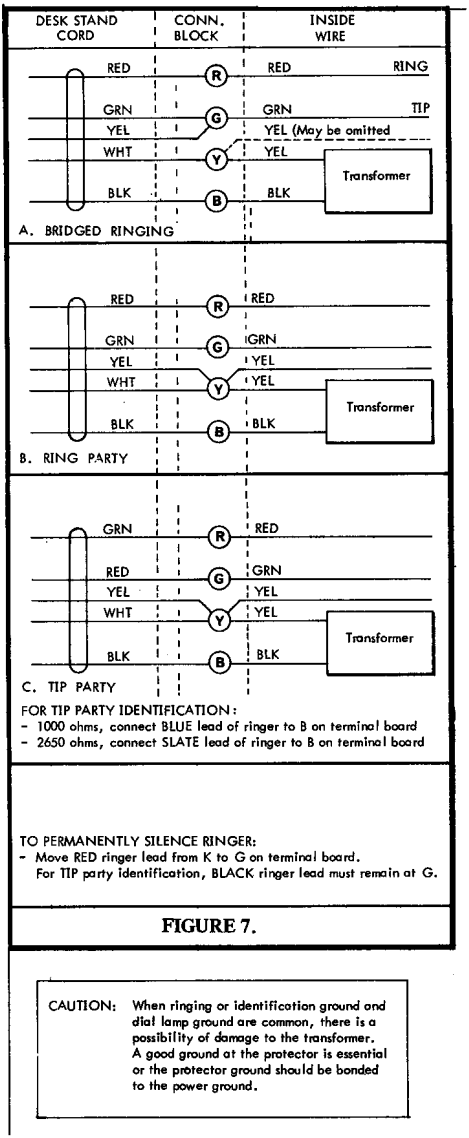


FIGURE 7.

CAUTION: When ringing or identification ground and dial lamp ground are common, there is a possibility of damage to the transformer. A good ground at the protector is essential or the protector ground should be bonded to the power ground.

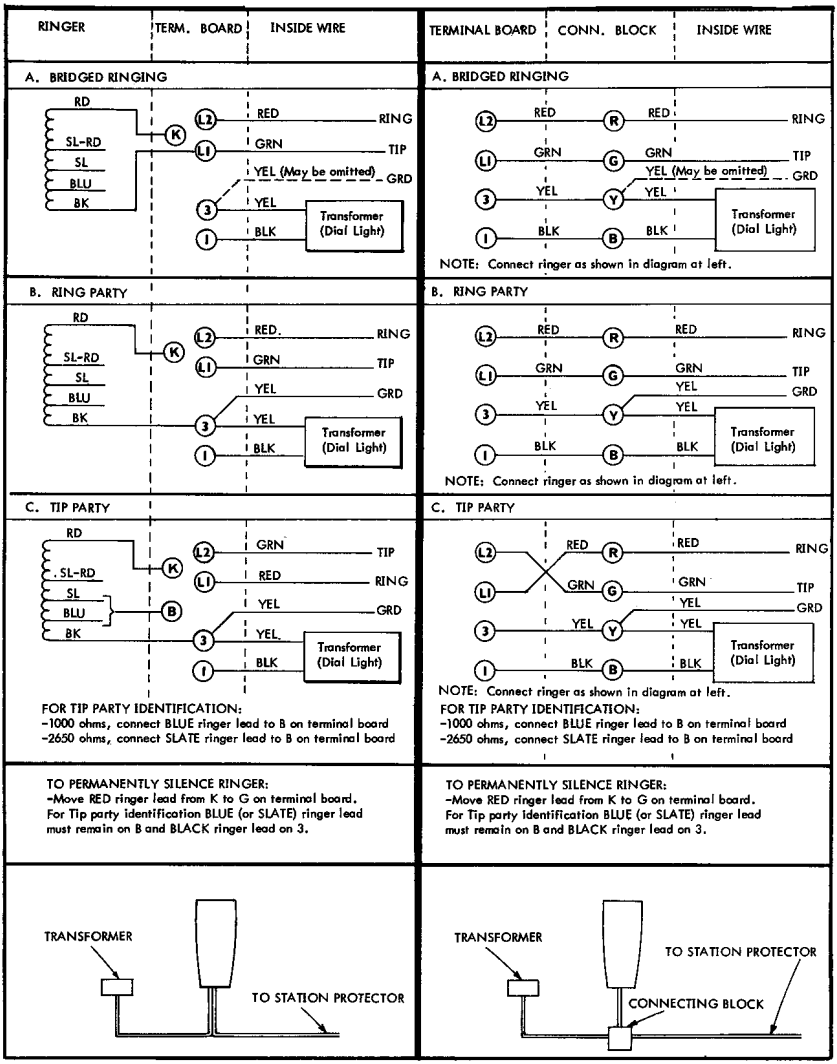


Figure 8A. Connections, wall Trendline telephone when not using a connecting block.

Figure 8B. Connections, wall Trendline telephone, using a connecting block as a common connecting point for inside wire and transformer leads.

FIGURE 8.

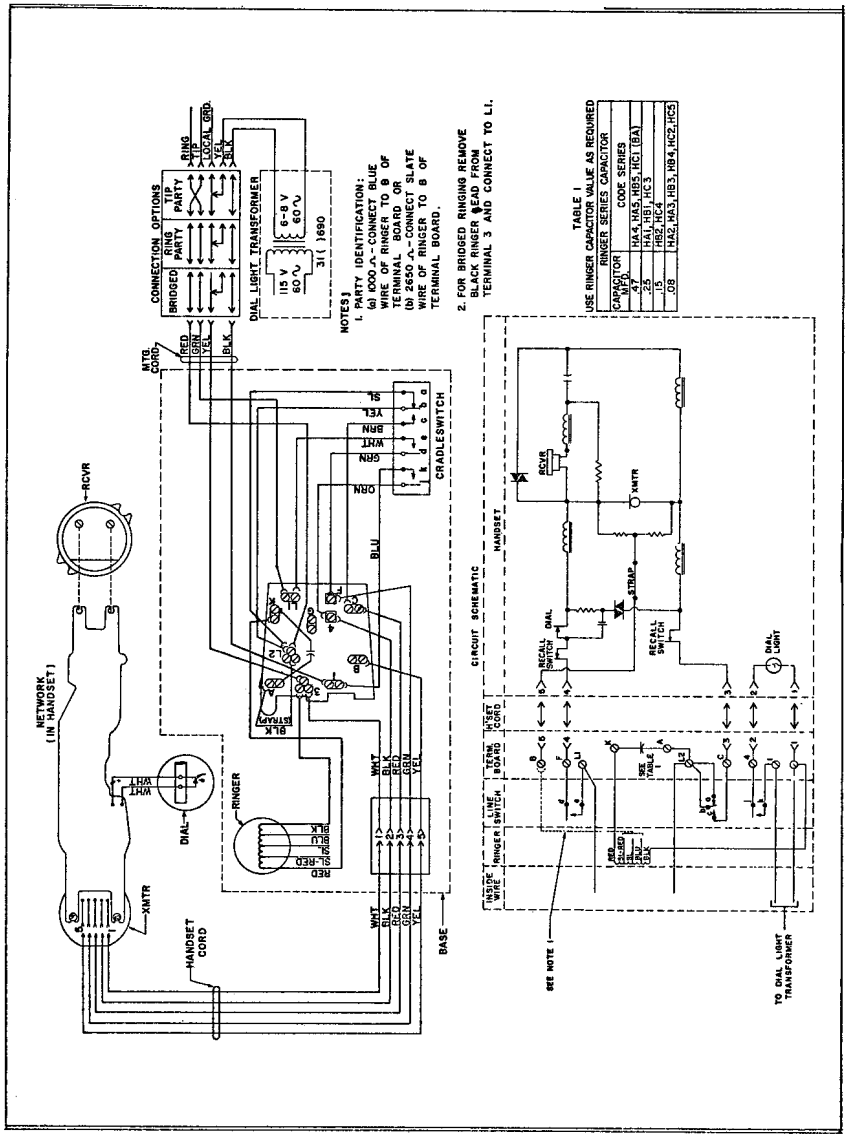


FIGURE 9. Desk Type.

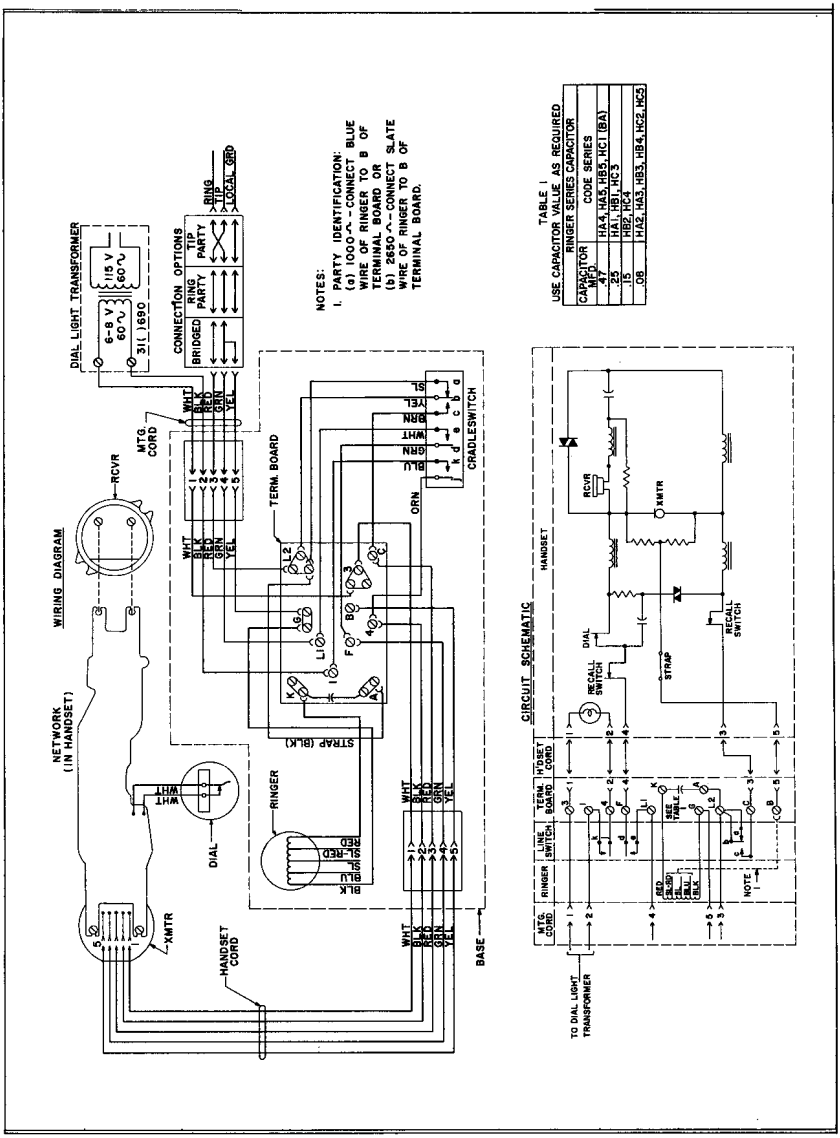


FIGURE 10. Wall Type.

6. ORDERING INFORMATION

6.01 When ordering a telephone set or cord, complete the code number by adding the appropriate number denoting the desired color. For example, 220D02 denotes a wall phone in red. See Table B.

TABLE B ORDERING INFORMATION

CODE	DESCRIPTION
COMPLETE TELEPHONES	
220D**( ) 30M 220C**( ) 30M	Telephone, Desk; Dial-in-Handset (Trendline) Telephone, Wall; Dial-in-Handset (Trendline)
	Insert Ringer Code as follows: (BA) - Straight line biased ringer (type 153) (LR) - Less ringer
	Substitute Color Code as follows: 00 - Black 12 - Blue 02 - Red 13 - Beige 04 - Yellow 14 - Gray 05 - Green 15 - White 09 - Ivory 30 - Turquoise 11 - Pink
COMPONENTS	
220A**-30M AC1**( ) AD1**( )	Handset (Substitute color code for asterisks) Wall Base Assembly Desk Base Assembly ( ) Insert ringer code above **Substitute color code above
HANDSET CORDS	
1027**-03 1027**-25 1027**-26	Handset Cord Assembly, 6-feet Handset Cord Assembly, 9-feet Handset Cord Assembly, 13-feet
	**Substitute Color Code
TRANSFORMER	
31 ( ) 690	Transformer, for Dial Light Operation
DESK STAND (LINE) CORDS (Included with Desk Base)	
3060**013 3060**-25 3060**-26 3060**-24	Cord, Desk Stand, 68 Inches (Standard) Cord, Desk Stand, 9 feet Cord, Desk Stand, 13 feet Cord, Desk Stand, 25 feet
CIRCUIT LABELS	
180200 180201	Label, Circuit, Desk Trendline Telephone Label, Circuit, Wall Trendline Telephone

TABLE C

CONNECTIONS FOR 4-PARTY FULL SELECTIVE OR 8-PARTY SEMISELECTIVE RINGING USING 180640 DIODE

PARTY		LEADS OR COLOR	–RING	–TIP	+RING	+TIP
LINE WIRE CONN AT CONN BLOCK	Ring	R	R	R	R	R
	Tip	G	G	G	G	G
	GRD	Y	Y	Y	Y	Y
180640 Diode			L2	L2	3	3
			G	G	G	G
Mtg Cord at Conn Block		R	R	G	R	G
		G	G	R	G	R
		Y	Y	Y	Y	Y
		W	Y	Y	Y	Y
		BK	B	B	B	B
Mtg Cord or Inside Wire at Term. Board		R	L2	L2 / L1*	L2	L2 / L1*
		G	L1	L1 / L2*	L1	L1 / L2*
		Y	3	3	3	3
		W	3	3	3	3
		BK	1	1	1	1
Ringer Leads		BK	K	K	K	K
		R	3	3	L2	L2
		S	‡	‡	‡	‡
		S-R	G	G	G	G
		BL	B	B	B	B
Dial Light Transformer Lds		1	Y	Y	Y	Y
		2	B	B	B	B
Strap from A		BK	3	3	L2	L2
Line Switch		S	‡	‡	‡	‡

* Connections for K254 base (Wall)

‡ Insulate and store

● Denotes zener anode end

TELEPHONE SET
500 TYPE
DESCRIPTION

1. GENERAL

1.01 This practice describes the type 500 telephone set which is a standard common battery desk-style telephone. All of the type 500 instruments may be used for dial or manual common-battery services. High impedance ringers are standard for biased, harmonic, synchromonic and decimonic ringing requirements. See Figure 1.

FIGURE 1 **THE 500 DESK TYPE TELEPHONE**

2. COMPONENTS

2.01 The housing, which covers and protects the base assembly, has a cradle upon which the handset rests and an opening at the back for use as a handhold to conveniently carry the telephone set. The plunger assembly is a part of the cradle assembly and contains the two plungers for activating the switch hook contacts, in the base, when the handset is removed or replaced.

2.02 The handset consists of the receiver unit, transmitter unit, transmitter holder assembly, handset cord, and two removable caps, which hold the transmitter and receiver units in place.

a. The transmitter unit has a wide frequency response and is stable in operation. Two springs in the transmitter holder assembly provide electrical connection to the transmitter.

b. The receiver unit consists of a ring armature receiver assembly and a varistor. The ring armature receiver is a domed diaphragm that is actuated at its circumference by a ring-shaped armature. This type of construction increases the receiver efficiency and frequency range. The varistor is directly across the receiver to protect the user from peak acoustical outputs and the receiver from electro magnetization by abnormal transient electrical influences.

c. The short hand piece provides a means of getting the transmitter closer to the subscriber, and results in increased transmission.

d. The four (4) conductor handset cord has a jacket and is anchored to the handset by a cord strain relief band. At the base end of the cord a similar hook anchors the cord to the base plate.

2.03 The base plate is attached to the housing-plunger assembly by two removable lockscrews. The base assembly consists of a dial mounting bracket switch assembly, network, ringer, all of which are mounted on the steel base plate. Two holes are provided in the rim of the base plate for attaching cords.

2.04 The dial consists of the number card assembly, finger plate, numeral ring, finger stop, and the dust-cover to protect the cams and contact spring assembly. In cases of lucite finger plates, the card assembly is part of the finger plate. The characters on the numeral ring are outside the finger plate, providing greater visibility. The characters are white on a black background, or black on a light colored background, with a marker spot under each finger hole to facilitate dialing. The contact spring assemblies consist of a pair of off normal contacts and a pair of pulsing contacts. When closed, the off normal contacts shunt the receiver circuit. The dial is attached to its mounting bracket by the two removable screws.

2.05 The ringer used in the 500 type telephone set is of a single-coil design with a high impedance, allowing more ringers to be placed on the line with no increase in bridging loss, or increase in unbalance on divided ringing circuits.

a. A volume control is provided by which the subscriber may adjust the sound output. The two gongs have harmonically related frequencies, the fundamentals of which are reinforced by resonant air chambers below the gongs.

b. A laminated soft iron core carries the single coil and is clamped to the soft iron yoke which is bolted to the cast non-magnetic alloy frame.

c. The armature and clapper are mounted to the frame to allow them to vibrate. Due to the magnetic field produced by the coil, increased sensitivity is provided by biasing the armature by means of a permanent magnet clamped in the frame.

d. The ringers are designed to function from an alternating current source and are equipped with flexible wire leads for connecting to other components in the telephone set.

3. TURN AND PUSH KEY ASSEMBLIES

3.01 The turn and push keys are mounted to the base of either the desk or wall type telephones so that the lucite knob projects through the housing. Various types of contact assemblies are available to meet the requirements for the different types of telephone circuits.

3.02 Each of the contact springs is provided with a flexible, plastic insulated wire lead, with bare or spade terminal end, for connections to the other components in the telephone instrument.

3.03 Each of the various types of turn and push keys used in the key-phone versions of the type 500 telephone set consists of a bracket and plunger assembly in which the plunger is free to slide and rotate in a bushing on the upper part of the bracket. Either one or two spring nest assemblies may be independently mounted on the lower part of the bracket; one is actuated by depressing the plunger and the other by rotating the plunger one quarter turn. The rotary action is locking in both positions while the push action is non-locking. A lucite knob is fitted to the top of the plunger.

4. LOCATION OF THE CONNECTING BLOCK

4.01 The location of the connecting block will be affected by the location of the telephone set. However, the following considerations should be kept in mind:

a. Avoid locations that are hazardous to installers, repairmen, and subscribers.

b. Locate the connecting block where it will be accessible for repair or maintenance; avoid closets.

c. Do not locate the connecting block near radiators or steam pipes, the plastic base assembly may be damaged by heat.

d. Mount the connecting block on a back board, when the wall location is damp or uneven.

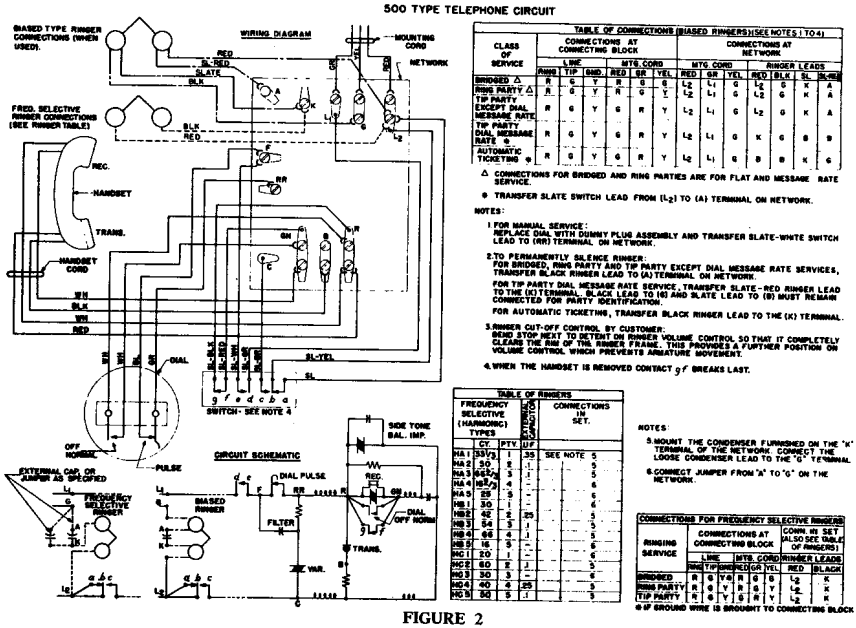


FIGURE 2

5. CONNECTIONS

5.01 The connections at the connecting block and terminal board of the network assembly will depend upon the type of ringing (biased or frequency selective) and the ringing service (See Figure 2 and 3).

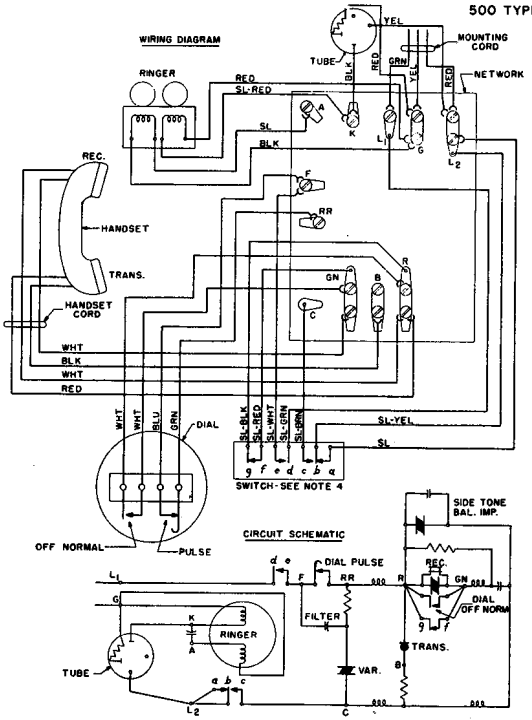


TABLE OF CONNECTIONS (POLARIZED RINGING)

CLASS OF SERVICE	CONNECTIONS AT CONNECTING BLOCK						CONNECTIONS AT NETWORK						
	LINE			MTG. CORD			TUBE LEADS			RINGER LEADS			
	RING	TIP	GRD.	RED	GRN	YEL	YEL	BLK	RED	RED	BLK	SL	SL-RED
(-) RING	R	G	Y	R	G	Y	L_2	K	G	G	G	A	K
(+) RING	R	G	Y	R	G	Y	G	K	L_2	L_2	L_2	A	K
(-) TIP	R	G	Y	G	R	Y	L_2	K	G	G	G	A	K
(+) TIP	R	G	Y	G	R	Y	G	K	L_2	L_2	L_2	A	K

NOTES:

1. FOR MANUAL SERVICE:
   REPLACE DIAL WITH DUMMY PLUG ASSEMBLY AND TRANSFER SLATE-WHITE SWITCH LEAD TO (RR) TERMINAL ON NETWORK.
2. TO PERMANENTLY SILENCE RINGER:
   FOR RING PARTY, CONNECT THE YELLOW MOUNTING CORD CONDUCTOR TO THE (R) TERMINAL OF THE CONNECTING BLOCK. FOR TIP PARTY, CONNECT THE YELLOW MOUNTING CORD CONDUCTOR TO THE (G) TERMINAL OF THE CONNECTING BLOCK.
3. RINGER CUT-OFF CONTROL BY CUSTOMER:
   BEND STOP NEXT TO DETENT ON RINGER VOLUME CONTROL SO THAT IT COMPLETELY CLEARS THE RIM OF THE RINGER FRAME. THIS PROVIDES A FURTHER POSITION ON VOLUME CONTROL WHICH PREVENTS ANY MOVEMENT.
4. WHEN THE HANDSET IS REMOVED CONTACT gf BREAKS LAST.

FIGURE 3

6. NETWORK TYPE 75335-1

6.01 The type 75335-1 network assembly provides all the components necessary to connect and match the impedance of the handset transmitter and receiver units to a two wire telephone circuit.

6.02 The unit incorporates radio frequency filter and side tone balancing circuits and a 0.5 MFD ringer capacitor in addition to the other circuits.

6.03 All the components are mounted on the underside of the molded terminal board, which is clipped to the sealing compound filled mounting container.

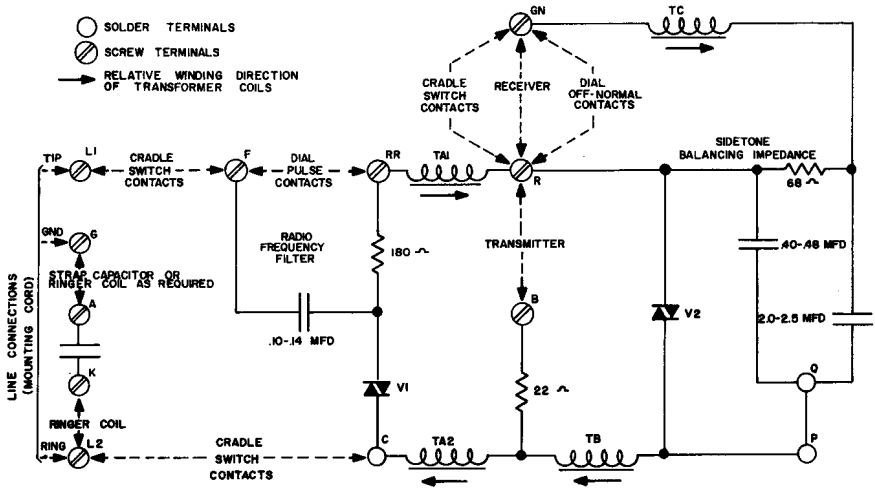


FIGURE 4. CIRCUIT DIAGRAM

6.04 The circuit shown in Figure 4 indicates by dashed lines the typical connections to other components of a complete telephone instrument. The features of the circuit are briefly discussed in the following paragraphs.

6.05 The basic network design provides an increase in transmission characteristics of some 10 db over previous circuits. It has therefore been possible to include the two shunt varistors in the circuit to produce increased losses on short loops and yet have negligible effect on long loops; the varistor effective resistances changing inversely to the current flowing through them.

6.06 The direction of winding of the four coils of the transformer is indicated by arrows in Figure 4. Received speech currents pass via windings TA_1, TB and TA_2, each of which produces an additive voltage in winding TC. The received currents also produce a voltage across the 68Ω resistor that opposes and is almost equal to that produced by the induced voltages in winding TC. There is very little power loss in the resistor and varistor and maximum power in the receiver. The low impedance of the transmitter is matched to the loop by the turns ratio of winding TB to windings TA_1 and TA_2.

6.07 The current variations due to the transmitter are in opposite phase in windings TA and TB. The induced voltages in winding TC are also in opposite phase and the resultant voltage is opposed by the voltage produced across the 68Ω resistor. The net effect is that very small signals are produced in the receiver due to transmitter current changes and sidetone is very low. Also, as there is little power loss in the receiver, maximum transmitting levels are attained. Both varistors contribute to this condition by automatically compensating for various loop conditions to provide close matching of the loop impedance and the balancing network impedance with the transmitter circuit.

6.08 The 180Ω resistor and .10 MFD capacitor provide a filter network to suppress high frequency signal components of the dial pulses which might otherwise be radiated from the telephone line and cause local interference with broadcast radio reception.

7. TESTING OF THE NETWORK ASSEMBLY

7.01 Thorough testing of the network assembly can only be performed with elaborate test equipment. An adequate check on performance, for maintenance purposes, is to compare a suspected unit with a known good unit by substitution. Resistance and capacitance checks can be carried out between many of the terminals, as can be seen from Figure 4. Note that the soldered connection between terminals P and Q can be opened to permit testing of the two network capacitors. Figure 5 shows the layout of the terminal board of the assembly.

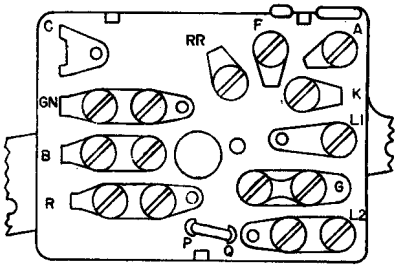


FIGURE 5 TERMINAL BOARD LAYOUT

7.02 To assist in testing network assemblies in the field, Table 1 gives the values of resistance and capacitance which should be measured when tests are made between various pairs of terminals.

8. TYPE 502–30 DESK TELEPHONE SET

8.01 The 502–30 desk telephone is a standard desk type instrument with the addition of a switch that is actuated by raising the left hand plunger in the handset cradle. Raising the plunger opens the circuit to any extension telephones on the line and prevents overhearing of confidential conversations. Replacing the handset automatically resets the switch to the normal position. An external two wire circuit connection is provided that may be used to light a "busy" lamp at all extensions.

9. TYPE 510–30 AND TYPE–36 DESK TELEPHONES

9.01 The 510–30 and 510–40 telephones are standard desk type instruments with the addition of a turn and push key which permits the instrument to be switched to either one of two lines. The ringer is permanently connected to Line 1 and a separate ringer must be provided for Line 2.

9.02 Both units are available with biased or frequency selective ringers for bridged ringing service. The 510–30 unit may be wired for divided ringing service if the signalling circuit is not used or if one conductor of this circuit may be grounded.

9.03 The instruments are designed for service in small business establishments where a switchboard or key telephone system would be uneconomical. A 6-way cord and a 10-way terminal block are provided with the 510–30 unit and the push section of the key is wired for an interphone signalling circuit. A 4-way cord and terminal block are provided with the 510–36 unit and the push section of the key is ineffective.

10. TYPE K-554 WALL TELEPHONE SET

10.01 The K-554 series provides a range of compact, anti-sidetone type wall mounting telephones which operate efficiently over a wide range of loop resistance and loop impedance.

10.02 The instrument is available with its internal components and circuit arranged for any class of service on any type of automatic or manual telephone system. It can be supplied in a number of different versions with various special features, as required.

11. TYPE 558–30 WALL TELEPHONE SET

11.01 The 558–30 telephone is a standard wall type instrument with the addition of a turn and push key which permits the instrument to be switched to either one of two lines. The ringer is permanently connected to Line 1 and a separate ringer must be provided for Line 2.

11.02 This instrument is designed for service in small business establishments where a switchboard or key telephone system would be uneconomical.

11.03 The instrument is available with biased or frequency selective ringers for bridged or divided ringing.

TABLE 1: POINT TO POINT TEST VALUES (Fig. 5)

Terminals	Components	Test Value
F - RR	Filter Capacitor	.09 - .14
A - K	Ringer Capacitor	.43 - .54
R - Q	Network Capacitors	(4) 2.4 - 3.0
C - RR	V1 and filter resistor	(1) 4.7K min (2) 890-1070
C - P	TA_2 and TB windings	28.8-35.2
B - C	TA_2 winding and resistor	35.1-42.9
B - P	TB winding and resistor	33.3-40.7
R - GN	TC winding and resistor	74.3-90.7
R - RR	TA; winding	12.1-14.9
R - P	V2	(1) 1.6K min (3) 72-87

NOTES: All capacitance values in microfarads and all resistance values in ohms.
(1) with 1 ma dc flowing through circuit.
(2) with 10 ma dc flowing through circuit.
(3) with 100 ma dc flowing through circuit.
(4) with strap P-Q removed.

12. TYPE 576–30 DESK TELEPHONE SET

12.01 The 576–30 desk telephone is a six-button type of key instrument with the same transmission circuit as the 500 series of instruments. It is designed for use on either regular exchange lines or interphone circuits in small business offices, where up to three lines are required on the one telephone. A small push (recall) button is fitted in front of the handset cradle to provide a signal circuit for PBX operation.

12.02 The six keys are arranged in pairs. The right hand key of each pair is the LINE key and the left hand key is the HOLD key. All line keys are interlocked so that only one line may be picked up at any time, although one or more lines may be held at the same time. Optionally, the third HOLD key may be modified to provide an interphone signalling circuit. ALL operated HOLD keys are automatically released when the handset is replaced in the cradle.

13. TYPE 564—30 AND TYPE 564-40—DESK TELEPHONE SET

13.01 The 564–30 and 564–40 desk telephones are six-button types of key instruments with the same transmission circuit as the 500 series of instruments. They are designed for use on key telephone systems, which may be installed as branch exchanges or completely private systems, of either the automatic or manual type. The only difference between the two instruments is that the 564–40 telephone has its desk stand cord terminated in an amphenol plug. This feature allows the instrument to be changed quickly and easily should such action become necessary for maintenance purposes or system testing.

13.02 The six keys on the units are allocated for use, from left to right, as follows. The first key is a HOLD key which may be used to hold a call received on any line while another call is made on a second line. The second and third keys are individual LINE keys and the remaining three keys may each be optionally wired as either LINE or interphone SIGNAL keys. Thus a maximum of five lines may be accessed from the one instrument, with a common hold key, and up to three of these lines may be connected as private intercommunication lines to other instruments, one additional key being used for the common interphone signalling circuit.

14. TYPE 565–30 AND TYPE 565–40 DESK TELEPHONES

14.01 The 565–30 and 565–40 desk telephones are six-button types of key instruments with the same transmission circuit as the 500 series of instruments. They are designed for use on key telephone systems, which may be installed as branch exchanges or completely private systems, of either the automatic or manual type. The only difference between the two instruments is that the 565–40 telephone has its desk stand cord terminated in an amphenol plug. This feature allows the instrument to be changed quickly and easily should such action become necessary for maintenance purposes or system testing. These instruments incorporate an exclusion switch, operated by lifting the left hand plunger which is automatically reset when the handset is replaced, so that any other telephones on one of the lines may be disconnected for confidential conversations. See Figure 6.

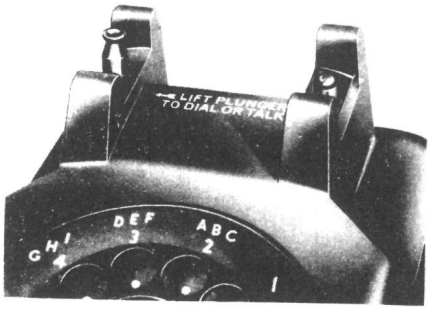


Fig. 6 565–30/40 Telephone Set

The six keys on the units are allocated for use, from left to right, as follows. The first key is a HOLD key which may be used to hold a call received on any line while another call is made on a second line. The second and third keys are individual LINE keys and the remaining three keys may be optionally wired as either LINE or interphone SIGNAL keys. Thus a maximum of five lines may be accessed from the one instrument, with a common hold key, and up to three of these lines may be connected as private intercommunication lines to other instruments, one additional key being used for the common interphone signalling circuit.

15. TYPE 565–39 AND TYPE 565–42 DESK TELEPHONES

15.01 The 565–39 and 565–42 desk telephones are six-button types of key instruments with the same transmission circuit as the 500 series of instruments. They are designed for use on key telephone systems, which may be installed as branch exchanges or completely private systems, of either the automatic or manual type. The only difference between the two instruments is that the 565–42 telephone has its desk stand cord terminated in an amphenol plug. This feature allows the instrument to be changed quickly and easily should such action become necessary for maintenance purposes or system testing. These instruments incorporate an exclusion switch, operated by lifting the left hand plunger which is automatically reset when the handset is replaced, so that any other telephones on one of the lines may be disconnected for confidential conversations.

15.02 The instrument is also wired for use with speaker phone equipment. The six keys on the unit are allocated for use, from left to right, as follows. The first key is a HOLD key which may be used to hold a call received on any line while another call is made on a second line. The second and third keys are individual LINE keys and the remaining three keys may each be optionally wired as either LINE or interphone SIGNAL keys. Thus a maximum of five lines may be accessed from the one instrument, with a common hold key, and up to three of these lines may be connected as private intercommunication lines to other instruments, one additional key being used for the common interphone signalling circuit. Two wire circuits are provided for each signalling lamp thus allowing flexibility in lamp signal circuitry.

TELEPHONE SETS 510–30 AND 510–36 CONNECTIONS

1. GENERAL

1.01 This practice provides the connecting information necessary in the installation of the types 510–30 and 510–36 telephone sets.

1.02 Figure 1 shows a top view and parts identification while Figures 2 and 3 show the connections necessary for installation.

Item	Description
1	Base Assy. c/w items 2 through 7
2	Network Assembly
3	Cradle Switch Assembly
4	Bind. Hd. Mach. Screw
5	Spring Washer
6	Hex. Nut
7	Cabinet Lock Screw
8	Ringer Assy. Biased
9	Dial Assembly
10	Handset and Cord Assembly
11	Desk Stand Cord
12	Housing and Plunger Assembly
13	Turn and Push Key Assembly
14	Special Screw
15	Terminal Board Assembly
16	Mounting Plate
17	Bind. Hd. Mach. Screw

NOTE: Ringer, Dial and Dummy Plug Assemblies are all supplied complete with mounting screws.

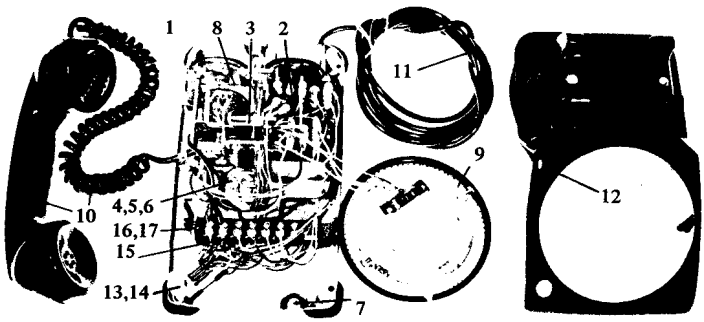


Fig. 1 TOP VIEW – HOUSING REMOVED

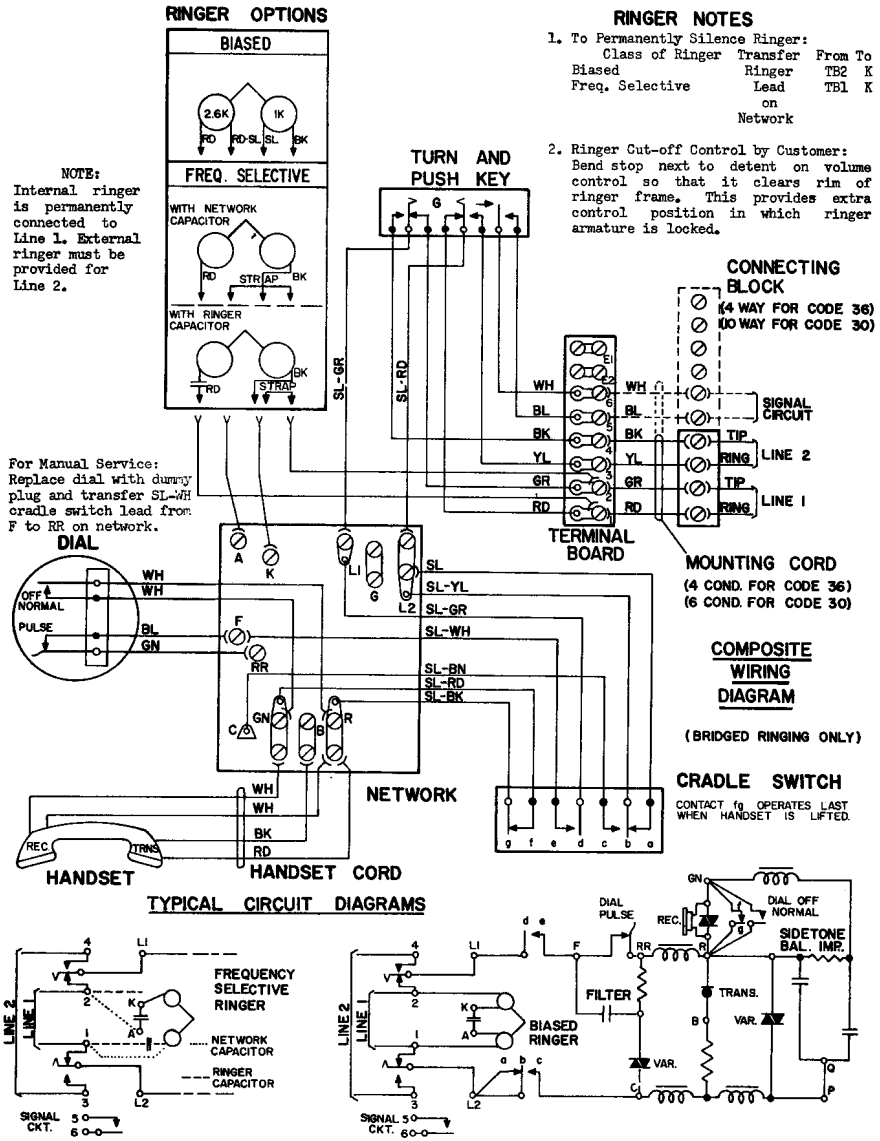
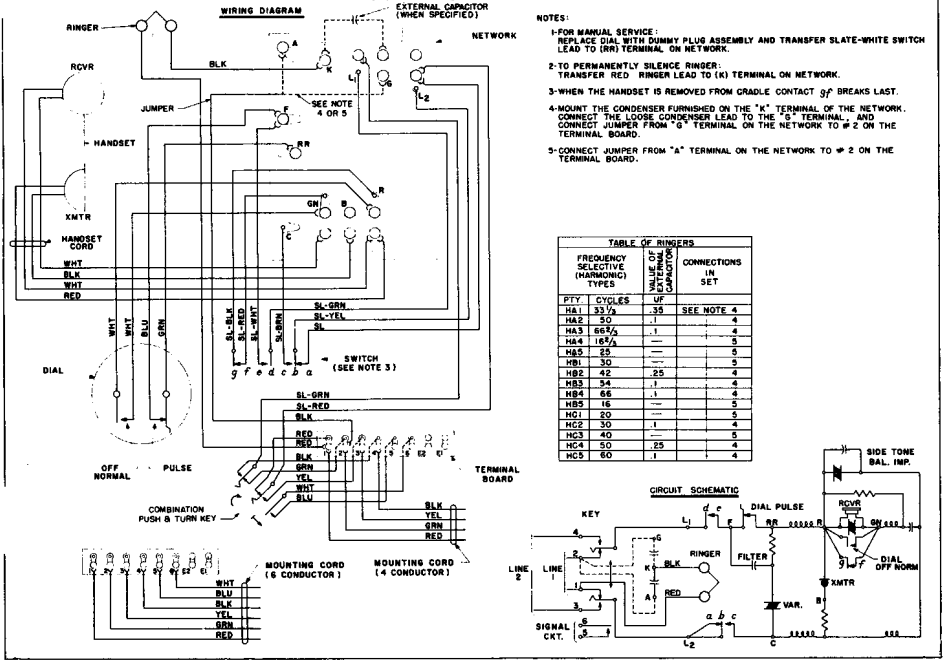


Fig. 2 DIAGRAMS 510–30- TELEPHONE
AND 510–36- TELEPHONE

510 TYPE TELEPHONE CIRCUIT



NOTES:

1-FOR MANUAL SERVICE:
REPLACE DIAL WITH DUMMY PLUG ASSEMBLY AND TRANSFER SLATE-WHITE SWITCH LEAD TO (RR) TERMINAL ON NETWORK.

2-TO PERMANENTLY SILENCE RINGER:
TRANSFER RED RINGER LEAD TO (K) TERMINAL ON NETWORK.

3-WHEN THE HANDSET IS REMOVED FROM CRADLE CONTACT gf BREAKS LAST.

4-MOUNT THE CONDENSER FURNISHED ON THE "K" TERMINAL OF THE NETWORK. CONNECT THE LOOSE CONDENSER LEAD TO THE "G" TERMINAL, AND CONNECT JUMPER FROM "G" TERMINAL ON THE NETWORK TO # 2 ON THE TERMINAL BOARD.

5-CONNECT JUMPER FROM "A" TERMINAL ON THE NETWORK TO # 2 ON THE TERMINAL BOARD.

TABLE OF RINGERS

FREQUENCY SELECTIVE (HARMONIC) TYPES		VALUE OF CAPACITOR (MFD)	CONNECTIONS IN SET
PTY.	CYCLES	UF	
HA1	33 1/3	.35	SEE NOTE 4
HA2	50	.1	4
HA3	66 2/3	.1	4
HA4	16 2/3	—	5
HB5	25	—	5
HB1	30	—	5
HB2	42	.25	4
HB3	54	.1	4
HB4	66	.1	4
HB5	16	—	5
HC1	20	—	5
HC2	30	.1	4
HC3	40	—	5
HC4	50	.25	4
HC5	60	.1	4

CIRCUIT SCHEMATIC

TELEPHONE SET
502–30 CONNECTIONS

1. GENERAL

1.01 This practice provides the connecting information necessary in the installation of the type 502–30 telephone set.

1.02 Figure 1 shows a top view and parts identification while Figures 2 and 3 show the connections necessary for installation.

Item	Description
1	Base Assy. c/w items 2 through 7
2	Network Assembly
3	Cradle Switch Assembly
4	Bind. Hd. Mach. Screw
5	Spring Washer
6	Hex. Nut
7	Cabinet Lock Screw
8	Ringer Assy. Biased
9	Dial Assembly
10	Handset and Cord Assembly
11	Desk Stand Cord (6 Cond.)
12	Housing and Plunger Assembly
13	Plunger Switch Assembly
14	Terminal Board Assembly
15	Mounting Plate
16	Bind Hd. Mach. Screw

NOTE: Ringer, Dial and Dummy Plug Assemblies are all supplied complete with mounting screws.

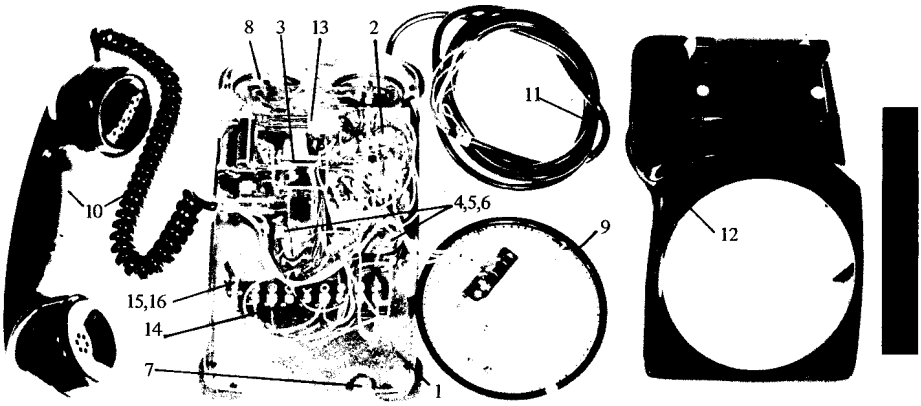


Fig. 1 TOP VIEW - HOUSING REMOVED

TABLE A
GUARD ASSEMBLY CONNECTIONS

WIRE OR LEAD		REMOVE FROM	CONNECT TO
Dial	(BK)	RR Net.	T of Guard Assembly
Line Switch	(BR)	C Net.	S of Guard Assembly
Guard Assembly	(G)		Term. RR Net.
	(W)		Term. C Net.

TABLE B
LINE AND RINGER CONNECTIONS

WIRE OR LEAD			INDIV OR BRIDGED	RING PARTY	TIP PARTY		
					NO IDENT. GROUND	IDENT. GROUND	
						1000Ω	2650Ω
Mtg. Cord at Conn Block	Tip	G	G	G	G	R	R
	Gnd	Y	G	Y	Y	Y	Y
	Ring	R	R	R	R	G	G
Ringer Leads		R			L1	K	B
		S-R				B	G
		S				B	K
		BK				G	B
Line Switch Leads		S				A	A
		W				C	C
		BR				F	F

Note: To silence ringer permanently:

(a) For all classes except identification ground insulate and store (BK) ringer lead.

(b) For 1000Ω gnd — insulate and store (S-R) ringer lead.

(c) For 2650Ω gnd — insulate and store (BK) ringer lead.

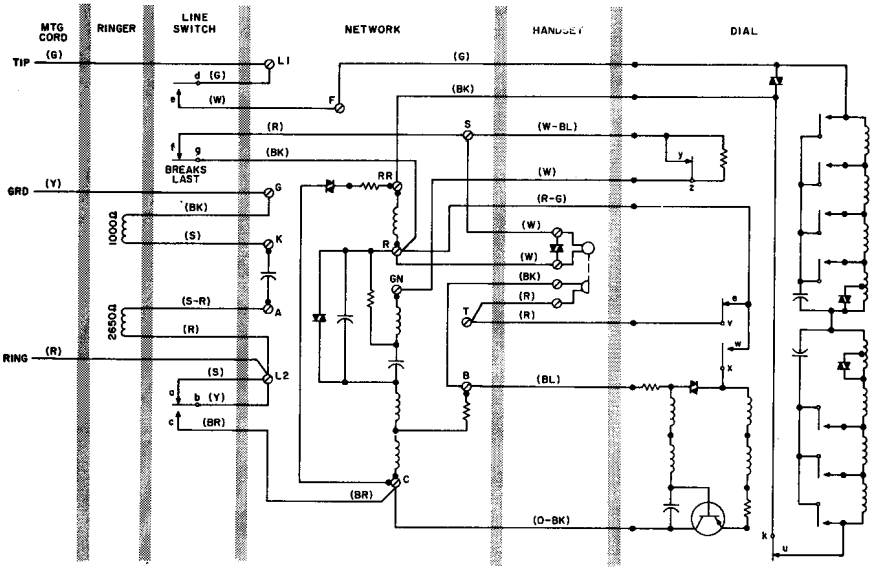


FIGURE 2. 2500**(BA) 33M Telephone Set Connections

K-554 TELEPHONE SET CONNECTIONS

1. GENERAL

1.01 This practice provides connecting information for the installation of the type **K-554 wall telephone set.**

1.02 This practice is reissued to correct CTSP 480-105-406, Issue 1, 1968, in its entirety, **all copies of which should be removed from the file and destroyed.**

1.03 Figure 1 shows the K-554 wall instrument, Figure 2 shows an exploded view of the components of the set and Figure 3 is the wiring diagram.

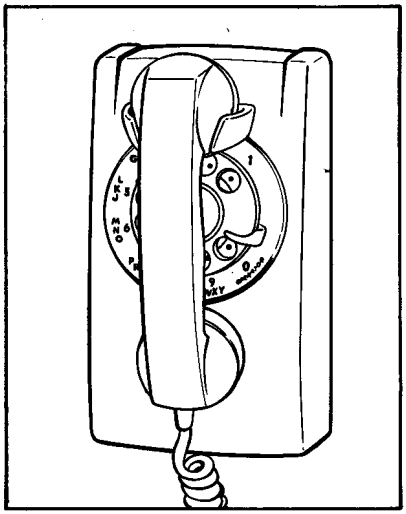


FIGURE 1. K-554 Wall Telephone

ITEM	DESCRIPTION
1	BASE
2	NETWORK
3	HOOKSWITCH
4,5,6	SCREWS, WASHERS & NUTS
7	RINGER
8a & 8b	DIAL
9	HANDSET
10	HOUSING
11	CONNECTING CORD
12	CATCH

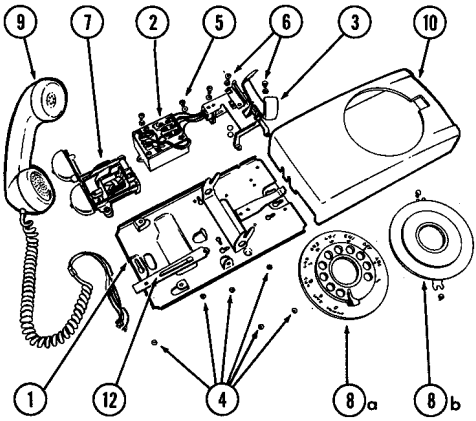


FIGURE 2. K-554 Component Parts—Exploded View

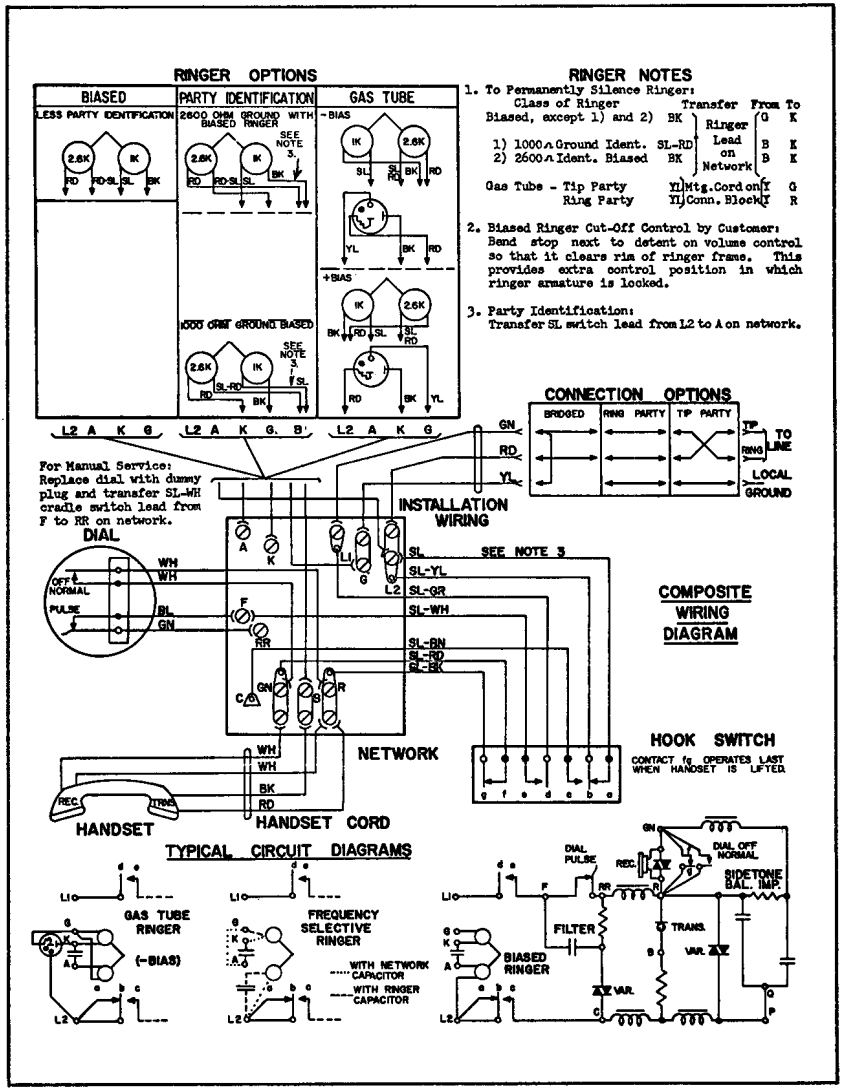


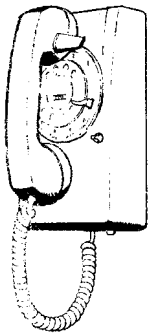
FIGURE 3. K-554 Wiring Diagram

TELEPHONE SET
558–30 CONNECTIONS

1. GENERAL

1.01 This practice provides the connecting information necessary in the installation of the type 558–30 telephone set.

1.02 Figure 1 shows the 558–30 type telephone while Figure 2 shows an exploded view of the set's components, Figures 3 and 4 are the wiring diagrams.



558 Wall Phone with 2-line Pickup Feature

FIGURE 1

Item	Description
1	Base Assembly
2	Network Assembly
3	Hook Switch Assembly
4	Bind. Hd. Mach. Screw
5	Spring Washer
6	Hex. Nut
7	Ringer Assy. Biased
8	Dial Assembly
9	Handset and Cord Assembly
10	Housing Assembly
11	Fastener Stud
12	Turn and Push Key Assembly
13	Special Screw
14	Terminal Board Assembly
15	Mounting Plate
16	Bind. Hd. Mach. Screw
17	Bracket (Turn and Push Key)

NOTE: Ringer, Dial and Dummy Plug Assemblies are all supplied complete with mounting screws.

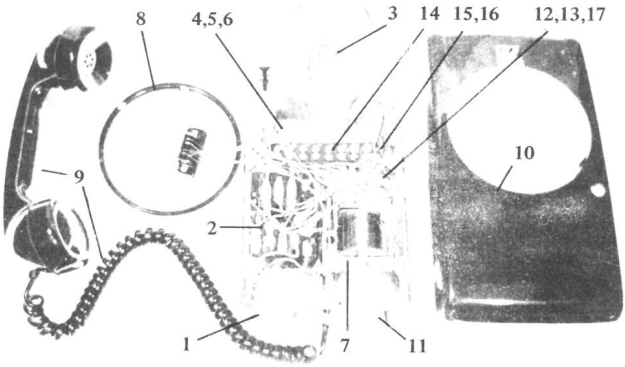


FIGURE 2. TOP VIEW - HOUSING REMOVED

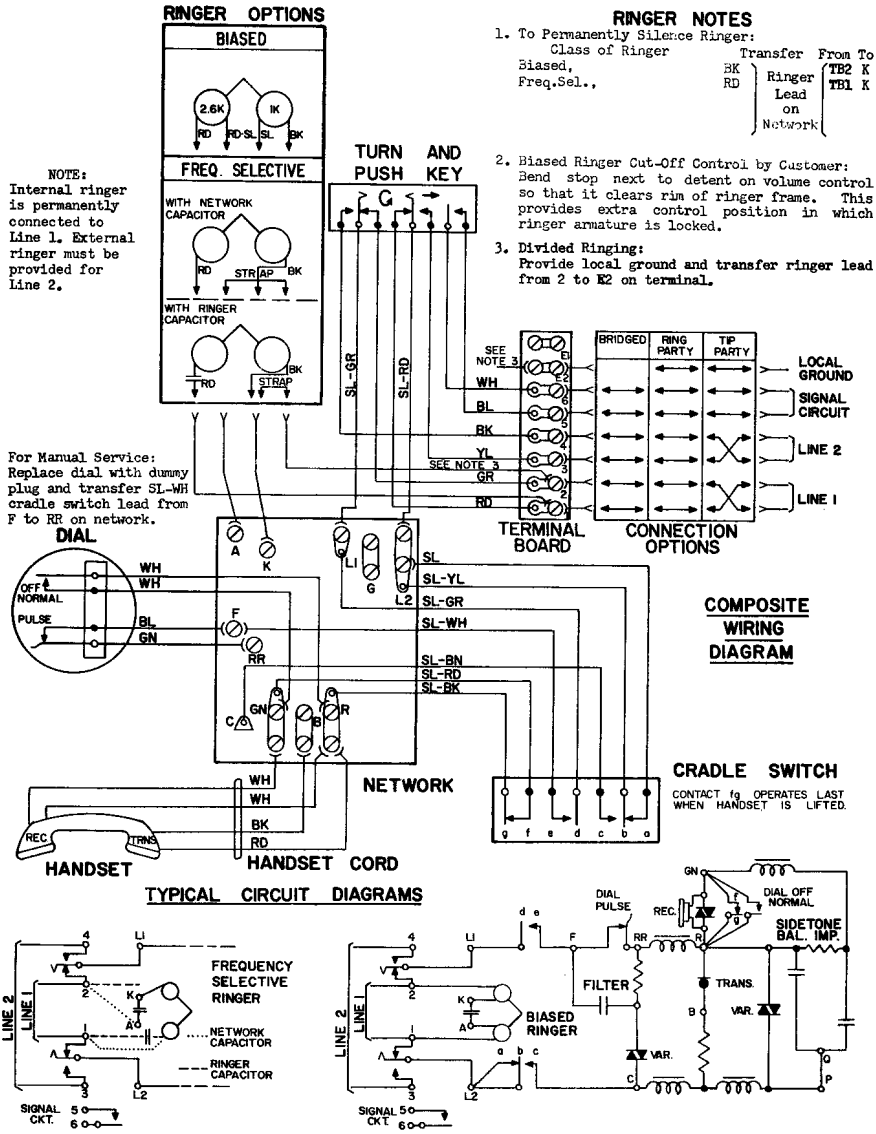


FIGURE 3. DIAGRAMS 558-30 TELEPHONE

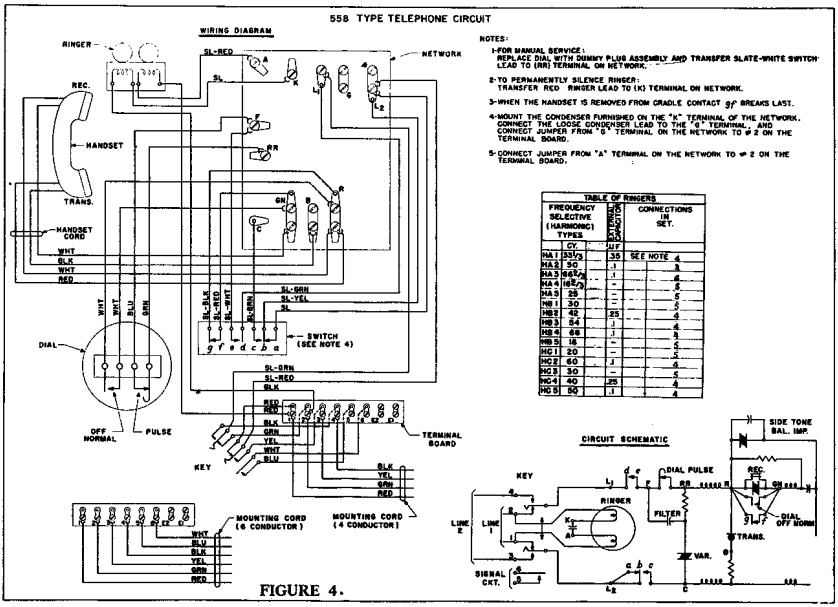

558 TYPE TELEPHONE CIRCUIT
WIRING DIAGRAM
NOTES:
1-FOR MANUAL SERVICE:
REPLACE DIAL WITH DUMMY PLUG ASSEMBLY AND TRANSFER SLATE-WHITE SWITCH LEAD TO (RR) TERMINAL ON NETWORK.
2-TO PERMANENTLY SILENCE RINGER:
TRANSFER RED RINGER LEAD TO (K) TERMINAL ON NETWORK.
3-WHEN THE HANDSET IS REMOVED FROM CRADLE CONTACT sp BREAKS LAST.
4-MOUNT THE CONDENSER FURNISHED ON THE "L" TERMINAL OF THE NETWORK. CONNECT THE LOOSE CONDENSER LEAD TO THE "6" TERMINAL; AND CONNECT JUMPER FROM "6" TERMINAL ON THE NETWORK TO ⏚ 2 ON THE TERMINAL BOARD.
5-CONNECT JUMPER FROM "A" TERMINAL ON THE NETWORK TO ⏚ 2 ON THE TERMINAL BOARD.
RINGER
SL-RED
NETWORK
REC.
HANDSET
TRANS.
HANDSET CORD
WHT
BLK
WHT
RED
DIAL
OFF NORMAL
PULSE
SL-GRN
SL-YEL
SL
SWITCH (SEE NOTE 4)
SL-GRN
SL-RED
BLK
TERMINAL BOARD
KEY
BLK
YEL
GRN
RED
MOUNTING CORD (6 CONDUCTOR)
MOUNTING CORD (4 CONDUCTOR)
WHT
BLU
BLK
YEL
GRN
RED
TABLE OF RINGERS
FREQUENCY SELECTIVE (HARMONIC) TYPES
EXTERNAL CONDENSER
CONNECTIONS IN SET.
CY.
MF
RA1 331/3 — 35 SEE NOTE 4
RA2 50 .1 3
RA3 66 2/3 .1 4
RA4 16 2/3 — — 5
RA5 25 — — 5
RB1 30 — — 5
RB2 42 25 — 3
RB3 54 .1 4
RB4 68 .1 4
RB5 15 — — 5
RC1 20 — — 5
RC2 60 .1 4
RC3 30 — — 5
RC4 40 .25 4
RC5 80 .1 4
CIRCUIT SCHEMATIC
KEY
RINGER
LINE 1
LINE 2
SIGNAL CKT.
DIAL PULSE
FILTER
VAR.
SIDE TONE BAL. IMP.
REC.
DIAL OFF NORM.
TRANS.

FIGURE 4.

TELEPHONE SETS

2500**(BA)33M CONNECTIONS

1. GENERAL

1.01 This practice provides the connections for the 2500**(BA)33M type telephone set. This set is a desk type, lift to talk, touch-tone type of telephone instrument. See Figure 1.

FIGURE 1.

2. CONNECTION INDEX

2.01 The following tables and figure provide connection information:

a. Guard Assembly Connections–Table A.

b. Line and Ringer Connections–Table B.

c. 2500**(BA)33M Telephone Set Connections–Figure 2.

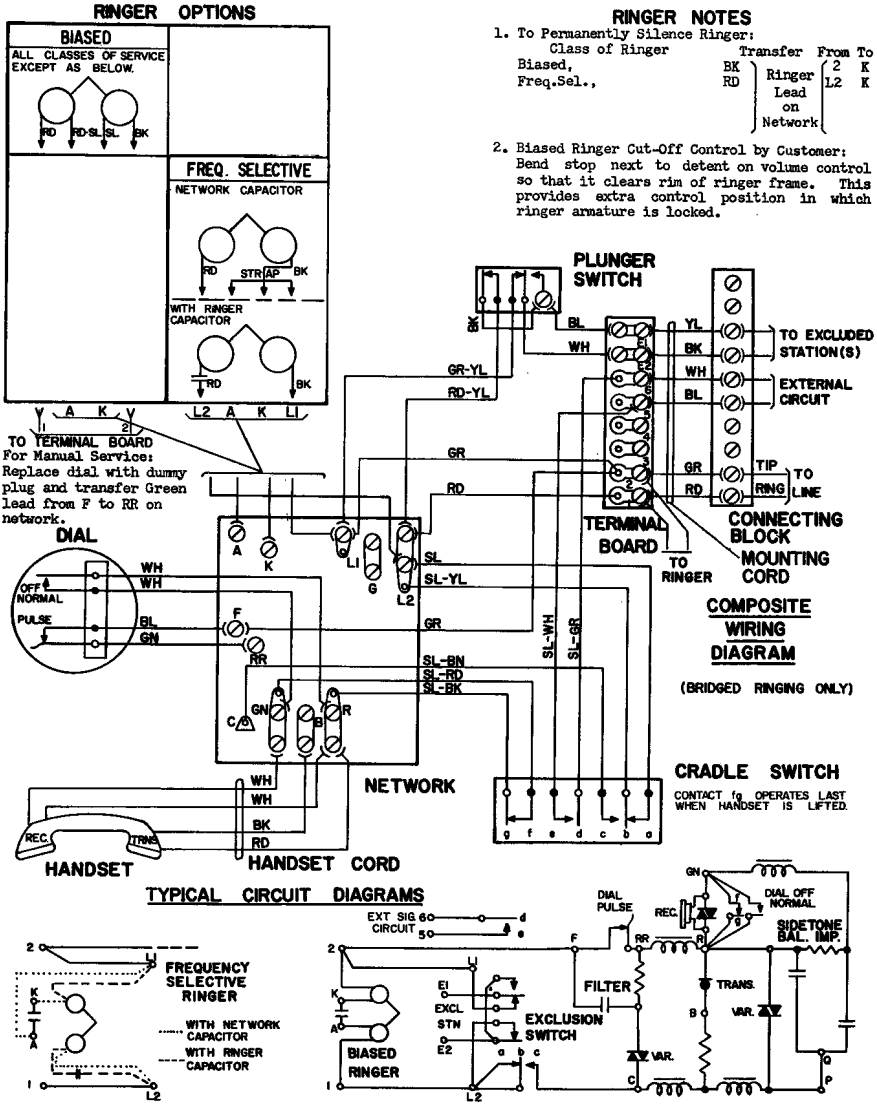


Fig. 2 DIAGRAMS 502–30 TELEPHONE

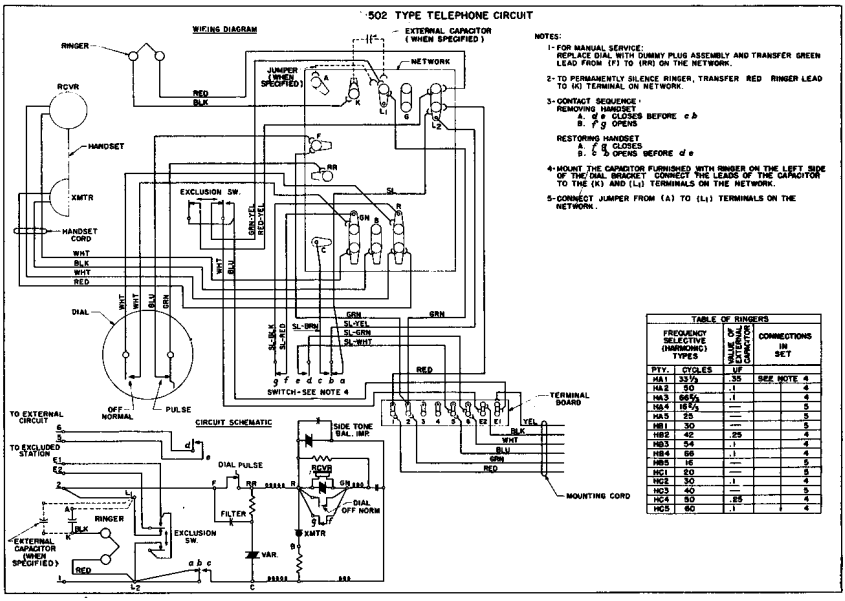


TABLE OF RINGERS

FREQUENCY SELECTIVE (HARMONIC) TYPES		VALUE OF EXTERNAL CAPACITOR	CONNECTIONS IN SET
PTY.	CYCLES	MF	
HA1	33⅓	.35	SEE NOTE 4
HA2	50	.1	4
HA3	66⅔	.1	4
HA4	16⅔	—	5
HA5	25	—	5
HB1	30	—	5
HB2	42	.25	4
HB3	54	.1	4
HB4	66	.1	4
HB5	16	—	5
HC1	20	—	5
HC2	30	.1	4
HC3	40	—	5
HC4	50	.25	4
HC5	60	.1	4

TELEPHONE SETS

2502**(BA)30M CONNECTIONS

1. GENERAL

1.01 This practice provides the connections for the 2502**(BA)30M telephone set. This set is a desk type, touch-tone instrument equipped with an exclusion switch. See Figure 1.

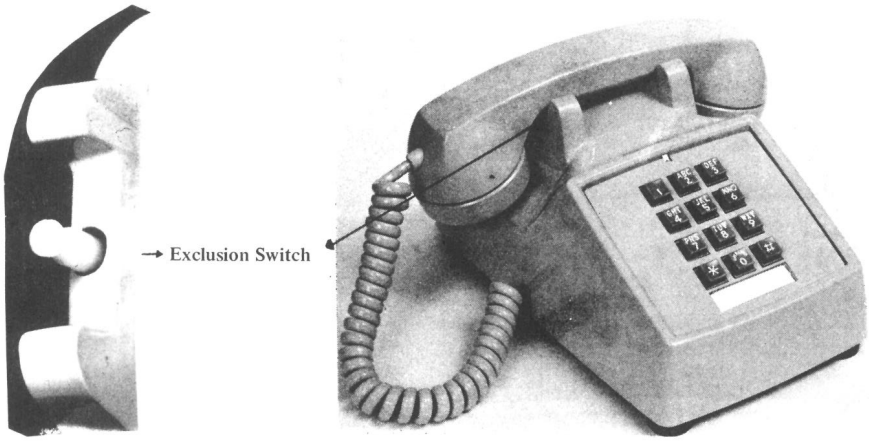


FIGURE 1. The Left Hand Cradle Plunger Serves as the Exclusion Switch

2. CONNECTION INDEX

2.01 The following table and figure provide connection information:

a. Polarity Guard Connections–Table A.

b. 2502**(BA)30M Telephone Set, Connections–Figure 2.

TABLE A

POLARITY GUARD CONNECTIONS

COMPONENT	LEAD	REMOVE FROM	CONNECT TO
Line Switch	W	C (Net.)	S*
Dial	BK	RR (Net.)	T*
Polarity Guard	W		C (Net.)
	G		RR (Net.)

* Terminal on polarity guard

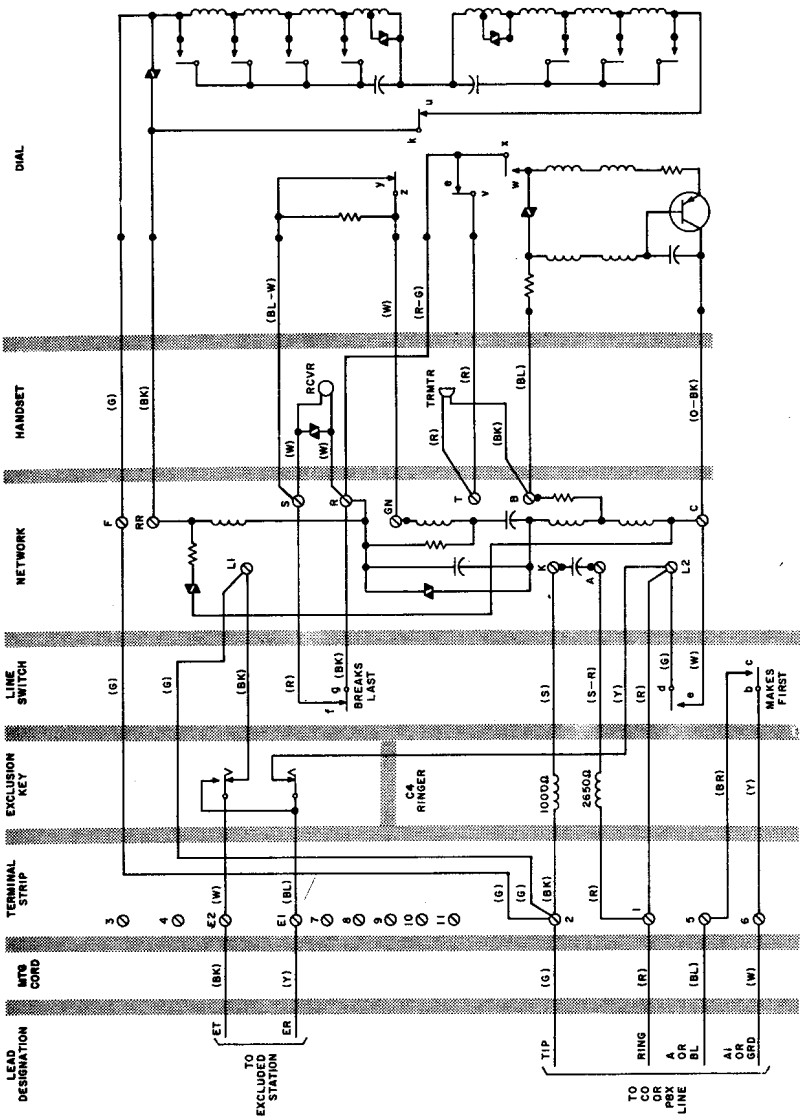


FIGURE 2. 2502**(BA)30M Telephone Set, Connections

TELEPHONE SETS

2510**(BA)30M CONNECTIONS

1. GENERAL

1.01 This practice provides the connections for the 2510**(BA)30M telephone set. This set is a desk type instrument, touch-tone dial equipped for 2 line pickup and signaling. See Figure 1.

FIGURE 1.

2. CONNECTION INDEX

2.01 The following tables and figures provide connection information:

a. Polarity Guard Connections–Table A.

b. Line and Ringer Connections–Table B.

c. 2510**(BA)30M Telephone Set, 2 Line Pickup and Signaling–Figure 2.

d. 2510**(BA)30M Telephone Set, 1 Line Pickup, Cutoff Extension Station or Extension Line Ringer–Figure 3.

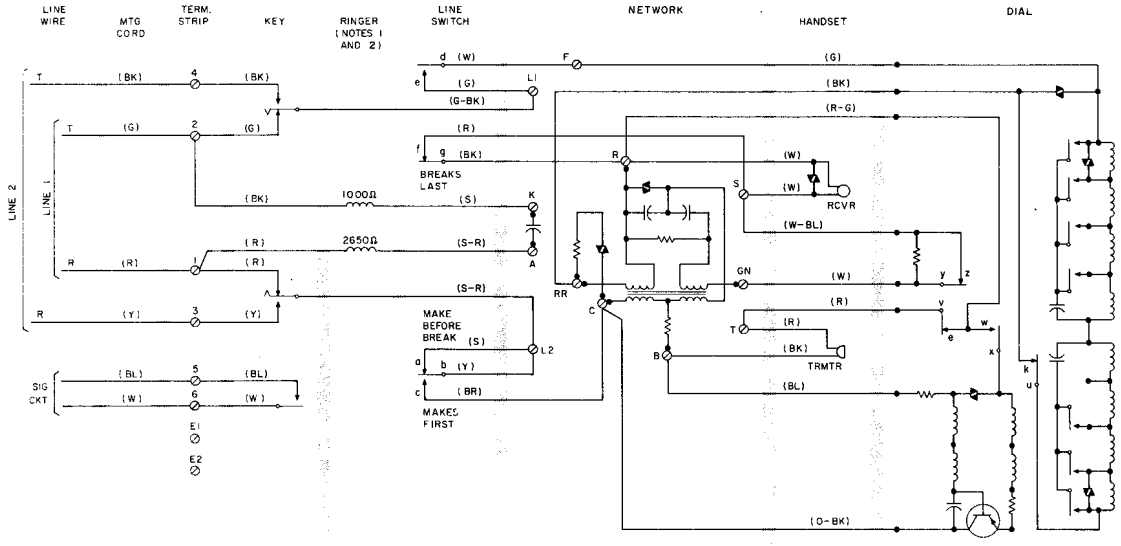
TABLE A
POLARITY GUARD CONNECTIONS

COMPONENT	LEAD	REMOVE FROM	CONNECT TO
Line Switch	BR	C (Net.)	S*
Dial	BK	RR (Net.)	T*
Polarity Guard	W		C (Net.)
	G		RR (Net.)

* Terminals on polarity guard

TABLE B
LINE AND RINGER CONNECTIONS

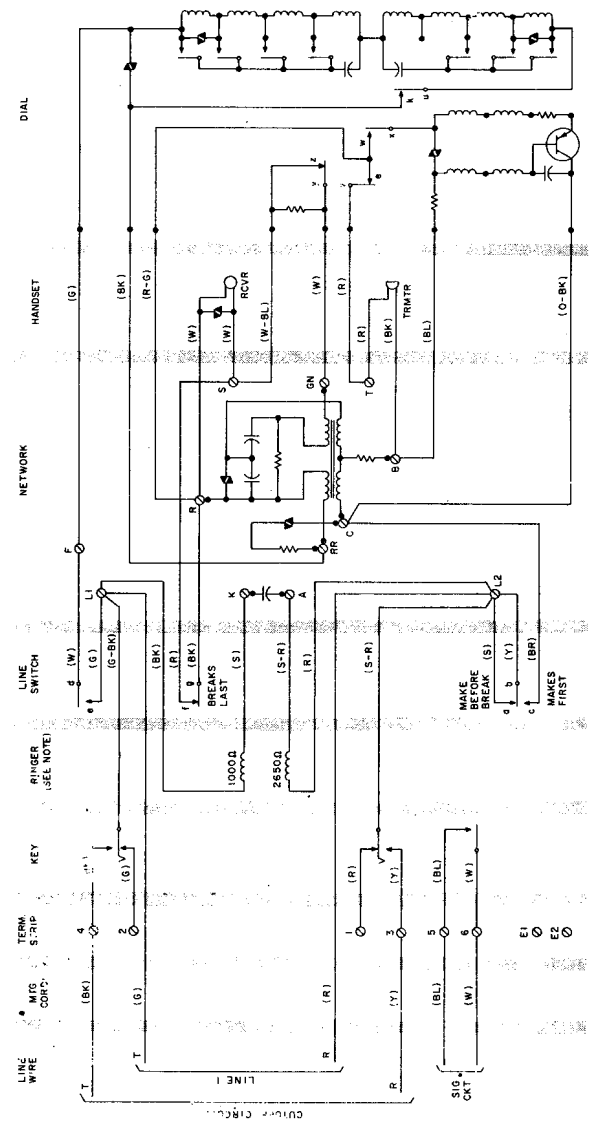
FEATURES							CONNECTIONS TO TERMINALS INSIDE SET												EXTERNAL CONNECTIONS FOR MOUNTING CORD									
NUMBER OF LINES PICKED UP	SIGNALING	RINGER IN SET USED AS		TURNKEY USED IN CUT OFF			MOUNTING CORD LEADS						TURN-KEY LEADS		RINGER LEADS NOTES 1 AND 2 FIG. 1				LINE 1		LINE 2		SIGNAL CIRCUIT		CUTOFF CIRCUIT		COM OR PVT LINE RINGER CIRCUIT	
		LINE RINGER	COM OR PVT LINE RINGER	EXT STA OR EXT LINE RINGER	RINGER IN SET	AUX RCVR	R	G	Y	BK	BL	W	S-R	G-BK	R	BK	S	S-R	RING	TIP	RING	TIP	S	GRD	RING	TIP	R	B
1	•	•		•			L2	L1	3	4	5	6	L2	L1	L2	L1	K	A	R	G			BL	W	Y	BK		
1	•	•		•	•		L2	L1	3	4	5	6	L2	L1	1	2	K	A	R	G			BL	W	Y	BK		
1	•	•				•	L2	L1	3	4	5	6	G	R	L2	L1	K	A	R	G			BL	W	Y	BK		
2	•	•					1	2	3	4	5	6	L2	L1	1	2	K	A	R	G	Y	BK	BL	W				
2			•				1	2	3	4	E1	E2	L2	L1	E1	E2	A	A	R	G	Y	BK					BL	W



NOTES:

1. CONNECTIONS SHOWN ARE FOR RINGING ON LINE 1. TO RING ON LINE 2, MOVE (R) AND (BK) RINGER LEADS TO TERMINALS 3 AND 4. TO SILENCE RINGER, CONNECT (BK) TO K TERMINAL.
2. WHERE COMMON OR PRIVATE LINE RINGER IS REQUIRED, CONNECT:
   - (BL) AND (W) CORD LEADS TO E1 AND E2
   - (R) AND (BK) RINGER LEADS TO E1 AND E2
   - (S-R) RINGER LEAD TO K

FIGURE 2. 2510(BA) 30M Telephone Set, 2 Line Pickup and Signaling**



NOTE:
WHERE COMMON OR PRIVATE LINE RINGER IS REQUIRED, CONNECT:
(BL) AND (W) CORD LEADS TO E1 AND E2.
(R) AND (BK) RINGER LEADS TO E1 AND E2.
(S-R) RINGER LEAD TO K.

FIGURE 3. 2510(BA) 30M Telephone Set, 1 Line Pickup, Cutoff Extension Station or Extension Line Ringer**

TELEPHONE SETS

TYPE 2511 CONNECTIONS

1. GENERAL

1.01 This practice provides the connections for the type 2511 telephone sets. This set is a desk type instrument, equipped with a touchtone dial and 2 line pickup with exclusion features.

1.02 The two types of the 2511 (F or H) are identical except that one (F) is equipped with a D20J mounting cord (spade tipped conductors) and the other (H) is equipped with a D20K mounting cord (plug-ended).

2. CONNECTION INDEX

2.01 The following tables and figures provide connection information:

a. Guard Assembly Connections–Table A.

b. Wiring Changes to Provide 1 Line Pickup, Cutoff Extension Station or Extension Line Ringer–Table B.

c. Wiring Changes to Provide 2 Line Pickup, Hold on Line 1, and Signaling (Used Without 1A1 or 1A2 KTS)–Table C.

d. Wiring Changes to Provide 1 Line Pickup, Hold, and Secretarial Service–Table D.

e. 2511F/H Telephone Set Connections, 2 Line Pickup With Exclusion on Line 1, Signaling, and 3 Type Speakerphone (Factory Wired)–Figure 1.

f. 2511F/H Telephone Set Connections, 2 Line Pickup With Exclusion on Line 1, Signaling, Wired for 1A1 and 1A2 Key Telephone Systems–Figure 2.

g. 2511F/H Telephone Set Connections, 1 Line Pickup, Cutoff Extension Station or Extension Line Ringer–Figure 3.

h. 2511F/H Telephone Set Connections, 2 Line Pickup, Hold on Line 1 and Signaling (Used Without 1A1 or 1A2 Key Telephone Systems)–Figure 4.

i. 2511F/H Telephone Set Connections, 1 Line Pickup, Hold and Secretarial Service–Figure 5.

3. POLARITY GUARD

3.01 Polarity guards should be installed only when instructed by local administrative procedures for end-to-end signaling purposes where battery/ground reversals are encountered.

a. When a polarity guard is required, order separately as a P-90D052 guard assembly.

b. Refer to paragraph 4 for installation information.

c. Connect in accordance with Table A.

TABLE A

Guard Assembly Connections

WIRE OR LEAD		REMOVE FROM	CONNECT TO	
		NETWORK	GUARD ASSEMBLY	NETWORK
Dial	BK	RR	T	
	G-W	C	S	
Line Switch	W	C	S	
Guard Assembly	G			RR
	W			C

4. POLARITY GUARD INSTALLATION

4.01 To install polarity guard assembly in desk type sets:

a. Remove set housing and loosen right-hand dial mounting screw.

b. Mount guard assembly to the dial upright with the component side of the board oriented to the rear of the set. The bracket is placed under the dial mounting screw with its lip over the top of the dial upright.

c. Tighten dial mounting screw.

d. Connect polarity guard in accordance with the appropriate connection practice.

e. Replace set housing.

4.02 To install polarity guard assembly in wall type sets:

a. Remove set housing. If set is mounted on wall surface, remove set to gain access to rear of baseplate.

b. Remove dial but do not disconnect dial leads.

c. From the rear of the baseplate, place two screws through the holes located below the ringer resonator. Place the guard assembly terminal board over the screws with its components facing the front of the set. Secure using two hex nuts furnished with the guard assembly.

d. Connect polarity guard in accordance with the appropriate connection practice.

e. Replace dial.

f. Replace set (if removed from wall) and replace housing.

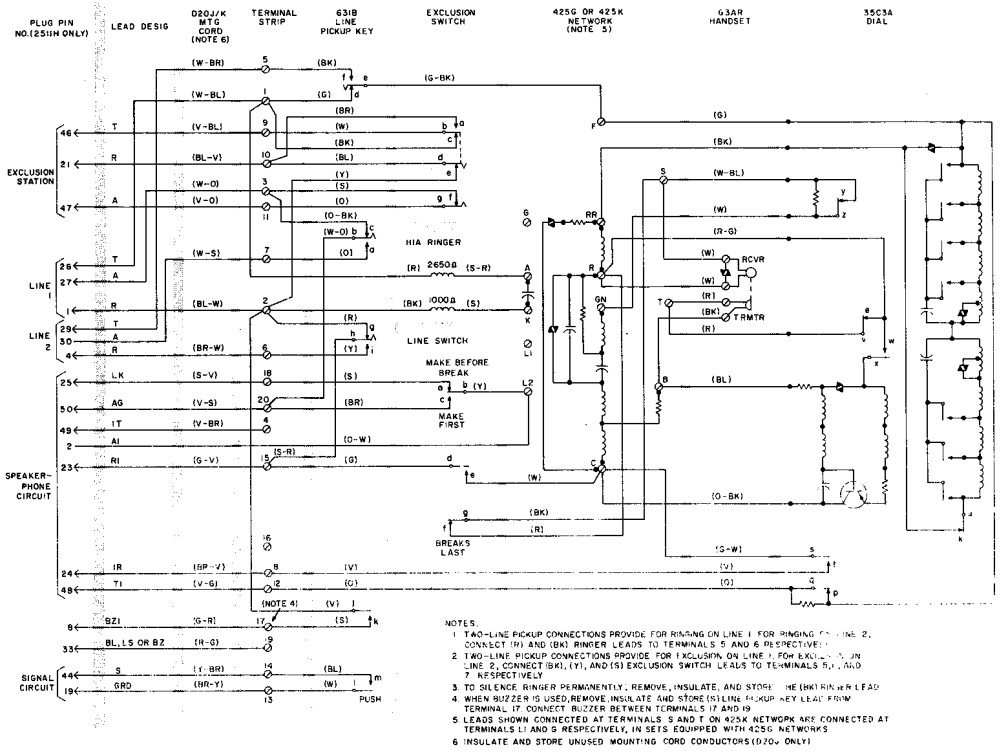


FIGURE 1. 2511F/H Telephone Set Connections, 2 Line Pickup With Exclusion on Line 1, Signaling, and 3 Type Speakerphone (Factory Wired)

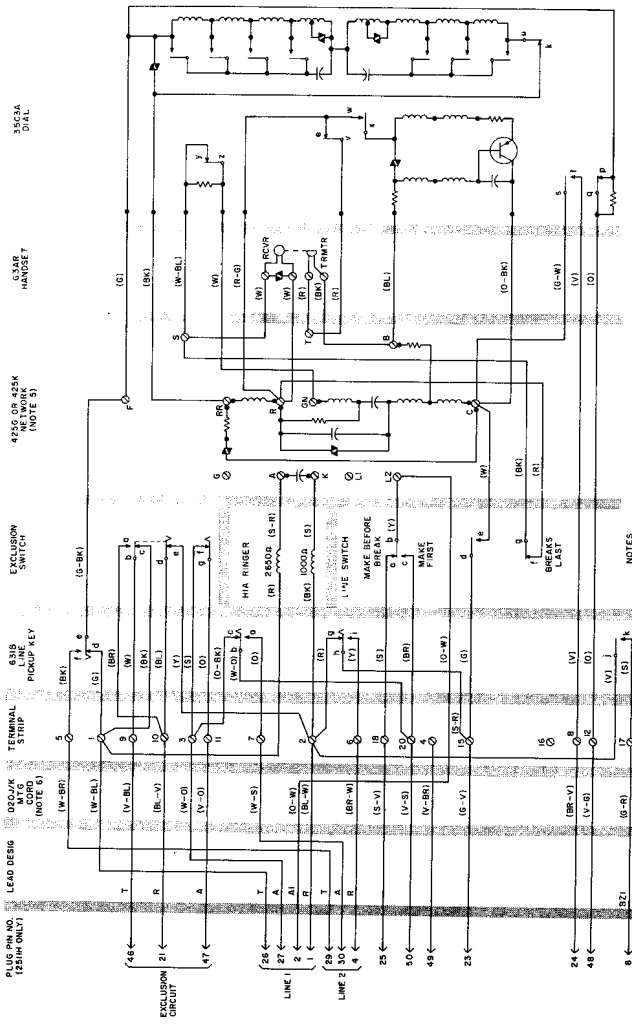


FIGURE 2. 2511F/H Telephone Set Connections, 2 Line Pickup With Exclusion on Line 1, Signaling, Wired For 1A1 and 1A2 Key Telephone Systems

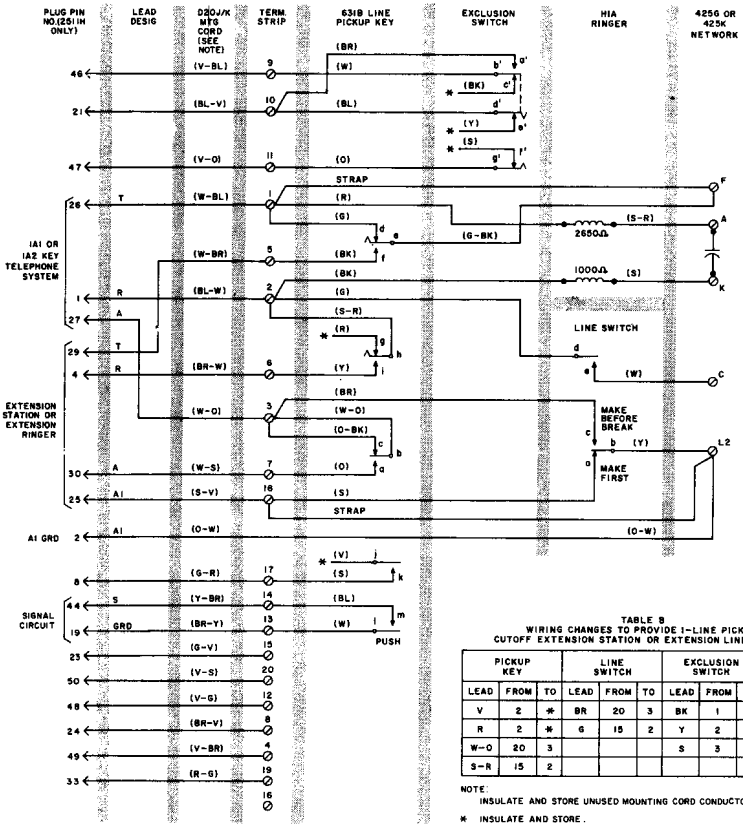


TABLE B
WIRING CHANGES TO PROVIDE 1-LINE PICKUP, CUTOFF EXTENSION STATION OR EXTENSION LINE RINGER

PICKUP KEY			LINE SWITCH			EXCLUSION SWITCH			MIW STRAP	
LEAD	FROM	TO	LEAD	FROM	TO	LEAD	FROM	TO	FROM	TO
V	2	*	BR	20	3	BK	1	*	1	F
R	2	*	G	15	2	Y	2	*	18	L2
W-O	20	3				S	3	*		
S-R	15	2								

NOTE:
INSULATE AND STORE UNUSED MOUNTING CORD CONDUCTORS (D20J ONLY)
* INSULATE AND STORE.

FIGURE 3. 2511F/H Telephone Set Connections, 1 Line Pickup, Cutoff Extension Station or Extension Line Ringer

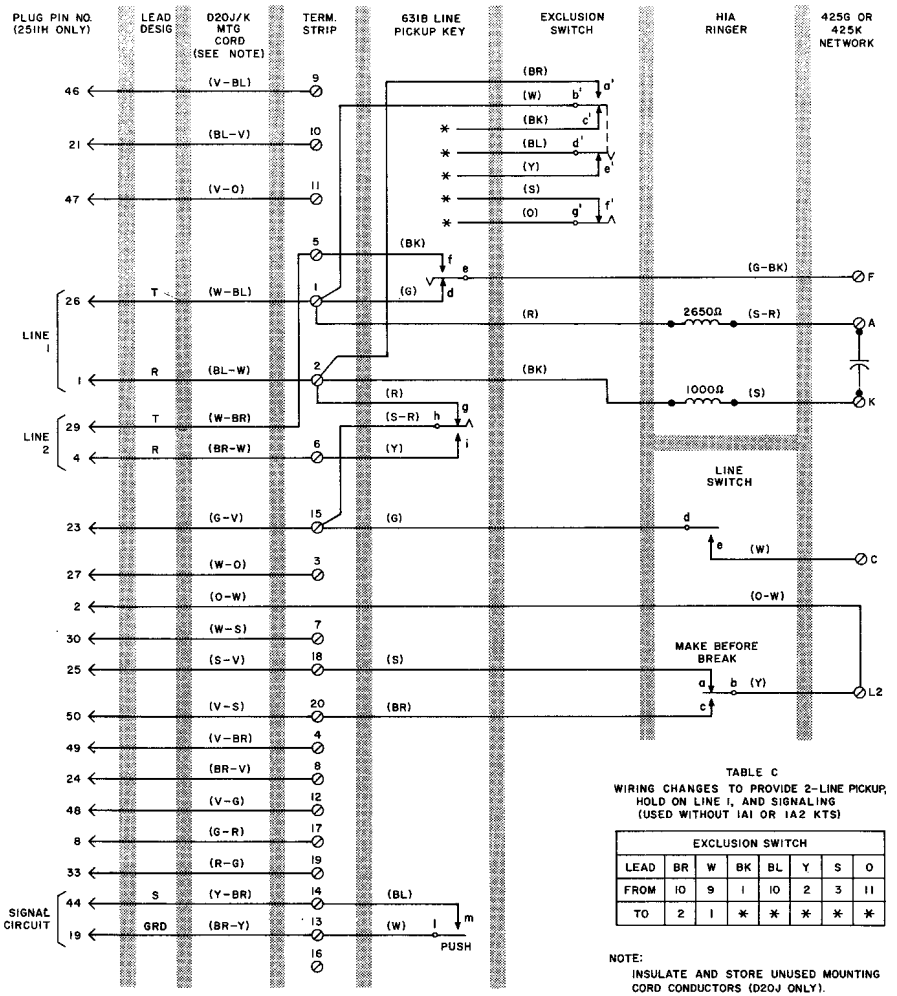


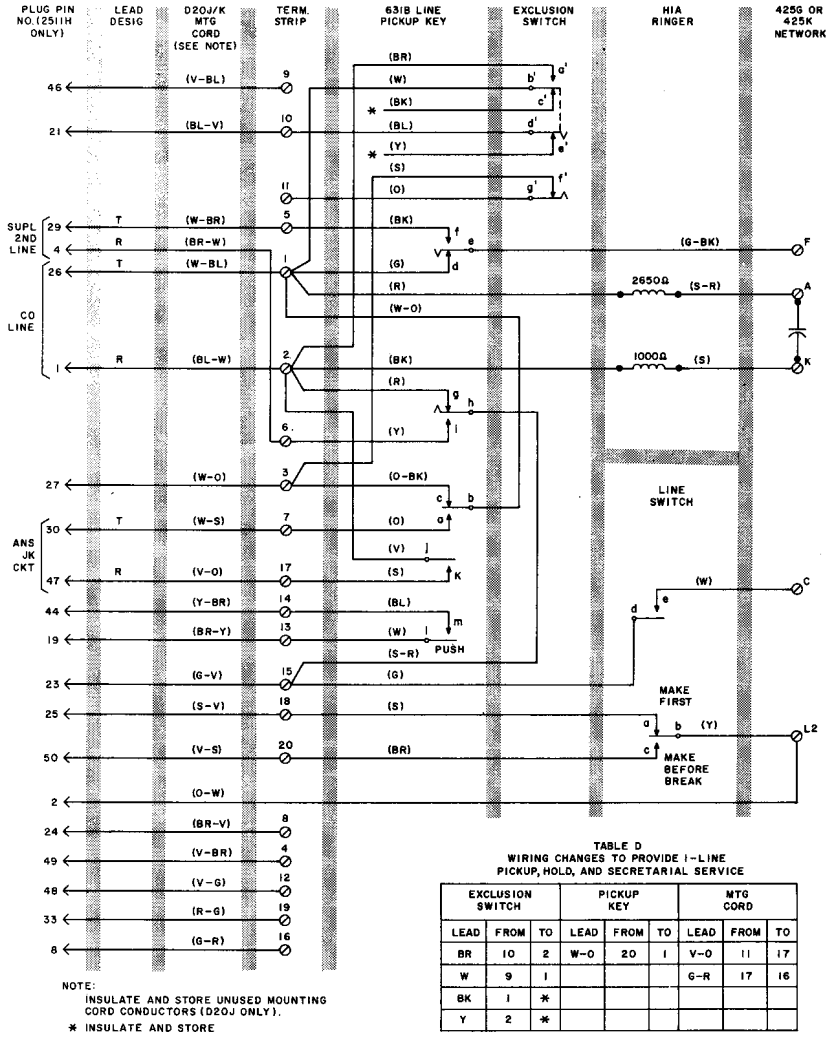
TABLE C
WIRING CHANGES TO PROVIDE 2-LINE PICKUP, HOLD ON LINE 1, AND SIGNALING (USED WITHOUT 1A1 OR 1A2 KTS)

EXCLUSION SWITCH							
LEAD	BR	W	BK	BL	Y	S	O
FROM	10	9	1	10	2	3	11
TO	2	1	*	*	*	*	*

NOTE:
INSULATE AND STORE UNUSED MOUNTING CORD CONDUCTORS (D20J ONLY).

* INSULATE AND STORE

FIGURE 4. 2511F/H Telephone Set Connections, 2 Line Pickup, Hold on Line 1, and Signaling (Used Without 1A1 or 1A2 Key Telephone Systems)



NOTE:
INSULATE AND STORE UNUSED MOUNTING CORD CONDUCTORS (D20J ONLY).
* INSULATE AND STORE

TABLE D
WIRING CHANGES TO PROVIDE 1-LINE PICKUP, HOLD, AND SECRETARIAL SERVICE

EXCLUSION SWITCH			PICKUP KEY			MTG CORD		
LEAD	FROM	TO	LEAD	FROM	TO	LEAD	FROM	TO
BR	10	2	W-O	20	1	V-O	11	17
W	9	1				G-R	17	16
BK	1	*						
Y	2	*						

FIGURE 5. 2511F/H Telephone Set Connections, 1 Line Pickup, Hold, and Secretarial Service

TELEPHONE SETS

2554**(BA)30M CONNECTIONS

1. GENERAL

1.01 This practice provides the connections for the 2554**(BA)30M type telephone set. This set is a standard wall type touch-tone instrument equipped with a straight line ringer. (See Figure 1).

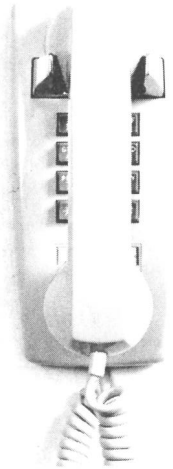


FIGURE 1.

2. CONNECTION INDEX

2.01 The following tables and figures provide connection information:

a. Guard Assembly Connections–Table A.

b. Line and Ringer Connections–Table B.

c. Modification For Use With 1A1 or 1A2 Key Telephone System Line–Table C.

d. 2554**(BA)30M Telephone Set, Connections (Factory Wired)–Figure 2.

e. 2554**(BA)30M Telephone Set, Connections For 1A1 or 1A2 Key Telephone Systems–Figure 3.

TABLE A
GUARD ASSEMBLY CONNECTIONS

WIRE OR LEAD		REMOVE FROM	CONNECT TO
Dial	(BK)	RR net.	T of guard assembly
Line Switch	(BR)* (BL)†	C net.	S of guard assembly
M1W Cord‡			
Guard Assembly	(G)		Term. RR net.
	(W)		Term. C net.

NOTE: For use when specified by local instructions for end-to-end signaling installation.

* Factory-wired telephone set.

† Set wired for 1A1 or 1A2 KTS.

‡ Set not equipped with j-k line switch contacts and associated (O) and (BL) leads.

TABLE B
LINE AND RINGER CONNECTIONS

WIRE OR LEAD			INDIV. OR BRIDGED	RING PARTY	TIP PARTY		
					NO IDENT. GROUND	IDENT. GRD.	
						1000Ω	2650Ω
Inside Wire	Tip	(G)	1	1	2	2	2
	Ring	(R)	2	2	1	1	1
	Grd	(Y)		3	3	3	3
Ringer Leads		(BK)	1	3	3	3	3
		(BL)	*	*	*	*	*
		(S)	*	*	*	B	*
		(S-R)	*	*	*	*	B
		(R)	K	K	K	K	K
Line Switch		(W)	F	F	C	C	C
		(S)	A	A	A	A	A
		(BR)	C	C	F	F	F

* Insulate and store.

NOTES: To silence ringer permanently:

1. For all classes except identification ground insulate and store (BK) ringer lead.
2. For tip party with 1000Ω or 2650Ω identification ground remove, insulate, and store the (R) ringer lead at K of the network.

TABLE C
MODIFICATION FOR USE WITH 1A1 OR 1A2 KEY TELEPHONE SYSTEM LINE

WIRE OR LEAD		REMOVE FROM		CONNECT TO			INSULATE AND STORE
		TERM. STRIP	NET.	TERM. STRIP		NET.	
Line Switch	(S)		A				•
	(Y)	2				L2	
	(O)*		L2	2			
	(BR)		C	3			
	(BL)*		L2			C	
Place M1W Cord or Strap				2 ◄——► A			
P1A Ringer	(R)		K	R1	Ring lead using D-161488† connector		
	(BK)	1		B1			
Inside Wire	(G) Tip			1			
	(R) Ring			2			
	(BK) A					L2	
	(Y) A1			3			
	R1			(R)	Ringer lead using D-161488† connector		
	B1			(BK)			

* Connect these leads as shown in sets equipped with j-k line switch contacts, otherwise connect M1W cord from terminal 2 to C of network.

† See Note 2, Figure 3.

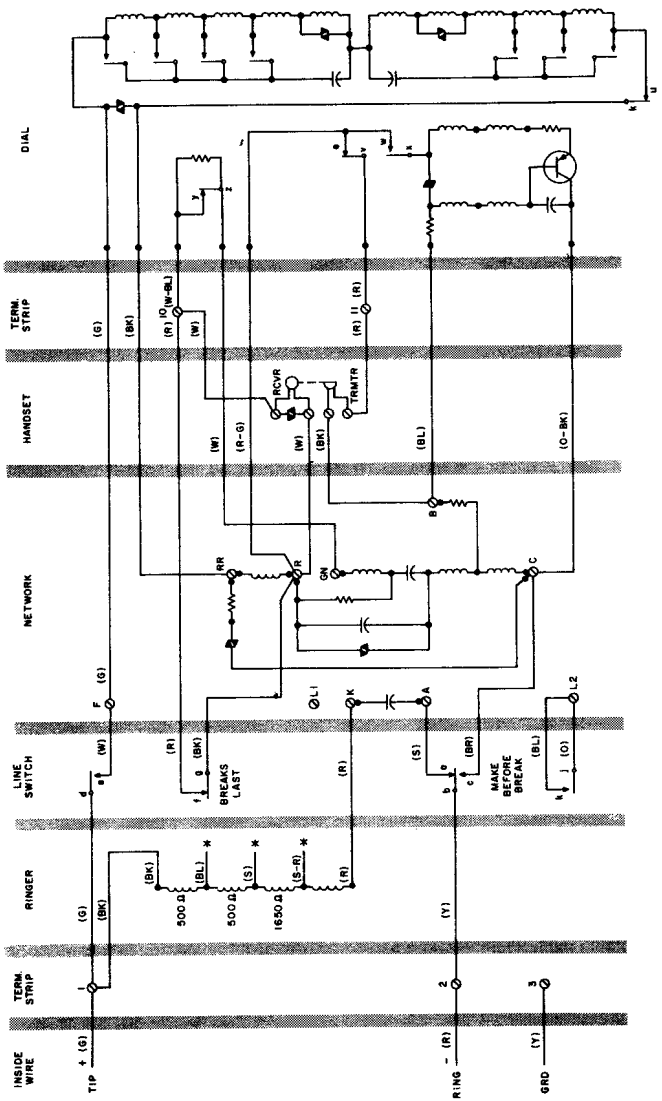


FIGURE 2. 2554**(BA) 30M Telephone Set, Connections

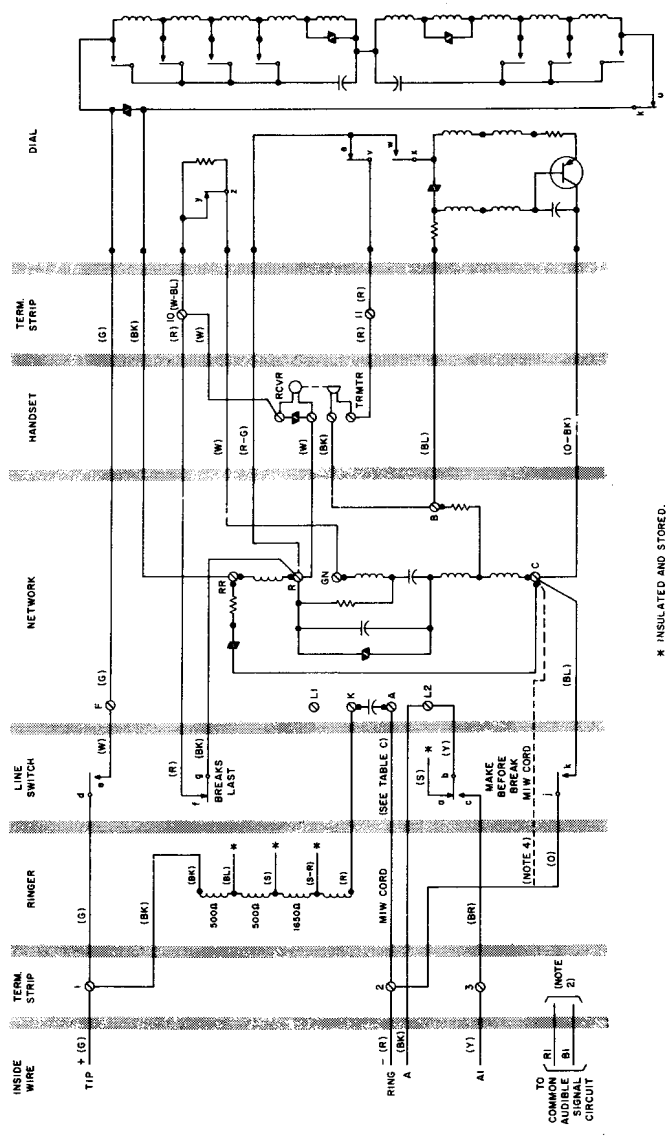


FIGURE 3. 2554**(BA) 30M Telephone Set, Connections for 1A1 or 1A2 Key Telephone Systems

TELEPHONE SETS–2558 CONNECTIONS

1. GENERAL

1.01 This practice provides the connections for the 2558 type telephone set. This set is a wall type instrument, tone dial equipped for 2 line pickup.

2. CONNECTION INDEX

2.01 The following tables and figures provide connection information:

a. P-90D053 Guard Assembly Connections–Table A.

b. Wiring Changes to Provide 1 Line Pickup, Cutoff Extension Station or Extension Ringer–Table B.

c. Wiring Changes to Provide 2 Line Pickup, Hold on Line 1, Nonkey System Use–Table C.

d. Wiring Changes to Provide Secretarial Service With Hold–Table D.

e. 2558 Telephone Set Connections, 2 Line Pickup With Exclusion on Line 1, Signaling, Wired for 1A1 and 1A2 Key Telephone Systems–Figure 1.

f. 2558 Telephone Set Connections, 1 Line Pickup, Cutoff Extension Station or Extension Line Ringer–Figure 2.

g. 2558 Telephone Set Connections, 2 Line Pickup, Hold on Line 1, Nonkey System Use–Figure 3.

h. 2558 Telephone Set Connections for Secretarial Service With Hold–Figure 4.

TABLE A

P-90D053 Guard Assembly Connections

WIRE OR LEAD		REMOVE FROM	CONNECT TO
Dial	(BK)	RR Net.	T of Guard Assembly
Line Switch	(W)	C Net.	S of Guard Assembly
Guard Assembly	(G)		Ter. RR Net.
	(W)		Ter. C Net.

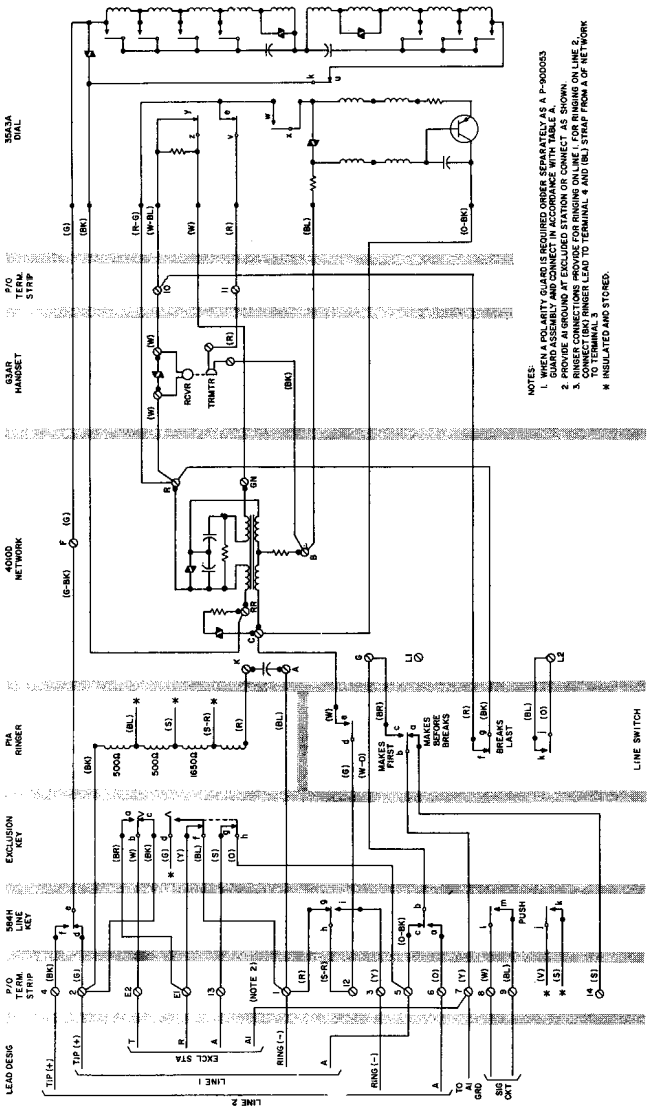


FIGURE 1. 2558 Telephone Set Connections, 2 Line Pickup With Exclusion on Line 1, Signaling, Wired for 1A1 or 1A2 Key Telephone Systems

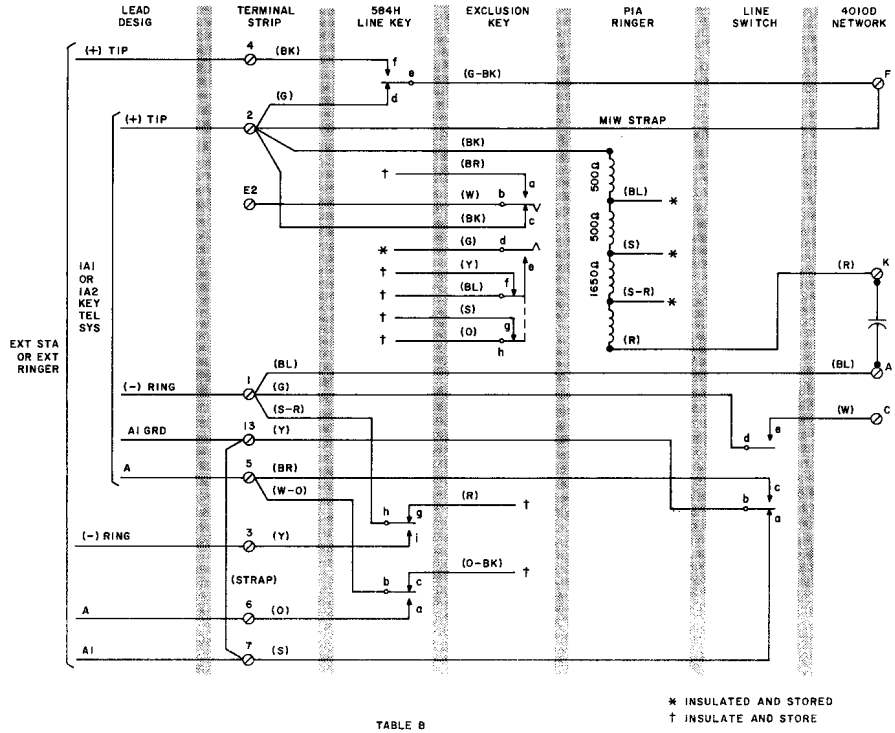


TABLE 8
WIRING CHANGES TO PROVIDE 1-LINE PICKUP, CUTOFF EXTENSION STATION OR EXTENSION RINGER

584H LINE KEY			EXCLUSION KEY			LINE SWITCH		
LEAD	FROM	TO	LEAD	FROM	TO	LEAD	FROM	TO
(R)	1	†	(BR)	E1	†	(G)	12	1
(S-R)	12	1	(Y)	E1	†	(Y)	7	13
(O-BK)	5	†	(BL)	1	†	(S)	14	7
(W-O)	G	5	(S)	13	†	(BR)	G	5
			(O)	5	†			
STRAP 7 TO 13 ON TERMINAL STRIP STRAP F OF NETWORK TO 2 ON TERMINAL STRIP								

FIGURE 2. 2558 Telephone Set Connections, 1 Line Pickup, Cutoff Extension Station or Extension Line Ringer

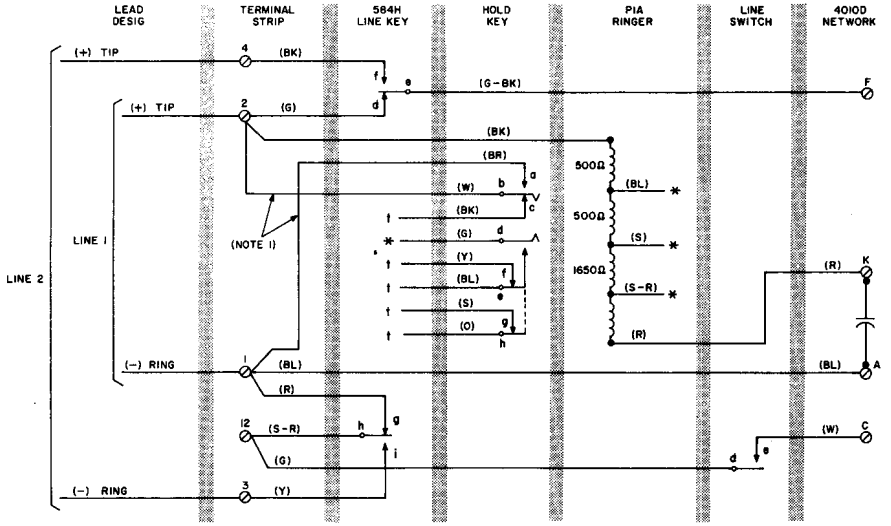


TABLE C
WIRING CHANGES TO PROVIDE 2-LINE PICKUP HOLD ON LINE 1, NON-KEY SYSTEM USE

	HOLD KEY (EXCLUSION KEY)						
LEAD	(BK)	(W)	(BR)	(Y)	(BL)	(S)	(O)
FROM	2	E2	E1	E1	1	13	5
TO	†	2	1	†	†	†	†

NOTES:
1. HOLD IS ON LINE 1: TO HOLD ON LINE 2, MOVE (W) AND (BR) HOLD KEY LEADS TO TERMS. 3 AND 4 RESPECTIVELY.
2. RINGER CONNECTIONS PROVIDE FOR RINGING ON LINE 1. FOR RINGING ON LINE 2, CONNECT (BK) RINGER LEAD TO TERM. 4 AND (BL) STRAP FROM A OF NETWORK TO TERM. 3.

* INSULATED AND STORED.
† INSULATE AND STORE.

FIGURE 3. 2558 Telephone Set Connections, 2 Line Pickup, Hold on Line 1, Nonkey System Use

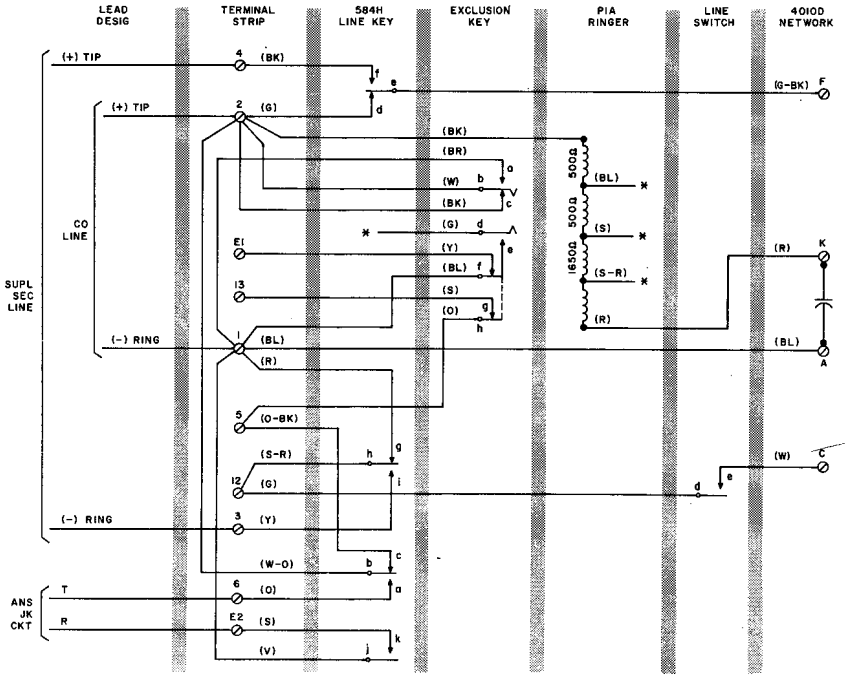


TABLE D
WIRING CHANGES TO PROVIDE SECRETARIAL SERVICE WITH HOLD

584H LINE KEY			EXCLUSION KEY		
LEAD	FROM	TO	LEAD	FROM	TO
(W-O)	G	2	(W)	E2	2
(S)	*	E2	(BR)	E1	1
(V)	*	1			

* INSULATED AND STORED.

FIGURE 4. 2558 Telephone Set Connections for Secretarial Service With Hold

700 SERIES DESK TYPE TELEPHONES

1. GENERAL

1.01 This practice presents a description of the 700 series of desk telephones. The 700 series provides a group of compact, anti-sidetone type desk telephones which operate efficiently over a wide range of loop resistance and line impedance. The instruments are intended for use in special locations, such as bedrooms, or where desk space is at a premium. Each instrument consists of an oval pressed aluminum baseplate, with a non-skid rubber mat underneath, on which all internal parts are mounted. A molded plastic housing covers the assembly and provides a cradle for the handset, which is connected to the internal components by a flexible plastic covered cord (See Figure 1). A second plastic covered cord connects the instrument to a molded terminal block or wall-mounted ringer unit. *A separate ringer unit must always be fitted with these instruments,* except when they are used as extension units, as the extremely compact design does not include an internal ringer.

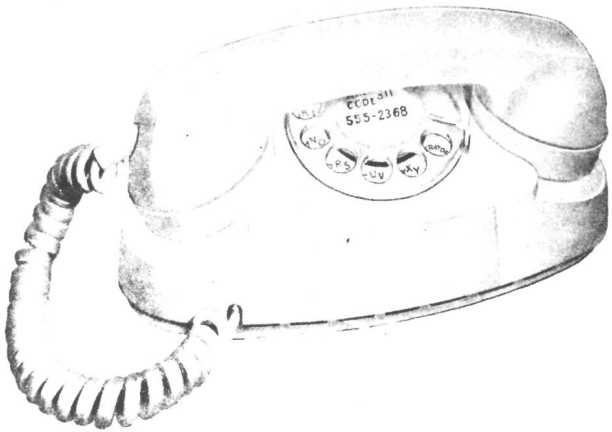


FIGURE 1 — 700-Type Telephone Set

1.02 The 700 telephone instrument is available for use on any class of service on any type of automatic or manual telephone system. It may be connected to its associated ringer to provide all necessary circuitry. Some special features may be provided with the instrument: specific details for each combination are given in individual C.T.S. practices.

1.03 Although any of the ringer units (Figure 2) may be used with the 700 telephone, specific types have been designed with the requirements of this series of telephones in view. Each of these ringers provides adequate terminal block facilities for the external circuits of the instruments.

1.04 Instruments in the 700 series can be supplied in various colors.

2. TYPE 701 (LR) 30 DESK TYPE TELEPHONE

2.01 The *701 (LR) 30 desk telephone* is a very compact desk type of instrument with a built-in combination dial and night light which illuminates the numeral ring. A switch, at the rear, may be set so that the light glows dimly or is off when the handset is in the cradle. With the

switch in either position the light glows brightly when the handset is lifted. A separate power source of 6-8 volts ac or dc at a current of about 1/4 amp. is required to supply the lamp. *A specially designed transformer, is available for use on 110V ac power circuits.*

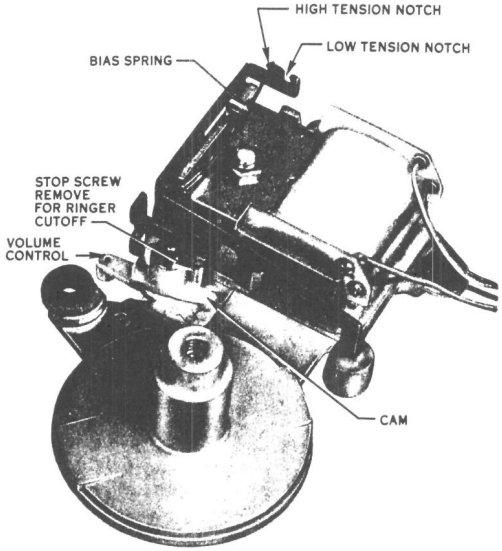


FIGURE 2 – M1A Ringer, Gong and Resonator Removed

3. TYPE 701 (LR) 37, 701 (LR) 38 TELEPHONES

3.01 The *701 (LR) 37 and 701 (LR) 38 telephone sets* are very compact desk types of instruments with built-in combination dial and night lights, which illuminate the numeral rings, and separate indicator lamps. A small neon lamp, located in front of the handset, may be caused to glow by applying a dc potential of 90 volts across the line conductors at a remote point. The instruments are intended for use on PBX installations where the glowing lamp is used to indicate that a message has been left at the switchboard in the absence of the called party.

3.02 A switch at the rear of the instrument may be set so that the dial light glows dimly, for use as a night light, or is off when the handset is on the cradle. With the switch in either position the light glows brightly when the handset is lifted. A separate power source of 6-8 volts ac or dc at a current of about 1/4 amp. is required to supply the dial lamp. *A specially designed transformer is available for use on 110V ac power circuits.*

3.03 The 701 (LR) 37 instrument is provided with a 1/5 watt neon indicator lamp while the 701 (LR) 38 is provided with a lower power 1/15 watt indicator lamp. *The lamps must not be interchanged as the sockets have different built-in series resistors.*

3.04 The installed telephone must be provided with a separately mounted, external ringer. See CSP 480-100-402 for wiring diagram.

4. TYPE 703 (LR) 30 DESK TYPE TELEPHONE

4.01 The *703 (LR) 30 set* is a very compact desk type of instrument. It is identical with the type 701 (LR) 30 telephone except that the built-in combination dial light/night light is omitted.

4.02 The installed telephone must be provided with a separately mounted external ringer. See CSP 480-110-403 for ringer wiring diagram.

4.03 The transmission circuit for the 701 and 703 type telephone sets is equivalent to the 500 type telephone set.

5. TYPE 703 (LR) 37, 703 (LR) 38 TELEPHONE SETS

5.01 The *703 (LR) 37 and 703 (LR) 38 telephones* are very compact desk types of instruments with the addition of indicator lamps. A small neon lamp, located in front of the handset, may be caused to glow by applying a dc potential of 90 volts across the line at a remote point. The instruments are intended for use on PBX installations where the glowing lamp is used to indicate that a message has been left at the switchboard in the absence of the called party. (See Figure 3).

5.02 The 703 (LR) 37 instrument is provided with a 1/5 watt neon indicator lamp while the 703 (LR) 38 is provided with a lower power 1/15 watt indicator lamp. *The lamps must not be interchanged as the sockets have different built-in series resistors.*

5.03 The installed telephone must be provided with a separately mounted external ringer. See CSP 480-110-404 for ringer wiring diagram.

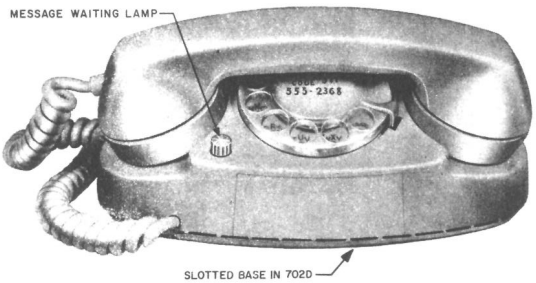


FIGURE 3 — 701D and 702D Telephone Sets Equipped With Message Waiting Lamp

6. NETWORK

6.01 The type 190107 network assembly provides all the components necessary to connect and match the impedance of the handset transmitter and receiver units to a two wire telephone circuit.

6.02 The unit incorporates radio frequency filter and side tone balancing circuits in addition to the impedance matching components.

6.03 All the components are mounted to the underside of the molded terminal board, which is clipped to the sealing compound filled mounting container.

7. CIRCUIT DESCRIPTION

7.01 The circuit is shown in Figure 4, the dash lines show typical connections to other components of a complete telephone instrument. The features of the circuit are briefly discussed in the following paragraphs.

a. The basic network design provides an increase in transmission characteristics of some 10 db over previous circuits. It has therefore been possible to include the two shunt elements in the circuit to produce increased losses on short loops and yet have negligible effect on long loops, the varistor effective resistances changing inversely to the current flowing through them.

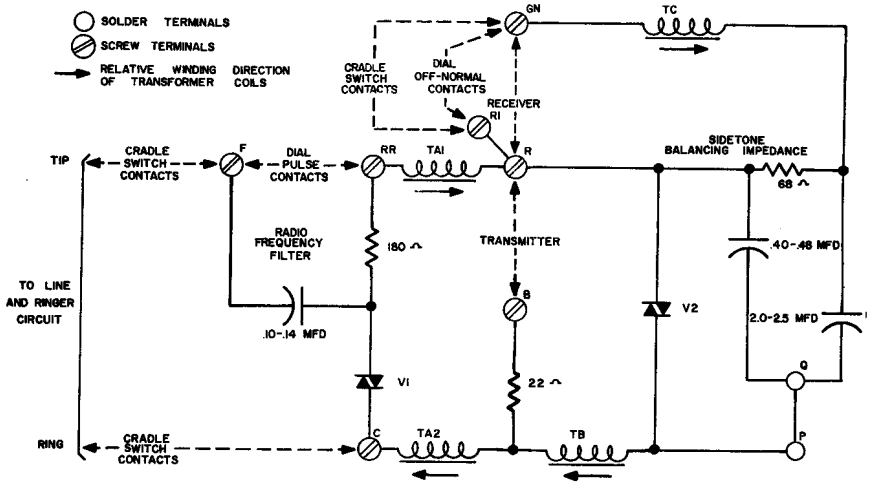


FIGURE 4 CIRCUIT DIAGRAM

b. The direction of winding of the four coils of the transformer is indicated by arrows in Figure 4. Received speech currents pass via windings. TA_1, TB and TA_2, each of which produces and additive voltage in winding TC. The received currents also produce a voltage across the 68Ω resistor that opposes and is almost equal to that produced by the induced voltages in winding TC. There is, therefore, very little power loss in the resistor and varistor and maximum power in the receiver. The low impedance of the transmitter is matched to the loop by the turns of winding TB to winding TA_1 and TA_2.

c. The current variations due to the transmitter are in opposite phase in windings TA and TB. The induced voltages in winding TC are also in opposite phase and the resultant voltage is opposed by the voltage produced across the 68Ω resistor. The net effect is that very small signals are produced in the receiver due to transmitter current changes and sidetone is very low. Also there is little power loss in the receiver, maximum transmitting levels are attained. Both varistors contribute to this condition by automatically compensating for various loop conditions to provide close matching of the loop impedance and the balancing network impedance with the transmitter circuit.

d. The 180Ω resistor and .10 MFD capacitor provide a filter network to suppress high frequency signal components of the dial pulses which might otherwise be radiated from the telephone line and cause local interference with broadcast radio reception.

8. TESTING

8.01 Thorough testing of the network assembly can only be performed with elaborate test equipment. An adequate check on performance, for maintenance purposes, is to compare a suspected unit with a known good unit by substitution. Resistance and capacitance checks can be carried out between many of the terminals, as can be seen from Figure 4. Note that the soldered connection between terminals P and Q can be opened to permit testing of the two network capacitors. Figure 5 shows the layout of the terminal board of the assembly.

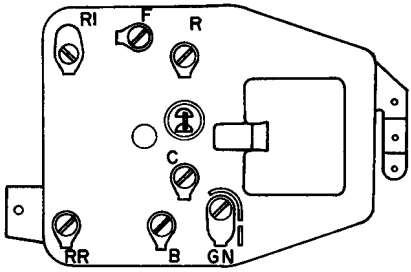


FIGURE 5 TERMINAL BOARD LAYOUT

8.02 To assist in testing network assemblies in the field, Table 1 gives the values of resistance and capacitance which should be measured when tests are made between various pairs of terminals.

Table 1 POINT TO POINT TEST VALUES

Terminals	Components		Test Value
F – RR	Filter capacitor		.09 – .14
R – Q	Network capacitors	(4)	2.4 – 3.0
C – RR	V1 and filter resistor	(1)	4.7K min
		(2)	890-1070
C – P	TA_2 and TB windings		28.8-35.2
B – C	TA_2 winding		35.1-42.9
B – P	TB winding		33.3-40.7
R – GN	TC winding and resistor		74.3-90.7
R – RR	TA winding		12.1-14.9
R – P	V2	(1)	1.6K min

NOTES: All capacitance values in microfarads and all resistance values in ohms
(1) with 1 ma dc flowing through circuit.
(2) with 10 ma dc flowing through circuit.
(3) with 100 ma dc flowing through circuit.
(4) with strap P-Q removed.

TELEPHONE SET
TYPE 701 (LR) 30 DESK
CONNECTIONS

1. GENERAL

1.01 This practice provides the connecting information necessary in the installation of the 701 (LR) 30 desk type telephone set.

1.02 The installed telephone must be provided with a separately mounted external ringer.

2. INSTALLATION REQUIREMENTS

2.01 A 110-120 volt ac receptacle is required for the dial light transformer. This receptacle should be on a circuit that is not controlled by a switch. One transformer should be used for a single telephone set.

2.02 For proper illumination of the dial, the length of the wire between the transformer and the telephone set should not exceed 25 feet of standard inside wire. Do not use a 25-foot mounting cord because of added resistance.

2.03 When a ringer is required, any ringer including the specially designed ringers for this series of telephones may be used. See Figure 1 for ringer wiring diagram.

3. PORTABLE INSTALLATION

3.01 For portable installation of the Type 702 telephone set arrange as follows:

a. Cut off or insulate the unused conductors in the mounting cord when terminated in a wall plug.

b. Extend tip, ring, ground, and transformer leads to a wall jack. On 2 party tip stations requiring ground identification, be sure that jacks and plugs are installed in accordance with local practice.

3.02 Portable installation of Type 701 sets can be made if the service involved does not require more than 12 conductors in the mounting cord.

3.03 In portable installations where only one dial light set is installed, one transformer may be multipled to two or more jacks.

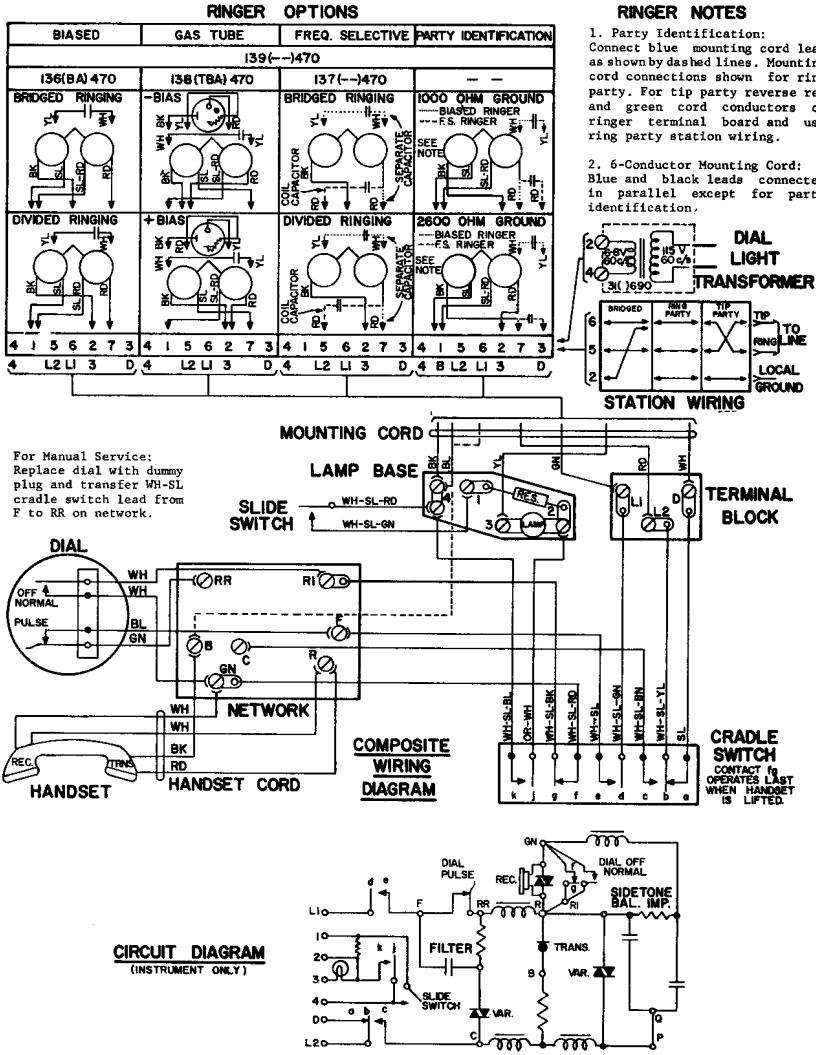


FIGURE 1 DIAGRAMS 701--(LR)30- TELEPHONE

TELEPHONE SET
TYPE 701 (LR) 37 AND 38
CONNECTIONS

1. GENERAL

1.01 This practice provides the connecting information necessary in the installation of the 701 (LR) 37 and (LR) 38 type telephone sets.

1.02 The installed telephone must be provided with a separately mounted external ringer. See Figure 1 for a wiring diagram.

2. INSTALLATION REQUIREMENTS

2.01 A 110-120 volt ac receptacle is required for the dial light transformer. This receptacle should be on a circuit that is not controlled by a switch. One transformer should be used for a single telephone set.

2.02 For proper illumination of the dial, the length of the wire between the transformer and the telephone set should not exceed 25 feet of standard inside wire. Do not use a 25-foot mounting cord because of added resistance.

2.03 When a ringer is required, any ringer including the specially designed ringers for this series of telephone may be used. See Figure 1 for ringer wiring diagram. Types 136, 137, 138 and 139 are recommended.

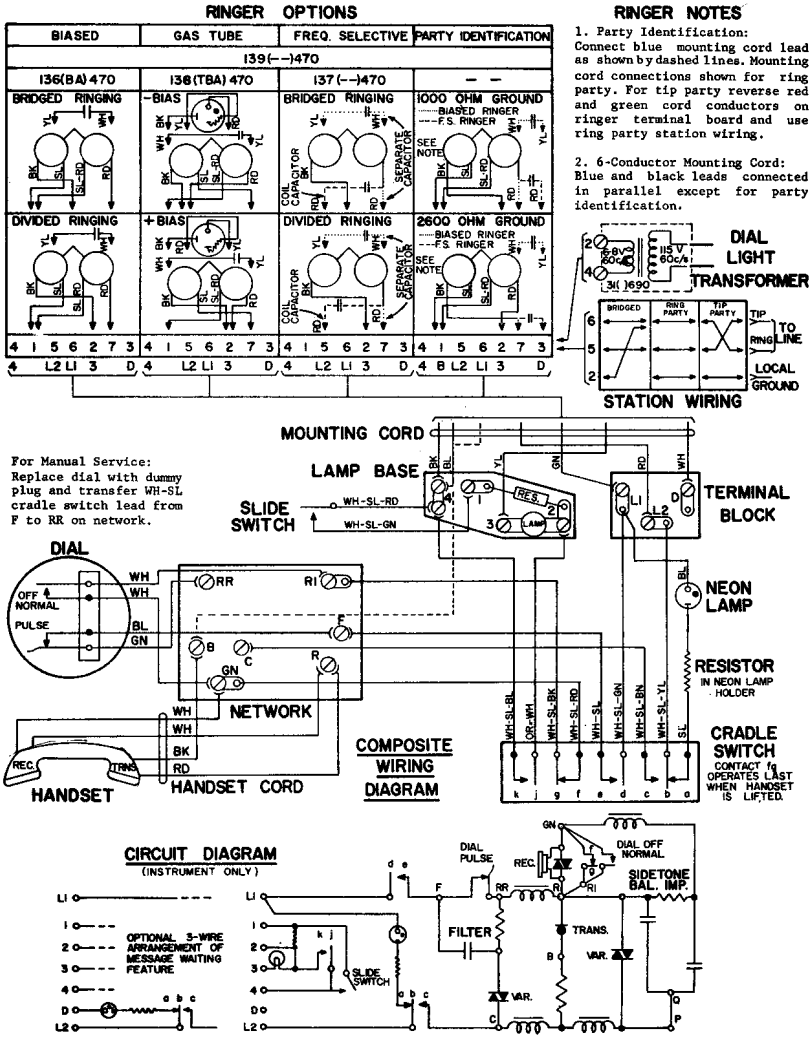


FIGURE 1. DIAGRAMS 701--(LR)37- TELEPHONE AND 701--(LR)38- TELEPHONE

TELEPHONE SET
TYPE 703 (LR) 30 DESK
CONNECTIONS

1. GENERAL

1.01 This practice provides the connecting information necessary in the installation of the 703 (LR) 30 desk type telephone set.

1.02 The installed telephone must be provided with a separately mounted, external ringer, types 136, 137, 138 and 139 are recommended. See Figure 1 for ringer wiring diagram.

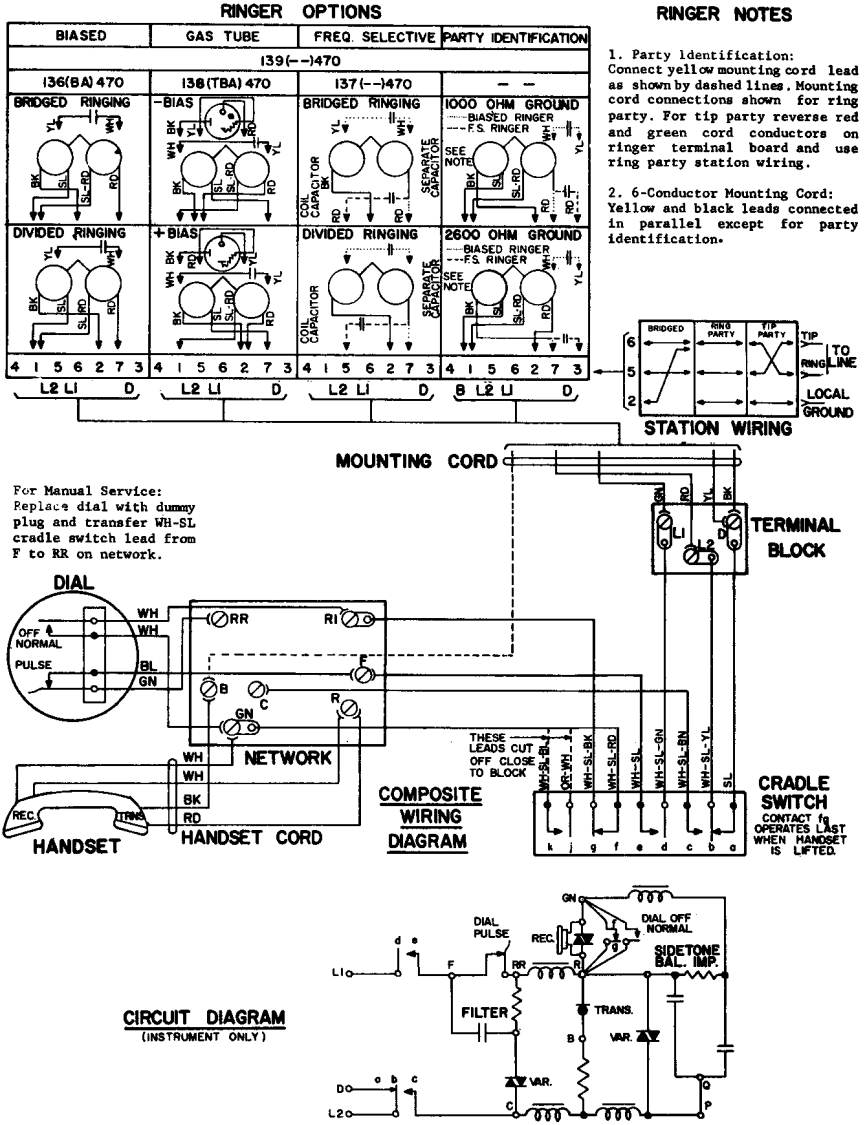


FIGURE 1. DIAGRAMS 703--(LR)30- TELEPHONE

TELEPHONE SET
TYPE 703-(LR) 37 AND 38
CONNECTIONS

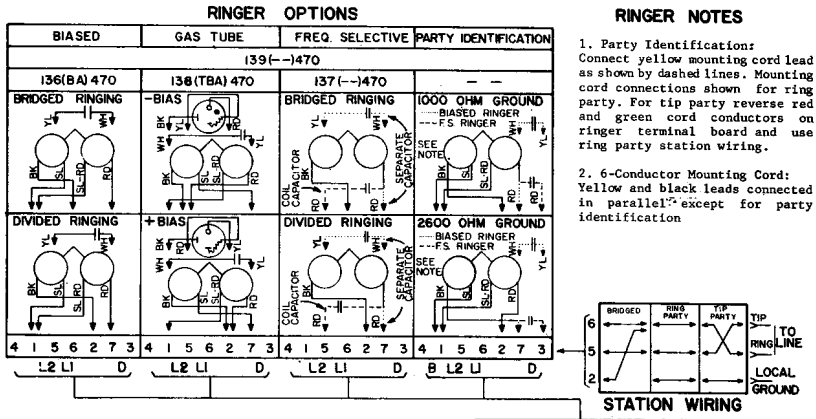
1. GENERAL

1.01 This practice provides the connecting information necessary in the installation of the 703-LR37 and LR38 type telephone sets.

1.02 The installed telephone must be provided with a separately mounted external ringer. See Figure 1.

2. INSTALLATION REQUIREMENTS

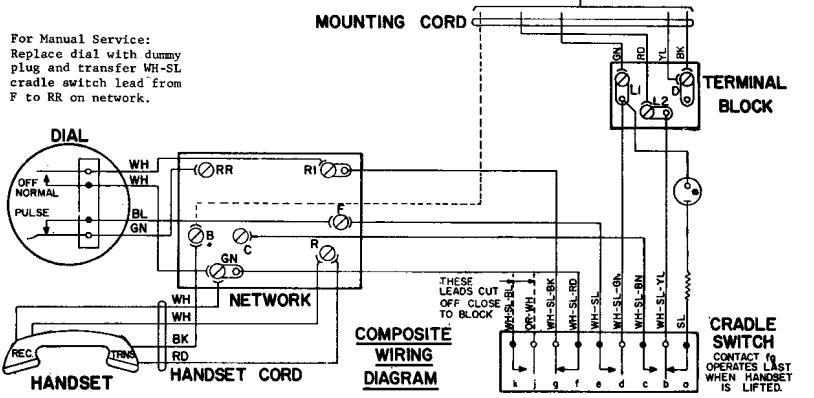
2.01 When a ringer is installed any ringer including the specially designed ringers for this series of telephones may be used. See Figure 1 for ringer wiring options.



RINGER NOTES

1. Party Identification: Connect yellow mounting cord lead as shown by dashed lines. Mounting cord connections shown for ring party. For tip party reverse red and green cord conductors on ringer terminal board and use ring party station wiring.

2. 6-Conductor Mounting Cord: Yellow and black leads connected in parallel except for party identification



For Manual Service: Replace dial with dummy plug and transfer WH-SL cradle switch lead from F to RR on network.

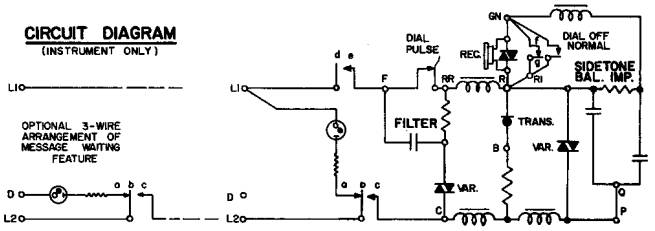


FIGURE 1. DIAGRAMS 703--(LR)37- TELEPHONE AND 703--(LR)38- TELEPHONE

TELEPHONE SETS
TYPES 701, 703 MAINTENANCE

1. GENERAL

1.01 This practice provides the maintenance requirements of the 701 and 703 type telephone sets.

1.02 Maintenance of the 700 series of telephone sets is limited to replacement of a few components and burnishing or adjustment of certain contacts.

1.03 A careful visual inspection may disclose broken, cracked, or worn components which should be replaced.

2. TRANSMISSION

2.01 The transmission quality of 701, 703 telephone sets is the same as that of the 500 type set.

2.02 If there is trouble in the telephone set, check the following points:

a. Worn, open or noisy cords.

b. Defective network.

c. Loose connections.

d. Dirty or imporperly adjusted switchhook or dial contacts.

e. Defective transmitter or receiver unit.

2.03 With the exception of burnishing of switchhook or dial contacts, and slight adjustments of switchhook contacts, trouble should be cleared by substitution of affected part.

3. DIAL

3.01 Maintenance of the dial should be limited to fingerwheel or number plate replacement, contact burnishing, or cleaning of exposed surfaces.

4. DIAL LIGHT

4.01 Slide switch for night-light operation is located on rear of base. When handset is removed, dial light increases in brilliance for dialing purposes.

a. With switch operated to the left and handset in place, night light (reduced illumination) is obtained.

b. With switch operated to the right, lamp will light only when handset is removed.

4.02 If lamp fails to operate, check the following points:

a. Defective or unplugged transformer.

b. Loose connections.

c. Defective lamp.

d. Dirty or improperly adjusted switchhook contacts.

e. Defective slide switch.

4.03 If illumination is poor, be certain that the length of inside wire between the transformer and telephone does not exceed the length specified in CTS practice 480-110-401. Only one dial light is allowed for each transformer.

5. RINGER

5.01 When the ringer fails, be sure that the armature moves freely and that adjacent wires do not interfere with movable parts.

6. TEST AND ADJUSTMENT OF CRADLE SWITCH

6.01 The operating arm, and the insulated actuator strip mounted on it, must move freely between the sets of contact springs. The normal position of the assembly is with the operating arm fully released and the operated position is with the arm fully depressed.

6.02 Adjust the contact springs of the assembly to meet the requirements detailed in the following paragraphs:

a. The spring pressures between each pair of closed contacts must be within the range of 10 to 20 grams. This is measured at each tip of the break springs on the side of the assembly where the springs are in contact with the actuator strip, and at each tip of the lever springs on the opposite side of the assembly when the operating arm is in the normal position. The same conditions must be satisfied when measuring at each tip of the lever springs on the side of the assembly where the springs are NOT in contact with the actuator strip when the operating arm is in the fully operated position. With the operating arm in either position, each spring not making electrical contact must be tensioned against a buffer spring or the central insulating block.

b. The spring clearances between each pair of open contacts, in either the normal or operated condition, must be at least .020". There must be a perceptable clearance between any buffer spring and the contact spring which rests on it, in either position of the operating arm, when the contact spring is in electrical contact with another spring in the other position of the operating arm.

c. The contacts in each assembly must operate in the sequence shown by the circled numbers in Figure 1 when the operating arm is moved from the normal position. Contacts marked with the same number should function at approximately the same time. The two contacts of each mating pair of springs must make and break simultaneously. The bar contacts must mate approximately on centers.

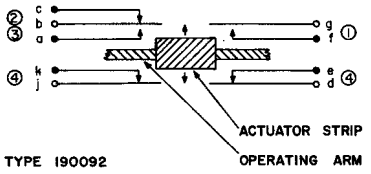


FIGURE 1 CONTACT ARRANGEMENTS

7. LUBRICATION

7.01 Any existing lubricant must be cleaned off with a good quality, non-filming commercial solvent. Using a small camel hair brush, apply a small amount of high quality lubricant to each of the two bearing points of the bearing pin. *Avoid excessive lubrication.*

Item	Description
1	Base Assy. c/w items 2 thru 20
2	Network Assembly
3	Spring Assembly (Cradle)
4	Insulator
5	Bracket (Dial)
6	Bracket (Housing Mtg. Screw)
7	Rivet
8	Lamp Base Assembly
9	Rivet
10	Switch
11	Rivet
12	Connecting Block Assembly
13	Insulator
14	(Lead) Weight
15	Screw

Item	Description
16	Hex Nut
17	Mat
18	Lockwasher Screw
19	Wire Assembly (WH-SL-GR)
20	Wire Assembly (WH-SL-RD)
21a	Dial Assembly
b	Dummy Plug Assembly
22	Handset and Cord Assembly
23	Desk Stand Cord
24	Cradle Switch Bracket Assy.
25	Spring
26	Lamp Socket Assembly
27	Lamp
28	Resistor
29	Housing and Plunger Assembly

NOTE: The 703 (LR) 30 is identical to Figure 1 except that the built-in combination dial light/night light is omitted. See Figure 1.

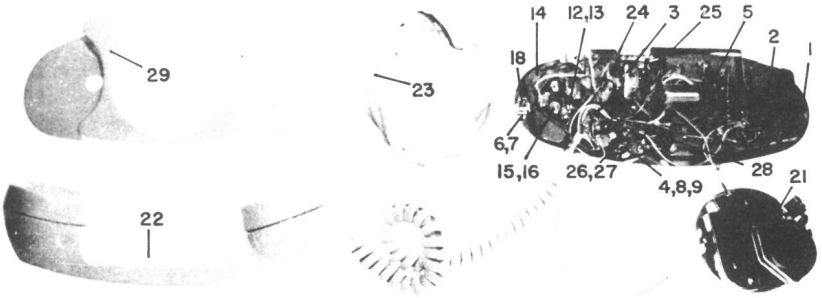


Fig. 1 TOP VIEW - HOUSING REMOVED

DISASSEMBLY AND ASSEMBLY
700 TYPE INSTRUMENT

1. GENERAL

1.01 This practice provides instructions for the disassembly and assembly of the basic type 700 telephone instrument. (Maintenance)

1.02 Tests and adjustments outlined in paragraph 7 shall be made on all assembled instruments.

2. DISASSEMBLY AND ASSEMBLY

2.01 The exploded view of Figure 1 shows all the component parts and sub-assemblies of the 700 basic instrument.

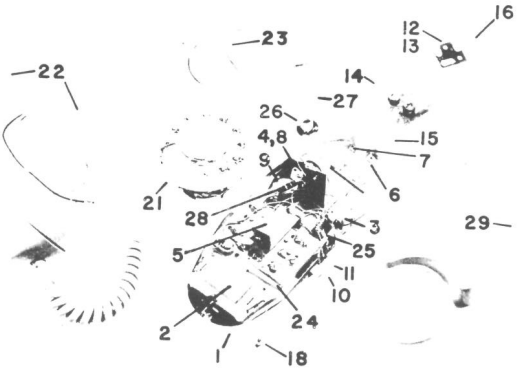


FIGURE 1. COMPONENT PARTS - EXPLODED VIEW

Procedures for disassembly and assembly are given in the following paragraphs. Additional parts which are included to provide special features should be removed and replaced in any convenient order. Note that the lamp of the message waiting light may be replaced by unscrewing the holder in the base of the instrument, then changing the lamp in the holder (Figure 2).

3. DISASSEMBLY OF THE BASIC INSTRUMENT

3.01 a. Loosen the lockwasher screws (18 of Figure 1) and remove the housing (29 of Figure 1).

b. Loosen the clamping screws, lift out the dial (21), if fitted, and disconnect the leads.

c. Disconnect the leads and remove the handset and cord assembly (22).

d. Disconnect the leads and remove the desk stand cord (23).

e. Remove the lamp (27) and socket assembly (26).

f. Remove spring (25) and cradle switch bracket assembly (24).

The remaining major components of the complete instrument are riveted to the base plate. If it should become necessary to remove one of these components the rivets must be drilled out and the replacement component mounted with new rivets, if riveting equipment is available, or with suitable machine screws, spring washers and hexagonal nuts.

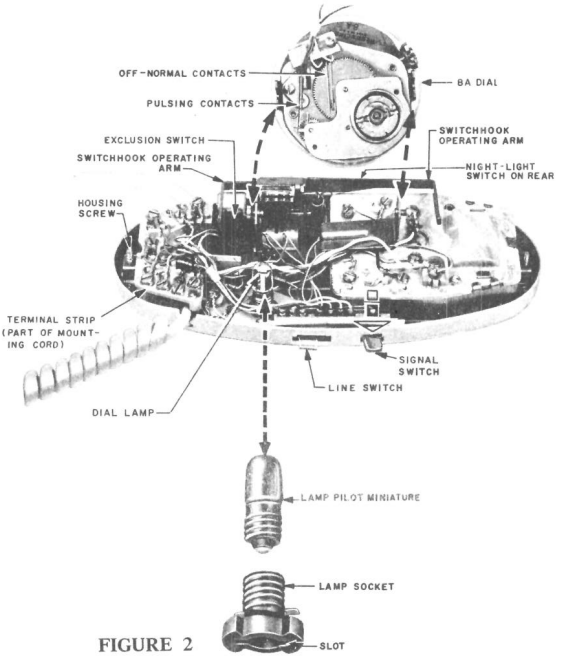


FIGURE 2

4. ASSEMBLY OF THE BASIC INSTRUMENT

4.01 Reassemble the instrument in the reverse order to that given for disassembly, noting the points listed below.

a. Refer to the appropriate wiring diagram to reconnect the various leads.

b. Make certain that the leads of the handset and mounting cords do not interfere with the operation of the cradle switch.

c. Make sure that the locating spots and holes mate correctly to locate the dial squarely in its mounting bracket.

d. The housing must fit freely without binding on any part. Make sure that the dial gasket is in its correct position.

e. Check that any screws, washers and nuts, used to replace rivets, do not interfere with any other parts of the instrument.

f. Check the assembled unit as detailed in the paragraph on test and adjustment.

5. CRADLE SWITCH ASSEMBLIES

5.01 These cradle switch assemblies are used on the 700 Series of compact desk telephones. Each assembly consists of a spring loaded operating arm, pivoted on a bearing which is molded into the same plastic block as the contact springs, mounted with two sets of contacts on each side of the insulating actuator block which is riveted to the center part of the operating arm. The coiled spring holds the operating arm in a position which operates two of the sets of contacts when the arm is in the raised or off-hook position. These two sets of contacts are released and the opposite two sets are operated when the arm is moved to the on-hook position.

5.02 Separate flexible wire leads are provided for each contact spring to connect them to the other components in the telephone instrument. The leads are joined to the contact springs inside the molded portion of the assembly.

5.03 The complete assembly is mounted to the base of the telephone instrument by means of three rivets through its bracket, which is molded into the same block as the contact springs, so that placing the handset in the cradle depresses the plungers against the extremities of the operating arm to actuate the contact springs.

6. DISASSEMBLY AND ASSEMBLY

6.01 The various parts of the cradle switch are identified in Figure 3.

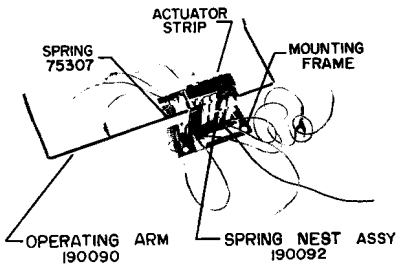


FIGURE 3. TYPICAL CRADLE SWITCH

6.02 To disassemble the unit, first remove the coil spring holding the operating arm in the raised position, then lift the arm carefully from between the sets of contact springs. Reassemble the parts by placing the operating arm over its pivot pin and between the sets of contact springs. Then hook the loops of the coiled spring over the lugs on the arm and the assembly mounting bracket. Make sure that the operating arm functions freely and is securely pivoted in the groove of the bearing pin.

6.03 *The spring nest assembly cannot be taken apart.* In the event of damage to the contacts, springs or leads the complete spring nest assembly must be replaced. Note that the 703 type telephone instruments do not require the use of one set of make contacts. It may be possible, therefore, to use certain damaged assemblies from 701 type instruments in 703 type instruments.

7. TEST AND ADJUSTMENT

7.01 The following checks must be made on the completely assembled instrument:

a. Check that either plunger will fully operate the spring assembly of the cradle switch, before being depressed to a point 1/8" above the housing molding and that the plungers may be lifted slightly after the handset is removed. Using two pairs of pliers, bend the sidearms of the actuator to adjust, if necessary.

b. Connect the telephone to a working line and check for correct operation of the following:

1. Dial, if fitted.

2. Transmitter and receiver.

3. Cradle switch.

4. Adequate suppression of side tone.

5. Correct party identification, in conjunction with a suitable ringer, if applicable.

6. Absence of noise due to loose contacts when the instrument is gently bumped or shaken.

7. Special features, if installed.

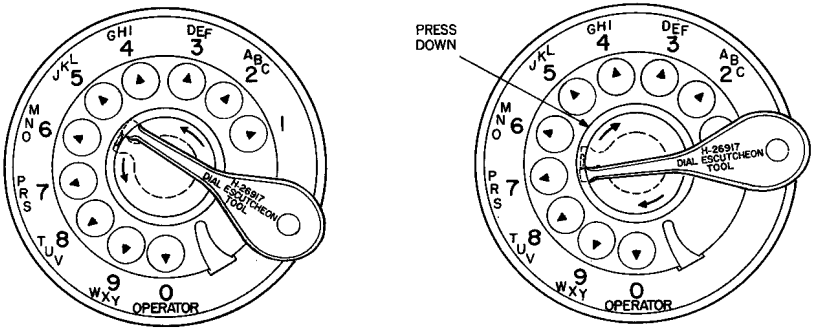
INSTALLATION AND REMOVAL
TELEPHONE SET DIAL FINGERWHEELS

1. GENERAL

1.01 This practice covers the installation and removal of fingerwheels and number cards from various dials commonly used on telephone instruments, data sets, teletypewriters, testboards and tollboards.

2. A.E. CO. DIALS

2.01 To remove the escutcheon assembly from an A.E. Co. metal fingerwheel, use either a small screwdriver with a blade that is both narrow (about 1/8") and thin, or standard escutcheon tool. Hold the tool parallel to the fingerwheel and insert its tip between the escutcheon ring and the acetate disc which covers the number card, passing under the edge of the ring at a point even with the 5/JKL hole (see Figure 1). Taking care not to scratch the acetate disc, press the tip of the tool downward slightly and move it counter-clockwise toward the 6/MNO hole. It should engage the tab of the escutcheon lock, and further movement of the tool toward the 7/PRS hole will then force the escutcheon lock counter-clockwise so that it no longer holds down the tab of the escutcheon ring. Lifting the tip of the tool when it reaches the 7/PRS hole should raise the entire escutcheon assembly out of the depression in the center of the fingerwheel.



1a. Removal

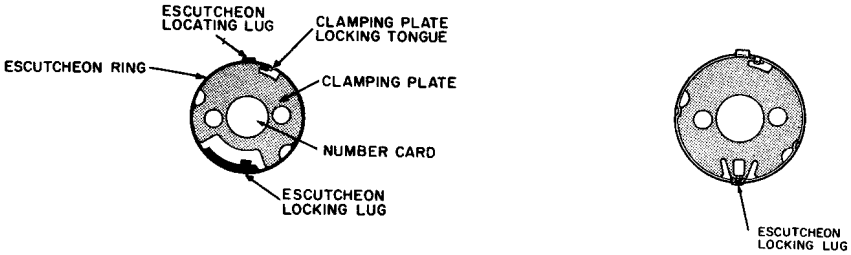
1b. Installation

FIGURE 1. Escutcheon Installation and Removal, A.E. Co. Metal Fingerwheel.

2.02 To remove an A.E. Co. metal fingerwheel from the dial shaft, use a screwdriver with a blade that is both broad (about 1/2") and thin. Loosen the broad-head screw, remove it and the escutcheon lock, and lift the fingerwheel off the hub of the shaft.

2.03 To take apart the metal escutcheon assembly from an A.E. Co. fingerwheel in order to install or change the number card, hold the assembly, rear side up, with the fingers of both hands and press on the clamping plate with the thumbs adjacent to the semicircular indentations on its edge (see Figure 2). Rotate the plate counter-clockwise until the indentations clear the ridges formed into the edge of the escutcheon ring, at which time the locking tongue will also

clear the channel similarly formed for it to engage. Push against the acetate disc with a finger to force the disc, number card and clamping plate out of the escutcheon ring, and slide these parts out from under the locking lug.



2a. Metal Fingerwheel. 2b. Acrylic Fingerwheel.

FIGURE 2. Escutcheon Disassembly, A.E. Co. Fingerwheels.

2.04 When installing a new number card in an A.E. Co. metal escutcheon assembly, wipe the acetate disc to remove dirt and fingermarks. If the disc is scratched or discolored, replace it. Hold the escutcheon ring with its rear side up, and insert the edge of the acetate disc under the locking lug of the ring at the point where the edge of the disc has a long indentation. Lay the narrow indentation or slot in the opposite edge of the disc over the channel formed inside the edge of the ring. With a blunt-ended object, such as the eraser end of a pencil, snap the disc over the two ridges formed in the edge of the ring, so that the disc is seated. Insert the number card in the same manner. Its edge has two semicircular indentations which allow it to clear the ridges in the ring. Insert the clamping plate with its concave side up, and push down its edges with the thumbs to flatten it. Once flat, rotate the plate clockwise until its edges are caught beneath the ridges in the wall of the escutcheon ring, and its locking tongue is seated in the channel formed inside the wall.

2.05 To install an A.E. Co. metal fingerwheel on the dial shaft, position its center hole on the shaft hub so that the finger holes are aligned with the designations on the number plate. Lay the escutcheon lock over the hub so that it sits between the two detents located at the 5/JKL and 7/PRS positions. Using a broad-bladed screwdriver with a thin edge, insert the broad-head screw in the hole in the hub and drive it part way. Center the circular portion of the escutcheon lock so that it rides free of the lip on the under surface of the screw head, then tighten the screw.

2.06 To install the escutcheon assembly on an A.E. Co. metal fingerwheel, move the escutcheon lock counter-clockwise until it strikes the detent, and insert the index tab on the escutcheon ring into the slot in the wall of the depression in the fingerwheel at a point just above the finger stop. Press the opposite edge of the escutcheon ring into the depression and insert a blade such as described in Paragraph 2.01 between the ring and the acetate disc. Keeping the tool parallel with the fingerwheel and taking care not to scratch the disc, insert the tip under the edge of the ring at a point even with the 7/PRS hole. Press the tip of the tool downward slightly and move it clockwise toward the 6/MNO hole. It should engage the tab of the escutcheon lock, and further movement of the tool toward the 5/JKL hole will then force the escutcheon lock clockwise so that it holds down the tab of the escutcheon ring.

2.07 To remove the chrome escutcheon assembly from an A.E. Co. acrylic fingerwheel, use a small screwdriver with a blade that is narrow (about 1/8"), and thin. Hold the blade parallel to the

fingerwheel and insert its tip between the escutcheon ring and the acetate disc which covers the number card, passing under the edge of the ring at a point midway between the 5/JKL and 6/MNO holes (see Figure 3). With the tip of the blade seated against the outer wall of the escutcheon ring, gently apply force upward and outward until the latch releases with a click. Then lift the escutcheon assembly clear of the fingerwheel with the screwdriver.

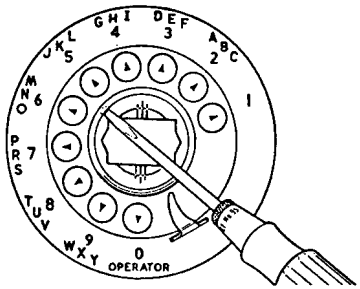


FIGURE 3. Escutcheon Removal

2.08 To remove an A.E. Co. acrylic fingerwheel from the dial shaft, select a screwdriver appropriate to the type of fastening used. Early production of these fingerwheels used a flat steel washer and a screw with an 11/16" diameter head. This appears similar to the screw used on metal fingerwheels, but has a longer thread and lacks any lip on the under surface of its head. In later production, a dished washer was used which has a depression in the center and is fastened by a coventional binding head screw. For the broad-head screw, use a screwdriver with a blade that is both broad (about 1/2") and thin. For the binding-head screw, a breadth of approximately 1/4" should suffice. Loosen the screw, remove it and the washer, and lift off the fingerwheel. Ordinarily, the escutcheon locking plate will remain in contact with the fingerwheel, because of the snug fit of their mating segments. Raise the fingerwheel until the center opening in the locking plate is free of the hub on the dial shaft, and slide both toward the upper left, away from the finger stop.

2.09 To disassemble the chrome escutcheon assembly from an A.E. Co. acrylic fingerwheel, follow the same procedure as specified in Paragraph 2.03. This is simplified somewhat, since the escutcheon locking lug is not in the way on the escutcheon ring, but protrudes from the clamping plate and makes the latter easier to rotate.

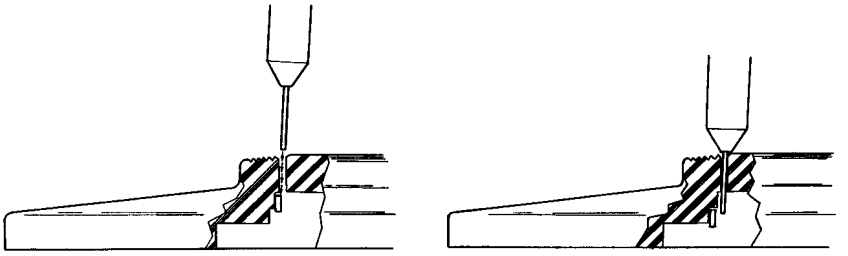
2.10 To install a new number card in the chrome escutcheon assembly from an A.E. Co. acrylic fingerwheel, follow the same procedure as specified in Paragraph 2.04. The escutcheon ring has no locking lug, and the long indentation in the edge of the acetate disc and number card serves no purpose in this assembly.

2.11 To install an A.E. Co. acrylic fingerwheel on the dial shaft, insert the escutcheon locking plate into the openings in the rear of the fingerwheel. Ordinarily, the snug fit of the segments of the plate in the mating depressions in the fingerwheel is sufficient to keep the two in contact. With the locking plate and fingerwheel held together, slide the assembly over the pawl plate and under the finger stop, align the finger holes with the designations on the number plate, and position the center opening in the locking plate over the hub of the dial shaft. Install the proper screw through the large washer into the hub of the dial shaft, and drive the screw until firmly seated, but not so tightly as to stress the plastic and crack it. When using the flat style of washer, be sure to install it with the stamped circle, denoting the slightly convex surface,

on the upper side (away from the fingerwheel), and to use a broad-head screw. Only the type which has no lip or shoulder on the under surface of its head will be found long enough to fasten the assembly. When using the dished style of washer, be sure to use a binding head screw with a conventional-sized head, as a broad-head screw will protrude too far above the dished washer to permit installing the escutcheon.

2.12 To install the chrome escutcheon assembly on an A.E. Co. acrylic fingerwheel, insert the index tab on the excutcheon ring into the slot in the formed ear of the locking plate which protrudes through the fingerwheel adjacent to the finger stop. Placing a thumb just inside the escutcheon ring on the opposite side, between the 5/JKL and 6/MNO finger holes, press down firmly against the acetate disc and number card until the latching tab on the clamping plate engages the protruding lug of the escutcheon locking plate with a click. In some cases it may be necessary to use a small screwdriver to apply the proper force to engage the latch. Wipe the acetate disc free of finger marks.

2.13 To remove an A.E. Co. acrylic fingerwheel from the dial shaft, either for replacement or to install the number card, use a standard escutcheon tool, and insert the end into the small hole located in the ribbed area of the fingerwheel surrounding the number card, adjacent to the 6/MNO finger hole. As may be seen in Figure 4, the end of the tool must engage the narrow edge of the latching lug on the clamping disc. To insure this, insert the tool in the hole at a slight angle, so that the end below the surface of the fingerwheel is aimed in the direction of the 6/MNO finger hole. Once the end is seated against the latching lug, push gently downward on the tool. This should force the lug down and out of its latching detent, where it is held under tension, and allow it to spring free along a shoulder molded into the under surface of the fingerwheel. Once this is done, the lug will be clear of the small hole, and even if the wire be reinserted, it will not again engage the lug. Insert a finger in the zero hole, wind the dial in the usual manner, and with another finger turn the wheel farther in the clockwise direction, until the zero hole again reaches, and goes slightly beyond, the zero position on the number plate. Release the fingerwheel and allow it to return to rest, at which point the zero hole will be found between the 8/TUV and 9/WXY positions on the number plate. Lift the fingerwheel slightly, until it clears the projections on the clamping disc, and slide it toward the upper left, away from the finger stop.



4. Insertion. End of Standard Escutcheon Tool Engages Edge of Latching Tab and Forces it Downward.

4b. Withdrawal. Latching Tab has Snapped into Recess Molded in Fingerwheel, out of Reach of Tool.

FIGURE 4. Use of Standard Escutcheon Tool

NOTE: If the latching lug on the clamping disc fails to spring out of its detent when pushed down by the wire, the zero finger hole will not pass beyond the finger stop when the dial is wound. In this case, hold the fingerwheel in the fully-wound position, insert the tool, and press against the lug, while turning the fingerwheel farther in the clockwise direction.

2.14 To remove the clamping disc from an older A.E. Co. dial which has been equipped with an acrylic fingerwheel, use a screwdriver with a blade that is both broad (about 1/2") and thin to loosen the broad-head screw which fastens the clamping disc to the hub on the dial shaft. On most dials manufactured after May, 1964, a clamping disc is welded in place to accommodate this fingerwheel. If such a disc has been damaged, the entire pawl plate assembly must be replaced. Since the hub is not drilled to accept a screw, it is not possible to pry off the damaged disc and install a removable disc or a metal fingerwheel.

2.15 Before installing a new number card in an A.E. Co. acrylic fingerwheel, wipe the window area in the center to remove dirt and fingermarks. If this area has been scratched or defaced, the entire fingerwheel must be replaced.

2.16 To install a clamping disc on an older A.E. Co. dial in order to adapt it to the acrylic fingerwheel, position the center hole of the disc over the hub of the dial shaft so that the latching tab lies in the upper left quadrant, adjacent to the 5/JKL and 6/MNO designations on the number plate (see Figure 5). Using a broad-bladed screwdriver with a thin edge, fasten the clamping plate to the shaft with the broad-head screw provided with the clamping disc.

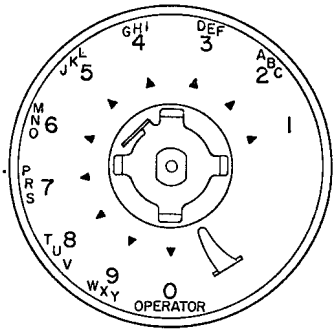
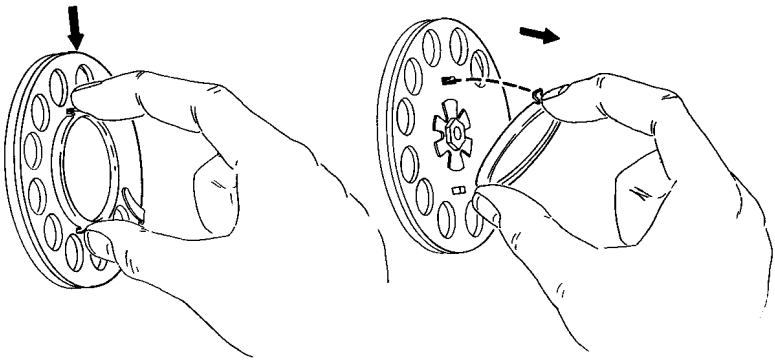


FIGURE 5. Proper Position of Clamping Disc When Installing A.E.Co. Acrylic Fingerwheel.

2.17 To install an A.E. Co. acrylic fingerwheel on a dial equipped with the accompanying clamping disc, hold the fingerwheel parallel to the number plate, with its zero hole positioned between the 8/TUV and 9/WXY designations. Move the fingerwheel toward the upper left, then tip it so that the lower right edge slides under the finger stop, and guide it back into its previous position. With the center portion resting on the projections of the clamping disc, rotate the fingerwheel counterclockwise, parallel to the number plate, as the zero hole passes the 9/WXY position. When the zero position is reached, the latching lug on the clamping disc should engage its detent in the fingerwheel with a click.

3. W.E. CO. DIALS

3.01 To remove the card holder assembly from a W.E. Co. metal fingerwheel, press against the upper edge of the card holder frame, between the 2/ABC and 3/DEF finger holes, with a forefinger, while stabilizing the lower edge of the frame with a thumb. With the frame thus pinched slightly out of round, the upper locking tab will clear the edge of its slot in the fingerwheel, and may be withdrawn from the slot (see Figure 6). Then tilt the card holder assembly forward and disengage the lower locking tab from its slot. Except in unusually stubborn cases, avoid the use of metal tools, such as a screwdriver or knife blade, to pry off the card holder assembly, since the finish on both it and the fingerwheel is very easily scratched.



6a. Depressing Upper Locking Tab. 6b. Tilting Card Holder Forward and Out.

FIGURE 6. Removal of Card Holder Assembly from W.E.Co. Metal Fingerwheel.

3.02 To remove a W.E. Co. metal fingerwheel from the dial shaft, use a 7/16" nut driver to loosen the fingerwheel clamping nut. Separate the nut and lock washer from the shaft stud, and lift the fingerwheel off the hub of the shaft.

3.03 To take apart the card holder assembly from a W.E. Co. metal fingerwheel in order to install or change the number card, grasp the two protruding prongs of the card retainer spring between the thumb and forefinger, pinch them together and withdraw the spring from the frame. Push against the acetate window with a finger to force the window, number card and card retainer out of the card holder frame. On more recent assemblies which lack the card retainer and spring, a card support with a serrated edge is used, and is considerably more difficult to remove. Insert the tips of a pair of long nose pliers in the serrations which lie second from the top on each side, and gently compress the card support while drawing it out of the card holder frame (see Figure 7).

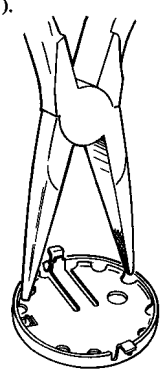


FIGURE 7. Removal of Card Support from W.E.Co. Card Holder Frame.

3.04 When installing a new number card in a W.E. Co. card holder assembly, wipe the acetate window to remove dirt and fingermarks. If the window is scratched or discolored, replace it. Hold the card holder frame with its rear side up, and lay the notch in the acetate window over the locating tab in the frame. Insert the number card in the same manner, followed by the card retainer and card retainer spring. Each part is notched to fit over the locating tab. On more recent assemblies which lack the card retainer and spring, press the serrated edge of the card support into the frame until the lip on the edge is flush with or below the edge of the frame.

3.05 To install a W.E. Co. metal fingerwheel on the dial shaft, position its center hole on the shaft hub so that the chamfered or beveled side of the finger holes is facing out, and the holes are aligned with their respective designations on the number plate. Lay the lock washer over the stud of the dial shaft, start the fingerwheel clamping nut on the stud by hand, and tighten it with a 7/16" nut driver.

3.06 To install the card holder assembly on a W.E. Co. metal fingerwheel, engage the lower locking tab of the card holder frame in the larger of the two slots in the fingerwheel, between the 8/TUV and 9/WXY positions. While stabilizing this lower edge with a thumb, press against the upper locking tab with a forefinger, so that the frame is pinched slightly out of round and the upper locking tab can be inserted in its slot in the fingerwheel.

3.07 To remove a W.E. Co. acrylic fingerwheel from the dial shaft, either for replacement or to install the number card, use standard escutcheon tool and insert the end into the small hole in the raised rim around the number card, between the 9/WXY and zero finger holes. Insert a finger in the zero hole, wind the dial in the usual manner, and with another finger turn the wheel farther in the clockwise direction while pressing the wire of the tool into the small hole. As may be seen in Figure 8, the end of the wire presses against the broad surface of the latching lug on the clamp plate, forcing it out of its latching detent so that the fingerwheel can be turned on the clamp plate until the zero hole passes the finger stop and goes slightly beyond the zero position on the number plate. Remove the wire, release the fingerwheel and allow it to return to rest, at which point the zero hole will be found at about the 9/WXY position on the number plate. Lift the fingerwheel slightly, until it clears the projections on the clamp plate, rotate it clockwise until the zero hole is above the 8/TUV position, and slide it toward the upper left, away from the finger stop.

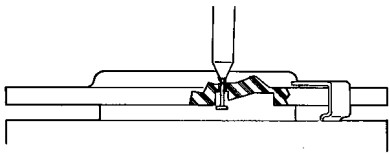


FIGURE 8. Use of Standard Escutcheon Tool to Unlatch W.E.Co. Acrylic Fingerwheel.

3.08 To remove the clamp plate from a W.E. Co. Number 5, 6, or 7 dial equipped with an acrylic fingerwheel, use a 7/16" nut driver to loosen the fingerwheel clamping nut. Separate the nut and lock washer from the shaft stud, and lift the clamp plate off the hub of the shaft.

3.09 To remove the number card from a W.E. Co. acrylic fingerwheel, hold the assembly rear side up and rotate the card support about 60° in a clockwise direction to free its projections from the grooves in the inner wall of the window retaining portion.

3.10 Before installing a new number card in a W.E. Co. acrylic fingerwheel, wipe the acetate window, or the window area in the center of the fingerwheel, to remove dirt and fingermarks. If an acetate window is scratched or discolored, replace it. If the window area on a fingerwheel has been scratched or defaced, the entire fingerwheel must be replaced. For use on an acrylic fingerwheel, the card must have not only the notch used with metal card holder assemblies, but a nick in the edge adjacent to the 5/JKL finger hole, for locating purposes. On a fingerwheel, insert the acetate window and the number card from the rear, followed by the card support with its projections facing away from the window. Rotate the card support about 60° in a counter-clockwise direction until its projections are seated in the grooves in the inner wall of the window retaining portion of the fingerwheel. On a fingerwheel used on a Number 6L dial, follow the same procedure, but eliminate the acetate window, since a window is molded integrally with the wheel. In this case the narrow projection of the card support must be engaged in the short groove to the right (as viewed from the rear) of the cut-out portion of the wall, in order for the other two wider projections to reach the ends of their longer grooves. On a fingerwheel used on a Number 8 dial, it is necessary only to insert the number card, since the clamp plate on the shaft assembly also serves as a card support.

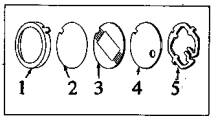
3.11 To install the clamp plate on a W.E. Co. Number 5, 6 or 7 dial in order to adapt the latter to an acrylic fingerwheel, position its center hole on the shaft hub so that the locking tab lies between the 9/WXY and zero positions on the number plate. Lay the lock washer over the stud of the dial shaft, start the fingerwheel clamping nut on the stud by hand, and tighten it with a 7/16" nut driver.

3.12 To install a W.E. Co. acrylic fingerwheel on a dial equipped with the accompanying clamp plate, hold the fingerwheel parallel to the number plate, with its zero hole positioned above the 8/TUV designation. Move the fingerwheel toward the upper left, then tip it so that its lower right edge slides under the finger stop, and guide it back into its previous position. With the center portion resting on the serrations of the clamp plate, rotate the fingerwheel counter-clockwise, parallel to the number plate, as the zero hole moves beyond the 9/WXY position. When the zero position is reached, the latching lug on the clamp plate should engage its detent in the fingerwheel with a click.

4. KELLOGG DIAL

4.01 To install the number card on a dial-type set, remove and disassemble the number card assembly. Place the number card between the protector and the retainer disc. Reassemble and remount the number card assembly on the dial.

4.02 To install the number card on a manual-type set, if the dummy plug assembly is already installed, mount the number card in the same manner as explained for the dial-type set. However, if a dial set is to be converted for manual service, remove the dial and mount the dummy plug assembly. Then, mount the number card in the number card assembly. See Figure 9.



1. Retaining Ring
2. Protector
3. Number Card
4. Retaining Disc
5. Retaining Spring

FIGURE 9

5. LUCITE FINGER PLATE AND NUMBER CARD

5.01 Revolve the finger plate (A) in a clockwise direction as far as it will go. Then insert one end of an opened paper clip (B) into the tab release hole (C) and depress the tab approximately 1/8". With the locking tab depressed, continue to turn the finger plate in a clockwise direction until a second stop is reached. Remove the paper clip (B) and lift the finger plate from the dial. (See Figure 10).

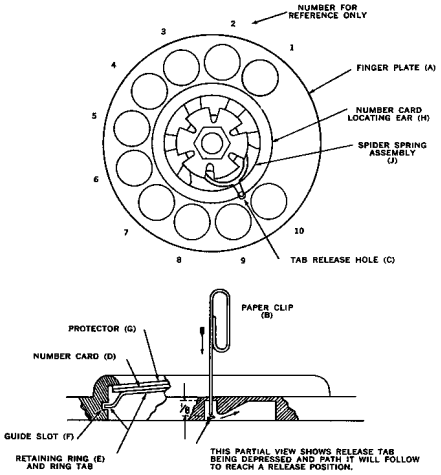


FIGURE 10

5.02 To remove the number card, the finger plate must first be removed as outlined in paragraph 3.02. Then turn the finger plate assembly over and revolve the retaining ring (E) until the three tabs of the ring are clear of the guide slots (F). Then lift the ring, card (D) and protector (G) out of the finger plate.

5.03 For assembly of protector, number card and retaining ring, place the protector (G) and number card (D) in the finger plate (A). Note that the notches of these parts fit into a locating ear (H) of the finger plate (A). Then place the ring tabs (E) in the guide slots (F) of the finger plate (A) and turn until the ring (E) is properly seated.

5.04 To assemble the finger plate (See Note), place the finger plate (A) squarely over the spider spring assembly (J) on the dial with the Number 10 hole of the finger plate (A) directly over the center of the Number 9 dot on the numeral ring. Turn the finger plate (A) firmly in a counter-clockwise direction until the finger plate (A) locks in place.

NOTE: *Before assembling the finger plate on the dial, the number card, protector and retaining ring must be assembled.*

TELEPHONE RINGERS

1. GENERAL

1.01 This practice provides general information on all types of single-gong and two-gong ringers. Specific information and special adjustments are given in the individual practices.

1.02 Each ringer consists of a cast, non-magnetic, alloy frame on which all the component parts are mounted. A typical ringer is illustrated in Figure 1. A laminated soft-iron core carries the single coil and is clamped to the soft-iron yoke which is bolted to the frame. The armature and clapper assembly is spring mounted to the frame so that the clapper may be vibrated by the armature, due to the magnetic field produced by the coil and yoke, to strike the gong(s). Increased sensitivity is provided by biasing the armature by means of a small permanent magnet clamped in the frame. A mechanical volume control is fitted on most types of ringer so that the user may adjust the sound output level. The coil is provided with flexible wire leads for connection to the other components in the telephone.

1.03 The ringers are designed to function from an alternating current source. Units are available for all the standard ringing frequencies from 16 to 66-2/3 cycles per second. The sensitivity is such that satisfactory operation is obtained on the longest circuits, and the high impedance prevents excessive bridging and unbalance losses on multi-party lines. A three point, anti-vibration mounting to the telephone base is provided.

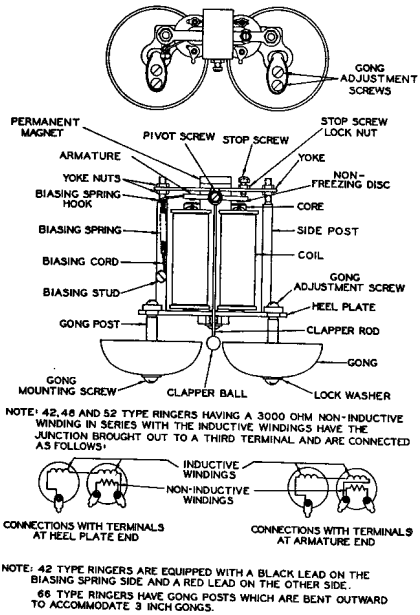


Fig. 1 — Typical Numbered Ringers

2. DISASSEMBLY AND ASSEMBLY

2.01 The gongs and resonators, if fitted, are removed by unscrewing their lockwasher mounting screws. Note that earlier models of some ringers had the resonators riveted to the frame. The gong mounting control wheels of the frequency selective ringers are removed by unscrewing the hexagonal head, lockwasher screws.

CAUTION: The strength of the permanent magnet is adjusted after assembly of the ringer. Disassembly of any of the parts of the magnetic circuit may adversely affect the performance of the ringer. Special equipment is necessary to remagnetize and adjust the strength of the magnet in order to obtain optimum performance.

2.02 In order to remove the magnet from a BA type ringer, first remove the armature and clapper assembly then slide the magnet out of the frame. Do not strain the tab of the frame holding the magnet, as it may break off. The magnet of a frequency selective type ringer may be lifted out after the screws and clamping plate are removed.

2.03 The coil is removed from a BA type ringer by unscrewing the lamination clamping screws, and from a frequency selective type ringer by loosening the shunt bar and slide plate clamping screws.

2.04 Reassembly is a reversal of the procedures given for disassembly. The following points must be noted:

a. All Ringers

(1) The end of the magnet nearest the armature must repel the north seeking pole of a compass and the opposite end of the magnet must be tight against the pole piece assembly.

(2) When facing the gong end of a two-gong ringer and with the frame facing downwards, gong "B" is on the left and gong "A" is on the right.

b. BA Type Ringers

(1) When replacing the armature, the end of the bias spring must be located in its adjusting slot in the bracket on the frame.

(2) When replacing the coil, the number of core laminations used should result in the coil core being comfortably filled but not force fitted. A minimum weight of 16 grams of laminations must be used.

3. LUBRICATION

3.01 Ringers without volume controls do not require lubrication.

3.02 First clean away all existing lubricant from the volume control mechanism then apply a light film of Lubriplate or similar non-drying lubricant to all rubbing surfaces of the volume control parts. Take care to avoid excessive lubrication.

4. TEST AND ADJUSTMENT

4.01 Thorough checking of ringers requires the use of specialized test equipment which will not always be available in the field. These steps may be omitted at the cost of a reduction in the overall performance of the ringer. *Note that the strength of the permanent magnet will only be reduced by a small amount if care is taken not to disturb the armature, magnet and shunt bar or pole piece when changing a faulty coil.*

4.02 The ringer under test must be firmly mounted in a test fixture, such as a telephone base plate which has been weighted to the normal weight of a complete instrument, in order to carry out the tests and adjustments correctly.

4.03 For test and adjustment purposes, telephone ringers may be conveniently divided into the two general classifications of straight line and frequency selective types. The generalized test and adjustment procedures for these two groups are given in the following paragraphs. Reference must also be made to the individual practices for each type of ringer where specific sensitivity values and test and adjustment figures are quoted.

5. STRAIGHT LINE RINGERS

5.01 First check the individual practice in which the specific ringer is described, for details of any special tests or adjustments, then proceed as outlined below.

5.02 Mechanical Adjustments:

a. The residual plate must lie flat on the rear face of the armature. Reshape the plate if necessary.

b. With the bias spring set in the low notch, nearest the coil, the armature must be firmly tensioned against the rear pole face. Bend the bias spring near its base to adjust.

c. The clapper stem must be straight and in line with the armature. Reshape the clapper stem if necessary.

d. There must be a clearance of about 1/16" between the clapper and the "B", or single, gong when the armature is held against the rear pole face. Slightly bend the rear pole face to obtain this clearance. Note that on two gong ringers the identifying letter on the "B" gong must be positioned directly above the mounting screw before making this adjustment which should result in the clapper stem being approximately in line with the notch in the frame bridge piece.

e. With the armature resting against the rear pole face there must be a clearance of .045" to .050" between the armature stud and the front pole face. Slightly bend the front pole face, at the portion parallel to the length of the magnet, to obtain the required clearance.

f. If the ringer is fitted with a volume control check the stop rod, single gong ringer, two gong ringer, or rubber cam adjustment as detailed in the individual ringer subsection.

g. Slight readjustment of the "B" gong and/or clapper set may be required in order to obtain an even, good quality ring during the electrical tests. The final adjustments, however, must meet the requirements outlined above.

5.03 Electrical Tests: The objective of the electrical tests is to obtain optimum balance between the forces, acting on the armature, from the bias spring and the permanent magnet. Take care to avoid demagnetization of the magnet if magnetization equipment is not available.

6. FREQUENCY SELECTIVE RINGERS

6.01 First check the individual practice in which the specific ringer is described, for details of any special tests or adjustments. Then proceed as outlined below.

6.02 Mechanical Adjustments:

a. Slightly loosen the hexagonal head mounting screws and rotate the gongs away from the clapper, using a screwdriver through the slot in the control wheel, with its tip in one of the slots in the casting, as a lever.

b. The tuning stem must be parallel to the frame edge and the weight must be centered between the gongs of a two-gong ringer. Carefully adjust the stem near its base, if necessary.

c. If a separate clapper unit is fitted the ball must be centered between the gongs and be in line with their mounting screws on the two gong ringer or must rest 1/16" to 3/32" away from the gong and strike it within 1/8" of its edge on a single gong ringer. Slightly bend the clapper stem, forward of the angled section, to obtain these settings. Check that the clapper ball and stem are clear of the tuning weight by about 1/32". The clapper stem must rest against the rubber tubing on the tuning stem with a pressure within the range given in the individual ringer subsection. Slightly bend the clapper stem near its base to obtain this adjustment.

d. Check that the two arms of the armature are straight and parallel to the frame; and the gaps between the armature and laminations are about equal. Damaged armatures should be replaced and not readjusted.

e. Loosen the slide plate clamping screw and adjust the eccentric screw to about the mid-point of its range. Tighten the clamping screw.

6.03 Electrical Tests: The objective of the electrical tests is to adjust the ringer mechanism for mechanical resonance and to set the electrical sensitivity.

RINGERS—B-TYPE MAINTENANCE

1. GENERAL

1.01 This practice covers maintenance, adjustment procedures, and requirements for B-type ringers, including 301-type loud ringing bells.

1.02 Figure 1 shows a typical B-type ringer and its component parts. Figure 2 illustrates a typical 301 subscriber set (loud ringing bell).

Item	Description
1	Mounting Frame
2	Control Wheel (B)
3	Control Wheel (A)
4	Washer
5	Hex. Hd. Lockwasher Screw
6	Gong (A)
7	Gong (B)
8	Resonator
9	Rd. Hd. Lockwasher Screw
10	Eccentric Washer
11	Slide Plate & Lamination Assy.
12	Coil
13	Rind. Hd. Flat Washer Screw
14	Shunt Bar
15	Rd. Hd. Lockwasher Screw
16	Magnet
17	Clamping Plate
18	Rnd. Hd. Lockwasher Screw
19	Armature
20	Weight
21	Clapper Assy.
22	Rnd. Hd. Lockwasher Screw
23	Rubber Foot
24	Mounting Screw
25	Wire Assy.(With Coil 75582 Only)
26	Damper Spring (Type 131 Only)
27	Rubber Tubing (For Tuning Stem)
28	Headless Set Screw (For Weight)

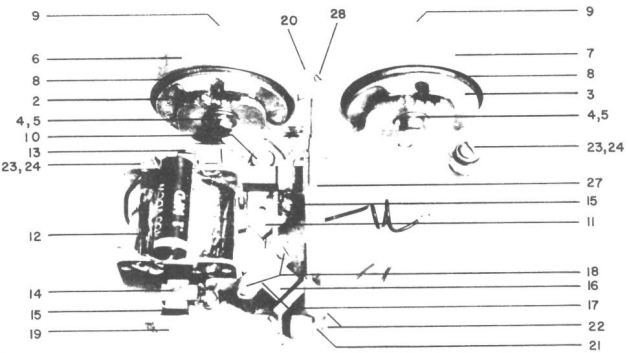


FIGURE 1 TOP VIEW

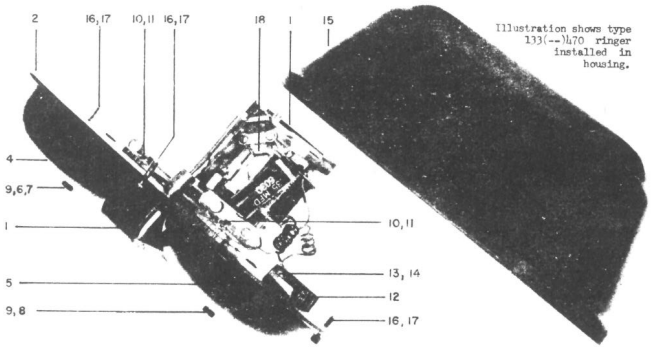


FIGURE 2 FRONT VIEW - COVER REMOVED

Item	Description
1	Bracket
2	Baseplate
3	Hex. Hd. Lockwasher Screw
4	Gong (B)
5	Gong (A)
6	Bushing (Gong B)
7	Washer (Gong B)
8	Washer (Gong A)
9	Hex. Hd. Lockwasher Screw
10	Washer
11	Hex. Hd. Lockwasher Screw
12	Terminal Strip
13	Lockwasher - internal teeth
14	Rd. Hd. Mach. Screw
15	Cover
16	Spring Washer
17	Cabinet Lock Screw
18	Ringer
19	Capacitor
20	Tubing (for item 19 leads)

1.03 The 131 ringer is a single coil, two gong, frequency selective type of unit equipped with a mechanical volume control and assembled on an open, die-cast metal frame. The 133 ringer is identical except that the volume control is omitted. The 141 and 142 ringers are similar units in all respects except that they are provided with split winding coils for party identification on toll ticketing systems. Flexible wire leads are provided for the coil connections of the ringer which is mounted on the telephone base by a locating stud and two screws, each with a shock absorbing rubber bushing.

2. MECHANICAL REQUIREMENTS

2.01 If the armature pin of a B-type ringer does not function properly, replace ringer. Check by feel and visual inspection for binding, excessive wear, or end play.

2.02 The pressure of the clapper stem against the rubber sleeve on the tuning stem must be set within the following ranges:

Ringer Frequency	Pressure
16,16-2/3, 20, 25 cps	0-2 ozs 0-60 grams
30, 33-1/3 cps	1-3 ozs 20-90 grams
40, 42 cps	2-3 ozs 60-90 grams
50, 54 cps	3-4 ozs 90-120 grams
60, 66, 66-2/3 cps	3-5 ozs 90-150 grams

The pressure must be measured at the top of the angled portion of the clapper stem.

2.03 In the high volume control (damper) position both snubbers must be clear of the gongs.

In the middle position the snubber must rest firmly on gong "B".

In the low position both snubbers must rest firmly against their respective gongs.

Bend the spring arms carrying the snubbers to effect the adjustments.

2.04 Sensitivity (using moving coil meter and ERG source). The ringer should function strongly with the maximum voltages, steadily with the minimum voltages and just tinkle with the ultimate voltages applied across the coil only for the 16 through 25 cycle ringers and across the coil and capacitor for the 30 through 66-2/3 cycle ringers.

2.05 If a buzzer tone is desired with the B-type ringer, spread gongs as far apart as possible. Reduce armature stroke as in 3.02, until clapper will not strike gongs. If this adjustment cannot be made, gongs may be removed.

3. SPECIAL ASSEMBLIES

3.01 The 75–301 ringer is only supplied with either the 79938 or 79939 ringer installed or less ringer unit. It is possible to mount the following ringer types in the type 75 housing, however, the desired ringer and housing must be ordered separately:

131–470	141–470
133–470	142–470

These ringers are mounted on the baseplate in the same manner as types 79938 and 79939 after the gongs, resonators and control wheels have been removed.

3.02 It is not possible to mount ringers type 130–470 in the type 75 housing without considerable modification to the ringer frame.

4. BIAS SPRING POSITION

4.01 B-type ringers, sent to the field in instruments or shipped separately, have the bias spring located in the high notch (see Figure 3).

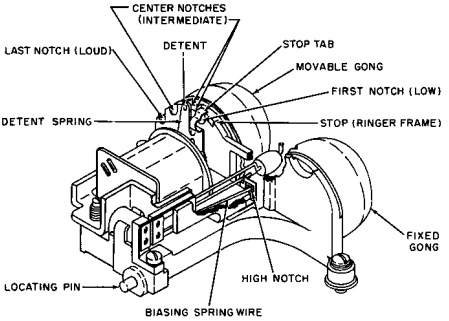


FIGURE 3
Code 130(BA)470 Ringer

4.02 Table A illustrates proper notch for bias spring to prevent bell tap and cross ring, and to provide proper ringing margin. Where the conductor loop resistance is about 1000Ω ring may be unsatisfactory. To correct, place bias spring in next lower notch.

TABLE A

Class of Service	Bias Spring Notch
Bridged Ringing	
Individual Line and PBX Stations*	High
Nonselective Party Lines†	Medium
Grounded Ringing	
2-party Flat and Message Rate	High
4-party Semiselective‡	High
4-party Selective and 8-party Semiselective	Low
Divided Code†	Medium

4.03 Obtain a ring for ringing test in accordance with local instructions. Ringing should be clear and steady. Observe during dialing that bell does not tap.

4.04 If bell tap is encountered with bias spring in medium notch and ringer is poled properly, move bias spring to high notch. Repeat ringer test and, if ringer fails to operate properly, change ringer.

NOTE: *Make certain line and ringer are poled correctly. Correct bias spring tension has been set at the factory. Do not bend bias spring.*

When three or more ringers are bridged across the line and ringer operation is unsatisfactory, placing bias spring in medium notch on all ringers may clear the trouble.

If ringer buzzes on short loop installations, when the party of opposite polarity is being called, place bias spring in high notch. If ringer still buzzes or fails to ring properly, replace ringer.

Where four ringers are connected between one side of line and ground, and ringer operation is unsatisfactory, placing bias spring in medium notch on all ringers on that side of line may clear the trouble.

5. TEST AND ADJUSTMENTS–BELL TAP

5.01 To test for bell tap–manual ring–capacitor-type bridge, operate switchhook rapidly with talking battery on the line. Bell should not ring or tap.

5.02 To test for bell tap–machine ring–dial system–capacitor-type bridge, dial any digit over 5 which is not a special code, such as long distance, operator, etc. Repeat test as many times as required. Dial tone should be heard on the line before each test.

5.03 To test for bell tap–ground identification, some specific classes of service require a ground identification from the subscriber set (e.g. tip-party). On this type, connect hand test set across terminals L1 and L2. To test, use dial of test set.

5.04 In an adjustment to stop bell tap, test polarity of ringers and line. If correct, turn biasing stud clockwise 1/16 turn at a time, until bell tap is stopped. When station or ringer cutoff key is provided, test for tapping with key in all positions. Prepay coin collector stations must be tested with coin trigger operated (circuit grounded).

5.05 To test for cross ring–manual ring–party line common battery stations, notify customer of opposite polarity that tests are being made. After tests are complete, notify customer again. Request operator to give a series of rings of the opposite polarity and proceed as follows:

a. With receiver on switchhook, bridge hand test set across terminals L1 and R of subscriber set.

b. During a silent interval, short-circuit terminals L2 and R with a suitable test cord.

c. On next ring (as indicated by audible ringing sound in test set receiver) bell should not ring or tap.

6. TEST AND ADJUSTMENT–CROSS RING

6.01 To test for cross ring–machine ring–manual and dial party line stations, reverse line wire at subscriber set terminals and proceed as follows:

a. Bridge hand test set across terminals L1 and L2 of the subscriber set, and monitor the line.

b. Obtain ring at the station. During a ringing interval, short-circuit terminals L1 and L2 as indicated by the audible signal in receiver of hand test set. If bell rings or taps, proceed as in 5.02. If bell does not ring or tap, restore original line connections.

6.02 An adjustment to stop cross ring, increase biasing spring tension by turning biasing stud not more than 1/16 turn at a time in a clockwise direction, testing for cross ringing each time, until bell is silent (see 6.01).

6.03 Final adjustment and margin test: After completing tests and adjustments to prevent tapping and cross ringing of bell, obtain a ring and increase biasing spring tension 1/2 turn of biasing spring stud. Ringing should start after a silent interval and continue clearly and steadily while the extra tension is being applied. If this test is met satisfactorily, reduce tension 1/4 turn of biasing spring stud. If ringer fails to pass test, replace ringer and repeat all tests and adjustments.

7. GONG ADJUSTMENTS

7.01 Operate armature from side to side (by means of biasing hook, if present) holding it momentarily in extreme positions of its travel. Do not grasp clapper rod to operate armature. See that clapper ball strikes each gong to produce a single clear tone, but does not rest against either gong, except in the case of 301-type loud ringing bells, where it is permissible to have clapper ball just touch the gongs at the end of each stroke. On ringers where the airgaps are changed from 0.035 inch and 0.012 inch to 0.060 inch and 0.012 inch, or vice versa, it may be necessary to bend clapper rod slightly to meet this requirement. If this is the case, a pair of long-nosed pliers should be used to bend rod close to armature. If clapper rod strikes coil or other part of ringer or, the side of the hole through which the rod protrudes, the rod may be straightened or slightly bent, as required.

7.02 Operate armature and see that clapper strikes each gong to produce a single clear tone. On the B-type ringer and 301 loud ringing bell, clapper must not rest against either gong.

7.03 To reduce the loudness of B-type ringers, make these adjustments. Reduce stroke by bending stroke limiting arm against yoke until stop pin on other side strikes pole piece. Then back off arm until proper volume is obtained. Use long-nose pliers for bending. Place pliers about 1/8 inch from the point where it enters the armature. Make final adjustment by bending arm near the middle, and readjust gongs to meet requirements in 6.03.

8. DISTINCTIVE TONES

8.01 For reduced loudness, reduce the stroke (travel) of the armature by reducing the airgap on the stop screw side and readjusting the gongs. Never reduce the airgap below 0.004 inch, the blade may enter with slight looseness or slight friction.

CAUTION: If ringer is to be silenced, do not use the above method. Disconnect ringer and see that connections for remaining ringers are in accordance with the connection paragraphs of individual descriptive practices.

8.02 For increased loudness, adjust ringer for maximum stroke (travel) according to airgap requirements in 8.01 and gong adjustments in 7.01.

8.03 If there is a complaint of low ringer volume, the B-type ringers may be adjusted to have louder volume by setting the gap at 0.060 inch on the biasing spring side and 0.024 inch on the other side. After the airgaps have been set, readjust gongs. If bell taps or cross-rings, see 5.02 and 6.01.

RINGERS – C TYPE MAINTENANCE

1. GENERAL

1.01 This practice contains procedures, methods and requirements recommended for maintenance of C-type Ringers.

1.02 The 79938 ringer mechanism is a double wound coil, straight line, biased type of unit without gongs. (See Figure 1.) It is assembled on an open die-cast metal frame. In combination with type 79939 frequency selective ringer mechanism (See Figure 2) it provides a range of telephone line ringer mechanisms for use with separately mounted gongs. Flexible wire leads are provided for the coil connections of the mechanism and the frame is provided with a number of alternative mounting holes.

Item	Description
1	Mounting Frame
2	Coil
3	Magnet
4	Pole Piece Assembly
5	Core Lamination
6	Rd. Hd. Lockwasher Screw
7	Flat Fil. Hd. Mach. Screw
8	Clapper Assembly

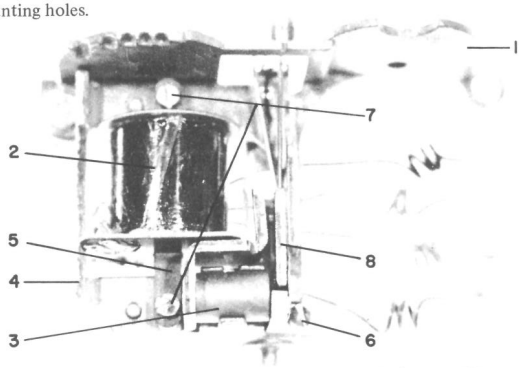


FIGURE 1. TOP VIEW

Item	Description
1	Mounting Frame
2	Coil
3	Magnet
4	Clamping Plate
5	Slide Plate & Lamination Assy.
6	Rd. Hd. Lockwasher Screw
7	Rnd.Hd. Lockwasher Screw
8	Clapper Assembly
9	Armature
10	Weight
11	Rnd. Hd. Lockwasher Screw
12	Shunt Bar
13	Washer
14	Eccentric Washer
15	Rubber Tubing (for Tuning Stem)
16	Headless Set Screw (for Weight)

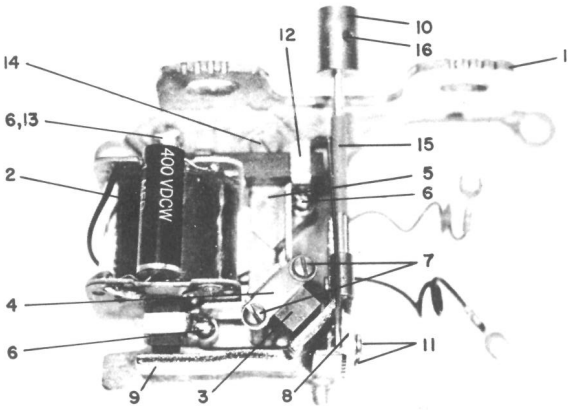


FIGURE 2. TOP VIEW

Distribution C D

1.03 The 79939 Ringer mechanism is a single wound coil, frequency selective type of unit without gongs. It is assembled on an open die-cast metal frame. In combination with type 79938 straight line ringer mechanism, it provides a range of telephone line ringer mechanisms for use with separately mounted gongs. Flexible wire leads are provided for the coil connections of the mechanism and the frame is provided with a number of alternative mounting holes.

1.04 The 130 ringer is a double wound coil, two gong, straight line, biased type of unit equipped with a mechanical volume control and assembled on an open, die-cast metal frame. (See Figure 3.) In combination with types 131, 133, 141 and 142 frequency selective ringers, it provides a complete range of units which meets the requirements of every class of telephone line ringer. (See Figure 4.) Flexible wire leads are provided for the coil connections of the ringer. The unit is mounted to the telephone instrument base by a locating stud and two screws, each with a shock absorbing rubber bushing.

2. MECHANICAL REQUIREMENTS

2.01 The armature of C-type ringers, when manually displaced, shall restore to non-operate side of airgap, with bias spring in LOW notch and volume control wheel in high position. Should armature fail to restore, replace ringer.

CAUTION: *Never bend bias spring or stop rod or adjust armature clearance.*

2.02 With ringer lying flat (as mounted in 500-type set) or mounted vertically (gongs down, as in 700-type subscriber set mounted on wall), armature in nonoperate position, and volume control wheel in low position, the clapper shall clear movable gong by a minimum 1/64 inch, maximum 1/32 inch. If this requirement is outside its limits, ringer should be replaced. Clearance between clapper and fixed gong shall be 1/64 inch. Fixed gong may be repositioned to meet this clearance. Both these clearances may be gauged visually.

3. VOLUME CONTROL

3.01 The volume control wheel may be adjusted for ringer cut off when requested by customer or in accordance with local instructions.

NOTE: *When ringer cut off feature is requested, bend stop tab up and out to just clear stop on ringer frame.*

3.02 The volume control wheel shall operate smoothly over entire range. Detent spring shall have a positive detent action at each position of wheel. Lubricate detent spring by rubbing graphite from a soft lead pencil onto bearing surface.

3.03 The adjusted ringer must function in such a manner that both gongs are equally audible in the three loudest positions of the volume control when the maximum voltages specified are applied. This same condition is desirable, but not essential, in the lowest volume position of the control.

3.04 Rotate the "A" gong to the minimum loudness position. The stop rod must line up with the reference mark on the eccentric cam and, with the armature operated, must strike the rim of the cam in all volume positions except maximum loudness so that the clapper is held 1/16" away from the "A" gong. Bend the rod near its base to obtain these adjustments. Check that the stop rod does not touch the bias spring bracket or the "A" gong.

3.05 With the stop tab on the detent spring bent away from the frame and the control wheel rotated to the cut-off position check that the stop rod rests on the eccentric cam and prevents movement of the armature assembly.

Item	Description
1	Mounting Frame Assy.
2	Gong (A)
3	Gong (B)
4	Resonator
5	Rd. Hd. Lockwasher Screw
6	Support Pole Piece Assy.
7	Core Lamination
8	Coil
9	Flat Fil. Hd. Mach. Screw
10	Magnet
11	Armature & Clapper Assy.
12	Rubber Foot
13	Mounting Screw

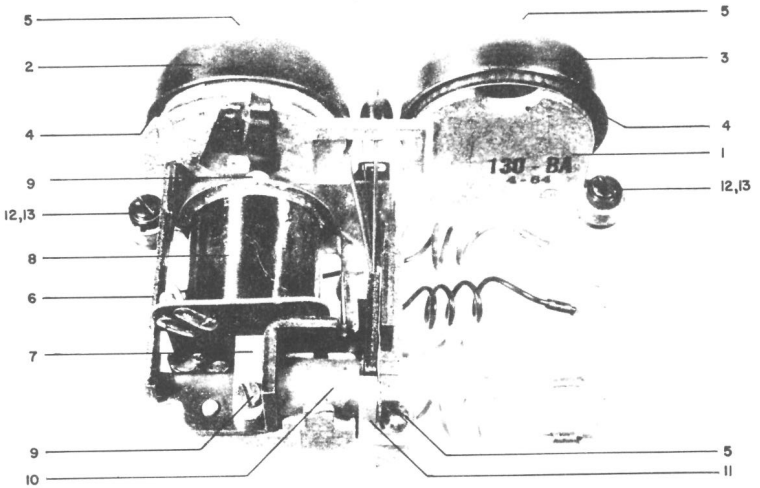


FIGURE 3. TOP VIEW

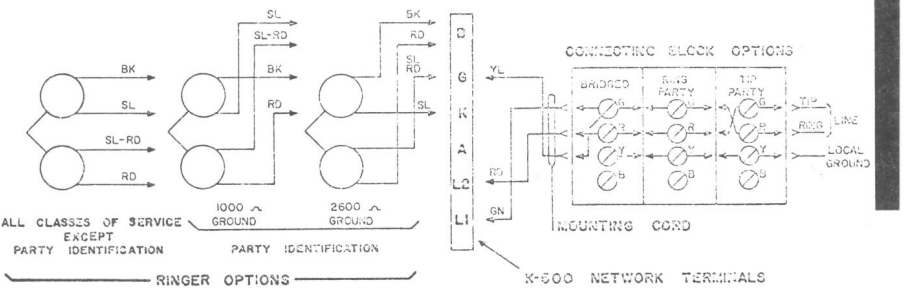


FIGURE 4. TYPICAL WIRING DIAGRAMS

3.06 Sensitivity (using moving coil meter and ERG source) the ringer should function strongly with the maximum voltages, steadily with the minimum voltages and just tinkle with the ultimate voltages applied across the coil and capacitor.

Condition	Frequency	Max. V	Min. V.	Ult. V
Low Bias	16 cps	44	36	26
	20 cps	63	48	37
	30 cps	88	56	40
High Bias	16 cps	67	58	47
	20 cps	87	77	61
	30 cps	120	107	81

4. BIAS SPRING POSITION

4.01 Bias spring settings for class of service and number of ringing bridges are shown in Table A. High tension notch of bias bracket is adjacent to fixed gong. The low notch is adjacent to movable gong.

NOTE: Correct bias spring tension has been set at factory. *Do not bend bias spring.* Do not use tools when relocating bias spring.

5. INSPECTION

5.01 Table B is a guide for requirements, tests, and procedures for C-type ringers when they are placed in service and on maintenance visits.

5.02 After completing work, obtain a ring for ringing tests according to local instructions. Check for bell tap while dialing.

5.03 If bell taps with bias spring in low notch and ringer properly poled, move bias spring to high notch. Repeat ringer test. If ringer fails to operate properly, change ringer.

5.04 When replacing C-type ringer, see that locating pin is inserted into rubber grommet before captive mounting screws are tightened. Check that ringer lead connections are tight.

TABLE A

BIAS SPRING POSITION

Class of Service	Bias Spring Notch
Bridge Ringing Services	
Individual Line and PBX Stations*	High
Nonselective Party Lines	Low
Grounded Ringing Services	
2-party Flat and Message Rate	High
4-party Semiselective†	High
4-party Selective	High, C3A Ringer
8-party Semiselective	Low, C4A Ringer
Divided Code	Low

* When three or more ringers are bridged across line and operation is not satisfactory, bias spring may be placed in low notch on all ringers. If condition is not corrected, change ringer.

† Where five ringers are connected between same side of line and ground and operation is not satisfactory, bias spring may be placed in low notch on all ringers on that side of line. If condition is not corrected, change ringer.

TABLE B
C-TYPE RINGER TESTS AND REQUIREMENTS

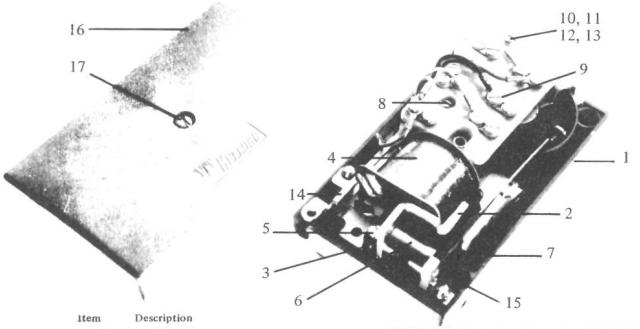
Subject	Remarks
Volume Control Wheel	See 4.01, 4.02 and 4.03.
Bias Spring	See 5.00 and Table A.
Ringer	1. Leads dressed properly and connections tight. 2. Positioned properly; mounting screws tight. 3. Clean (see section entitled Ringers, General Maintenance and Ringing Tests). 4. Gong mounting screws tight and clapper to gong clearance in accordance with 3.03. 5. Ringer shall produce a steady ring on at least one gong when volume control wheel is in low notch and on both gongs as wheel is advanced to hight notch.
Airgap	With volume control wheel in high notch, displace armature manually toward inner pole piece; check for stop pins and see that they make contact with adjacent pole pieces. If stop pins are missing, replace ringer (C4A ringer has only one stop pin). If stop pins are present but fail to make contact, determine cause. Remove dirt if found (see section entitled Ringers, General Maintenance and Ringing Tests). If stop rod is deformed, replace ringer.

RINGERS–D TYPE MAINTENANCE

1. GENERAL

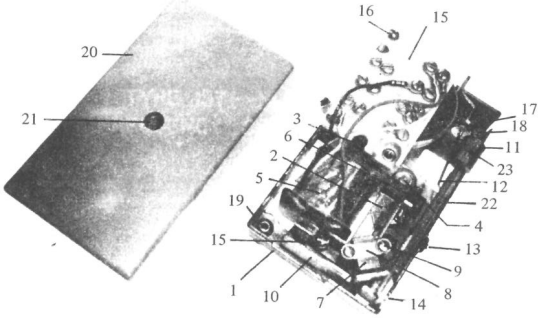
1.01 This practice contains information and maintenance procedures of the D-type ringers.

1.02 The 136 compact ringer is a double wound coil, single gong, straight line, biased type of unit equipped with a mechanical volume control and assembled on a die-cast metal base with a molded plastic cover. (See Figure 1) The 138 ringer is identical except for the addition of a gas tube and the use of a large cover. In combination with the type 137 frequency selective ringer these units provide a complete range which meet the requirements of every need for a compact telephone line main or extension ringer. Screw terminals are provided for all lead connections. (See Figure 3) The base casting is fitted with four shock absorbing rubber feet through which the mounting screws are inserted.



Item	Description
1	Frame and Gong Assy.
2	Support Pole Piece Assy.
3	Core Lamination
4	Coil
5	Flat Fil. Hd. Mach. Screw
6	Magnet
7	Armature and Clapper Assy.
8	Rd. Hd. Lockwasher Screw
9	Terminal Board
10	Rd. Hd. Mach. Screw
11	Spacer
12	Lever Lock
13	Lever Stop
14	Cord Retainer
15	Rubber Foot
16	Cover
17	Cabinet Lock Screw

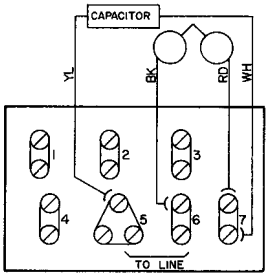
FIGURE 1 TOP VIEW - COVER REMOVED



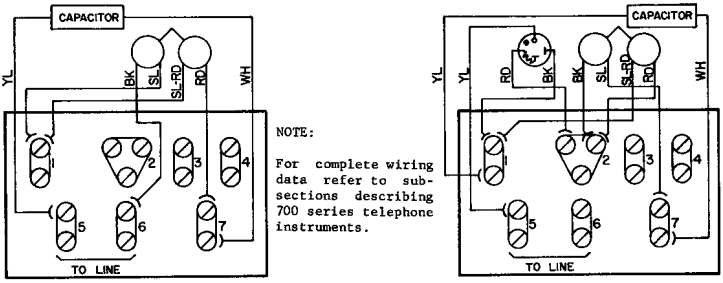
Item	Description
1	Frame and Gong Assy.
2	Slide Plate & Lamination Assy.
3	Binding Hd. Flat Washer Screw
4	Eccentric Washer
5	Coil
6	Shunt Bar
7	Magnet
8	Clamping Plate
9	Rnd. Hd. Lockwasher Screw
10	Armature
11	Weight
12	Clapper Assy.
13	Grommet
14	Rnd. Hd. Lockwasher Screw
15	Terminal Board
16	Rd. Hd. Mach. Screw
17	Cord Retainer
18	Flat Fil. Hd. Mach. Screw
19	Rubber Foot
20	Cover
21	Cabinet Lock Screw
22	Rubber Tubing (For Tuning Stem)
23	Headless Set Screw

FIGURE 2 TOP VIEW - COVER REMOVED

1.03 The 137 compact ringer is a single coil, single gong, frequency selective type of unit, with a volume control, assembled on a die-cast metal base and fitted with a molded plastic protective cover. (See Figure 2) In combination with types 136 and 138 it provides a complete range of units which meet the requirements of every class of service for compact telephone line main or extension ringers. Screw terminals are provided for all lead connections (see Figure 3A) and the base casting is fitted with shock absorbing rubber feet.



RINGER WIRING (AS SHIPPED)
(BRIDGED RINGING)



a) TYPE 136 (BRIDGED RINGING)

b) TYPE 138 (-VE RINGING)

FIGURE 3 RINGER WIRING (AS SHIPPED)

2. MAINTENANCE

2.01 When ringer fails to operate properly, check first that customer is familiar with volume control operation. If volume control is set correctly and ringer still fails, proceed as follows:

a. Check airgap at armature for dirt or foreign material and clean if necessary.

b. Be sure all connections are tight and correct.

c. Check that leads do not interfere with operation of the ringer.

d. Check mechanical requirements and bias spring position.

2.02 Replace ringer if requirements are not met. Do not disassemble, adjust, or replace armature, coil, or permanent magnet, since these are factory aligned.

2.03 With the control lever in the lowest volume position there must be a clearance of 1/16" between the tip of the rubber cam and the bushing of the clapper. Rotate the rubber cam on the shaft to obtain the required clearance. The top surface of the bushing of the clapper must be set between, level with and 1/32" below the top surface of the rubber cam. Bend the stem of the clapper near its base to effect this adjustment.

2.04 The lever lock may be set to prevent the volume control being moved from the loud position, if desired. The lever stop may be set to prevent the volume control lever from being lifted over the step of the frame into the cut-off position. No free movement of the clapper is permissible in the cut-off position.

2.05 Moving the volume control from the highest to the lowest position should result in a reduction in sound output of 10 db. This may be measured on a sound output meter. Slight repositioning of the rubber cam or clapper may be necessary to achieve this variation.

2.06 Sensitivity (using moving coil meter and ERG source) the ringer should function strongly with the maximum voltages, steadily with the minimum voltages and just tinkle with the ultimate voltages applied across the coil and capacitor.

Condition	Frequency	Max. V	Min.V	Ult. V
Low Bias	16 cps	44	36	26
	20 cps	63	48	37
	30 cps	88	56	40
High Bias	16 cps	67	58	47
	20 cps	87	77	61
	30 cps	120	107	81

2.07 The type 138 gas ringer tube must first be checked, and adjusted if necessary, in the same manner as the type 136 ringer. Then connect the gas tube and apply the ringing signals in series with a 45 to 48 volt battery.

With the bias spring in the low tension position and the gas tube biased to conduction the ringer must function strongly with a series resistance of 10,000Ω in circuit at frequencies of 16, 20 and 30 cps. When the gas tube is reverse biased the ringer must not function, or may tinkle very slightly, with no series resistance in circuit. It will probably be necessary to set the bias spring in the high notch in order to obtain these conditions.

3. MECHANICAL REQUIREMENTS

3.01 The armature will restore to nonoperate side of airgap when manually operated.

3.02 Clearance between clapper and gong should be a minimum of 1/64 inch. The pressure of the clapper stem against the rubber sleeve on the tuning stem must be set within the following ranges:

Ringer Frequency	Pressure	
16, 16-2/3, 20, 25 cps	0-1 ozs	0-30 grams
30, 33-1/3 cps	0-3 ozs	0-90 grams
40, 42, 50, 54, 60, 66, 66-2/3 cps	3-5 ozs	90-150 grams

The pressure must be measured at the top of the angled portion of the clapper stem.

3.03 Volume-control lever should operate smoothly over entire range. The sleeve on the volume control lever must rest tightly against the gong in the quiet position and must be clear of the gong in the loud position. Reshape the tip of the lever if necessary.

4. BIAS SPRING POSITION

4.01 The ringer is shipped with bias spring in the high (outside) notch. Table A indicates proper position for various classes of service.

TABLE A

BIAS SPRING POSITION

Class of Service		Bias Spring Notch	Remarks
Bridged Ringing Service	Individual Line and PBX Stations	High	If three or more ringers are bridged across line and operation is not satisfactory, place bias spring in low notch on all ringers. If condition still exists, replace ringer.
	Nonselective Party Lines	Low	
Grounded Ringing Service	2-Party Flat and Message Rate	High	
	4-Party Semiselective	High	If five ringers are connected between same side of line and ground, and operation is not satisfactory, place bias spring in low notch on all ringers on that side of line. If condition still exists, replace ringer.
	4-Party Selective 8-Party Semiselective Divided Code	Low	If ringer buzzes on short-loop installations when the party of opposite polarity on same side of line is being called, place bias spring in high-tension notch. If ringer still buzzes or fails to ring, replace ringer.

NOTE: *Do not bend bias spring. Correct bias spring tension has been set at factory. Do not use tools when relocating bias spring.*

4.02 Obtain a ringing test after completing work. Check for bell taps while dialing.

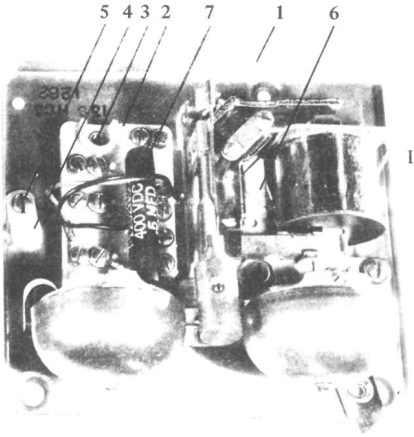
4.03 If bell taps with bias spring in low notch and with ringer properly connected, move bias spring to high notch. Repeat ringing test. If ringer still fails to operate properly, replace ringer.

EXTENSION RINGER
TYPE 139

1. GENERAL

1.01 The Type 139 Ringer is designed for use as an extension unit. It may be used as the main ringer if the telephone is not equipped with an internal ringer.

1.02 The assembly consists of a type 130, 131 or 133 ringer mounted on a steel baseplate and protected by a molded, snap-on plastic housing. See Figure 1.



Item	Description
1	Baseplate
2	Terminal Board
3	Rd. Hd. Mach. Screw
4	Cable Hanger
5	Bind. Hd. Mach. Screw
6	Ringer
7	Capacitor Assembly

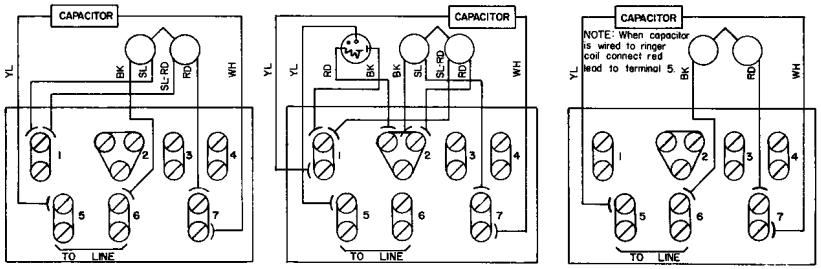
Fig. 1 TOP VIEW - COVER REMOVED

1.03 External connections are made to a terminal block mounted on the baseplate which is provided with mounting holes. Units fitted with type 130 or 131 ringer assemblies are equipped with volume controls. See Figures 2 and 3.

1.04 The cover of the assembly is removed by loosening the screw on the top edge of the cover, pulling the bottom of the cover away from the base, then lifting the cover clear of the baseplate.

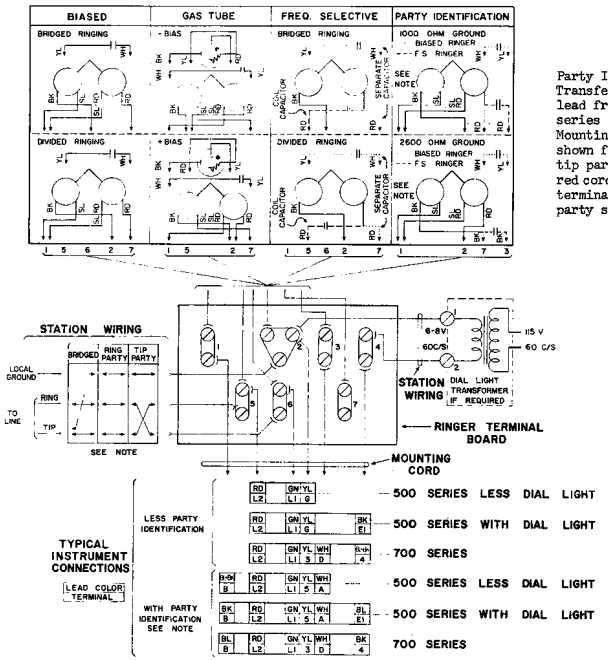
2. RINGERS AND CAPACITORS

2.01 Refer to the appropriate descriptive practices for specific details of each of the ringer units which may be fitted in the type 139 extension ringer housing. See Table 1.



a) BA RINGER (Bridged Ringing) b) TBA RINGER (-ve Ringing) c) FS RINGER (Bridged Ringing)

FIGURE 2 RINGER WIRING (AS SHIPPED)



NOTE

Party Identification: Transfer slate hook switch lead from L2 to A on 500 series telephone network. Mounting cord connections shown for ring party. For tip party reverse green and red cord conductors on ringer terminal board and use ring party station wiring.

FIGURE 3 RINGER INSTALLATION WIRING

TABLE 1 RINGERS AND CAPACITORS

Code	Frequency	Ringer	Capacitor
LR	-	None	190440-6
BA	20	130(BA)470	190440-7
TBA	20	130(BA)470	190440-7
*A1	33-1/3	**(HA1)470	None
*A2	50	**(HA2)470	None
*A3	66-2/3	**(HA3)470	None
*A4	100-1/3	**(HA4)470	190440-6
*A5	25	**(HA5)470	190440-6
*B1	30	**(HB1)470	190440-6
*B2	42	**(HB2)470	None
*B3	54	**(HB3)470	None
*B4	66	**(HB4)470	None
*B5	16	**(HB5)470	190440-6
*C1	20	**(HC1)470	190440-6
*C2	60	**(HC2)470	None
*C3	30	**(HC3)470	190440-6
*C4	40	**(HC4)470	None
*C5	50	**(HC5)470	None

F1A RINGER

1. GENERAL

1.01 This practice covers the description, installation and maintenance procedures of the BELL-CHIME F1A ringer. Three types of signal operation are available. By operating a control lever as shown in Fig. 1, the customer selects either a CHIME, a LOUD ring, or a LOW ring.

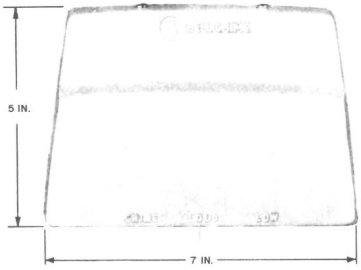


FIGURE 1. F1A Ringer with 125A Cover in Place

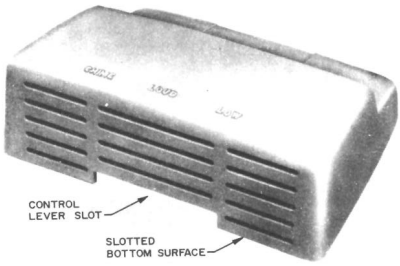


FIGURE 2. 125A Cover

1.02 The plastic cover (Fig. 2) is not supplied with the F1A ringer. Order separately as follows:

a. Cover 125A-50 (Ivory)

b. Cover 125A-63 (Gold)

2. INSTALLATION REQUIREMENTS

2.01 The F1A ringer is installed when covered by a contact memo (see Fig. 3). Typical installations include:

a. Centrally located BELL-CHIME ringer

b. Extension ringer

c. Ringer for Cinderella telephone set

d. Loud ringer

2.02 This ringer may be connected with the following classes of service:

a. Individual flat and message rate

b. 2-party flat and message rate

c. Regular PBX stations.

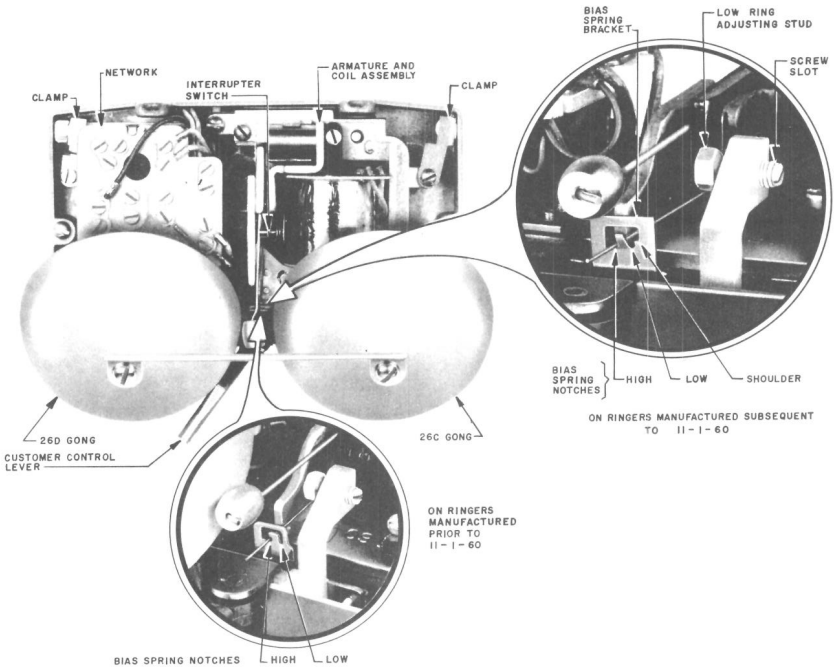


FIGURE 3. F1A Ringer, Components

2.03 This ringer *is not to be used* with cold cathode tube-type ringing bridges for the following classes of service:

a. 4-party selective

b. 8-party semiselective

2.04 In areas where inductive interference requires cold cathode tube-type ringing bridges, this ringer may be connected as shown in Figures 4 and 5.

2.05 Since the customer may experience difficulty distinguishing rings in the CHIME position, do not use with these code ringing services:

a. Nonselective party lines

b. Divided code ringing

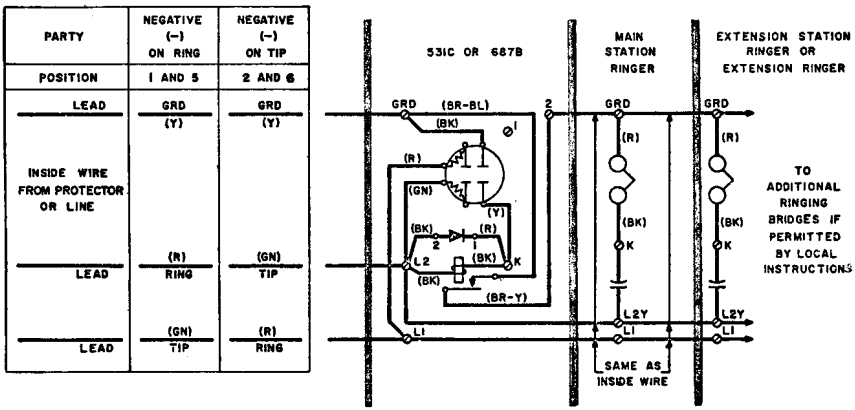


FIGURE 4. Modified 500 Subscriber Set Connections
Negative Parties - Severe Induction

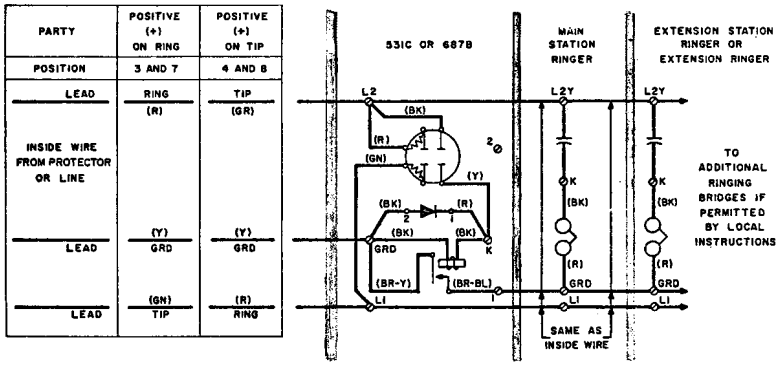


FIGURE 5. Modified 500 Subscriber Set Connections
Positive Parties - Average to Severe Induction

2.06 When tip party identification is required, it must be obtained through the ringer associated with each station. The connections are shown in the practice for particular telephone set used.

2.07 If tip party identification is required and the customer does not wish the telephone set associated with F1A ringer to ring:

a. F1A ringer should not be used for tip party identification.

b. F1A ringer should be connected as normal tip party ringer

c. Telephone set should be connected for tip party identification with the ringer silenced as described in the practice related to set.

3. DESCRIPTION

3.01 The F1A is a single coil, high impedance ringer with 2-position bias spring. The component parts, shown in Fig. 3, are:

a. Die-cast base for mounting components; it also provides cord clamps for telephone set mounting cord.

b. Armature and coil assembly similar to C-type ringers.

c. Network (498A) containing necessary electrical circuit elements which provide a 7-terminal connecting block.

d. Customer switch assembly for changing from bell to chime.

e. Interrupter switch assembly operated by movement of clapper rod to control chime operation. (Earlier model ringers have a 4-leaf spring assembly; later models have 3-leaf spring assembly.) (See Fig. 6.)

f. Stop bar to position cover away from gong assemblies.

4. INSTALLATION

4.01 Standard ringing bridge limitations apply to the use of this high impedance ringer.

4.02 Suggest a location so the customer can hear the chime or low ring in largest area of residence. The F1A will usually provide satisfactory coverage when centrally located on an inside partition about 5 feet above floor with control lever accessible to customer.

4.03 Ringer location shall allow space for tightening cover screws on top and adjusting low ring stud on right side.

4.04 Fasten directly to wall surface with two fasteners. Select length of fastener to provide secure mounting to particular wall material.

a. Use No. 8 RH wood screws when fastening to wood, wood studs.

b. Use toggle bolt (or similar) on wall surfaces of hollow construction.

4.05 Inside wire may enter ringer from back, bottom, or either side. (See Fig. 7 and 8.)

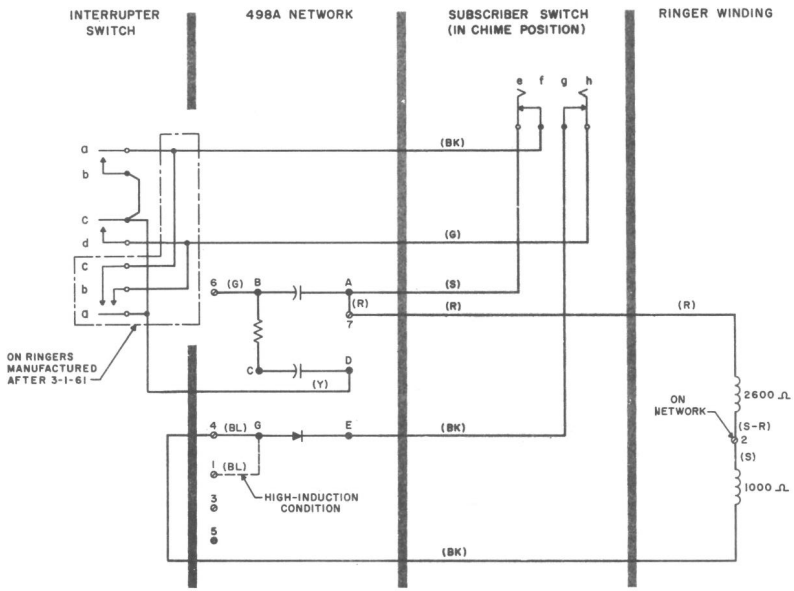
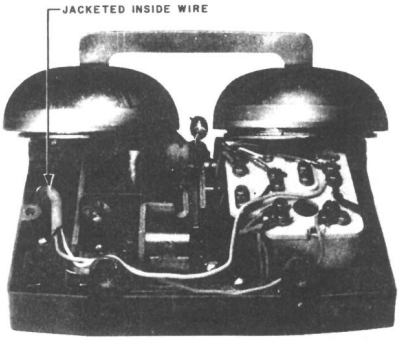
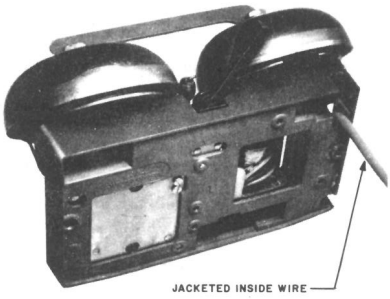


FIGURE 6. F1A Ringer, Schematic



F1A Ringer, Top View, Showing Jacketed Inside Wire Entering Through Rear

FIGURE 7.



F1A Ringer, Rear View, Showing Jacketed Inside Wire Entering Through Rear

FIGURE 8.

4.06 When inside wire enters ringer from bottom or back, mounting cord from telephone set may be brought into either end of the ringer. When inside wire enters from one end and set cord enters from opposite end, secure set cord to ringer with clamps provided.

CAUTION: *On earlier models of the F1A ringer, the interrupter switch assembly was not mounted separately. Loosening the left clamp screw may allow the component plate to shift, changing the position of the interrupter switch. On later models of the F1A ringer (Fig.3), the rack arm may become displaced from under the 26C gong plate preventing movement of the ringer control lever to the LOUD or CHIME position. Use care to prevent these conditions when loosening the left clamp screw and fully tighten clamp screw when the set cord is installed.*

4.07 Adjust volume of low ring by moving adjusting stud (Fig. 3) right or left; use a small screwdriver in slotted end located beneath right gong. Be sure that rack arm does not snag on gong plate.

NOTE: *The installer should be sure to acquaint customer with location and use of ringer control lever.*

TABLE 1.

BIAS SPRING POSITION

Class of Service		Bias Spring Notch	Remarks
Bridged Ringing Service	Individual Flat, Message Rate and PBX Stations	High	The bias spring may be placed in low notch when double tap is experienced in CHIME position or when operation is not satisfactory with bias spring in high notch. If repositioning bias spring results in dial tap or poor operation, check ringer as outlined in 6.00.
Grounded Ringing Service	2-party Flat and Message Rates	High	

5. BIAS SPRING POSITION

5.01 The ringer is shipped with bias spring in loud (left) notch. Table 1 indicates proper position of bias spring for various classes of service. (See Fig. 3.)

NOTE: *Correct bias spring tension has been set at factory. Do not bend bias spring.*

5.02 After completing installation work, obtain a ringing test in all three positions of subscriber switch. Obtain tests according to local instructions. Check for bell taps while dialing.

CAUTION: *Proper poling of the F1A ringer is very important to avoid double-tap in the CHIME position and bell taps while dialing.*

5.03 The biasing spring bracket has been changed on later models of the F1A ringer. (See Fig. 3.)

NOTE: *On later type brackets, bias spring must never be placed on shoulder located to right of low notch.*

6. MAINTENANCE

6.01 On a maintenance visit where ringer fails to operate properly, proceed as follows:

a. Check airgap at armature for dirt or foreign material and clean if necessary.

b. Make sure all connections are tight and *correct.*

c. See that all wires are dressed so that they do not interfere with operation of the ringer.

d. Clean interrupter switch assembly contacts when required, by carefully burnishing with a 265C tool.

NOTE: *Care must be taken to avoid changing adjustment of spring gap and spring tension of interrupter switch.*

6.02 If ringer rings properly but armature sticks in operated position when subscriber switch is in CHIME position, replace ringer.

6.03 If ringer rings with customer control lever in CHIME position, proceed as follows:

a. Shift network mounting plate until interrupter switch stud just touches clapper rod.

b. If Step a. results in double-tap, shift component plate *back* slightly toward original position.

c. If Step a. and b. does not correct trouble, replace ringer.

NOTE: On earlier models of the F1A ringer the interrupter switch was mounted to the network mounting bracket. On later models the interrupter switch is mounted separately to the ringer base and steps a., b. and c. will not apply.

7. CONNECTIONS

7.01 Table 2 gives connections for F1A ringer and circuit drawing is provided in Fig. 6.

TABLE 2.

LINE AND RINGER CONNECTIONS FOR F1A RINGER

Wire or Lead			Individual or Bridged	Ring Party	Tip Party
Inside Wire	Ring	R	6	6	1
	Tip	G	4	1	6
	GRD	Y	–	4	4
Ringer		R	7	7	7
		S-R	2	2	2
		S	2	2	2
		BK	4	4	4
Network Straps	G	BL	4	4	4
	A	R	7	7	7
	B	G	6	6	6

STATION APPARATUS
TROUBLE LOCATING

1. GENERAL

1.01 This addendum is issued to change a CTSP reference in regard to radio interference.

1.02 With red ink or pencil, change existing practice to read as stated in paragraph 2 of this addendum.

1.03 File this addendum directly in front of practice 480-120-700.

1.04 All holders of Station Installation Manuals should make changes as stated in paragraph 2 of this addendum and paste this addendum in front of practice located in Part III of the Station Installation Manual.

2. CHANGE

2.01 Change page 3, Table I, Transmission Troubles, Radio Interference, to read as follows:

Radio Interference	Pick up of local radio station in receiver.	Refer to CTSP 480-122-401.

STATION APPARATUS
TROUBLE LOCATING

1. GENERAL

1.01 This practice provides a station apparatus and trouble locating guide for installation, maintenance and repair.

1.02 The tests described in the following paragraphs and tables should be performed upon completion of all installation procedures and used as a guide during inspections, checks and adjustments, removal and replacement of parts, and trouble shooting.

2. TESTS WITH TROUBLE DESK – COMMON BATTERY STATIONS

2.01 The test should be made with the aid of a test desk man on the dial set or the manual set in accordance with local procedures. For tests at P.B.X. stations, check for the following conditions:

a. Dial the proper test code or call the test desk man to make the telephone set ring. If the ringer does not ring or the bell taps, refer to Table I for remedial measures.

b. Lift the handset off hook and hold it in a vertical position. Contact and talk to the test desk man. Talk directly into the transmitter in a normal conversational tone. The lips should be almost touching the transmitter cap. Check for normal sidetone during this test. Check for difficult reception. Ask the test desk man if transmission is clear. If trouble is encountered in either case, refer to Table I for corrective procedures.

c. Perform the dial speed test with the test desk man or in accordance with other local procedures.

d. With the handset held firmly at the ear and mouth, shake the mounting cord and then the handset cord. If excessive noise is heard and it changes in magnitude as a cord is shaken, check the cord and replace it if necessary. Test the transmitter for excessive noise by blowing gently into it. If the noise changes in magnitude during the test, then the transmitter unit is defective and should be replaced. If either a cord or the transmitter is replaced, repeat tests a through c.

3. AUTOMATIC NUMBER IDENTIFICATION

3.01 Where automatic number identification is used, make all tests in accordance with local procedures.

4. SUBSCRIBER INSTRUCTION

4.01 The installer shall instruct the subscriber in the proper manner of using the telephone set, before leaving the premises, and shall thoroughly acquaint the customer in the services available as a telephone subscriber.

TABLE 1

DIALING TROUBLES		
TROUBLE		CORRECTIVE ACTION
No Dial Tone	Open in mounting or handset cord.	Replace cord.
	Open or shorted receiver unit.	Replace receiver unit.
	Dial pulse contacts open or off-normal contacts closed.	Adjust or replace dial.
	Open winding in network coils.	Replace network.
	Cradle switch contacts not functioning correctly.	Check for misplaced plastic cover. Adjust contacts or replace switch assembly.
Can't Break Dial Tone	Dial pulse contacts not opening.	Adjust or replace dial.
	Filter or ringer capacitor shorted.	Replace network or ringer capacitor.
Reaching Wrong Numbers	Dial pulse contacts wrongly functioning.	Adjust contacts or replace dial.
	Incorrect dial speed (For most conditions, dial speed must be considerably in error to cause trouble).	Adjust dial speed or replace dial.
	Leaky filter or ringer capacitor.	Replace network or ringer capacitor.
Dial Clicks In Receiver	Dial off-normal contacts not closing.	Adjust contacts or replace dial.
TRANSMISSION TROUBLES		
TROUBLE		CORRECTIVE ACTION
Cannot Hear	Open receiver unit or handset cord.	Replace receiver unit or handset cord.
	Dial off-normal contacts not opening.	Adjust contacts or replace dial.
	Open winding in network coils.	Replace network.

TRANSMISSION TROUBLES		
TROUBLE		CORRECTIVE ACTION
Cannot Hear	Cradle switch contacts not opening correctly.	Check for misplaced plastic cover. Adjust contacts or replace switch assembly.
	Shorted receiver or receiver varistor.	Replace receiver unit.
Other Party Cannot Hear	Shorted transmitter unit or handset cord.	Replace transmitter unit or handset cord.
	Shorted varistor in network.	Replace network.
High Sidetone Level	Defective balancing in network.	Replace network.
Distortion and/or Clicks	Faulty receiver unit or receiver varistor.	Replace receiver unit.
	Faulty transmitter unit.	Replace transmitter unit.
	Loose connections.	Retighten connections as necessary.
Radio interference	Pick up of local radio station in receiver.	Refer to CSP ~~410-600-404~~ 480-122-401
	RINGING TROUBLES	
TROUBLE		CORRECTIVE ACTION
Rings When Other Party Called	Wrong ringer.	Replace with correct type.
	Wrong ringer or line connections.	Check connections and rewire as necessary.
	Incorrect ringing frequency	Check ringing generator frequency.
	Frequency selective ringer incorrectly tuned.	Retune or replace ringer.
	Wrong capacitor for frequency selective ringer.	Replace capacitor or complete ringer assembly.
Unable to Trip Ringing	Open dial pulse contacts.	Adjust contacts or replace dial.

RINGING TROUBLES

TROUBLE		CORRECTIVE ACTION
Unable to Trip Ringing	Open coil winding or varistor in network.	Replace network.
	Loose or open connection.	Check connections and remake as necessary.
	Cradle switch contacts not making.	Check for misplaced plastic cover. Adjust contacts or replace switch assembly.
Trips Ring, Cannot Converse	Open handset cord, transmitter or receiver unit.	Replace faulty item.
	Dial off-normal contacts not open.	Readjust dial contacts or replace dial.
	Receiver 'shorting' contacts of cradle switch not open.	Check for misplaced plastic cover. Adjust contacts or replace switch assembly.
	Faulty coil winding or open capacitors in network.	Replace network.
No Ring	Wrong ringer type. (Most likely to be observed on new installation).	Check ringer type and replace if incorrect.
	Ringer disconnected or wrongly wired.	Check ringer wiring. Correct as necessary.
	Ringer wired for silencing.	Rewire for ringer operation.
	No ground (party line) connection.	Connect ground per local practices.
	Control wheel (biased ringer) in cut-off position.	Reset wheel to ring position and disable cut-off position if desired.
	Obstruction between magnet and armature or gongs and clapper.	Remove obstruction and readjust ringer if necessary.
	Open ringer coil.	Replace ringer.
	Open ringer capacitor.	Replace network or ringer capacitor.

RINGING TROUBLES		
TROUBLE		CORRECTIVE ACTION
Volume Too High Or Too Low	Control wheel in wrong position.	Reset wheel. Instruct customer if required.
	One or both gongs loose.	Tighten mounting screws and readjust.
	Obstruction between gongs and clapper or against armature or clapper stem.	Remove obstruction and readjust ringer if necessary.
	Telephone or extension ringer on sound absorbing material.	Relocate telephone or extension ringer in accordance with wishes of customer.
Bell Taps While Dialing	Wrongly connected ringer.	Check and reconnect as necessary.
	Bias spring in low notch (biased ringer).	Check ringer and set bias spring in high notch if necessary.

AUXILIARY SIGNAL—TELEHORN 110 DB, 120 VAC HORN INSTALLATION

CONTENTS	PARAGRAPH
GENERAL	1
INSTALLATION	2
HORN ADJUSTMENT	3

1. GENERAL

1.01 The Telehorn, CTS #80-55-082-7, is a loud signaling device that can be activated by telephone ringing current or 10-20 VAC signal battery, see Figure 1. It operates from 120 VAC line current.

1.02 The Telehorn can be used on one-party lines with bridged ringing and on one-party or two-party lines with divided ringing.

NOTE: Do not use the Telehorn on multifrequency ringing lines.

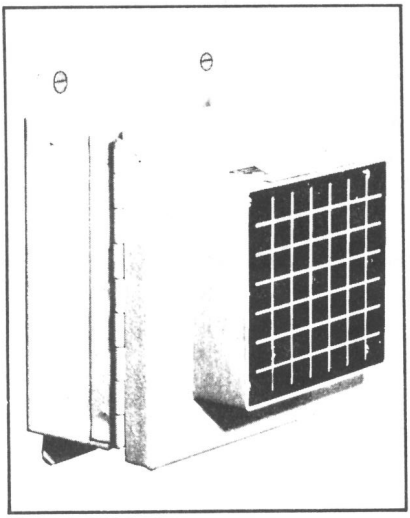


FIGURE 1. The Telehorn

1.03 10-20 VAC signaling battery, such as used in key telephone systems, can be used to activate the horn either manually or from a 207 C KTU.

1.04 A 5 foot, three conductor line cord equipped with a three-pronged plug comes with the Telehorn.

1.05 All components are contained inside the unit. The horn itself is located in the hinged cover.

2. INSTALLATION

2.01 The Telehorn can be mounted inside or outside. If mounted outside, be sure that it is not directly exposed to the elements but protected by a roof or overhang.

2.02 Locate the Telehorn within 5 feet of an electrical outlet.

NOTE: **Do not use an extension cord or splice the line cord.**

2.03 After securing the unit to a solid surface, run the inside wire to the right side of the unit. The wire should enter through the opening provided on the right side. Connect wiring as shown in Table A and Figure 2.

CAUTION: Do not plug the line cord into the receptacle until all inside wiring has been completed and cover has been secured.

2.04 Do not connect inside wire to the line side of the protector. The inside wire should come from the protected side of the protector.

2.05 When all the wires have been terminated in the Telehorn, close and secure the cover, then plug cord into 120 VAC supply receptacle.

CAUTION: If a three-way receptacle is not available, a No. 14 ground wire must be terminated on the terminal designated green and the other end must be terminated on an appropriate ground medium using a station ground clamp. The receptacle selected for supply should be one that is hot at all times.

3. HORN ADJUSTMENT

3.01 An Allen wrench (included with the Telehorn) is used to adjust the sound level. Adjust as desired by turning Allen screw located in front of the horn.

TABLE A

TERMINAL STRIP	GREEN	BLACK	WHITE	SPARE	3	2	1
Bridged Ringing One-Party						Ring (red)	Tip (Grn)
Divided Ringing Ring-Party				Tip (Grn)		Ring (red)	Grd
Divided Ringing Tip Party				Ring (red)		Tip (Grn)	Grd
10–20 VAC Signal Battery					10–20 VAC		Grd

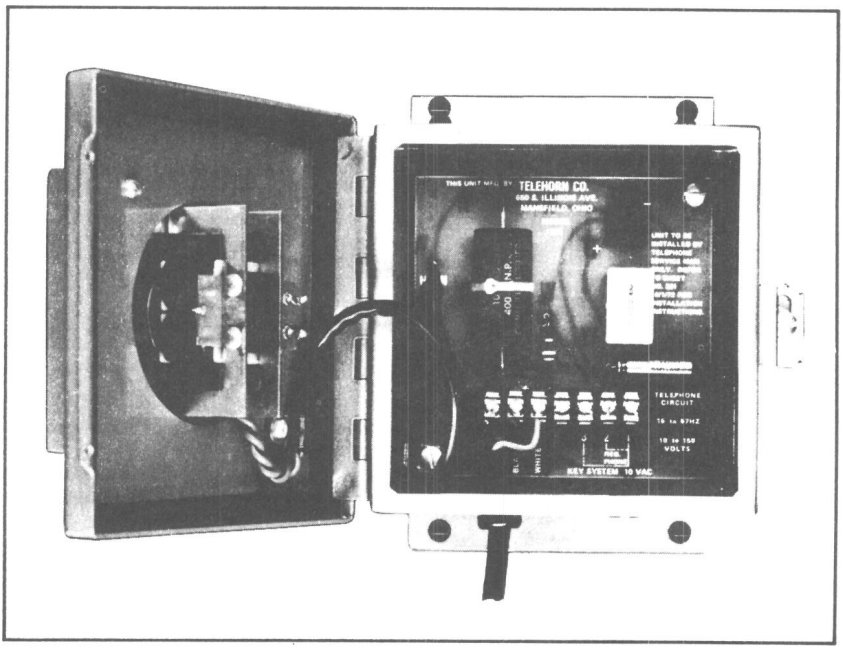


FIGURE 2. The Telehorn Showing Interior and Terminal Strip

RADIO FREQUENCY DEMODULATION SUPPRESSORS FOR TELEPHONE SETS

1. GENERAL

1.01 This practice provides information on how to *identify, select,* and *install* devices for the reduction of radio frequency interference (RFI) and covers both *inside* and *outside* plant conditions of radio frequency interference.

1.02 This practice replaces CTSP 410-600-404.

2. DESCRIPTION

2.01 Radio interference on customer's telephone set is generally caused by a radio station being too close to the customer's telephone facility or telephone instrument.

2.02 Some of the major causes of RFI has been found to be:

a. Corroded connections.

b. Loose wire terminations.

c. Abandoned drop wire still connected to the line.

d. Inside wire connected but not used.

e. Foreign attachments.

2.03 The following telephone set components may also act as effective demodulators:

a. Speech equalization varistors in networks.

b. Transistors in amplifiers of some networks or handsets.

c. Varistors and transistors such as in Touch-Tone dials.

d. Diodes in polarity guards.

e. Click suppression varistors across the receiver units.

f. Bad carbon transmitters.

2.04 In some cases, *high frequency potentials* of appreciable magnitude to ground may be present on cables or wires. It is possible for high frequency induction to cause arcing to ground across open space protectors, resulting in a sputtering or crackling noise in the receiver. Should it appear that an abnormal level of high frequency energy is present on a customer's line, refer the matter to your supervisor.

3. TEST PROCEDURE

3.01 A hand test telephone, with the transmitter shunted out, is required for the following test procedure. If the transmitter is not shunted out, it may demodulate the radio signal and render the test invalid. The following procedure is used to determine whether the source of RFI is within the telephone set, in a component, or in a line connection external to the set. The same procedure should also be used for interference testing on electronic equipment.

a. Place all telephone sets in the circuit to be tested on hook.

b. Bridge the modified (*transmitter shunted out*) hand test telephone across the line.

c. If radio interference is heard, it indicates that the source of the RFI is external to the telephone sets. In this case, perform corrective action as described in paragraph 4.

d. If radio interference is not heard, it indicates that the source of RFI is internal to one or more of the telephone sets. In this case, perform corrective action as described in paragraph 5.

3.02 Because of the numerous possible sources of such interference and the unpredictable level of RFI energy which might prevail, it is impossible to prescribe a specific series of instructions which may be uniformly applied in correcting all RFI trouble. Each case of RFI trouble must be investigated and a solution determined based on those conditions which are peculiar to the location involved. Therefore, one or more of the following corrective measures may be required to correct a given case of RFI.

3.03 If the methods outlined in this practice do not eliminate RFI, refer the problem to your supervisor.

4. RFI CORRECTIVE MEASURES–*EXTERNAL*

4.01 In those instances where RFI is determined to be external to the telephone set, it will first be necessary to check all line connections between the cable terminal and the telephone set connecting block. This check should also include an inspection of station protector and protected cable terminal carbons, where found. All corroded connections should be cleaned and defective carbon blocks should be replaced. If RFI problem is still evident, proceed as outlined in the following paragraphs.

NOTE: RFI energy may go to ground and be demodulated through the carbon in a protector with no apparent damage being done to the carbon. If this condition exists, remove the carbons and make proper tests.

4.02 Small ceramic disk type capacitors of ±20 percent tolerance and a 500 volt rating installed at the station protector should alleviate RFI. Capacitors of the following values should be obtained for RFI application:

$0.01\mu f$ $0.02\mu f$ $0.03\mu f$

4.03 Two capacitors are required for RFI suppression at the station protector (see Figure 1). It may be necessary to substitute capacitors of various values until interference is eliminated. It is desirable to employ the minimum capacitance necessary to eliminate the trouble. Thus, $0.03\mu f$ units would not be used if $0.01\mu f$ capacitors would clear the line and in no event would $0.01\mu f$ and $0.02\mu f$ or similar unequal combinations be employed. Install capacitors as follows:

a. Insulate capacitor leads with standard tubing. Keep leads as short as possible. See Figure 2a.

b. Terminate the other lead of each capacitor on the ground post of the protector. See Figure 2b.

c. Terminate one lead of the first capacitor on the tip and one lead of the second capacitor on the ring terminal on the station side of the protector. See Figure 2c.

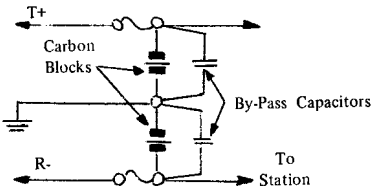


FIGURE 1. Capacitor Installation on Station Protector

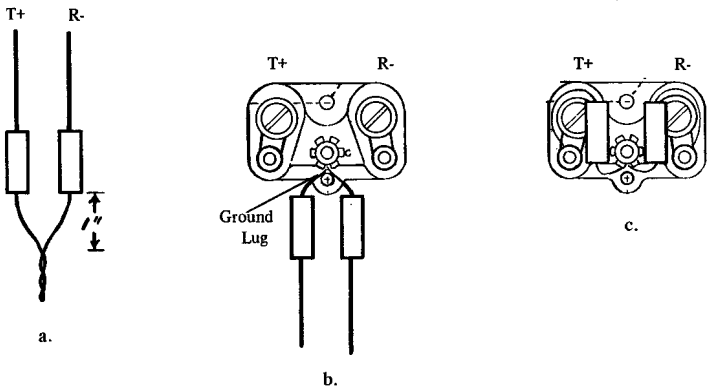


FIGURE 2. Capacitors Mounted on Station Protector

4.04 In some severe cases of RFI, it may be necessary to place bypass capacitors at the serving terminal in addition to those placed within the telephone set or protector. These additional capacitors shall be mounted outside the terminal in a one pair line arrestor (either cable or open wire type is acceptable). Mount the arrestor as close to the terminal as possible, keeping in mind the need to *avoid climbing area infractions* while maintaining easy access to the cable terminal. Remove carbon blocks before installing capacitors. Carbon blocks are not to be used in this application of the line arrestor. Refer to Figure 3 and proceed as follows:

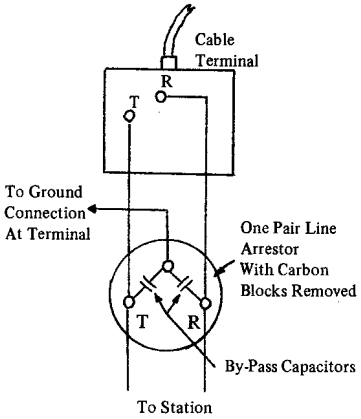


FIGURE 3. Capacitor Installation at Cable Terminal

a. Insulate capacitor leads with standard tubing. Keep leads as short as possible.

b. Terminate one lead of the first capacitor on the *tip* and one lead of the second capacitor on the *ring* terminal of the arrestor.

c. Terminate the other lead of each capacitor on the *ground* terminal of the line arrestor.

d. Connect short lengths of drop wire between tip terminals and between ring terminals of cable terminal and line arrestor.

e. Place a short length of wire between a dependable ground connection on the cable terminal and the ground terminal of the line arrestor.

5. RFI CORRECTIVE MEASURES–*INTERNAL SUPPRESSION DEVICES*

5.01 In those instances where RFI is determined to be internal to the telephone sets, it will first be necessary to check for *loose* or *corroded* line connections. This check should also include an inspection for defective *telephone cord sets.* Sometimes replacement of the *transmitter* and *receiver capsules* will eliminate an RFI problem. If the RFI problem is still evident after the above inspections and appropriate corrective measures, install drainage capacitors.

5.02 A CAC1542A *inductor* can be effectively used as a radio frequency suppression coil. The *inductor* should be installed as close as possible to the telephone set. The mounting block is designed to be mounted on a wall in place of the usual telephone connecting block. Inductor mounting block installation procedures are similar to connecting block installation procedures (see Figures 4 and 5). If the inductor is used with an instrument that does not require a connecting block, the inductor should be connected across the line as close as possible to the subset of the instrument.

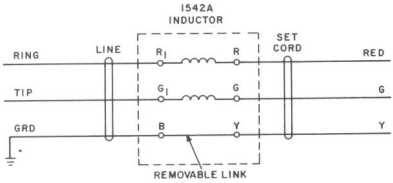


FIGURE 4. 1542A Inductor Schematic

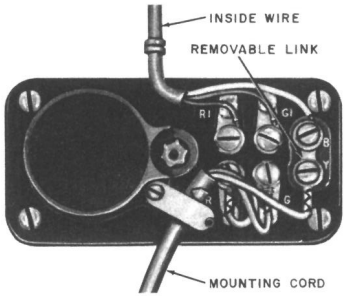
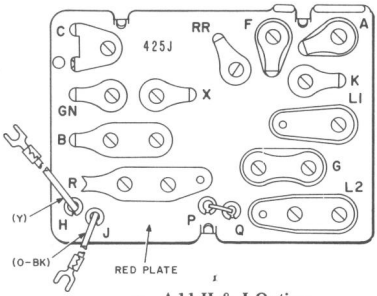
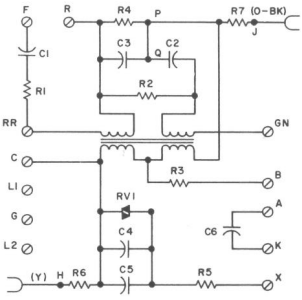


FIGURE 5. Cording Diagram, 1542A Inductor

5.03 A W.E. Co. 425J *network* eliminates the speech equalization varistors and adds *resistors* to remove radio interference (see Figures 6a. and b.). The 425J can be used for rotary or Touch-Tone dial applications. The 425J also contains an equalization network for Touch-Tone dials by using the X terminal (see Figure 6a.).



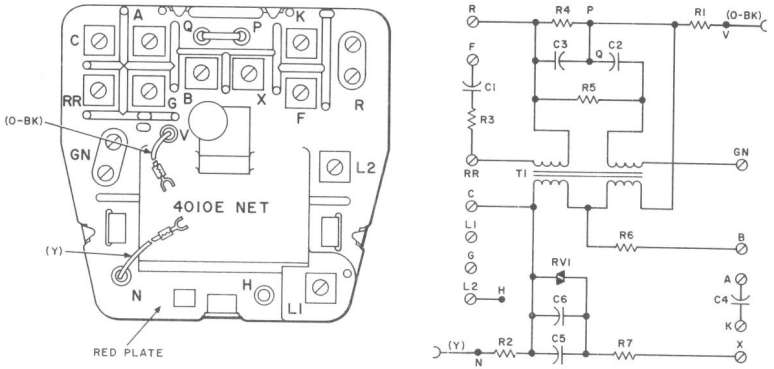
a. Add H & J Option



b. Add H & J Wiring Option

FIGURE 6. 425J Network and Schematic

5.04 The W.E. Co. 4010E *network* operates the same way as the 425 except that there is a difference in wiring options (see Figures 7a. and 7b.).

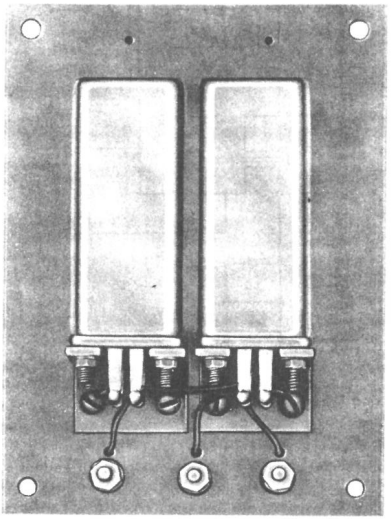


a. "N" and "V" Option

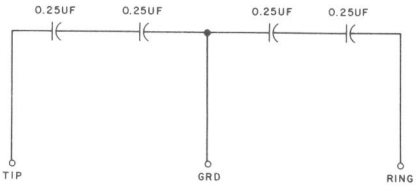
b. Add "N" and "V" Wiring Option

FIGURE 7. 4010E Network and Schematic

5.05 The W.E. Co. 40BA *capacitor* should be located at the protector to bypass radio frequency signals to ground. Bypass capacitors should be installed across all other components of the telephone set that may act as a demodulator, such as a *transmitter* unit, *receiver* unit, *transistors* in *amplifiers, polarity guards,* etc. (see Figures 8a. and b.).



a. Capacitor



b. Schematic

FIGURE 8. 40BA Capacitor and Schematic

6. INSTALLATION OF A PROTECTOR WITH THE 40BA *CAPACITOR*

6.01 The 40BA *capacitor* should be installed near and connected to the protector with as short a piece of inside wire as possible (see Figure 9).

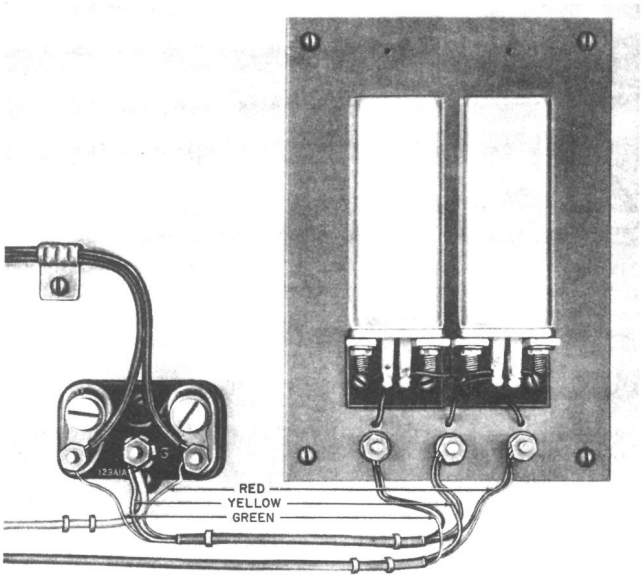


FIGURE 9. 123A1A Protector with 40BA Capacitor Installed

7. W.E. CO. KS-13814, LIST 7 *CAPACITOR*

7.01 The W.E. Co. KS-13814, List 7 capacitor or equivalent may be the most effective device for eliminating radio interference in 500 and 700 type telephone sets (see Figure 10).

FIGURE 10. KS-13814, List 7 Capacitor

7.02 The KS-13814, List 7 *capacitor* is installed in the 500 type telephone sets as shown in Figure 11. It is connected across the L and RW terminals of the 311A equalizers. Place the capacitor against the equalizer as shown. Cover the exposed portions of the leads with tubular insulation.

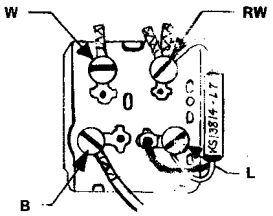


FIGURE 11. 500A, B or 501A, B Telephone Set, KS-13814, List 7 Capacitor Installed

7.03 The KS-13814, List 7 *capacitor* is installed in the 500 and 554 telephone sets as shown in Figure 12. It is connected across the F and L2 terminals of the 425 network. If the set is used as the tip station on two party message rate service, the capacitor should be connected across L1 and L2 of the 425 network. Cover the exposed portions of the capacitor leads with tubular insulation. For low frequency interference, another KS-13814, List 7 capacitor may be needed across terminals R and RR on the 425 network.

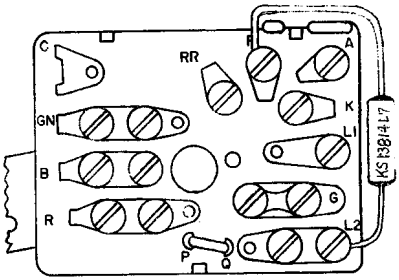


FIGURE 12. 500 and 554 Telephone Set, KS-13814, List 7 Capacitor Installed

7.04 The KS-13814, List 7 *capacitor* is installed in the 500 and 554 type telephone sets as shown in Figure 13. It is connected across the L2 and GN terminals of the 425 network as shown. Place the capacitor against the side of the network nearest the ringer. Cover the exposed portions of the capacitor leads with tubular insulation.

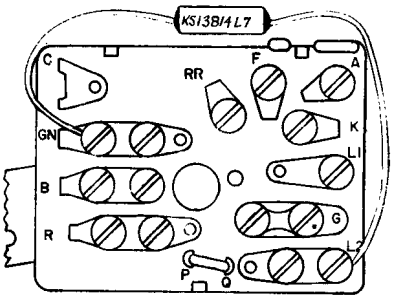


FIGURE 13. 500 and 554 Type Telephone Set, KS-13814, List 7 Capacitor Installed

7.05 The KS-13814, List 7 *capacitor* is installed in the 701 type telephone sets as shown in Figure 14. It is connected between the F and C terminals of the 495 network. Cover the exposed portions of the capacitor leads with tubular insulation.

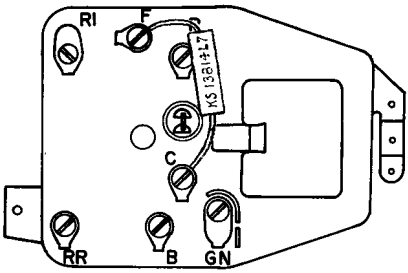


FIGURE 14. 701 Telephone Set, KS-13814, List 7 Capacitor Installed. Dial Removed for Clarity

7.06 The KS-13814, List 7 *capacitor* may be placed inside the G type handset to bypass the transmitter unit as shown in Figure 15. Place the capacitor against the transmitter cup, keeping the capacitor leads as short as possible.

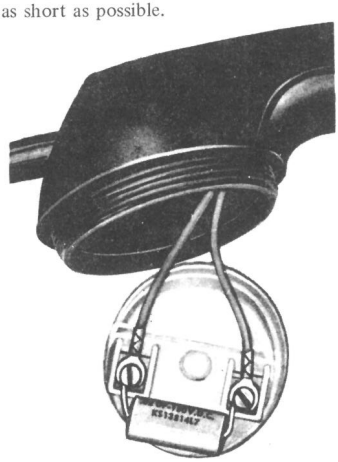


FIGURE 15. KS-13814, List 7 Capacitor, Handset Transmitter Cup

7.07 The KS-13814, List 7 *capacitor* may be used to bypass the 44A varistor on a U1 receiver unit as shown in Figure 16. Place the capacitor against the varistor, keeping the capacitor leads as short as possible.

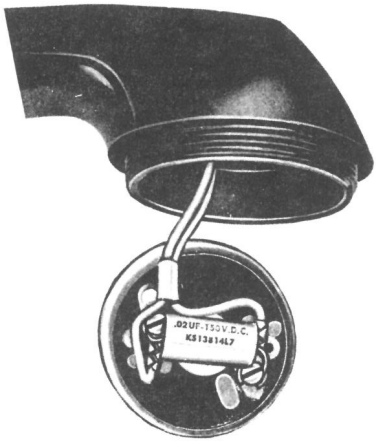


FIGURE 16. KS-13814, List 7 Capacitor, Handset Receiver Unit

MODULAR TELEPHONE APPARATUS DESCRIPTION AND INSTALLATION

CONTENTS

1. GENERAL

1.01 This practice provides the description and installation instructions for modular telephone apparatus.

1.02 Modular telephone apparatus provides the ability to accommodate telephones and other terminal equipment with plug and jack portability. Telephones and other terminal equipment are now being equipped with a miniature plug that is compatible with miniature jack apparatus.

1.03 Desk type apparatus is equipped with a plug-ended, flat silver satin line cord. Wall type instruments are fitted in the field with adapters that enable a plug and jack installation on modular type wall hardware.

1.04 The modular concept relies on a miniature plastic plug and jack arrangement. The plug is shaped to be inserted in one position only which guarantees polarity. The plug contacts are recessed in a comblike configuration and are precious metal covered. The plug has an integral snap lock that secures the plug into the jack. The jack has flexible wire spring contacts that are precious metal covered. When the jack receives the plug, the comb on the plug separates and insulates the contacts from one another. The design of the plug and jack allows for wire spring travel, ensuring good contact. See Figure 1.

1.05 The plug is removed by depressing the tab on the snap lock and at the same time pulling the plug out of the jack. The snap lock tab protrudes out of the jack allowing removal without the aid of any tools.

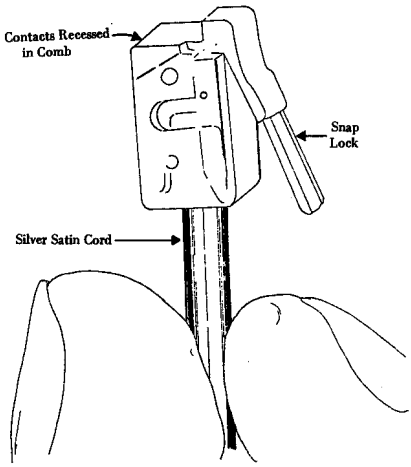


FIGURE 1. Miniature Plug

2. DESCRIPTION OF MODULAR CONNECTING APPARATUS

2.01 The following modular items are described in this practice.

a. Silver Satin Line Cord: 7 feet, CSS No. 30-54-627-3; 14 feet, CSS No. 30-54-628-0; and 25 feet, CSS No. 30-54-629-0.

b. (1) 625A Surface Mounted Jack, CSS No. 30-51-273-5.

(2) NT-625QA4 Surface Mounted Jack, CSS No. 30-51-273-5.

c. 625C Conversion Cover for 42A Connecting Block, CSS No. 30-51-255-7.

Distribution IV (C D)

d. 625F Flush Mounted Jack, CSS No. 30-51-256-5.

e. 630A Wall Telephone Jack Mounting, 6-Term, CSS No. 30-59-248-8 and 4-Term, CSS No. 30-59-247-0.

f. 228A Wall Adapter for 554 type telephones, CSS No. 30-59-460-0.

g. 229A Wall Adapter for 2554 type miniwall telephone, CSS No. 30-59-462-6.

h. 230A Wall Adapter for Trendline type telephone, CSS No. 30-59-461-8.

i. 191B Backboard for wall telephone, ash, CSS No. 30-90-006-9.

j. Spacer for surface wiring of wall telephones, CSS No. 30-97-240-0.

2.02 Additionally, the following hardware is discussed. For convenience, CSS numbers are provided.

a. 42A Connecting Block, CSS No. 30-51-251-4.

b. 43A Bracket, CSS No. 30-51-210-3.

c. 19A Faceplate, CSS No. 30-59-474-0.

d. 63A Junction Box, CSS No. 62-33-043-8.

e. 60 Type Mounting Ring, CSS No. 30-62-161-5.

f. 16A Faceplate, CSS No. 30-59-470-7.

g. Weatherproof Cover Assembly, CSS No. 30-59-122-8.

2.03 Some of the new modular hardware has been designed to be used with existing connecting apparatus described in the applicable paragraphs.

2.04 **Modular Silver Satin Line Cords (Figure 2):** Modular silver satin line cords are flat four-conductor cords with spade tips on one end and a miniature plug on the other end. In modular installations, the terminal apparatus will be hardwired by the spade tipped end. The miniature plug will mate with the miniature jack. Silver satin line cords are available in 7, 14, and 25 foot lengths.

2.05 **625A or NT-625QA4 Surface Mounted Baseboard Jack (Figure 3):** These jacks are designed to replace existing baseboard mounted connecting blocks. It is used for desk telephone applications.

2.06 **625C Conversion Cover for 42A Connecting Block (Figure 4):** This jack consists of a cover and jack assembly which fits over an existing 42A connector block, making it compatible with the modular system. The jack has spade-tipped leads which are connected to the existing screw terminals on the 42A block.

2.07 **625F Flush-Mounted Jack (Figure 5):** This flush-mounted jack is designed to accommodate plug-ended mounting cords used in modular installations. It can be mounted in any standard electrical outlet box by using a 43A bracket and 19A faceplate. This jack can also be used in prewired installations in conjunction with a 63A junction box, 60 ring, and a 16A faceplate.

2.08 **630A Wall Telephone Jack Mounting (Figure 6):** These jacks are designed for use with all wall-mounted telephone sets which have been equipped with the appropriate adapters. The metal cover assembly of the jack has two lugs which mate with corresponding keyholed slots in the telephone set adapter and permit installation or removal of the set for portability. These jacks can be mounted to a standard electrical outlet box for prewired installations, or directly to a wall surface using the optional spacer and the appropriate mounting hardware. See paragraph 2.11.

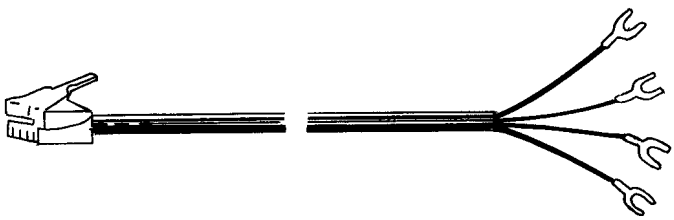
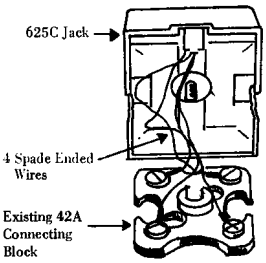
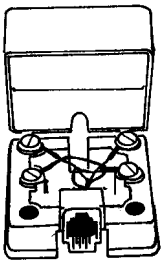


FIGURE 2. Modular Silver Satin Line Cord



625A



NT-625QA4

FIGURE 3. Surface Mounted Modular Jacks

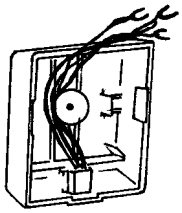


FIGURE 4. 625C Connecting Block Conversion

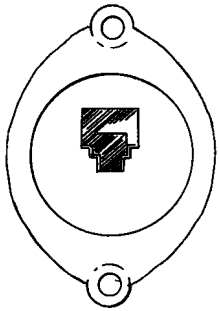


FIGURE 5. 625F Modular Jack

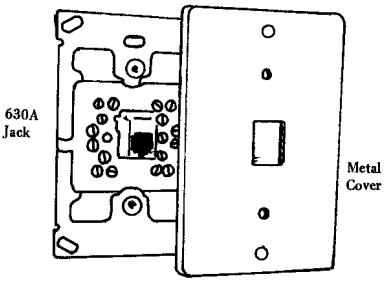
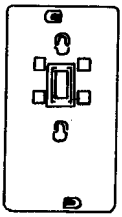
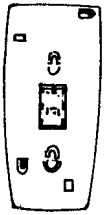


FIGURE 6. 630A Wall Telephone Modular Jack

2.09 Wall Telephone Adapters (Figure 7): Wall telephone adapters mount on the baseplate of standard wall-type telephone sets to adapt them for use with the miniature jack. All adapters have a self-aligning plug with four spade-tipped leads from each plug terminal to connect the plug to the telephone set circuitry. The adapters also have two keyholed slots which correspond to the mounting lugs on the jack cover assembly to permit installation or removal of the set.



228A For 554 or 3554 Telephone



229A For 2554 Miniwall Telephone

230A For Trendline or Slenderette Type

FIGURE 7. Adapters for Wall Telephones

2.10 191B Backboard (Figure 8): This backboard is designed to act as a frame around the 630A jack. It is used to cover up wall imperfections adjacent to the jack. It is held in place by a self-adhesive backing.

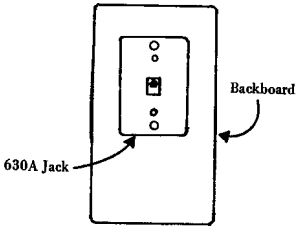


FIGURE 8. 191B Backboard

2.11 Spacer (Figure 9): The spacer adapts the 630A type jacks to wall surface mounting with surface wiring or concealed wiring. The 630A jack mounts on top of the spacer.

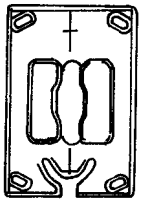


FIGURE 9. Spacer

3. INSTALLATION

3.01 Generally, instrument installation procedures are:

a. Install appropriate jack for a desk and/or wall set.

b. Plug telephone set into jack and test for proper operation.

NOTE: When mounting a modular wall set, the first thing that must be done is to guide the plug into the receptacle. it must remain

slightly engaged while the studs are being located. This is necessary to prevent damage to the plug caused by bumping against the jack. While mounting, it is helpful to view the wall set from the side. See paragraphs 3.06 and 3.07 for detailed information on installation of wall telephones.

c. Stamp Station Number Card "Q" to identify modular installation. See Figure 10.

Q AREA CODE 209

555-1212

CONTINENTAL SYSTEM

Q 209-555-1212

FIGURE 10. Station Number Cards

d. Test for proper operation.

3.02 **Installation of Jacks:** The 625A or NT-625QA4 jack provides a termination for station wire and the mounting cord as follows:

a. These jacks are intended for new installations of modular desk sets using a surface mounted jack. See Figure 11.

(1) The jacks are mounted on a baseboard or similar mounting surface with the jack opening facing downward or to the left or the right.

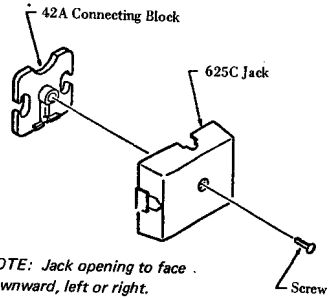
NOTE: The plug entrances of the jacks should be positioned facing downward if at all possible or to the right or left, never facing upward, to prevent foreign matter and cleaning fluids from entering the jack.

(2) Inside wiring is routed through the desired slot and connected to the appropriate terminals.

(3) The NT-625QA4 cover has knockouts to permit alternate wiring entries. The cover snaps over the jack base. To remove cover, insert a screwdriver in the slot on either side of the rear wire entry hole and twist screwdriver.

(4) The cover of the 625A (625C) is secured by a center screw.

b. The 625C is to convert existing 42A connecting blocks to accept plug-ended mounting cords. Remove the cover from the 42A block. Connect the leads from the 625C jack to the matching colors designated on the 42A block. Mount the jack on the connecting block with the screw provided. See Figure 12.



NOTE: Jack opening to face downward, left or right.

FIGURE 12. Conversion of 42A Connecting Block Using 625C Jack

c. The 625F (Figure 13) is intended for new or existing installations requiring flush-type connections. For an electrical box installation, use a 43A bracket (CSS No. 30-51-310-3) and a 19A faceplate (CSS No. 30-59-474-0). See Figure 14.

d. The 625F jack may be flush-mounted on a baseboard or wall panel as follows (Figure 15):

(1) Drill a 1 1/4-inch hole in the baseboard.

(2) Connect the inside wire to the R, G, Y, B terminals of the jack.

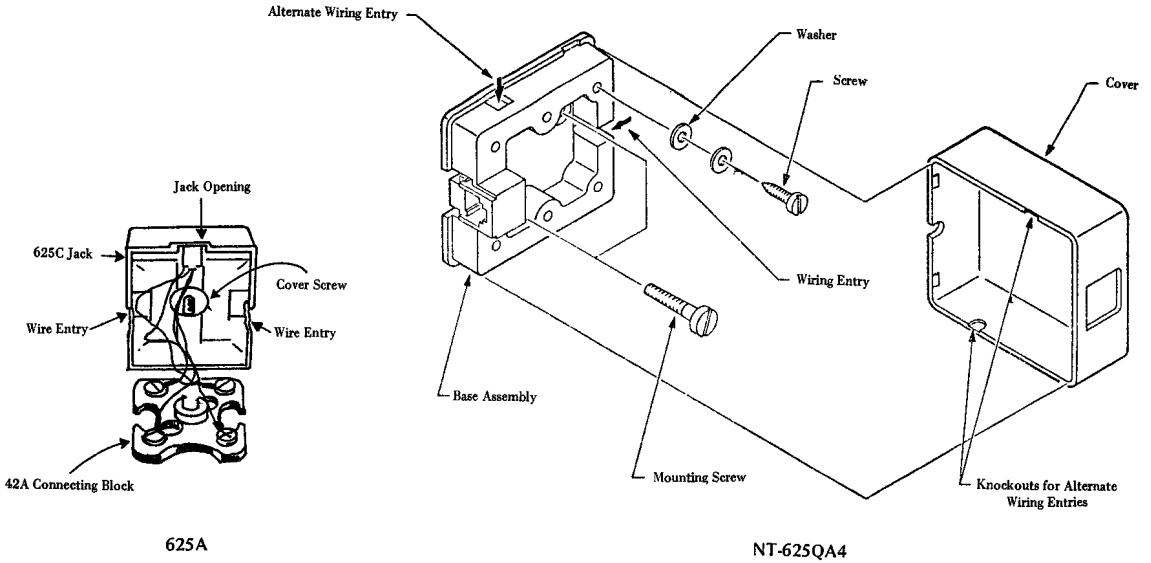
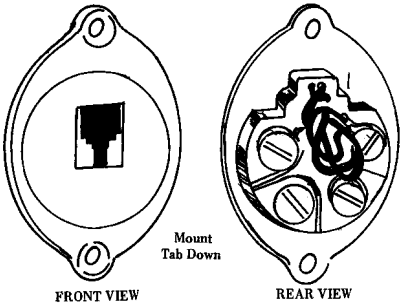


FIGURE 11. Baseboard Jacks



Flush-mounted jack for use in:

a. Standard Electrical Box using 43A bracket and 19A faceplate.

b. Prewired installation using 63A junction box and 16A faceplate.

c. Flush-mounted to baseboard or wall using 1 1-4-inch hole.

FIGURE 13. 625F Miniature Jack

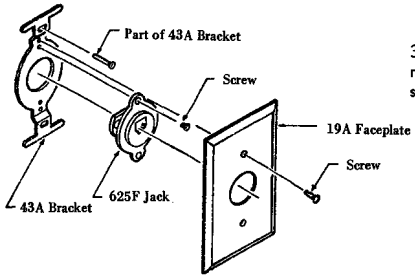


FIGURE 14. Installation of 625F in Flush Electrical Box

(3) Insert the jack in the hole and fasten with 2 screws provided.

e. For prewired installation, a 63A junction box (CSS No. 62-33-043-8), 60 type mounting ring (CSS No. 30-62-161-5), the 625 jack and a 16A faceplate (CSS No. 30-59-470-7) should be used. See Figure 16.

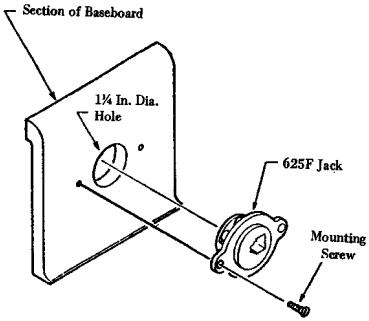


FIGURE 15. Baseboard Mounted 625F Miniature Jack

f. Outdoor installation can be accomplished using the 625F jack with a weatherproof cover assembly (CSS No. 30-59-122-8) installed in a weatherproof electrical box.

3.03 **630A Wall Telephone Jack:** This jack mounts on a standard electrical outlet box as described in the following steps:

a. Route the inside wire from the outlet box through one of the holes in the jack.

b. Fasten the jack to the outlet box with the two screws provided. See Table A.

c. Connect the inside wire to the appropriate terminals. Plumb jack. Tighten screws. In some cases, such as when mounting hardware is underflush, the jack will distort if screws are too tight. In such cases, tighten screws until just tight enough to make the assembly tight on the wall once mounting plate is attached.

TABLE A. Fasteners for 630A Jack (Note 1)

To Fasten Jack To:	USE TWO (2) EACH OF FASTENERS INDICATED			
	Flat Head No. 6-32 Machine Screw 3/4-Inch	Hollow Wall Anchor or Toggle Bolts	Plastic Screw Anchor	No. 8-15 By 1 Inch Flat Head Tapping Screw Type AB (Note 2)
63A Bracket, Device Box, Plaster Ring	X			
Stucco or Plaster on Wood Lath				X
Plaster on Metal Lath, Paneling on Furring Strips, or Plaster-board on Studs		*		X
Hollow Masonry		X		
Solid Masonry			X	X

* Alternate Fasteners

NOTES:

1. *If jack is not securely fastened to the wall with the recommended number of fasteners, additional fasteners should be used.*
2. *Or other available screw of equivalent (or greater) size, and thread engagement.*

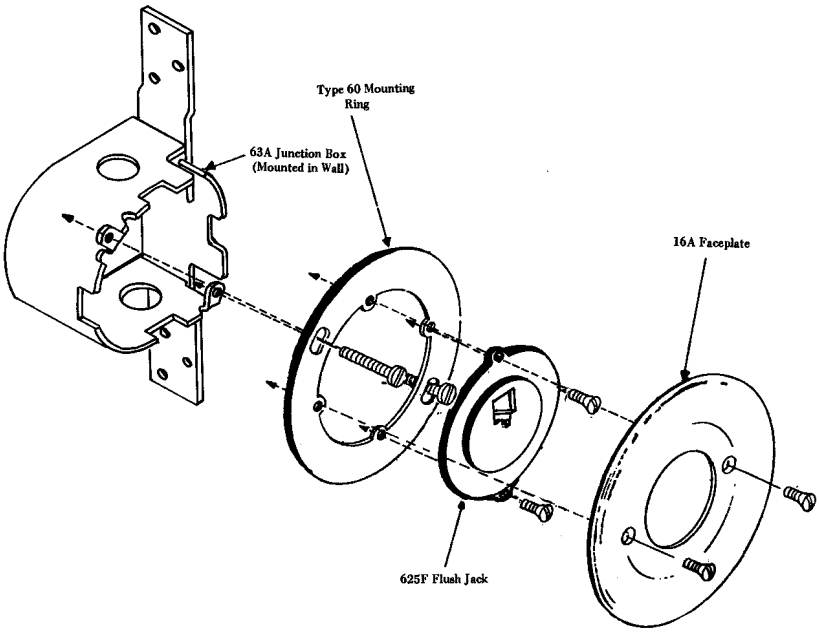


FIGURE 16. Installation of 625F Jack Using 63A Junction Box, 60 Ring and 16A Faceplate

d. Install the wall telephone mounting cover using the screws provided. See Figure 17.

3.04 If no outlet box is provided, the 630A can be mounted on a spacer (CSS No. 30-97-240-0). Provision is made in the spacer for entry of concealed wiring through the back or for surface wiring through the bottom. Install as follows:

a. Using the spacer as a template, drill the required mounting holes.

b. Route the inside wire through the spacer and through one of the holes in the jack.

c. Align the jack with the spacer and fasten both to the wall using four screws (not provided).

d. Connect the wires to the appropriate terminals.

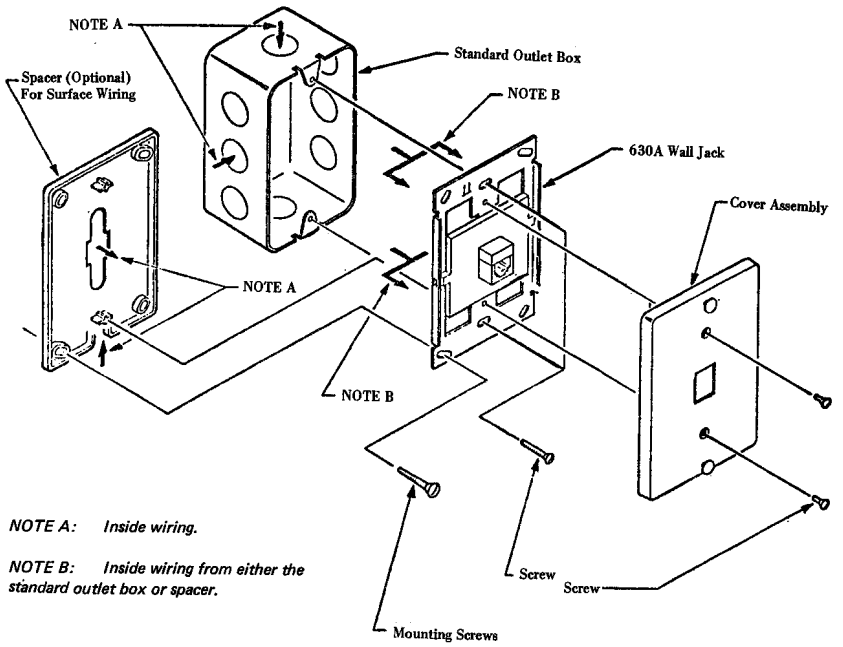


FIGURE 17. 630A Miniature Wall Jack

e. Install the cover plate using the two screws provided. See Figure 17.

NOTE: Care must be taken when mounting this wall jack to allow sufficient space to mount the telephone set when locating the set adjacent to door frames or cupboards, above moldings or counter tops.

3.05 191B Backboard: This backboard is used to cover an unpainted or damaged area surrounding the wall telephone jack. The backboard fits around the cover plate of the wall jack and is fastened to the wall using self-adhesive tape. See Figure 18.

3.06 Installation of 228, 229 or 230 Wall Telephone Adapters: The 228A adapter is used with 554 and 3554 type wall telephones. The 229A adapter is used with the 2554 type miniwall telephone. The 230A adapter is used with Trendline type wall telephones. Install all adapters as follows:

a. Remove the telephone set housing.

b. Route the wiring from the adapter through the hole in the back of the set. See Figures 19 and 20.

c. Fasten the adapter to the baseplate using the screws supplied.

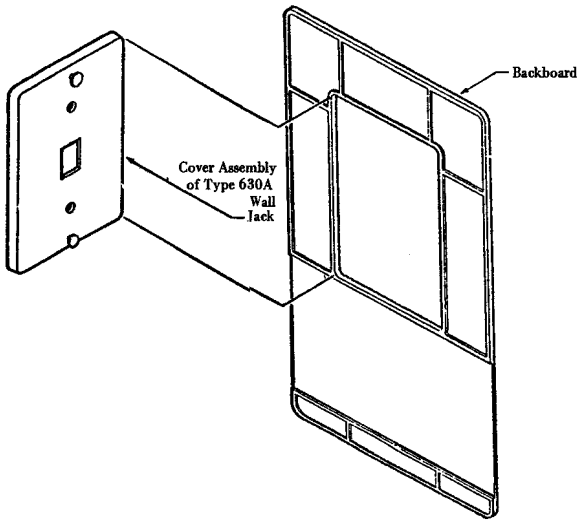


FIGURE 18. Backboard Installation Around a 630A Wall Jack

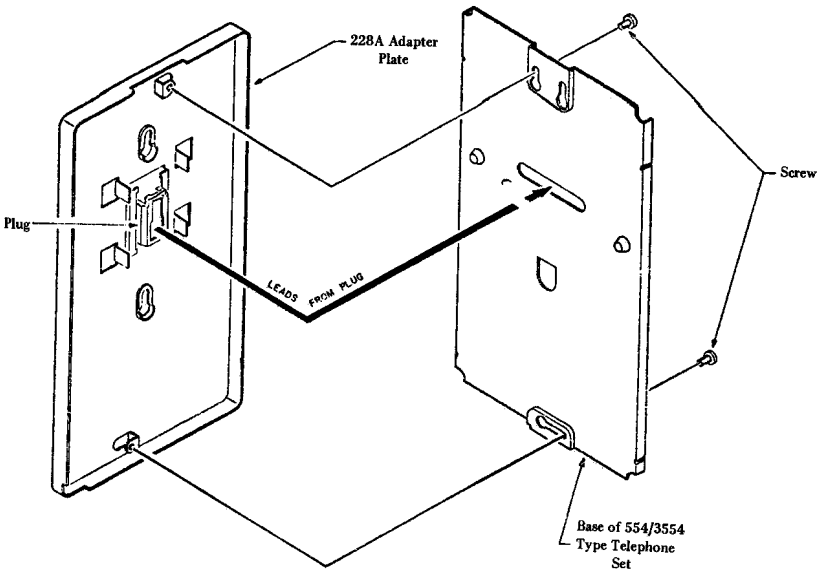


FIGURE 19. 228A Adapter Plate

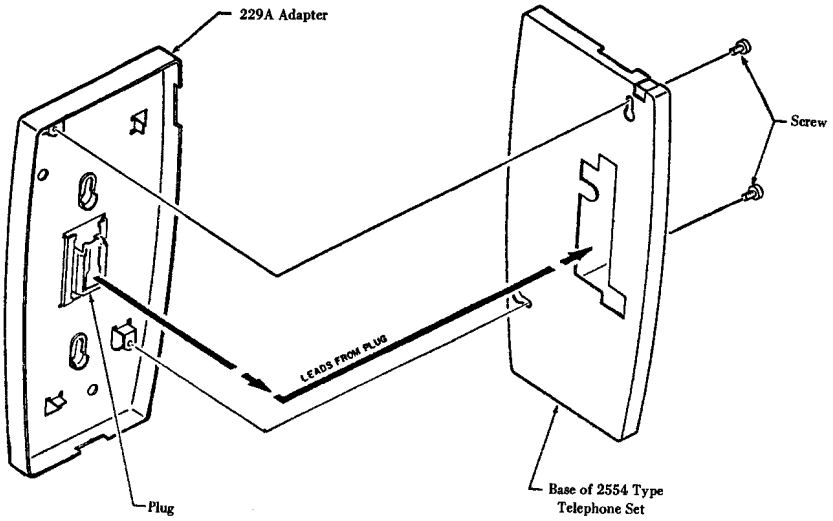


FIGURE 20. 229A Adapter Plate

d. Connect the adapter leads to the telephone as instructed in paragraph 4.

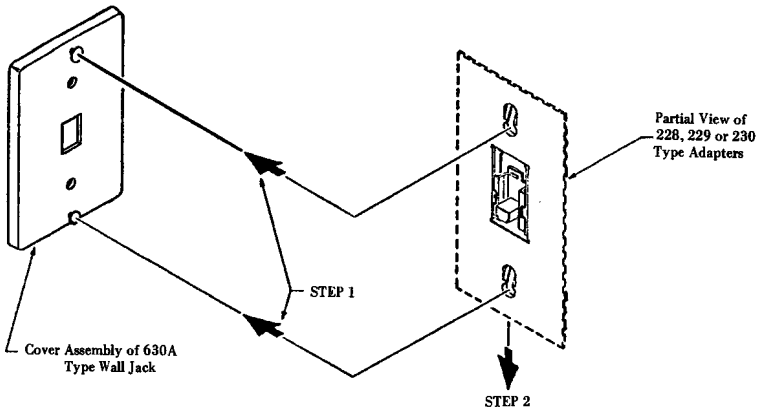
3.07 Installation of Adapter Equipped Wall Set Telephone:

a. Move the adapter plug down as far as it will go toward the bottom of the telephone.

b. Align the plug with the jack and the keyholed slots with the studs on the adapter.

c. Raise the telephone with plug slightly engaged and push toward wall to engage studs in corresponding slots of wall telephone adapter.

d. Pull set downward until firmly seated. See Figures 21 and 22.



NOTES:

1. *Begin with slight engagement of plug in receptacle.*
2. *Raise set (with plug slightly engaged) and push toward wall to engage studs in corresponding slots of wall set adapter. (The plug will slide up and down in the back of the wall set.)*
3. *Pull set downward until firmly seated.*

FIGURE 21. Mounting Wall Set With Adapter on 230A Wall Jack

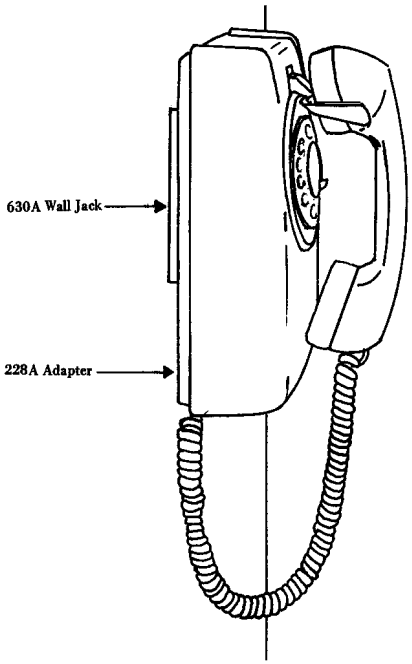


FIGURE 22. 554 Wall Telephone Mounted on 630A Wall Jack

4. CONNECTION OF MODULAR EQUIPMENT

4.01 All modular equipment must be wired in the same manner to be compatible with all modular telephones. Connect as shown in Table B.

TABLE B. Modular Jack Connections

INSIDE WIRE					CONNECTING BLOCK	
ONE-LINE SERVICE			TWO-LINE SERVICE	WIRE OR LEAD COLOR	TERMINAL	
NO DIAL LIGHT	DIAL LIGHT	1A1, 1A2 KTS			625-TYPE	630A4
Tip	Tip	Tip	Line 1 (T)	Green	G	T
Ring	Ring	Ring	Line 1 (R)	Red	R	R
	TRNSF	A	Line 2 (T)	Black	B	Aux
Ground*	TRNSF	A1	Line 2 (R)	Yellow	Y	Ground

*Supply ground for all one-line installations

PART VI
OUTSIDE PLANT

POLE CLIMBING

1. GENERAL

1.01 This practice provides basic instructions for ascending and descending a pole using the **3 points of contact method.**

1.02 One of the more hazardous jobs confronting the telephone man is climbing and working on poles. This practice provides safety precautions that must be observed before, during, and after pole climbing.

2. CLIMBING EQUIPMENT

2.01 To ensure personal safety when pole climbing, it is important that proper clothing is worn and proper equipment is used. To determine proper clothing, consideration should be given to the nature of the job, the environment, and weather conditions.

2.02 Pole climbing equipment consists of a body belt, a safety strap, and a pair of climbers. This equipment allows a craftsman to climb, stand, or change position on a pole when no other means of support is available; it also allows the free use of both hands while in any position on the pole.

2.03 Body Belt:

a. The body belt consists of a cushion section, a belt section with tongue and buckle ends, a tool saddle, and D-rings which are attached solidly to the cushion; or on shifting D-ring belts, attached solidly to a D-ring saddle. On the body belt, provision is usually made for a holster to carry one or more tools, in addition to the tools which are carried in the tool loops. Tool loops should be of proper size to prevent the tools from slipping through the loops and falling. There should be no tool loops for 2 inches on either side of the center in the back of the body belt. Older type belts may have tool loops within 2 inches of the center of the back; **DO NOT USE THESE LOOPS.**

b. Refer to CTSP 405-601-303 and CTSP 405-601-601 for safety precautions, use and care of body belts.

c. As a general rule, the body belt is marked in "D" sizes. The "D" size is the distance between the heels of the D-rings when the belt is laid flat. See Figure 1. To obtain the correct "D" size, measure from the prominent part of the right hip bone to the prominent part of the left hip bone across the back, and add 2 inches. See Figure 2. The waist size is determined by measuring the distance between the center of the buckle roller and the middle hole on the tongue end. See Figure 3. To obtain the correct waist size, measure the distance around the body at the point where the belt will be worn. This measurement should be made outside any clothing normally worn while climbing the pole. See Figure 4. The body belt should fit snugly, but not too tightly. The end of the strap should always be passed through the keeper when the belt is being worn.

d. Manufacturers have standardized on the relationship between the "D" size and the waist size. When the waist and "D" size do not coincide with the standard sizes, the belt should be ordered by the "D" size as the waist size is adjustable.

e. Pliers shall be carried in the pocket of the tool holster farthest from the D-ring to minimize the possibility of engaging the snap of the safety strap on the plier handles instead of in the D-ring.

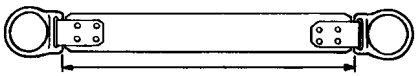


FIGURE 1. Distance Between Heels of D-Rings

FIGURE 2. Measuring for "D" Size

FIGURE 3. Distance Between Center of Buckle Roller and Middle Hole

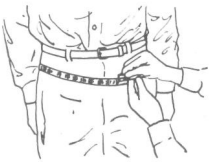


FIGURE 4. Measuring for Waist Size

2.04 Safety Strap:

a. The safety strap is used for support while working on poles, towers, or platforms. Snap hooks are provided on each end for attachment to the D-rings in the body belt.

b. When poles are being climbed under normal conditions, both snaps should be engaged in the same D-ring for safety. The snap on the double end should have the keeper facing outward; the other snap should face inward. See Figure 5.

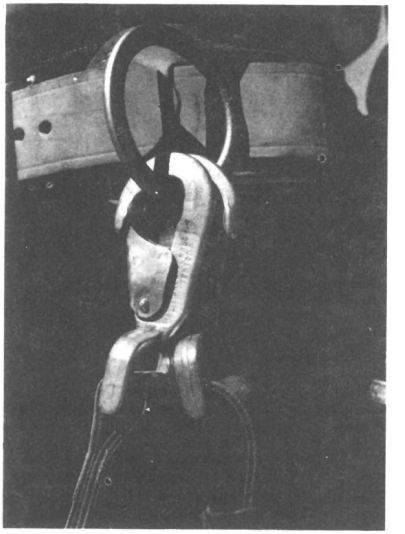


FIGURE 5.

c. When in use, one snap hook should be securely engaged in each D-ring; never both snaps in the same D-ring. The craftsman should look to be sure that snaps are properly engaged. **NEVER DEPEND ON SOUND OR FEEL FOR SECURITY.**

d. Safety straps are adjustable for length by means of a buckle in the strap to suit the craftsman and the size of the pole. When in use, the side of the strap to which the buckle is attached should be next to the pole, with the buckle tongue outward. See Figure 6.

e. The length of the safety strap should be adjusted so that the craftsman can comfortably reach his work. See Figure 7. The craftsman who uses a safety strap of the correct length can perform his work with a minimum of effort. He will be able to maintain good body balance and control of his work operations.

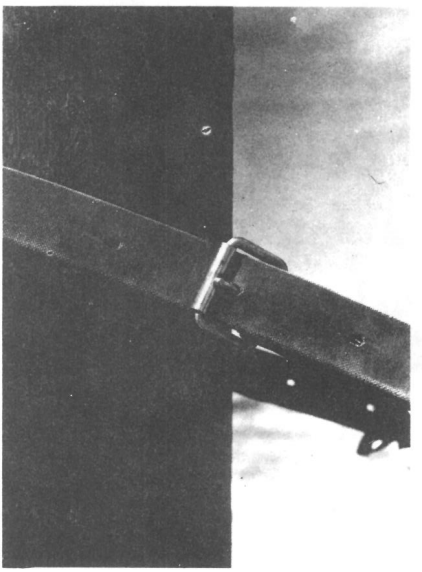


FIGURE 6.

FIGURE 7.

f. Refer to CTSP 405-601-303 and CTSP 405-601-601 for safety precautions, inspection, and maintenance of safety straps.

2.05 **Climbers:**

a. Climbers are used for ascending, descending, and maintaining the working position on poles when no other means of support is available. The condition, length, and shape of the gaffs of the climbers are of the utmost importance. The gaffs support the workman as he climbs, descends, and does his work.

b. Defective gaffs are dangerous. Inspection and maintenance procedures are covered in CTSP 405-601-310.

c. Climbers are made in adjustable or fixed lengths, from 14 to 21 inches by ½-inch increments. Gaff mountings are either permanent or replaceable. Proper fit requires a leg iron to reach about ½ inch below the prominence of the knee joint. Refer to CTSP 405-601-310 for correct fitting procedures.

d. Foot and leg straps are used to secure climbers to the craftsman's legs. These straps should be drawn up to a snug fit, but not so tight as to be uncomfortable. High-top shoes with heavy soles and heels should be worn for climbing. See Figure 8.

FIGURE 8.

e. The buckle on the foot strap should lie just outside the shoe lacing. Pads and straps are attached to the upper end of the leg irons. All leg and foot strap ends should be snugged down in their keepers after buckling; the strap ends should point to the rear and outside.

f. Before the leg straps are fastened, pull up the pant legs so that they bag at the knees and do not bind. Fold the pant legs snugly against the calf, toward the outside, as shown in Figure 9. This prevents the pant legs from tripping the workman while climbing.

FIGURE 9.

3. CLIMBING PRECAUTIONS

3.01 Before ascending a pole, inspect it carefully for unsafe conditions such as rake, rotted places, nails, tacks, cracks, knots, foreign attachments, pole steps, ice, etc. Remove rocks and other objects from the ground at the base of the pole.

3.02 Unauthorized attachments such as signs, radio aerials, clotheslines, etc., should be reported to the supervisor, according to local procedures.

3.03 Whenever possible, a slippery pole or one partly coated with snow or ice should be ascended with the gaffs in the slippery side and the hands held on the less slippery side.

3.04 Do not hold onto pins, crossarm braces and other hardware in ascending, descending, or changing position on a pole.

3.05 Always ascend and descend on the high side of a leaning, raked or bent pole.

3.06 Each employee should be sure that he is in good physical condition before climbing poles and should refrain from climbing poles when he feels it is not safe for him to climb and work aloft.

3.07 Arms and hands should be properly protected when climbing.

3.08 Estimate the length of the safety strap required at the working level and adjust the safety strap at the base of the pole before ascending. See Figure 10.

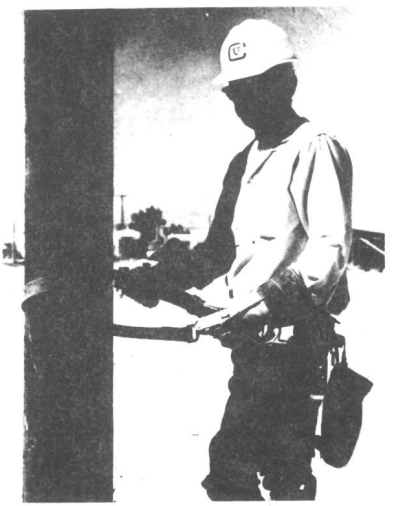


FIGURE 10.

3.09 Inspect the pole during ascent and descent to avoid placing gaffs in cracks, knots, holes, etc., which might cause a fall.

3.10 When ascending the pole, keep the arms and body relaxed, with the hips, shoulders, and knees a comfortable distance away from the pole.

3.11 Length of steps should be natural for each individual craftsman. Climb with the legs, using the hands and arms for balance only. Direct the gaffs toward the center (or heart) of the pole in a natural manner. The size of the pole and the length of the craftsman's legs between the hips and knees will determine the amount of gaff separation on the pole.

3.12 The effective leg stroke is that angle or stroke that will cause the gaff to cut into the pole wood without side thrust of any sort. An effective stroke results when the knee is thrown comfortably away from the pole (without straining the hip), the gaff is aimed at the target (the imaginary line down the center of the pole), and the leg force and travel are made to parallel the climber shank until proper penetration is accomplished. Kicking or slapping the gaffs against the pole should be avoided. The hands and feet should work in coordination with the weight being shifted gradually and easily from one foot to the other.

3.13 When ascending, removal of the gaffs is made easier by using a twisting action of the ankle (outward) and a slight prying action of the inside of the footwear against the pole.

3.14 Always use the body belt and safety strap when working aloft on a pole. Never place the safety strap around the top of the pole above the top crossarm or in any other place where it can accidentally slip off. If it is necessary to place the safety strap high on a bare pole, place a long through bolt in the top gain hole to keep the safety strap from slipping off the pole.

3.15 When descending, each leg is relaxed and straightened before being lowered. When the relaxed and straightened leg is "lined up" with the center of the pole and the body weight has been shifted above the gaff, drop the gaff into the pole. When descending, the leg is not stroked; it is merely lowered into position with the body weight behind it. Keep hips shoulders, and knees away from the pole. **Do not take long steps when descending.**

3.16 When descending, the climber gaffs should break out naturally with the outward and lowering movement of the knee. Removal of the climber gaff from the pole when the last step to the ground is taken is accomplished by a slight twisting and prying action, as in ascending.

3.17 Wear climbers only when necessary for climbing or working on poles.

3.18 Do not stand at the base of a pole while a man is ascending, descending, or working aloft.

3.19 If a second man is to ascend the pole, he should wait until the first man has placed his safety strap in his working position. When descending a pole, one man should remain in his working position with his safety strap in use until the other man has reached the ground and is safely out of the way.

4. ASCENDING A POLE—3 POINTS OF CONTACT METHOD

4.01 It is important for the lineman to have good control of all his motions while aloft. This may be accomplished by using **3 points of contact** with the pole at all times. That is, both hands and one foot, one hand and both feet; or, in working position, both feet and the safety strap should always be in contact with the pole. The object of the 3 points of contact concept is to form and maintain a "tripodlike" contact with the pole. This stance or position will resist side forces, such as wind. With the tripod effect, leverage is always available to maintain proper balance.

4.02 In ascending, the right hand leads the left foot, and the left hand leads the right foot. The right hand must be raised on the pole before the step up is made with the left foot, and vice versa with the left hand and the right foot. This will provide a balanced climbing position.

4.03 The following is the correct sequence for a craftsman taking the first step onto a pole with his right foot:

a. Take a standing position with both feet close to the base of the pole. Place both hands on the pole. See Figure 11.

FIGURE 11.

b. Raise the right hand up the pole a distance about equal to the height of the first step that will be taken up the pole. See Figure 12. This first step should be short, about 6 to 8 inches from the ground.

c. The right foot is raised, and the gaff stroked into the pole. No body weight is placed on the right gaff at this time. See Figure 13.

FIGURE 12.

FIGURE 13.

d. The left hand is then raised up the pole a distance about equal to the natural step up the pole for the individual craftsman. The left hand controls the body side swing as the weight is lifted onto the right foot.

e. Raise the body weight to the right climber. Lift the left foot up the pole a distance equal to the normal ascending step. Stroke the left gaff in the pole; the body weight is still on the right foot. See Figure 14.

f. The right hand is then raised up the pole. The distance the hand is raised will be about equal to the natural step up the pole for the individual workman. Lift the body weight to the left gaff. The right foot is removed from the pole, raised up and stroked into the pole. See Figure 15.

FIGURE 14.

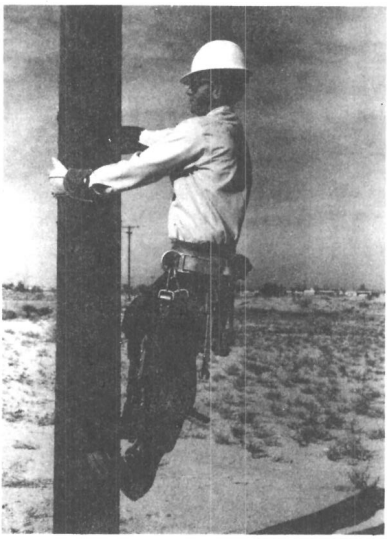


FIGURE 15.

g. With the body weight still on the left foot, the left hand is then raised up the pole. See Figure 16.

h. The body weight is raised to the right foot. The leverage to raise the body is obtained from the left hand; the side sway is controlled by the right hand. The left gaff is raised up and stroked into the pole. See Figure 17.

FIGURE 16.

FIGURE 17.

i. The sequence continues; the right hand is raised up the pole. The body weight is then raised to the left foot and the right foot is raised and stroked. The left hand is raised up the pole and the body weight is raised to the right foot.

5. DESCENDING A POLE—3 POINTS OF CONTACT METHOD

5.01 For the climber's safety, it is important that the **3 points of contact** method is used when descending a pole. When descending, the hand must be lowered on the pole before the downward step is taken; otherwise, the natural position cannot be maintained. Figures 18 through 21 show the leg, body, and arm sequence.

a. In Figure 18, the safety strap has been removed from the pole and is being stored in the left D-ring of the body belt. The feet are positioned with the left foot low; the right hand is high, holding securely to the pole.

FIGURE 18.

b. The left hand is then placed in the high position. Next, the right hand is lowered and the right foot is moved downward. See Figure 19.

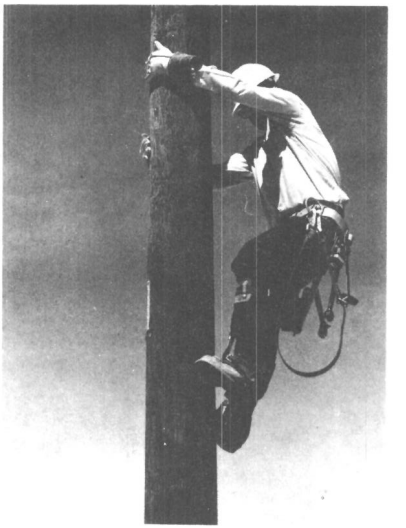


FIGURE 19.

c. The left hand is then lowered a distance equal to the next downward step. In Figure 20, the next step with the left foot has just been made.

d. For the next step (shown in Figure 21), the right hand is lowered and then the right foot descends.

FIGURE 20.

FIGURE 21.

5.02 The length of the downward step is controlled by keeping both hands on the pole while the descending step is being made. With both hands on the pole during the downward step, the craftsman is able to control his body swing. The hand and foot sequence described above gives the craftsman the greatest leverage; he can control his motions with little effort and more assurance.

6. STEPPING AWAY FROM A POLE

6.01 Stepping away from a pole incorrectly can result in severe gaff wounds, as well as injuries such as broken arms and wrists, bruised hips, shoulders, and backs; other injuries may also occur when a man loses his balance and falls. Figures 22 through 27 show the safe method of stepping away from a pole.

a. Observe the ground for safe stepping space before the first foot is placed on the ground. Three points of contact with the pole are maintained during this operation. The step to the ground should be made from 6 to 8 inches up the pole. Step from the pole with one foot. See Figure 22.

FIGURE 22.

b. Move the other foot from the pole to the ground, keeping both hands on the pole for balance and control. See Figure 23.

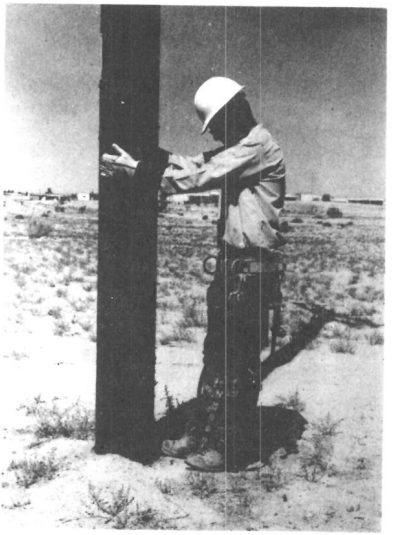


FIGURE 23.

c. The craftsman stepping away from the pole to his left, will drop his left arm and turn his head in the direction of the step so that he can observe the ground for safe stepping space. The right hand is kept on the pole. See Figure 24.

d. When both feet are on the ground, the left foot is moved a natural step away from the pole. The body balance is controlled by keeping the right hand on the pole. See Figure 25.

FIGURE 24.

FIGURE 25.

e. When the left foot has been moved, the body weight is transferred to it and the right foot carefully moved to a natural standing position with relation to the left foot. The right hand is kept on the pole for control during this step. See Figure 26.

f. When the move with the right foot has been safely made, remove the right hand from the pole. See Figure 27.

FIGURE 26.

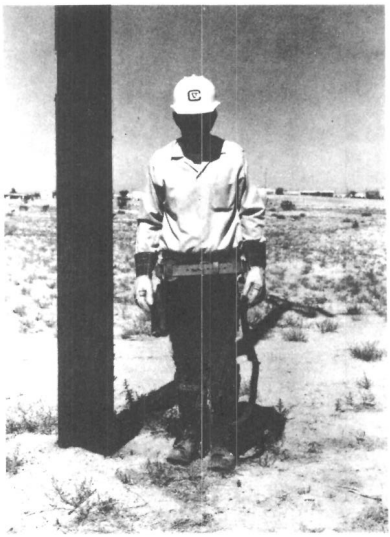


FIGURE 27.

g. Remove the climbers and replace the gaff guards on the gaffs. See Figure 28.

FIGURE 28.

NOTE: If the first step away from the pole is made to the right, the same sequence is followed except the right hand is dropped instead of the left.

6.02 The above method of stepping away from poles while wearing climbers works equally well when stepping away from stepped poles when climbers are not worn.

7. GOING AROUND A POLE

7.01 It is important that all craftsmen use the correct method of going around a pole. Figures 29 through 32 show the correct method to be used when going around a pole to the **left.**

NOTE: This method is reversed when going around a pole to the **right.**

a. The left (or lead) foot is removed from the pole and moved around to the left. It is set in the pole from 2 to 4 inches higher than the right foot (or following climber). The leg action is an ascending or stroking action toward the center or "heart" of the pole. Keep both hands on the pole while performing this operation. Figure 29 shows the position of the feet at the start of the movement to the left.

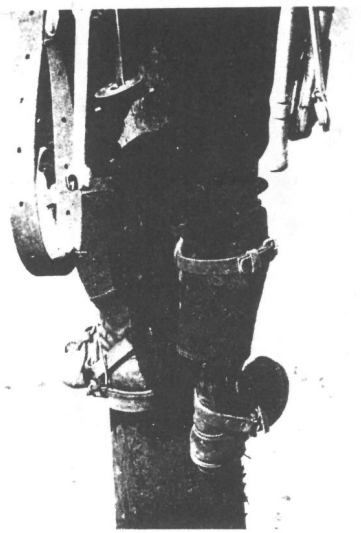


FIGURE 29.

b. Figure 30 shows the position of the feet after the lead (left) foot has been moved around and stroked into the pole. The following (right) foot has not been moved. The body weight is supported by the right foot.

c. The body weight is raised to the left (high) climber. The right (lower) gaff is removed from the pole and moved around to the left. The gaff of the right (lower) climber is lowered into the pole with the same leg and body action used in descending a pole. That is, the leg is kept straight, the gaff aimed at the "heart" of the pole, and the body weight lowered to the gaff. The lower gaff is not stroked. Figure 31 shows the position of the feet just after the body weight has been transferred to the lower (following) gaff.

FIGURE 30.

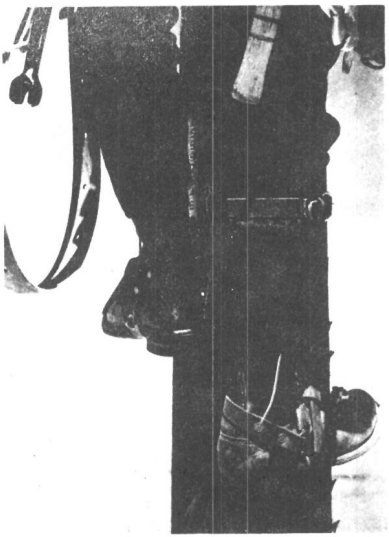


FIGURE 31.

d. The hands are shifted around the pole. The left gaff is removed and moved around the pole for the next step. Figure 32 shows the start of the second step with the lead (left) foot.

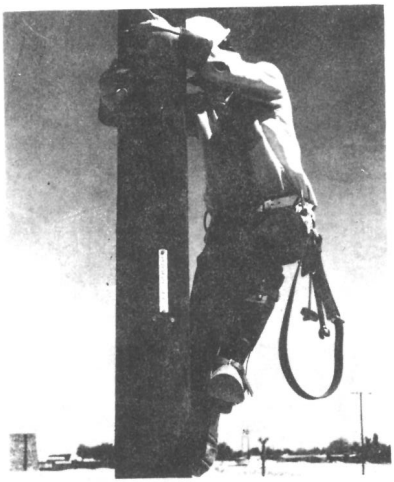


FIGURE 32.

7.02 The craftsman's body structure, wind conditions, whether the operation involves going from the high to the low (or the low to the high) side of the pole all have a bearing on the vertical separation of the gaffs. The distance that the gaffs are moved horizontally as each step is made is determined by the size of the pole, size of the craftsman's boots, wind conditions, etc. The step should be that which is most natural for the individual.

7.03 When using a safety strap for going around the pole, keep both hands on the safety strap and proceed as instructed in paragraphs 7.01 and 7.02, maneuver the safety strap with the hips.

7.04 The use of the safety strap is recommended for going around the pole. However, when circumstances require the removal of the safety strap due to obstacles such as down guys, cable extension arm braces, crossarm braces, etc., remove the safety strap and proceed as instructed in paragraphs 7.01 and 7.02.

8. WALKING WITHOUT CLIMBERS

8.01 Craftsmen shall remove their climbers when walking between poles, from a truck to a pole, etc., and at all other times except when actually climbing poles. The gaff guards shall always be on the gaffs when the climbers are being carried or stored.

8.02 The cutting edges of the gaffs will be dulled if the climbers are worn while walking. **DULL GAFFS ARE DANGEROUS TOOLS.**

8.03 Severe gaff wounds may be experienced if climbers are worn while walking. The safety strap should be placed over the shoulder while walking, particularly if walking on rough ground, through brush, on slopes, etc.

9. USE OF SAFETY STRAP

9.01 Putting Safety Strap Around Pole: The following sequence is for a craftsman who carries his safety strap on the left D-ring. The gaffs should be set in the pole with the right gaff higher than the left. This makes it easier to bring the right hip up to the pole and provides good "side sway" control.

a. The top safety strap snap is disengaged from the D-ring by depressing the keeper with the index finger of the left hand. The thumb backs up the snap hook as shown in Figure 33.

FIGURE 33.

b. The snap hook is removed from the D-ring. The body weight is supported with the right hand and both climbers while the snap is being disengaged. See Figure 34.

c. Pass the snap hook back of the pole toward the right hand. The snap is carried around the pole in the same position in the hand as when it was removed from the D-ring. The opening in the snap hook will be away from the pole. See Figure 35.

FIGURE 34.

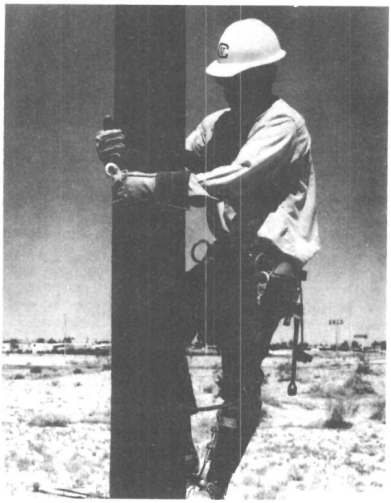


FIGURE 35.

d. The body weight is transferred from the right hand to the left hand. Do not transfer the safety strap snap to the right hand until the body weight has been shifted safely. See Figure 36.

e. The snap is taken by the fingers of the right hand and carried around the pole to the right D-ring. See Figure 37.

FIGURE 36.

FIGURE 37.

f. The safety strap should be kept at working height by letting it slide through the fingers of the left hand as the safety strap is passed around the pole to be engaged in the right D-ring.

g. The heel of the hand backs up the D-ring and prevents it from moving as the fingers apply pressure to the back of the snap. This hand action makes it easy for the craftsman to engage the snap. See Figure 38.

FIGURE 38.

NOTE: In the above figure, the glove has been removed so the heel of the hand and finger action may be shown more clearly. However, gloves should not be removed during actual climbing.

h. The opening in the snap should always be outward from the body. **LOOK, SEE, KNOW** that the snap is properly engaged in the D-ring. Most craftsmen will bring the right hip closer to the pole during this operation. This makes it easier to attach the snap to the D-ring.

i. Place the right hand on the safety strap between the pole and the right D-ring. Gradually lean back on the safety strap. Keep the left hand around the pole and the right hand on the safety strap as an added precaution until the body weight is safely supported by the safety strap and body belt. The safety strap should always be flat against the pole, with no twists in it. See Figure 39.

FIGURE 39.

j. The position of the safety strap on the pole may be readjusted once it is ensured that the snap is properly engaged.

k. The length of the safety strap can be readjusted at the working level after the craftsman has safely belted in. See Figure 40.

FIGURE 40.

l. When in working position, the openings of the snap hooks must be away from the body.

NOTE: Employees who carry the safety strap on the right side of the body belt will reverse the above procedures.

m. To move up or down on a pole with the safety strap in use, hold the pole with one hand as tension is released on the strap and move the strap up or down with the other hand.

9.02 Removing Safety Strap from Around Pole:

a. First, the craftsman should position his gaffs so that the right gaff is higher than the left. Support the body weight with the left hand. Move the right hip toward the pole to secure slack in the safety strap. Place the right hand in position on the snap. The right elbow is up from the D-ring and away from the body. See Figure 41.

FIGURE 41.

b. Depress the keeper with the thumb. Twist the snap around as shown in Figure 42 and remove it from the D-ring.

FIGURE 42.

c. The snap is passed around the pole to the fingers of the left hand, while the body weight is still supported by the left hand and arm.

d. The body weight is transferred to the right hand before the left hand (carrying the snap) is removed from the pole.

e. The snap is returned to the carrying D-ring. It is engaged on top of the keyed snap with the opening of the snap toward the body. A downward-forward motion is used to engage the snap. See Figure 43.

FIGURE 43.

NOTE: Employees who carry the safety strap on the right side will reverse the above procedures.

SAFETY PRECAUTIONS OBSERVATIONS AND VOLTAGE TESTS TO BE MADE AT JOINT USE POLES

CONTENTS

1. GENERAL

1.01 This practice provides information pertaining to observation and tests to made at joint use poles to protect Company personnel from electrical shock.

1.02 This practice is reissued to replace in its entirety CTSP 490-050-106, Safety Precautions—Voltage Tests To Be Made Before Climbing Joint Use Poles. **Remove from the file and destroy all copies of CTSP 490-050-106, Issue 1, 1968.**

1.03 For information pertaining to the description, testing, care and storage of the B Voltage Tester, refer to CTSP 405-503-350.

2. SAFETY PRECAUTIONS

2.01 When performing tests with the B Voltage Tester:

a. Wear proper head protection (safety cap).

b. Wear safety glasses.

c. Wear insulating gloves consisting of:

(1) Cloth glove liner (optional).

(2) High voltage insulating (synthetic rubber) gloves.

(3) Leather protector gloves.

2.02 When it is necessary to ascend a pole to perform tests with the B Voltage Tester, observe the climbing precautions provided in CTSP 490-025-110.

2.03 Insulating gloves are not to be used when ascending or descending the pole. Lineman's leather gloves are to be used when climbing. When voltage tests are required aloft, ascend the pole and maintain a distance of 60 inches from voltage potential. Remove the lineman's leather gloves, put on insulating gloves, and proceed with tests using the B Voltage Tester.

3. OBSERVATIONS

3.01 Examine the pole for potential hazards such as a ground wire, metallic conduit or street light fixtures. Also observe the pole for potential hazards such as improper clearances from power conductors or equipment, dangling wire, etc.

3.02 If a ground wire is present, make a voltage test as instructed in paragraph 4. Voltage tests are not required when the following conditions exist:

a. The power ground wire is bonded to a telephone cable strand.

b. The power ground wire is covered with a wood molding, or equivalent, up through the telephone space.

c. The ground wire is insulated and insulation is in good condition.

3.03 If a power conduit is present, make a voltage test as instructed in paragraph 4.

3.04 If a light fixture is present, make a voltage test as instructed in paragraph 5 only if the pole is supporting telephone cable, urban wire, rural wire, an isolated section of cable, or a bare ground wire.

3.05 Voltage tests are not required when the following conditions exist:

a. The light fixture is located in power space.

b. It is clearly visible that the light fixture is bonded to the telephone cable strand and is located **above** telephone attachments.

c. When the light fixture is located below telephone cable, it must be clearly visible that the light fixture is bonded to the telephone cable strand and the wiring through and below the telephone space is 40 inches out from the surface of the pole or is inaccessible.

4. VOLTAGE TESTS AT THE BASE OF THE POLE

4.01 When a voltage test is required from observations in paragraph 3.02 or 3.03, it shall be made as follows **before climbing or working on the pole:**

a. Attach the insulated clip of the B Voltage Tester (Figure 1) to one of the following:

(1) A telephone anchor rod or guy. (Do not attach to an anchor rod or guy that is bonded to the power ground wire.)

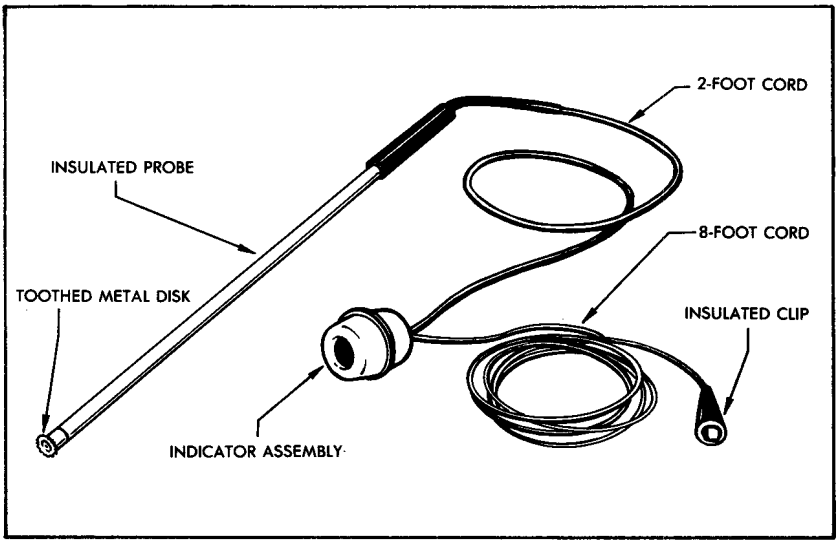


FIGURE 1. B Voltage Tester

(2) A fire hydrant, a projection on a manhole cover, or a metallic curb box.

(3) A 5-inch screwdriver blade pushed into the earth about 5 feet from the pole (Figure 2).

(4) A substantial metal object such as a piece of lead sleeving, a metal crossarm brace, or a half-pound bar of D seam solder, etc., and lay the object on the ground or pavement about 5 feet from the pole.

b. Standing about 3 feet from the pole, grasp the insulated probe in one hand and the indicator assembly in the other. Touch the toothed metal disk on the end of the probe to the ground wire, metal conduit, and pole being tested, and look into the open end of the indicator assembly.

c. If the indicator glows, the ground wire, metal conduit or pole is energized. Immediately remove the probe from contact with the ground wire, metal conduit or pole. **Do not climb or contact pole if the indicator glows. Notify your supervisor.**

d. If the ground wire is broken at ground level, test the upper portion.

e. If the lower 8 feet or so of the ground wire is protected with a wood molding, test above the molding.

4.02 If the voltage tester does not glow in performing the above test, the pole may be climbed as instructed in CTSP 490-025-110.

CAUTION: Care should be taken to avoid contacting the ground wire on metal conduit and telephone strand, cable or guys at the same time as a small voltage (of less than 60 volts) may be present. This caution is recommended to avoid possible surprise shocks.

4.03 If a shock is experienced as a result of an accidental contact between the ground wire or metal conduit and telephone strand, cable, guy or other grounded object, **notify your supervisor.**

5. VOLTAGE TESTS AND PRECAUTIONS ON THE POLE

NOTE: Attach B Voltage Tester bag containing test equipment and the bag containing insulating gloves to body belt.

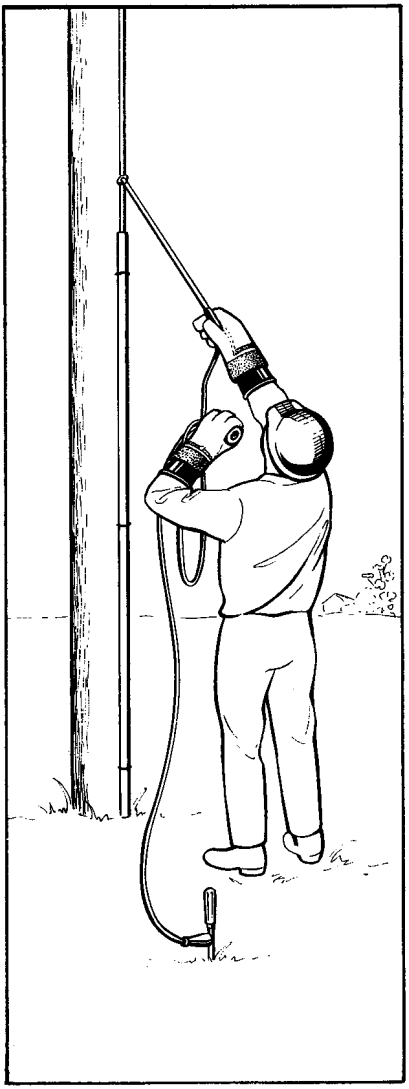


FIGURE 2.

5.01 Climb pole (as instructed in CTSP 490-025-110) to location approximately 60 inches from the potential hazard. Put on insulating gloves and proceed with test as instructed below.

CAUTION: Take care to avoid contacting hardware or wiring that could be energized.

5.02 When a voltage test is required for a light fixture as mentioned in paragraph 3.04, use the following procedure:

a. Attach the insulated clip of the voltage tester to the cable suspension strand support bracket or urban or rural wire or bare vertical power ground wire. Touch the toothed metal disk to the street light fixture and promptly look into the open end of the indicator assembly.

b. If the indicator does not glow, contact the fixture with the probe again to be sure that good contact has been made. If the indicator still does not glow, make a temporary bond as described in paragraph 5.03.

5.03 The B Temporary Bond is a 5-foot length of stranded copper, rubber covered cord with battery clips at each end. To use the B Temporary Bond, proceed as follows:

a. Make a temporary bond by attaching the small clip of the B Temporary Bond (Figure 3) to the cable suspension strand or the bare power vertical ground wire so as not to be in the way of work operations. **Do this first.** Then attach the larger clip of the bond wire to the street light fixture. **Do not bond** to the support bracket of urban or rural wire or the suspension strand of isolated cable.

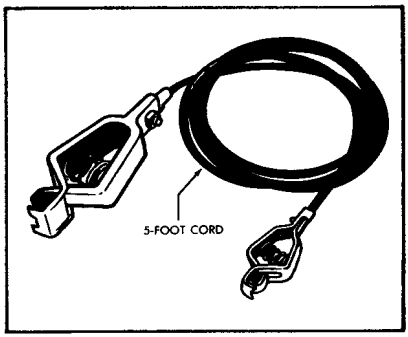


FIGURE 3. B Temporary Bond

b. Insulating gloves may be removed **only after** the temporary bond is in place, and then only if other protection requirements permit. Leave the B Temporary Bond in place until all work operations have been completed. Should the bond start smoking during the work operation, descend immediately without touching the fixture or its wiring. **Notify your supervisor.**

5.04 The B Voltage Tester is extremely sensitive and operates with very small currents. Street light fixtures may cause the indicator to glow even though they are energized only by leakage across damp cobwebs or induction between the fixture and its wiring.

5.05 For the condition mentioned in paragraph 5.04, the B Shunting Capacitor (Figure 4) is used to determine if the voltage present is excessive. To use the B Shunting Capacitor, proceed as follows:

a. Attach the clip of the B Voltage Tester and the clip of the B Shunting Capacitor to the cable suspension strand or to the bare power vertical ground wire.

b. Attach the small clip of the B Temporary Bond to the metal terminal of the B Shunting Capacitor and the larger clip to the metal cap behind the disk of the insulated probe.

CAUTION: Maintain at least 1 foot of separation between the B Voltage Tester and the B Temporary Bond and B Shunting Capacitor.

c. Touch the toothed metal disk to the street light fixture and promptly look into the open end of the indicator assembly (Figure 5).

CAUTION: Avoid bodily contact with temporary bond or capacitor during test.

d. If indicator glows, the fixture is energized. Immediately remove the probe from contact with the fixture, replace testing equipment in the carrying case, descend the pole and **notify your supervisor. Avoid contact with the fixture or its wiring.**

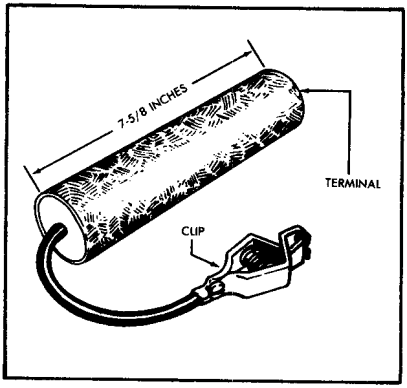


FIGURE 4. B Shunting Capacitator

e. If the indicator does not glow, contact the fixture with the probe again to be sure that good contact has been made. If the indicator still does not flow, proceed as instructed in paragraph 5.03.

5.06 When work operations are completed on a pole, remove the B Temporary Bond as follows:

a. Put on insulating gloves.

b. Remove the clip attached to street light fixture. **Remove this clip first.**

c. Remove the other clip.

CAUTION: If a spark is noticed when removing the bond, descend the pole immediately and notify your supervisor.

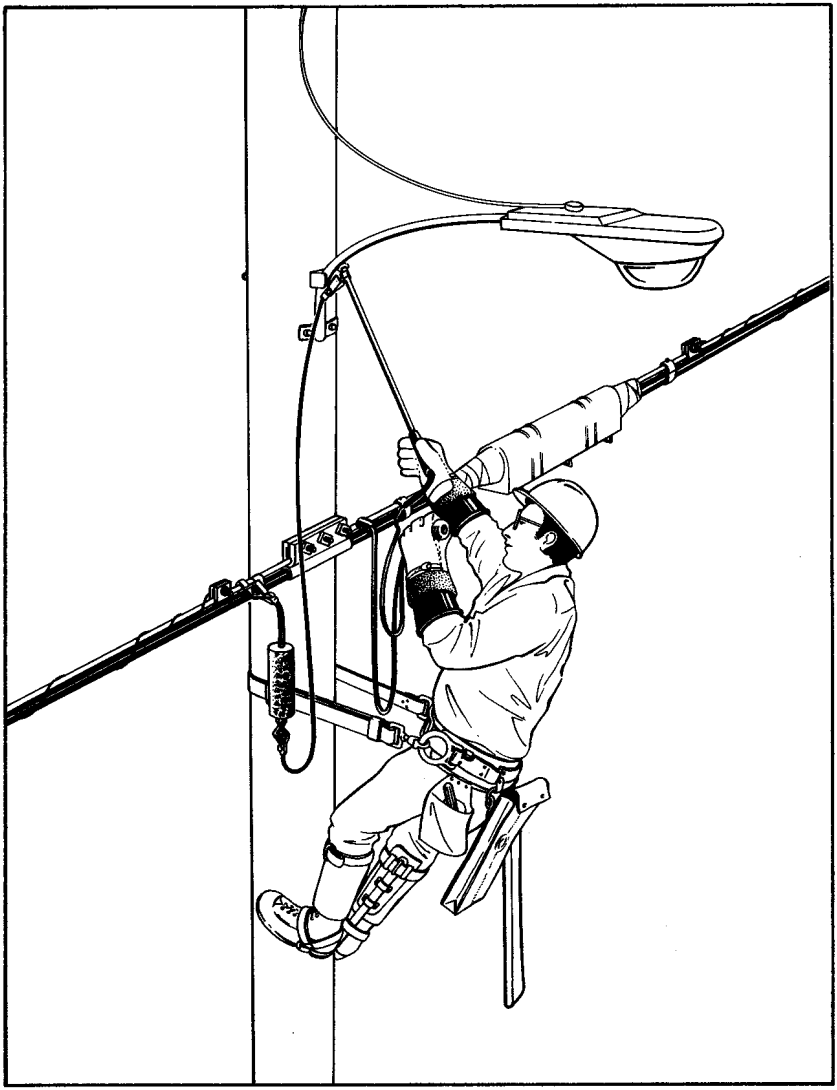


FIGURE 5.

—NOTES—

CLEARANCES AND SEPARATIONS

MEASURING CLEARANCES AND SEPARATIONS AERIAL PLANT

CONTENTS

1. GENERAL

1.01 This practice describes the methods and tools to be used in measuring clearances and separations for aerial plant and includes the safety precautions that must be observed. This practice is reissued to update information and introduce the pocket-sized card showing the minimum clearances and separations for joint use aerial plant. See Exhibits I and II. **Remove from the file and destroy all copies of CTSP 490-060-001, Issue 1, 1970.**

1.02 Refer to the appropriate practice in the 490-06X Plant Series and the 570-150 Engineering Series of practices for information on clearances and separations.

1.03 The clearances and separations recommended by the National Electrical Safety Code (Sixth Edition) should be used as the governing principle in all planning or inspection of aerial plant. These recommendations are the allowable minimum when no other values are specified on detail plans or work orders.

1.04 The clearances and separations specified by the NESC are those which will exist under ideal weather and wind conditions (60° F. with no wind). Refer to the appropriate practice in the CTS 490-200, 490-250, 490-355 and 490-360 series for any adjustment to the sag values contained in the NESC tables. (Unless otherwise specified, the NESC tables refer to the voltages between supply wires.)

1.05 The rearrangement of existing plant to meet the minimum clearances specified in the NESC tables is not always necessary. When a clearance problem is encountered, the supervisor should be consulted to determine the corrective action to be taken in accordance with local ordinances and procedures.

NOTE: In locations where state or municipal requirements are more stringent, locally prepared instructions shall be provided.

2. SAFETY PRECAUTIONS

2.01 It is essential that special precautions and safety practices are followed when working aloft or near any structure or equipment used for the distribution of electricity.

2.02 Plan and perform work in the vicinity of power facilities on the basis that any metallic part of the power structure is alive with dangerous voltage. In addition to recognized power systems, this also includes:

a. Power service drops to buildings.

b. Street lighting circuits.

c. Down guys, span guys, street lamp fixtures, and any other wires or hardware not normally energized.

d. Unprotected power company neutral grounds attached to poles.

2.03 When selecting the proper locations for telephone plant attachments, the following precautions shall be observed:

a. All methods or tools used for measuring separations shall be such that craftsmen are not exposed to foreign potentials.

b. When supply circuits of less than 750 volts are present, the actual separations can be measured only along a nonmetallic surface with a standard rule. **Rubber gloves shall be worn while making measurements.**

c. If more than 750 volts are present, the clearance must be estimated where gains or bolt holes are below the supply circuits; the distance can then be measured using the gain as a reference point.

d. Generally, when supply circuits are not in place at the time the telephone attachments are to be installed, the location of future power facilities and hardware will be noted on the Job Order. If they are not, the location should be obtained from the telephone company field engineer. Separation measurements may be taken with the Perkins PM 950-25 FI measuring pole, rules or linen tapes (see paragraph 3).

2.04 When work involves any boom equipment, the craftsman must thoroughly check all overhead

clearances. If there is a doubt about the height of any wire, actual measurements must be made to determine clearances. Field engineers shall consider clearances when planning jobs and place appropriate warning notes on the prints to inform the construction forces of potential hazards.

2.05 If power facilities prevent the safe performance of work, the work shall not be commenced until arrangements have been made for the necessary safeguards.

2.06 No telephone company employee shall touch or allow equipment or material to come in contact with power conductors or associated hardware of any voltage.

2.07 No work will be performed by a telephone company employee, or with company equipment at a radial clearance of less than 36 inches from any power conductors or associated hardware which are classed as primaries (above 750 volts).

NOTE: An exception to the above is a pole being erected, removed or straightened, which may be less than the 36-inch radial clearance provided it is covered with insulating pole guards on all surfaces of potential contact. During the performance of this work, all employees in contact with the pole or equipment shall wear protective rubber gloves. Refer to CTSP 400-100-100.

2.08 The use of steel measuring tapes aloft on poles, fixtures or in any other place where there is a possibility of contact with an energized wire is prohibited. Linen tapes with metallic reinforcing strands, or tapes dampened by rain, shall not be used to measure power clearances.

3. TOOLS

3.01 Depending on the plant involved, the tools used to measure clearances are divided into three groups:

a. Contact Tools: These include Perkins PM 950-25 FI measuring poles, clearance lines, linen tapes, and ropes which touch plant to be measured. They are used to measure the height of telephone line wires, cables, guys, and drop wires only when hazardous potentials are not present.

b. Proximity Tools: Perkins PM 950-25 FI measuring poles, tree pruner handles, pike poles and bamboo rods are used as reference markers when raised adjacent to the line. Due to the possibility of contact by teetering, their use is limited to measuring the height and vertical clearance of telephone line wires, cables, guys, and drop wires only when hazardous potentials are not present.

c. Optical Tools: These are tools equipped with lenses and include range finders (CTSP 405-600-305), height meters, etc. They are used to compute the height and vertical clearance of **all** telephone and supply wires and cables.

4. CLEARANCE AND SEPARATION CARD (FORM 49001-P)

4.01 Form 49001-P is a 3-1/2-inch x 6-inch plastic laminated card showing minimum clearances between power fixtures and telephone facilities carried on the same pole. Exhibit I shows the front of the card and Exhibit II shows the back.

4.02 System operating telephone companies who use the National Electrical Safety Code to meet local minimum requirements should obtain and issue the card to:

a. Line crew personnel.

b. Cable splicers.

c. Installer/Repairmen.

d. Plant Management personnel who supervise construction or maintenance of aerial plant.

e. Outside Plant Engineers.

4.03 Ordering Information: Form 49001-P is available in packages of 25 each. Order through local Purchasing channels specifying CSS No. 95-49-001-9.

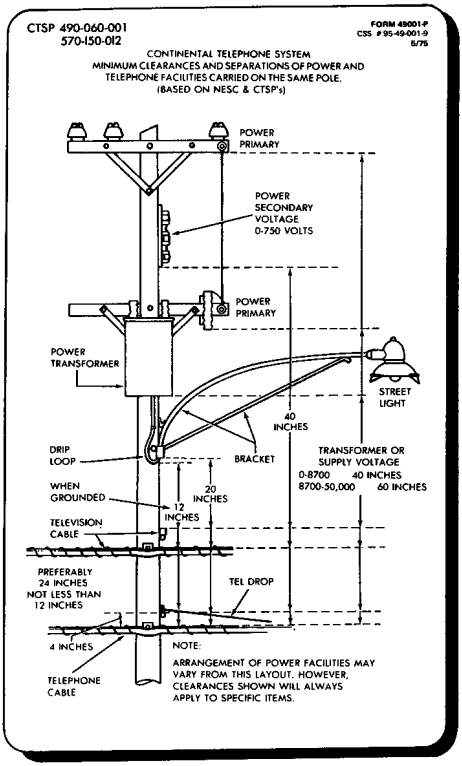


EXHIBIT I. Front of Clearances and Separations Card

MINIMUM CLEARANCE ABOVE GROUND FOR TELEPHONE OR CATV FACILITIES

ITEM	URBAN FEET	RURAL FEET
Where cables, guys, line or drop wires run along and within the limits of:		
(a) public highways, streets and roads	18	14
(b) public alleys	15	–
(c) ways accessible to pedestrians only	8	8
Where cables, guys, line or drop wires cross over private property or ground:		
(a) accessible to pedestrians only	8	8
(b) accessible to people on horses or loaded farm vehicles	–	+16
Where cables, guys, line or drop wires cross over:		
(a) public highways, streets and roads	18	18
(b) public alleys	+15	+15
(c) driveways in general unless height of loaded vehicles or equipment using drive requires extra clearance	+15	+15
(d) driveways–residential garages	10	10
(e) ways accessible to pedestrians only	8	8
(f) obstacles (billboards, roofs)	2	2
(g) flat roofs which may be used by tenants or workmen	8	8
(h) railroads–cable	25	25
(i) railroads–wire	27	27
(j) waterways (rivers, canals, etc.), provide clearance specified by proper authorities and on work plans		

+ secure additional clearance on new construction when warranted at specific locations.

MINIMUM CLEARANCES IN FEET AT CROSSINGS OF WIRES AND CABLES CARRIED ON DIFFERENT SUPPORTS

TYPE OF CROSSING WIRES AND CABLES	TELEPHONE OPEN WIRES, CABLES MESSENGER, DROPS AND GUYS	
	Crossing Under	Crossing Over
Open supply wires 0-750 volts and supply cables having effectively ground sheath or messenger–all voltages		NOT CTC PROCEDURE
(a) line wires	4	
(b) service wires	2	4
Open supply, line or service wires		
(a) 750-8700 volts	*6	NOT CTC
(b) 8700-50000 volts	6	PROCEDURE
Foreign guys, span wires, lightning protection wires	2	2
Foreign communication wires, cables and fire alarm wires	2	2
Trolley contact conductors		
(a) 750 volts or less	–	4
(b) 750-8700 volts	–	6

*Clearance for (a) may be reduced to 4 feet if crossing is more than 6 feet from communication pole

NOTE: The above clearances apply where the crossing span length of the upper conductor or wire does not exceed 175 feet for greater span lengths, increase clearances in accordance with NESC and CTS

MINIMUM HORIZONTAL CLEARANCE OF POLES FROM OTHER OBJECTS

OBJECT	MINIMUM CLEARANCE
Fire hydrants	Not less than 3 feet – 4 feet recommended
Curbs	6 inches measured to street side of curb
Railroad tracks	12 feet measured to nearest rail

EXHIBIT II. Back of Clearances and Separations Card

OPEN WIRE

NUMBERING OF PIN POSITIONS

1. GENERAL

1.01 This practice contains illustrations showing preferred numbering for various types of crossarms.

2. PIN POSITIONS

2.01 Pin positions are numbered from left to right; with your back to the central office, or facing ascending pole numbers.

2.02 The following illustrations shall be followed unless other numbering plans are established for certain lines.

Figure 1. 2-Pin Crossarm

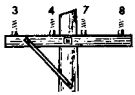


Figure 2. 4-Pin Crossarm

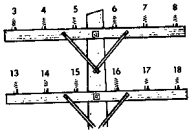


Figure 3. 6-Pin Crossarm

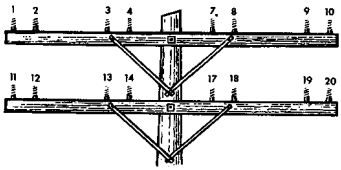


Figure 4. 8-Pin Crossarm (Carrier Design)

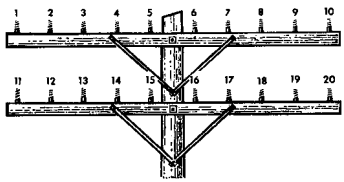


Figure 5. 10-Pin Crossarm

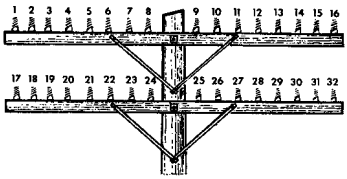


Figure 6. 16-Pin Crossarm

OPEN WIRE

POSITIONS OF WIRES ON CROSSARMS AND WOOD BRACKETS

1. GENERAL

1.01 This practice covers the assignment of wire positions on crossarms and wood brackets.

1.02 Detail work plans will generally be furnished to the construction forces before any work operations are begun. These plans will show the types of circuits to be placed, the designated wire positions, the type and points of transpositions, and the kind and size of wire to use. If such plans are not available, consult your supervisor.

2. WIRE POSITIONS ON CROSSARMS

2.01 Pin positions on a crossarm are numbered from left to right, with your back to the central office, or facing the ascending pole numbers, or in the direction determined for that line.

2.02 When tying or retying wires at straight line poles, attach them to insulators as shown in the following illustrations. In the case of type B crossarms, wire positions are the same as those illustrated except the pole pair wires are placed on the pole side of the insulators.

2.03 Figure 1 shows placement where wire is not point transposed.

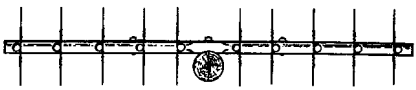


Figure 1. Type "A" Crossarm: Wires Not Transposed.

2.04 Figure 2 shows placement at corners.

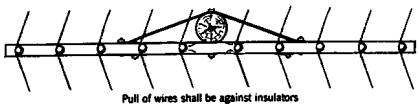


Figure 2. Type "A" Crossarm: Wire Placement at Corner.

3. WIRE POSITIONS ON WOOD BRACKETS

3.01 On bracket lines, place the wires on the side of the insulators toward the pole. If insulators are on the outside of a corner, tie the wires so they will pull against the insulators (Figure 3).

3.02 At some corners it may be necessary to place two wooden pole brackets so the line will clear the pole. When this is done, place the wires as shown in Figure 4.

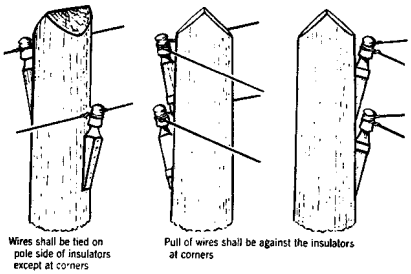


Figure 3. Placement of Wires on Bracket-Mounted Insulators.

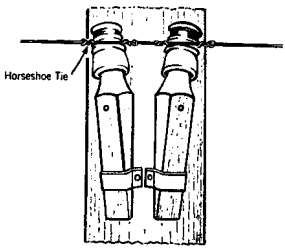


Figure 4. Placement of Wires on Adjacent Insulators.

OPEN WIRE

BRIDLING–OPEN WIRE LINES DESCRIPTION AND INSTALLATION

1. GENERAL

1.01 This practice provides methods of bridling open wire lines at the junction of open wire and cable, buckarm poles, protective equipment, and at the junction of open wire side lead terminations. This practice also covers methods of making bridle wire connections in both corrosive and non-corrosive areas.

2. DESCRIPTION

2.01 Three types of wire are available for bridling purposes:

a. No. 14 gauge twisted pair with rubber insulated, neoprene jacketed, hard drawn copper conductors.

b. No. 20 gauge twisted pair (red) 40% conductivity, rubber insulated, neoprene jacketed, copper steel conductors.

c. No. 18 two-conductor, (black), rubber insulated, neoprene jacketed, twisted, solid annealed copper conductors.

3. USE

3.01 Use No. 14 gauge wire at the following locations:

a. All bridling of toll circuits.

b. Bridling from exchange open wires to protected cable terminals.

c. Bridling from exchange open wires to external protectors such as 222 type arrestors (extend from external protectors to unprotected cable terminals with 18 gauge, as in paragraph 3.02 a.).

d. Bridling associated with battery feeders when specified.

e. Between poles at side-lead terminations.

3.02 Use No. 18 bridle wire (black) at the following locations:

a. Bridling of exchange circuits from unprotected cable terminals to external protectors (extend from protectors to exchange open wires with 14 gauge, as in paragraph 3.01 c.).

b. Bridling open wire exchange circuits at buckarm poles.

3.03 Use No. 20 gauge 40% conductivity bridle wire (red) between exchange open wire and one-pair-wire terminals.

3.04 All bridling wires should be free of splices.

4. ILLUSTRATIONS

4.01 The following illustrations (Figures 1 through 6) show the recommended positions of bridle wires on poles and crossarms.

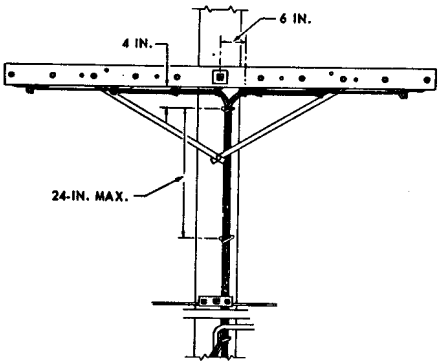


FIGURE 1. Bridle Wires at Dead-end Poles, Pole-mounted Terminals.

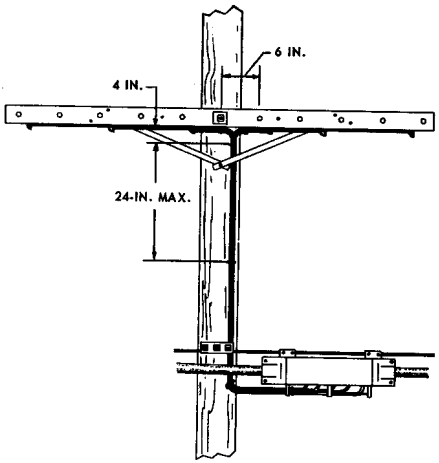


FIGURE 2. Bridle Wires at Dead-end Poles, Strand-mounted Terminals.

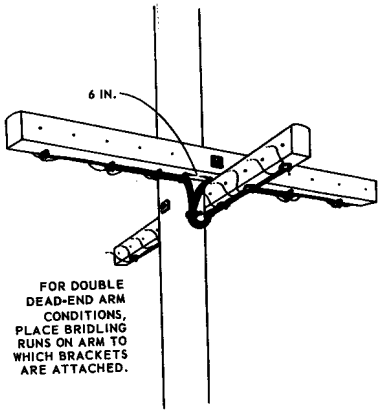


FIGURE 3. Bridle Wires at Buckarm Poles.

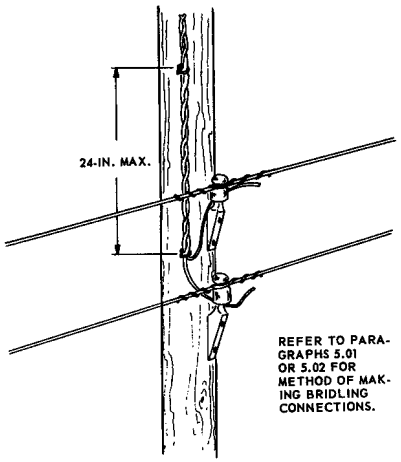


FIGURE 4. Bridle Wires at Wooden Pole Brackets.

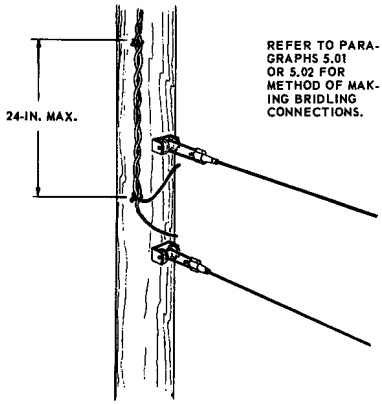


FIGURE 5. Bridle Wires at Bracket Dead-ends.

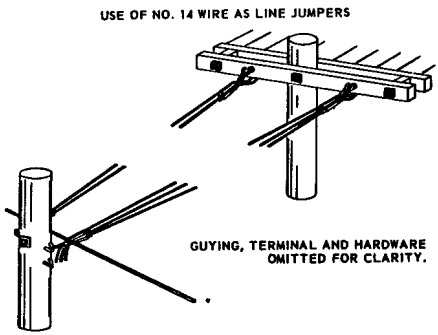


FIGURE 6. Bridle Wires at Side-Lead Terminations.

5. CONNECTIONS TO LINE WIRE

5.01 *Non-Corrosive Areas:* All connections between open wire and bridling wire in non-corrosive areas should be made with split sleeves of varying sizes depending on the type and gauge of wire of the main facility. Figures 7, 8 and 9 illustrate the split sleeve and some of its uses.

FIGURE 7. Split Sleeve.

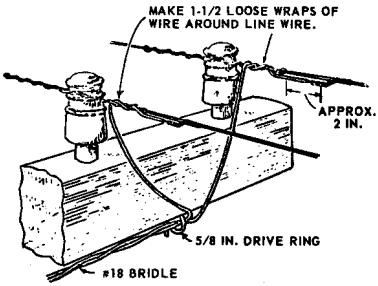


FIGURE 8. Placing Split Sleeve at an Intermediate Pole.

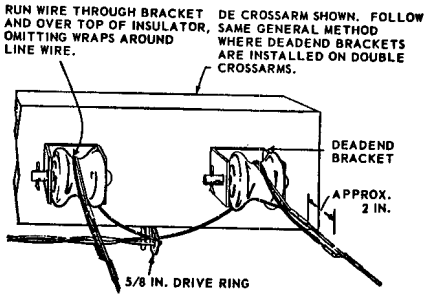


FIGURE 9. Placing Split Sleeve at a Dead Pole.

5.02 *Corrosive Areas:* All connections between open wire and bridling wire in corrosive areas should be made with bridging connectors of the appropriate size, depending on the type and gauge of the main facility. Figures 10, 11 and 12 illustrate the bridging connector and some of its uses.

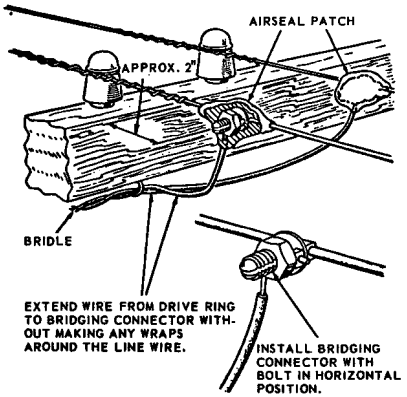


FIGURE 10. Installation of a Bridging Connector.

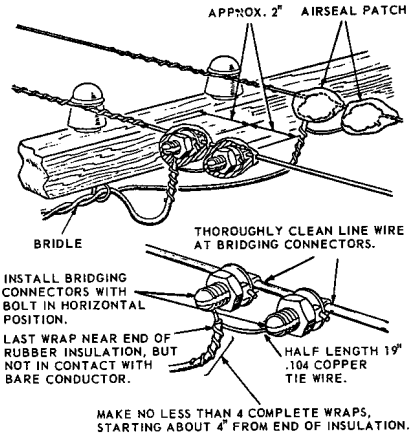


FIGURE 11. Bridle Wire Connection in a Highly Corrosive Area.

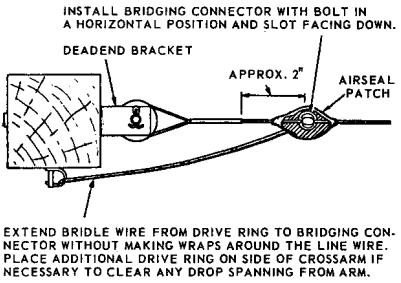


FIGURE 12. Bridle Wire Connection at Dead-ends.

6. PLACING SPLIT SLEEVES AT BRIDLING POINTS

6.01 Run the bridle wire on the pole or crossarms to provide sufficient wire to reach beyond the deadend or insulator tie as shown in Figures 13 and 14.

FIGURE 13. Placing Split Sleeve at the Dead-end.

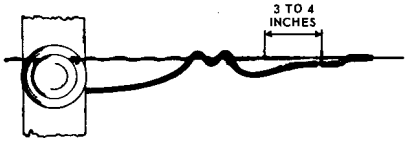


FIGURE 14. Placing Split Sleeve at the Insulator.

6.02 Install the bridging sleeve as follows:

a. Remove 2 inches of insulation from the bridle wire. Clean the copper conductor thoroughly with abrasive cloth.

b. Insert the cleaned wire in the sleeve so the end of the insulation is 3/4 inch from the end of the sleeve. See Figure 15.

c. Make at least five presses with the 31-DC Nicopress tool, starting at the inner end and working toward the outer end with adjacent presses overlapping slightly. When making the last press, the side of the presser jaws should extend slightly beyond the end of the sleeve. No attempt should be made to remove the fin by pressing a second time.

d. Wrap the bridle wire around the line wire one and one-half turns. See Figure 14. Clean the line wire thoroughly with abrasive cloth. Place the split sleeve on the line wire and close the split end of the sleeve down on the line wire throughout its length by pressing with the side cutting pliers. See Figure 16.

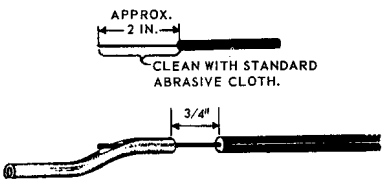


FIGURE 15. Placing Bridle Wire in the Sleeve.

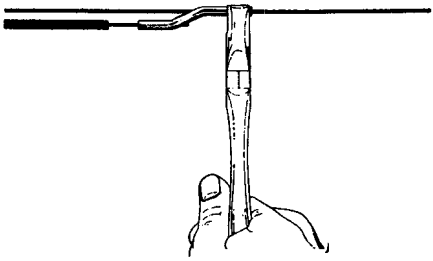


FIGURE 16. Closing Split Sleeve on Line Wire.

e. Make a minimum of eight presses with the 31-DC Nicopress tool, starting at the inner end of the split portion and working towards the outer end with adjacent presses overlapping slightly so as to result in a complete closure of the seam. When making the last press, the side of the presser jaws should extend slightly beyond the end of the sleeve. The pressing tool should be so positioned on the split sleeve that the seam will coincide with one of the fins formed in the pressing operation. This is necessary to insure a complete closure of the seam. No attempt should be made to remove the fin by pressing a second time. A completed sleeve is shown in Figure 17.

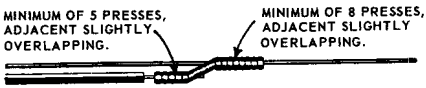


FIGURE 17. Completed Split Sleeve.

7. BRIDLE RINGS AND DRIVE RINGS

7.01 The type of bridle or drive ring used for bridle runs on poles or crossarms depends on the number and type of bridle wire used. Table A lists the type of ring to use.

TABLE A. Bridle or Drive Ring

Size of Wire	Number of Pairs		
	5/8-Inch Drive Ring	1-1/4 " C Bridle or Drive Ring	1-5/8 " A Bridle Ring
14GA. Twisted	3	6	12
18GA. Twisted	6	12	26

8. DISCONNECTING AND RECONNECTING BRIDLING-WIRE SPLIT SLEEVES

8.01 In disconnecting a bridging sleeve connection, cut the bridle wire as close to the split sleeve as possible. When making a reconnection, place the new bridging (split) sleeve adjacent (either side) to the previous attachment.

OPEN WIRE

OPEN WIRE LINES REPAIRING

1. GENERAL

1.01 This practice provides the basic methods in making repairs to open wire lines.

1.02 In doing open wire repair work the following general rules should be used as a guide:

a. Repair all items shown on prior inspection reports, as well as such items that may be observed during the course of other construction work that would cause service interruption, or be a potential hazard to workmen or the public.

b. There may be cases where existing plant does not conform to the latest standards. It is not ususally economical or necessary to change such plant unless service or safety is involved.

c. Temporary repairs should be avoided if at all possible.

d. Any dangerous plant conditions which cannot be corrected shall be reported through the lines of organization.

2. METHODS OF REPAIR

2.01 *Open Wire:*

a. Use new wire of the same size and type to repair breaks or other defects in open wire. Cut out any existing sleeves that are within 25 feet of the new splice to be made.

b. Kinks, bruises, flaws or other faults in bare open wire should be cut out and spliced with wire of the same kind and size.

c. Sag the repaired wire to the same sag as the existing wire.

d. In repairing open wire exchange circuits, caution should be exercised to maintain service. Test each circuit for busy and install appropriate jumper facility before opening. Do not allow wires to become shorted, grounded or crossed with another pair.

e. Where toll or special circuits are involved, call the appropriate testboard or supervisor for a circuit release before work is performed. It may be necessary to reroute such circuits, or to provide temporary parallel or twisted pair wire around the area being repaired or rearranged. When all work has been completed the testboard or supervisor should be advised, and an O.K. test obtained.

f. Before descending a pole on which work has been done, or leaving a job that has in any way disturbed the wires, see that all wires are clear and in proper condition.

2.02 *Ties and Insulators:*

a. Replace broken and missing ties with new ties of the proper size and type as specified in the appropriate CTS practice. Replace loose ties when line wire has pulled out of insulator groove. When removing or replacing ties, use care not to injure the line wire.

b. Replace broken or missing insulators in accordance with the appropriate CTS practice. Insulators that have pulled off pins shall be securely re-installed. If the threads are stripped or worn the pins shall be replaced.

3. CLEARANCES AND SEPARATIONS

3.01 When repairs or changes are made in open wire, the clearances specified in the appropriate CTS practice shall be maintained.

3.02 When slack is pulled or wire attachments are raised on poles, and especially when joint use is involved, the separations as shown in the appropriate CTS practice must be maintained.

3.03 When clearance from electric wires or structures requires correction, the telephone plant should be changed, or the power company requested to rearrange their plant. When the telephone plant is to be changed to provide the required clearances, the method outlined in the practices covering the particular type of plant involved should be followed.

4. SCRAP AND DEBRIS

4.01 All foreign material such as scrap wire, metallic objects, kite strings, or debris of any kind hanging on the wires should be removed. This material can some times be removed by shaking or whipping the wires. However, do not use pliers or tools to vibrate wires, as they may damage the wire. A handline placed over the wire, with both ends held securely, and made to slide along the wire, may dislodge the object, or bring it to a point that it can be removed.

4.02 Any scrap wire, metallic material, and debris removed from wires together with that found under or in the vicinity of the line should be gathered up and properly disposed of.

5. TREE INTERFERENCE

5.01 Where tree wardens, city foresters, or other authorities have control of trees, secure permission from the proper authorities as well as the consent of the property owner before work is started. Trees should be removed if permission to do so can be obtained. When this is impracticable or undesirable, remove sufficient growth to obtain adequate clearance from the wires. The amount of clearance required in any specific case depends on kind of tree, rate of growth, frequency of trimming, etc. Cutting to obtain clearance of a foot or so around wires is generally inadequate as the tree will grow back into the line within a short time. In cases where permission to trim for adequate clearance cannot be obtained it is usually desirable to trim as much as the tree wardens or property owners will allow. In these cases and also in cases where the owner will not allow trimming of any nature the matter should be referred to the supervisor.

5.02 All timber, brush, and debris cut or pruned should be removed from the premises and disposed of as covered by local instructions.

5.03 Where it is not possible to remove or trim trees, extension arms may sometimes be used to provide adequate clearance; or pins may be respaced to change location of wires through trees. However, the proper spacing of wires must be maintained where carrier circuits are involved.

5.04 The use of tree wire (or insulated wire) as a means of maintaining line insulation is not desirable due to the short life of the wire insulation. When tree wire is the only answer to the problem it should be placed as outlined in the appropriate CTS practice.

6. CONNECTIONS

6.01 Defective sleeves should be removed, and the wire spliced with standard sleeves.

6.02 All handmade joints or other types of unauthorized sleeves should be cut out and the wire respliced in a standard manner.

6.03 Where there is not sufficient slack in the wire to place new sleeves, cut in a short piece of wire of the same kind and size.

6.04 All loose connections at bridging points, binding posts, terminals, etc., shall be remade, after first thoroughly cleaning wire and contact surface, and remaking the connection properly. Defective test or bridging connectors, including bridging sleeves, should be replaced.

OPEN WIRE

INSPECTION

1. GENERAL

1.01 The open wire portion of the outside plant requires a careful and continuous preventive maintenance program. The fundamental principles involved in open wire construction, the scattered location of the plant, the general use of bare wire, the constant exposure to weather, and to interference by construction activities, electric light and power circuits, trees, vehicles, etc., make it a vulnerable part of the plant from the viewpoint of service interruption. Improper sag, scrap wire and fireign material on wires, tree interference, defective ties and insulators are some of the common causes of trouble in the open wire plant.

1.02 In order to detect and correct faulty conditions or remove potential sources of interference before service interruptions occur and to economically keep the open wire plant in a satisfactory service condition at all times, preventive maintenance work must be carefully planned and consistently carried out.

1.03 To accomplish this, a complete inspection of all open wire and associated plant should be carried out on a periodic basis, and the necessary repairs and adjustments made. (See CTSP on Open Wire Repairs). The inspection should include such items as power hazards, insufficient clearances at highways, driveways, sidewalks, over railroads or street railways, etc., or from guys or other obstructions, free interference, broken or loose ties, broken, missing or floating insulators, faulty connections and other similar sources of interruptions to service or hazards to employees or the public.

1.04 The frequency of inspection will in general depend upon the quality of work performed by telephone workmen, the cooperation of power and other wire using companies in properly constructing their plant, and the relations established with highway and building engineers and contractors for obtaining advance information concerning major projects affecting telephone plant. Usually inspections of exchange open wire carried out at intervals of about one year will be adequate. For toll circuits, inspections at more frequent intervals will generally be required. Local conditions are in all cases important factors in determining the required frequency of inspections. For either exchange or toll open wire, consideration should be given to the importance of the service carried on the lines, the character of the circuits, the age of the lines, prevalence and kind of tree growth, activities of power and other wire using companies, the amount of trouble, the general condition of the plant and fumes, smoke or moisture conditions, etc.

1.05 Extensive damage to plant by floods, forest fires, severe wind or sleet storms will sometimes require special inspection work, or have a direct bearing on the scheduling of regular inspections.

1.06 In general it is felt that a sufficiently accurate determination of the conditions can be made by observations from the ground. It seems desirable, however, that poles be climbed in order to secure closer observations of conditions on:

a. Terminal poles.
b. Reverse (buck) arm poles.
c. Test poles.
d. Side lead termination poles.
e. Poles at open wire loading points.
f. Railroad and river crossing poles.
g. Dead end and suspension poles or fixtures in long span construction.

1.07 Poles should also be climbed for making inspections when the observed conditions from the ground indicate that this procedure is warranted.

1.08 On certain classes of lines and for particular inspections local instructions may require that the inspector climb all poles.

1.09 In carrying out the inspection work for open wire plant, good judgment must be excerised on the part of the inspector in determining the conditions that are to be corrected. It should generally be the intent to carry out only that repair work necessary to insure uninterrupted and satisfactory service from the plant and the elimination of hazards to employees or the public. Minor deviations from standard practices, old standards of construction and obsolete materials should not be changed except where they present a hazard or may be expected to cause trouble.

1.10 Unauthorized attachments on poles should be noted and reported as it is desirable to have them removed if objectionable, or a suitable agreement for joint use executed if they are not objectionable.

1.11 Idle wire and associated plant shall be treated in the same manner as working plant in connection with the inspection work. Dead wire or other idle plant for which there is no further use should be reported for removal. When plant as described above and plant that is temporarily idle present hazards to employees, the public or to service, arrangements should be made to eliminate the hazards promptly.

1.12 Note building or other foreign construction operations that might interfere with telephone service or which might result in hazards to telephone employees. Consultation with those in charge of the operations, before they have progressed to a point where the telephone plant is endangered, will frequently prevent any interference with the telephone service. When it is noted that the telephone plant will interfere with the progress of building or other construction work, the conditions should be corrected or reported in accordance with local instructions.

1.13 In some cases it may be desirable to combine the open wire inspection work with inspections of drop wires, poles or cable. If combination inspections are to be made, detailed instructions concerning the various types of plant will be furnished the inspector.

1.14 The principal items which should be considered for the inspection of the open wire and associated plant are outlined in the following parts of this section.

2. CLEARANCES

2.01 Check all wires for conformity to local clearance regulations and for all clearances specified in the practices on clearances.

2.02 Check clearances of wires over or under railways and railroads to be sure that they conform to all requirements of practices on clearances for aerial plant and the instructions covering railroad crossings.

2.03 Check all wires for clearances from electric light, power, trolley feeders, contact wires, transformers, etc., including the supporting structures for plant of this nature to make sure that trouble from direct crosses, or "power arc follow up" will not occur and so that hazards to employees, or the public, will be eliminated. Note attachments of telephone plant to poles supporting high tension circuits or of high tension circuits to poles supporting telephone plant and report all such cases in accordance with local instructions. When it is not known whether power circuits are high or low tension, secure this information in accordance with local practices or as instructed by the supervisor.

2.04 Observe wires for proper separation from foreign communication circuits, signal circuits or other similar plant.

2.05 Observe clearances where wires cross or parallel suspension strand or guys, including guys from electric light, power, foreign telephone, telegraph or other pole lines.

2.06 Observe locations where action should be taken to eliminate fire hazards caused by close proximity of the line to inflammable materials or buildings.

3. SAG

3.01 Note that sag in wire is uniform, adequate and that no abnormal amount of slack is present in a sufficient degree to constitute a hazard to employees or the public or to cause interference with service. Where sag, obviously excessive, insufficient or non-uniform exists, guys, including crossarm guys, and anchors should be inspected for adequacy and defects.

4. SCRAP OR DEBRIS

4.01 Observe for pieces of scrap wire, metallic material or other debris hanging on wires. In some cases it will be found advisable to give attention to inspecting right of way, both sides of highways and vicinities immediately adjacent to open wire leads for the purpose of removing pieces of line wire, ties, cable rings, fence and bailing wire, metallic objects, etc., which might be picked up and thrown on the wires.

5. TREE INTERFERENCE

5.01 Inspect wire clearances through trees, hedges, etc., to see that there is adequate separation from limbs, branches or foliage. Clearances should be such that interference will not occur because of sleet, snow, rain and wind storms, or because of the growth which will occur before the next inspection period. Note that tree guards and attachments are in good condition and are used on insulated wire where required.

5.02 Note any dead limbs or dead trees which might fall into the line.

5.03 Where pruning has been done or where trees have been cut down, note that branches and brush have been disposed of properly.

5.04 When instructed locally to do so, inspect for brush and young tree growth under lines which are likely to cause future interference.

6. WIRE

6.01 Observe wires for badly rusted or corroded conditions and for kinks, cuts, nicks, tie burns, etc., all of which are common causes of trouble. In sections where it is not known that the condition of the wire is satisfactory or in lines in the vicinity of smelters, foundries, chemical plants, mills, railroad crossings, switch yards, etc., it is advisable to make a spot inspection by climbing a number of poles at suitably selected locations to definitely determine whether deterioration exists. If the results of such an inspection indicate that the wire is badly deteriorated, it is advisable to make further climbing inspections to determine the extent of the defective wire and the amount of replacement required.

6.02 Observe twisted pair, parallel or other insulated wire in long spans, ring runs and through trees, etc., including temporary twisted pair and emergency cable, for defective insulation, faulty ties and attachments, loose connections, etc.

6.03 Inspect (by climbing pole) open wire dead ends at terminal poles, reverse (buck) arm corners, test points, side lead terminations, railroad and river crossings, bridle wire insulators, etc., to see that they are properly made and secure. Note that wire jumpers, bridle cables and bridle wires are properly placed and terminated, that no loose connections exist and that bridle rings or similar attachments are used where required. Observe bridle wires and bridle cables for abraded insulation, kinks, loose or uninsulated splices, etc.

6.04 Observe that proper size of wire is used in spans crossing over railroads and in adjacent spans. Note that connections are in good condition and that line wire joints are not located in crossing span. See instructions covering railroad crossings.

6.05 Report locations where the placing of exchange cable or cable terminals will eliminate excessive wire. Report also the locations where it appears economical to replace defective drop wire in line spans with cable, or with crossarms and bare wire. Note locations where dead wire is in hazardous condition and should be removed.

6.06 At severe changes in grade, observe for excessive strain on attachments, wires and ties. See that wires are on the proper side of insulators with respect to the pull on corner poles.

7. CONNECTIONS

7.01 Hand made and other unauthorized or obsolete types of splices, joints or connections in line wire or between line and bridle wire, etc., should be observed and reported for replacement with standard sleeve splices or for correction.

7.02 Check all connections at or adjacent to poles climbed for other inspection purposes, to make sure that they are in good condition and properly made, for example, bridle wire and line wire connections at side lead terminations.

7.03 Inspect connections at cable terminals, binding posts, bridging and test connectors, etc., to be sure that they are tight and in good condition. Observe that test connectors on toll circuits are of the proper type and used only where authorized.

7.04 Line wire joints, at or adjacent to poles climbed for other inspection purposes, should be checked to see that they are properly made and free from excessive corrosion or other defects. High resistance connections and splices, generally caused by corrosion or rust (particularly in iron wire) are common sources of trouble and are difficult to locate. In areas where this trouble is prevalent, it may be desirable to make suitable tests to detect those conditions.

8. TIES

8.01 Observe line for missing, broken or loose ties. Note that ties appear in satisfactory condition, are properly placed and are of the correct size and type.

9. INSULATORS

9.01 Inspect line for missing, broken, floating and obviously loose insulators. Note also that the insulators are of the correct type.

9.02 Note that bridle wire insulators are used where required and that they are in good condition and properly installed.

9.03 Observe that interconnecting insulator wires and straps are in good condition and have been placed where required on open wire carrier circuits.

9.04 Note that the interconnecting straps clear the underside of insulator petticoats.

10. TRANSPOSITIONS

10.01 When specified locally, check transpositions for accuracy of layout and for correctness of type.

11. PROTECTIVE EQUIPMENT

11.01 Note that protector mounting is properly and securely attached to the pole. See that cover is not broken and that the hinge type covers close properly.

11.02 Inspect protector mountings for broken ground wires, defective or corroded protector springs, missing or defective protector blocks and for moisture or dust inside the mounting. Note that ground and bridle wires connecting protective equipment are properly installed and that all connections and protector blocks are in good condition.

11.03 Note that protector blocks are properly placed on open wires entering cables as required by the instructions covering cable protection and in accordance with local instructions with respect to the areas in which protector blocks should be provided on exchange open wires of less than one-half mile in length.

11.04 When any of the open wires or drops entering a particular terminal are equipped with protector blocks, as specified in the instructions covering cable protection, note that all open wires or drops entering the terminal are so equipped.

11.05 Note that the ground plate of protector mounting is properly connected to suspension strand or to sheath of underground or buried cable in accordance with the appropriate practices.

12. LOADING COILS

12.01 Note that loading coil cases and supports used in connection with open wire loading are in good condition and securely attached.

12.02 Inspect exposed wires for defective insulation and loose connections. Note that wires are placed properly and securely fastened.

13. LONG SPAN CONSTRUCTION

13.01 In addition to the inspection items outlined in the preceding paragraphs, special features involved in catenary and non-catenary long span construction shall be inspected as follows, unless otherwise instructed by the supervisor.

13.02 Inspect special steel crossarms and angle iron braces at dead end and suspension fixtures to see that they are securely attached.

13.03 Observe all steel work for excessive rust and see that galvanizing or protective paint is in good condition.

13.04 Inspect arms and braces for warping or buckling and for any other apparent defects that are likely to weaken the structure.

13.05 Inspect head guys, riding and suspension strand at dead ends to be sure that clamps are in good condition and securely attached.

13.06 Note that wire dead ending clamps are tight and that wire loop and splice are in good condition.

13.07 See that suspension insulator eye-bolt is in good condition and that end of bolt is upset to prevent it from becoming loose.

13.08 Note that suspension insulator is not broken, that wire hanger and wood block are in good condition and span wire is securely held.

13.09 When crossarms or suspension strand hangers are badly out of alignment, observe suspension strand for non-uniform sag and inspect hangers for loose clamps.

BURIED PLANT

BURIED SERVICE WIRE TERMINATIONS WITH AERIAL PLANT

1. GENERAL

1.01 This practice provides procedures for terminating buried service wires at junctions with aerial plant such as aerial cable, multiple wire, C rural wire or open wire.

2. JUNCTION WITH AERIAL CABLE

2.01 At the cable terminal or closure where buried service wire feeds from aerial cable and where the length of the buried service wire is:

a. 500 feet or less–Do not bond the armor wire or the aluminum tape to the strand or terminal housing. This will protect the subscriber's location from possible fire caused by excessive power fault, should the circuit come in sustained contact with power lines of any voltage.

b. More than 500 feet–Use direct buried wire and bond the armor wire to the strand or terminal housing. When the length of buried wire is greater than 500 feet, the resistance of the armor wire because of its length, limits the fault current to safe values. The buried service wire is not to be used for distances of more than 500 feet.

2.02 Carbon block protection is not required between the cable conductors and the buried service wire conductors unless severe lightning exposure exists. See paragraph 2.08.

2.03 Buried service wire can be brought up a pole and terminated directly in a pole or strand mounted cable terminal or cable closure if the cable conductor is 24 or 26 gauge. Where fuseless protectors are used at the station and the cable conductor is 22 gauge or 19 gauge and exposed to power contact, a fusible link is required between the cable pair and the service wire. The 24 gauge conductors in a cable stub or the connecting block of a 49 type cable terminal are satisfactory fusible links. At the groundline, the wire should be protected with an 8 foot length of No. 0 U cable guard. A typical installation terminating in a 49 type cable terminal is shown in Figure 1.

2.04 Where the direct buried wire is 500 feet or less in length, grounding of the armor wire or bronze tape at the cable terminal is omitted. Cut off the armor wire or bronze tape and wrap with two turns of vinyl tape to protect against sharp edges. See Figure 2.

2.05 Where the direct buried wire is over 500 feet in length and the armor wire of the wire is to be grounded to the cable terminal, terminate the armor wire in a grounding harness connector as shown in Figure 3.

2.06 Inside a cable terminal, the conductors of direct buried wire or buried service wire should be terminated on the binding post in the usual manner. The cable stub of the pole or wall mounted terminal provides the fusible link. In the case of a 50 type cable terminal, the 24 gauge conductors of the connecting block serve as the fusible links between the cable conductors and the buried plant conductors.

2.07 Where the length of the buried service wire is over 500 feet, grounding of the armor shield to the terminal housing with a grounding harness connector is required. In a Cook cable terminal, fasten the spade clip connector under a convenient nut or screw in the base assembly.

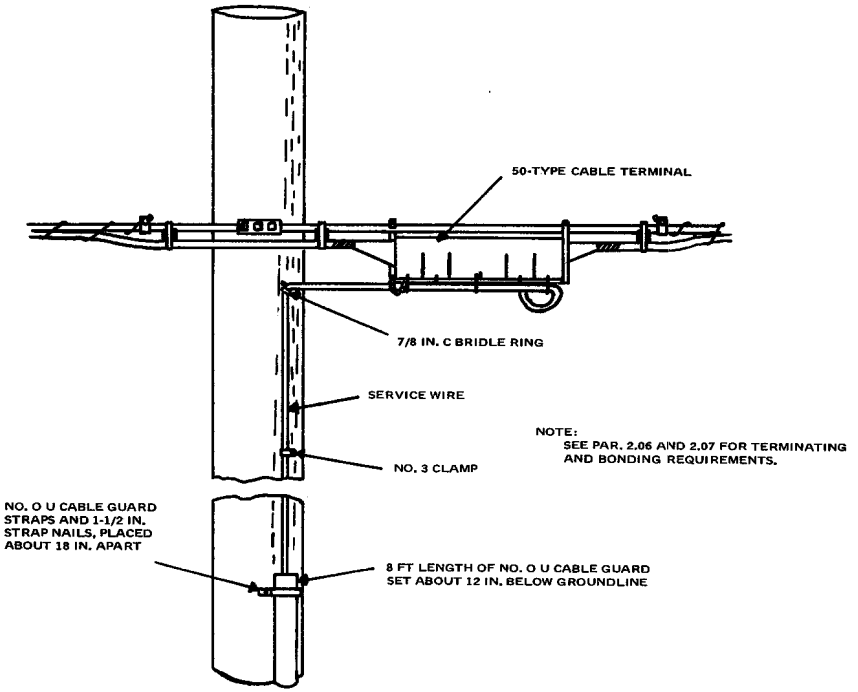


FIGURE 1. Buried Plant Run up a Pole

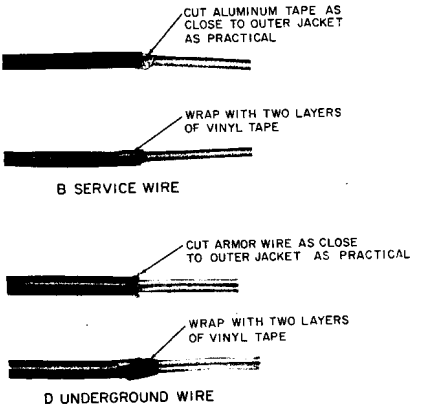


FIGURE 2. Removal of Aluminum Tape or Armor Wire

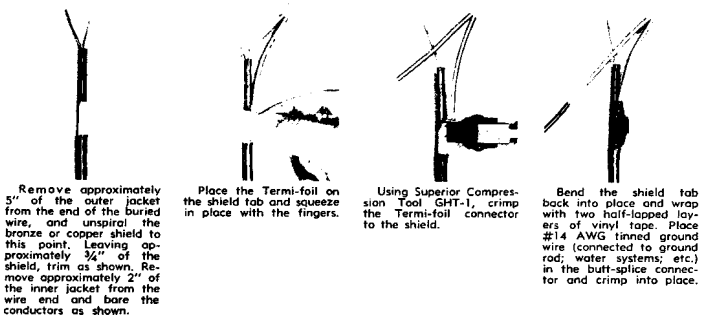


FIGURE 3. Bronze Shield or Direct Buried Wire Terminated in a Grounding Harness

2.08 In heavy lightning areas where the subscriber's station is severely exposed to lightning, it may be desirable to furnish additional lightning protection to buried service wires which are 500 feet or less in length. Under these conditions, detailed plans or other special instructions authorize bonding the armor shield or bronze tape at the aerial cable terminal. Such installations require the use of a type 123 or 128 protector (equipped with 2B1E protector units) and connection of the armor shield or bronze tape to the ground post of the protector. A connection is also required between the protector ground post and the cable strand. For the latter purpose, block wire is required as a fusible link to prevent the common wire or bronze tape from overheating. A typical installation is shown in Figure 4.

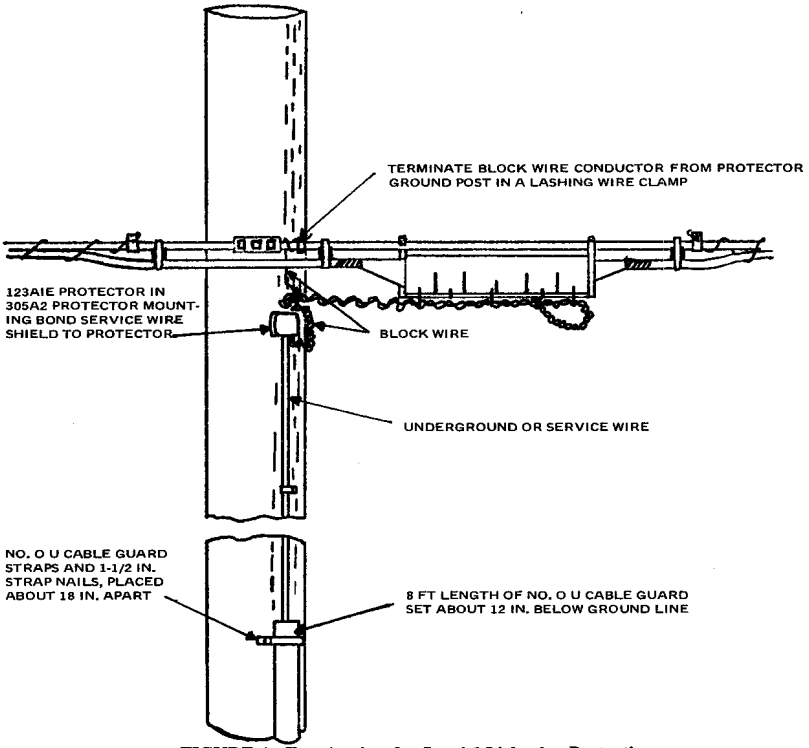


FIGURE 4. Termination for Special Lightning Protection

3. JUNCTION WITH MULTIPLE WIRE

3.01 Where multiple wire is exposed to power contact and a fuseless protector is used at the station, buried service wire should not be used with or fed from multiple wire, because of the relatively small size and low fusing level of the conductors or buried service wire. A satisfactory fusible link is not available for use between multiple wire conductors and buried service wire conductors.

3.02 Direct buried wire can be used with or fed from multiple wire where the multiple wire is exposed to power contact and fuseless station protection is used. Direct buried wire should be brought up a pole and terminated in a pole mounted wire terminal. At the groundline, the wire should be covered with an 8 foot length of No. 0 U cable guard. Cut off the armor wire as shown in Figure 2. Connect the conductors of the direct buried wire to the conductors of the multiple wire with block wire. Figure 5 shows a typical example of direct buried wire being connected to a strand mounted wire terminal.

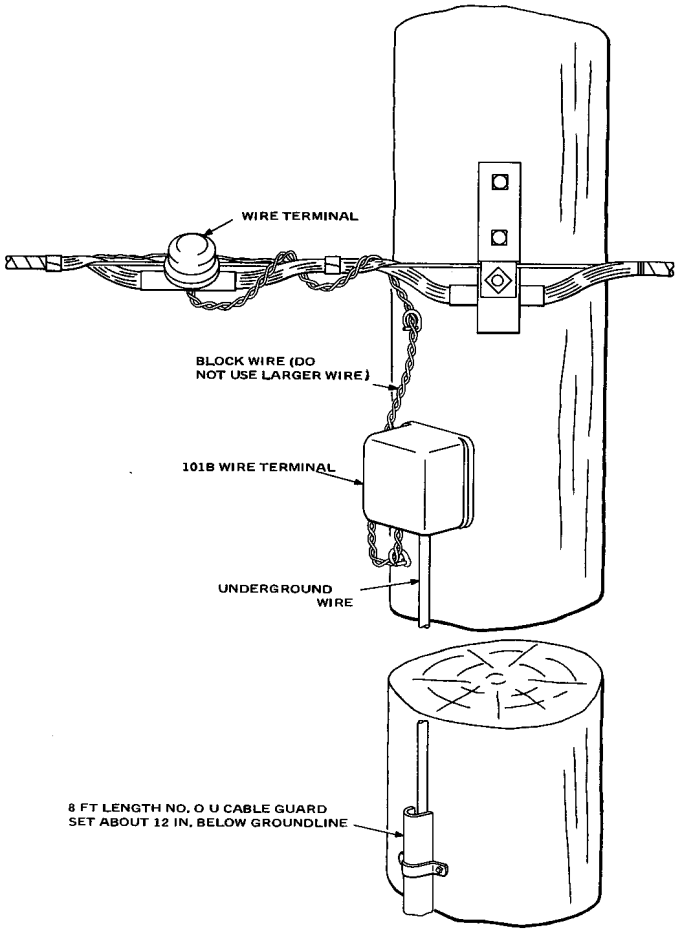


FIGURE 5. Underground Wire Terminated to Multiple Wire

3.03 The block wire serving as a fusible link between the direct buried wire conductors and the multiple wire conductors can be terminated in a pole mounted wire terminal.

4. JUNCTION WITH C RURAL WIRE

4.01 Do not connect buried service wire to C rural wire because of the small size of service wire conductors.

4.02 At the junction with C rural wire, direct buried wire can be brought up a pole and terminated in a pole mounted wire terminal. At the groundline, the direct buried wire should be covered with an 8 foot length of No. 0 U cable guard. The armor wire should be cut off as shown in Figure 2. Block wire should be used to bridle between the pole mounted wire terminal and the strand mounted wire terminal on the C rural wire. A typical installation is shown in Figure 6.

5. JUNCTION WITH OPEN WIRE

5.01 Buried service wire should not be used with or fed from open wire because of the relatively small size and low fusing level of service wire conductors.

5.02 At the junction with open wire, direct buried wire can be brought up a pole and terminated in a pole mounted wire terminal. At the groundline, the wire should be covered with an 8 foot length of No. 0 U cable guard. The armor wire should be cut off as shown in Figure 2. Block wire must be used between the protector and the open wire. A typical installation is shown in Figure 7.

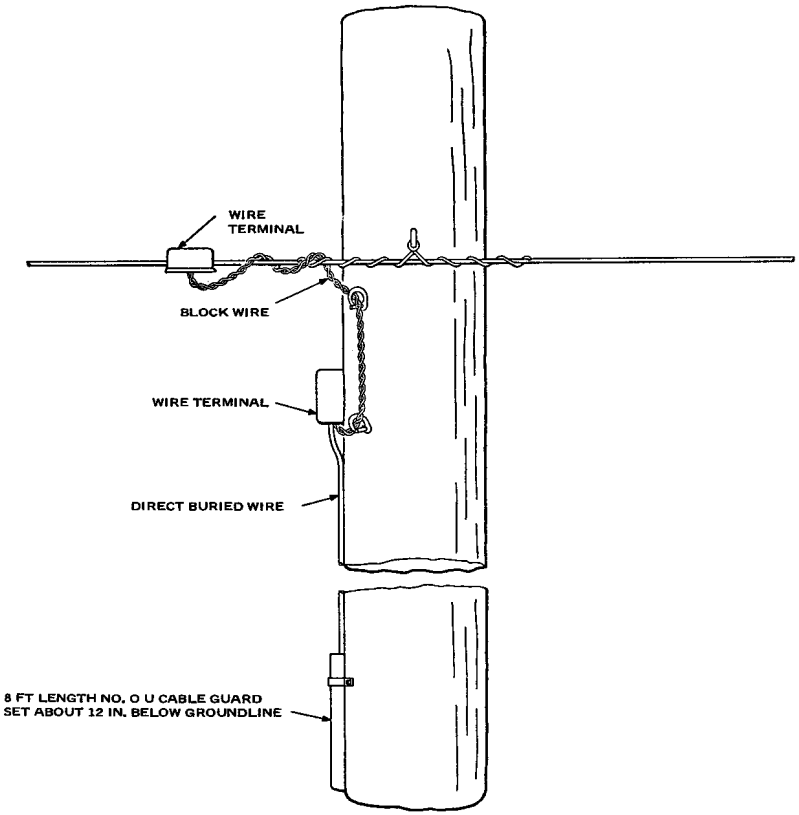


FIGURE 6. Termination of Underground Wire and Rural Wire

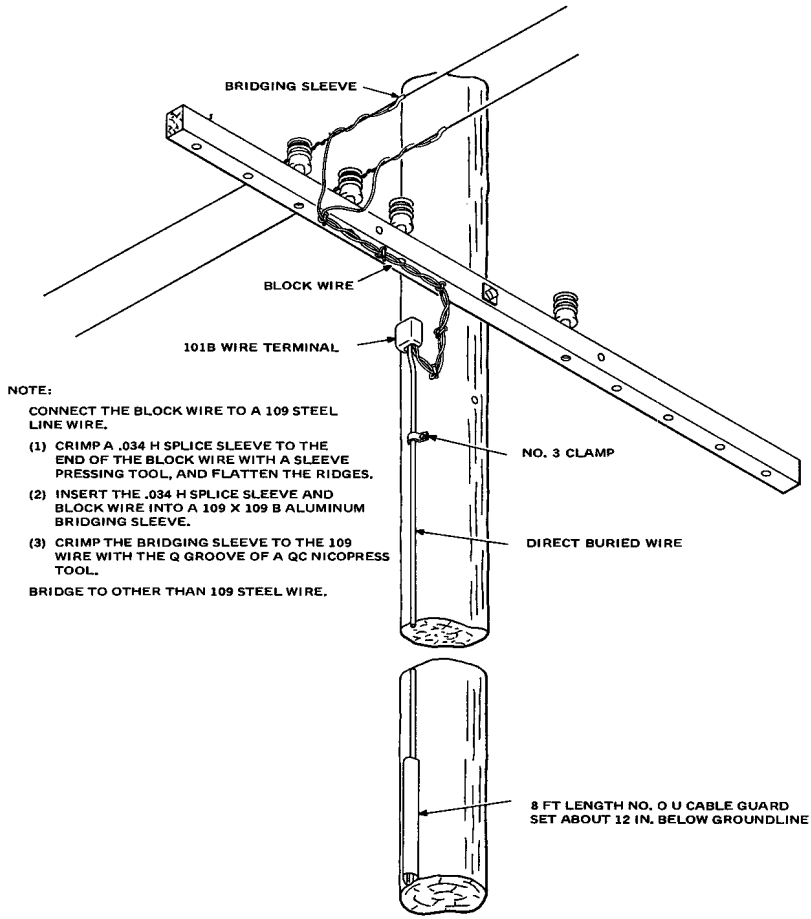


FIGURE 7. Termination of Underground Wire and Open Wire

BURIED PLANT

BURIED WIRE TERMINATIONS AT JUNCTIONS WITH BURIED PLANT

1. GENERAL

1.01 This practice provides procedures for terminating buried service wire and underground wire at junctions with other types of buried plant and at customer locations.

2. GROUNDING AND PROTECTION

2.01 The armor of direct buried wire must *always* be grounded at the customer's protector when the protector is fed from buried plant. The grounding is needed at customer locations to protect against lightning damage and to minimize shock or fire hazards caused by sustained power contact. The armored shield of the buried service wire should always be bonded to the terminal housing at the junction with buried cable.

2.02 At the older buried wire installations where a shield wire was used, the shield wire can be terminated in the same manner as recommended for bronze tape or armor wire. See CTSP 490-800-300.

2.03 Those stations which use fuseless protectors, and which are served from buried distribution cable of 19 or 22 gauge and are exposed to possible contact with power of over 300 volts (such as in random separation construction) require a fusible link in the circuit between the exposed cable and the station. This fusible link can be provided at junctions of buried cable and buried service wire by terminating the buried service wire at the terminal block with 24 gauge leads installed in a buried cable pedestal. The 24 gauge wire leads which are connected to the cable pair provide the fusible link. The terminal blocks can be used with F-1, F-2, F-3 and F-4 cable closures.

2.04 Buried service wires can be identified at terminations by means of tabs made from B glass tape. Cut about 5 inches of glass tape and wrap it around the wire, pressing the sticky side against itself to make the tag. It can be readily marked with pencil or pen to show the customer or to identify the route of the buried wire as shown in Figure 1.

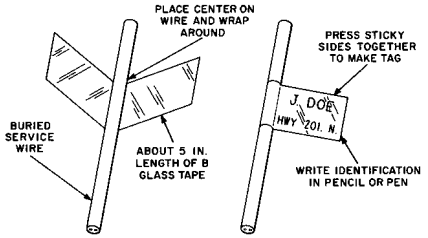


FIGURE 1. Identifying Tags

3. DISPOSITION OF UNTERMINATED PAIRS

3.01 Buried wire not in use may include new installations when some time may elapse before the buried wire is placed in service or where existing service is being disconnected. To avoid differences in potential between conductors and armor wire or bronze tape, buried wire which is not in use should be protected as follows:

a. New installations where the wire is not being terminated on a station protector at the time of placing:

(1) At the station end, twist the bare conductors and armor wires together and wrap with vinyl tape. (Make a water tight wrap if the service wire end is buried.)

(2) At the end toward the central office, bridge armor wires and connectors to a common ground post or if not available, follow the instructions in paragraph 3.01 a. (1).

b. Service disconnections where the wire has been terminated and existing service is being disconnected:

(1) At the station end, leave all terminations as they are; but where the station protector is being removed, twist the armor wires and bare conductors together and wrap with vinyl tape.

(2) At the end toward the central office when the wire terminates on a protector, leave the terminations as they are. Refer to paragraph 3.01 a. (2). (Dedicated plant only.)

4. JUNCTIONS WITH BURIED CABLE

4.01 To terminate buried service wire pull slack from the wire and mark the outer jacket about 6 inches above the ground line cover. Prepare the end as shown in Figure 2.

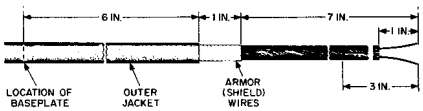


FIGURE 2. Preparation of Buried Service Wire for B Cable Closure

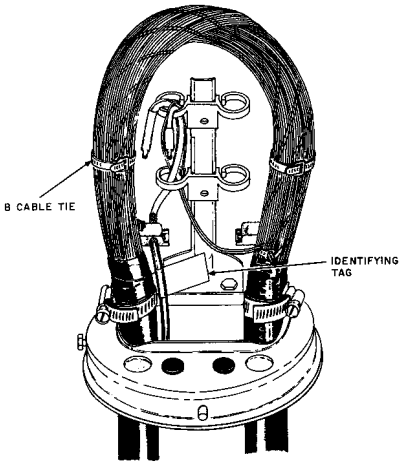
4.02 Attach the grounding harness connector and fasten securely with a compression tool.

4.03 Push any slack in the buried wire down into the terminal post. Arrange the identifying tags so that they are easily read.

4.04 Run the buried service wire through the plastic clamps (where applicable) and bend them down over the top clamps. Run the cable pair through the same route as the buried service wire. Bend the cable pair over the top plastic clamp and cut off wires about 1-1/2 inches below the bend. (See Figure 3 showing a typical installation). Connect the cable pair to the wire by using the appropriate size Scotchlok type wire connectors.

4.05 Where the binding posts on a connecting block installed for loading are not all used for loading, they should be used for any terminations required. Insert the armor wire into the grounding harness connector and terminate the conductors of the buried wire on the binding posts of the blocks in the usual manner.

4.06 To join buried wire directly to a cable conductor in a cable closure, prepare the wire as shown in Figure 4.



NOTE:
WHEN BURIED WIRE IS EXPOSED AND A FUSELESS PROTECTOR IS USED AT THE SUBSCRIBERS STATION AND IF CABLE IS 19- OR 22-GAUGE, PLACE A TERMINAL BLOCK AND TERMINATE THE BURIED SERVICE WIRE.

FIGURE 3. Buried Service Wire in B Cable Closure

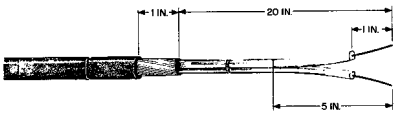


FIGURE 4. Preparation of Direct Buried Wire for Termination in a Cable Closure

4.07 Attach the armor shield of the buried wire to the grounding harness connector and fasten securely. Run the buried wire and the cable pair to be connected through the nylon cable clamp and bend down over it. Connect to the cable pair by using the appropriate size Scotchlok type connectors. See Figure 5.

4.08 The termination of buried service wire in an F-4 type pedestal mounting is illustrated in Figure 6.

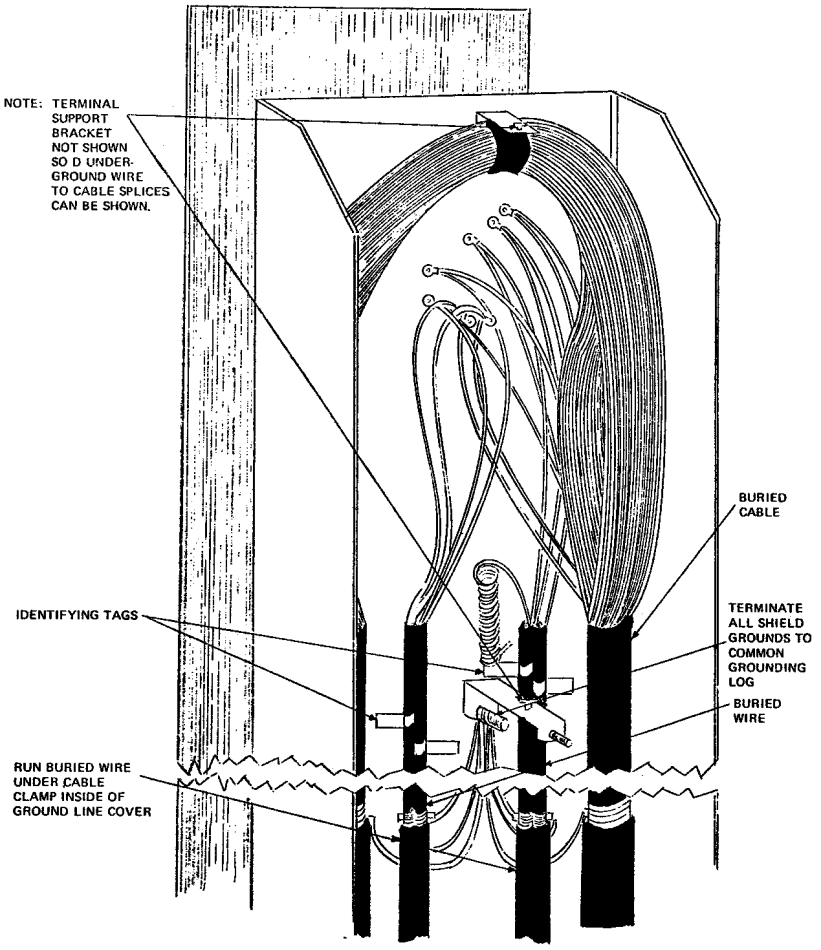


FIGURE 5. D Underground Wire in an F-3 Type Pedestal Mounting

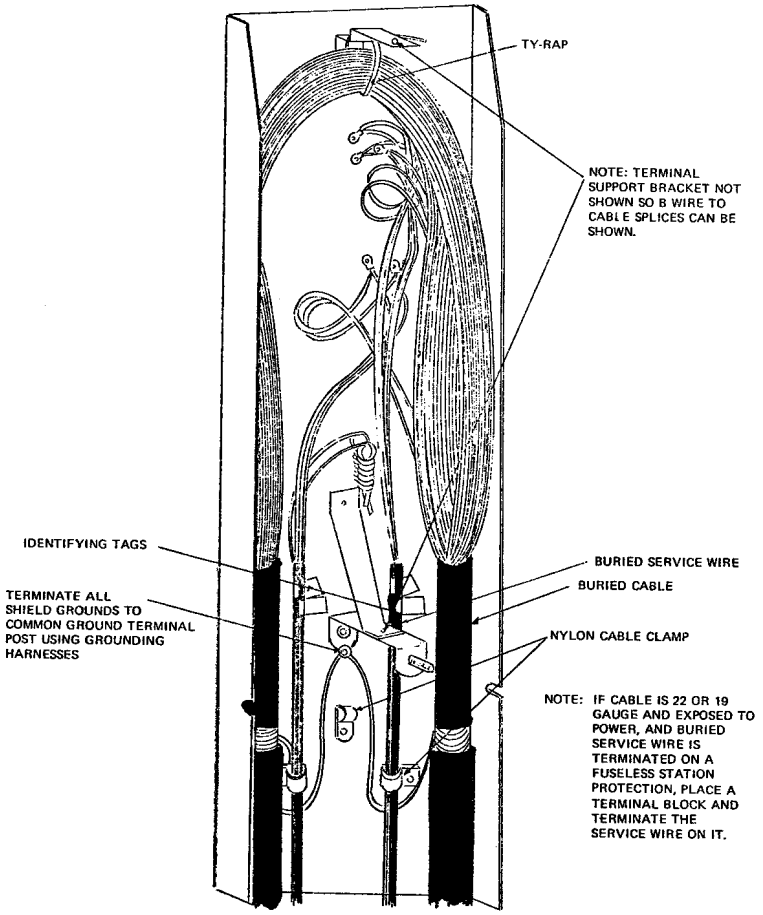


FIGURE 6. B Service Wire Terminated in an F-4 Pedestal Mounting

5. JUNCTIONS WITH BURIED WIRE

5.01 At junctions of buried wire with buried wire, place an F-3 or F-4 buried wire terminal as described in CTSP 490-500-432. Bridge the branch buried wire in the terminal as required. Each wire can be identified with a suitable designation by placing a tag made from glass tape as covered in paragraph 2.04. The armor wire or bronze tape of buried wire should always be connected to the ground post of each terminal.

6. TERMINATIONS AT CUSTOMER LOCATION

6.01 A grounding harness is used to bond the bronze tape of buried service wire to a protector ground post of the station protector. (Do not attempt to bond armor tape in any other manner.) The grounding harness has a spade clip which can be placed under the washer of the protector ground post without removing the nut. See CTSP 490-800-300.

6.02 Mount the station protector on the wall and mark the location of the grounding harness connector on the service wire. Cut off the wire about 5 inches beyond this point. Remove the outer jacket and proceed as follows:

a. Remove the bronze shield as shown in Figure 7.

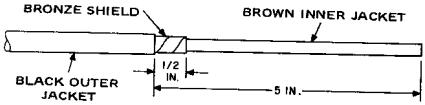


FIGURE 7. Strip Outer Jacket and Bronze Tape

b. Remove the inner jacket up to the bronze tape. Position the grounding harness on the wire as shown in Figure 8, and fasten securely with a compression tool.

Remove approximately 5" of the outer jacket from the end of the buried wire, and unspiral the bronze or copper shield to this point. Leaving approximately ¾" of the shield, trim as shown. Remove approximately 2" of the inner jacket from the wire end and bare the conductors as shown.

Place the Termi-foil on the shield tab and squeeze in place with the fingers.

Using Superior Compression Tool GHT-1, crimp the Termi-foil connector to the shield.

Bend the shield tab back into place and wrap with two half-lapped layers of vinyl tape. Place #14 AWG tinned ground wire (connected to ground rod; water systems; etc.) in the butt-splice connector and crimp into place.

FIGURE 8.

c. Terminate buried service wire on a protector as illustrated in Figure 9. Place the spade clip of the connector under the flat washer with the clip between the flat washer and brass washer. Tighten the nut securely. Install a cover over the protector.

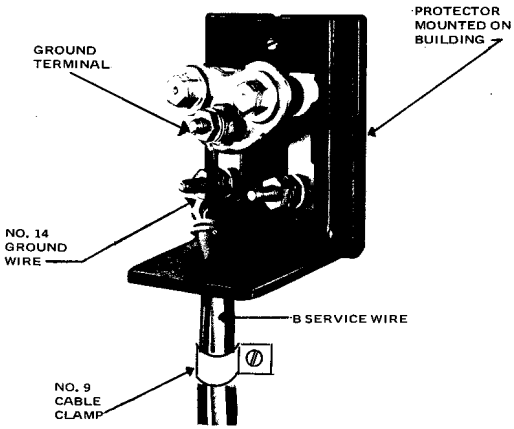


FIGURE 9. Buried Service Wire on Protector

d. Where a protector is not required, a buried service wire can be terminated on a connecting block on a backboard as shown in Figure 10.

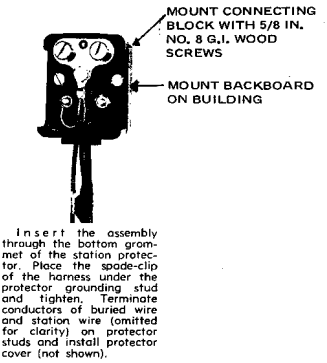


FIGURE 10. Buried Service Wire on Connecting Block

e. Buried Service wire can be terminated in a protector by preparing the end as shown in Figure 11. The spade clip connector can be placed on the ground post in a manner similar to placing the grounding harness connector (on buried service wire) on the ground post as described in paragraph 6.02 c.

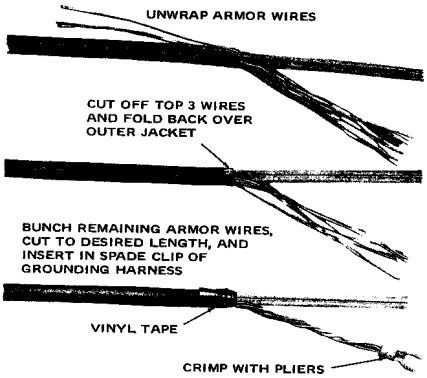


FIGURE 11. Preparation of Buried Service Wire for Termination on a Protected Terminal

BURIED PLANT

BURIED WIRE DESCRIPTION

1. GENERAL

1.01 This addendum is issued to correct the CTSP number referenced in paragraph 2.06.

1.02 With red pen or pencil, make the change noted in paragraph 2 of this addendum.

2. CHANGE

2.01 Paragraph 2.06 of CTSP 490-500-432 should read:

> **2.06** The recommended depths for placing B service wire are specified in CTSP 490-500-421.

BURIED PLANT

BURIED WIRE DESCRIPTION

1. GENERAL

1.01 This practice provides a description of the service wires used in buried distribution plant.

2. BURIED SERVICE WIRE (QUAD BURIED DISTRIBUTION SERVICE WIRE)

2.01 B service wire is a 2-pair wire intended for use as buried drop connections to subscribers' premises. This wire can be buried directly in the ground without added mechanical protection.

2.02 B service wire, illustrated in Figure 1, consists of four 19 AWG solid copper conductors, individually insulated with high density, colored polyethylene.

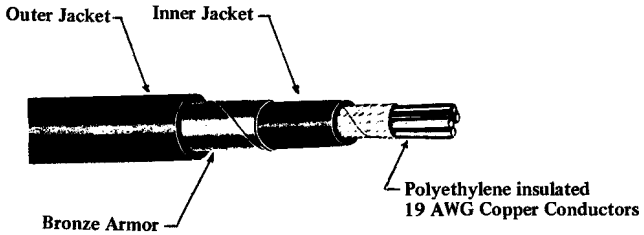


FIGURE 1

2.03 The conductors are stranded to form a star quad. The inner jacket is composed of high molecular, black polyethylene covered by spirally applied bronze tape armor.

2.04 The outer jacket is composed of high density polyethylene and is black in color. The mutual capacitance of the B service wire is .083 μ per mile. The resistance of B service wire is 92Ω per loop mile.

2.05 B service wire is available on reels containing lengths totaling 5,000 feet and 10,000 feet.

2.06 The recommended depths for placing B service wire are specified in CTSP 490-500-426.

3. D UNDERGROUND WIRE (PAIRED BURIED DISTRIBUTION SERVICE WIRE)

3.01 D underground wire, illustrated in Figure 2, is a 1-pair wire and is for use in buried distribution of telephone circuits. This wire can be buried directly in the ground without added mechanical protection.

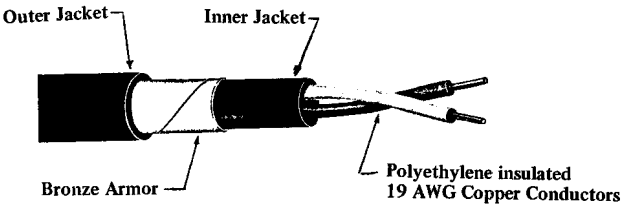


FIGURE 2

3.02 D underground wire consists of two parallel 19 AWG solid copper conductors individually insulated with high density, colored (Blue-white) polyethylene.

3.03 The conductors are twisted and covered with an inner jacket of high molecular, black polyethylene. The inner jacket is covered with spirally applied bronze tape armor.

3.04 The outer jacket is composed of high density polyethylene and is black in color. The mutual capacitance of the D underground wire is .083μ per mile. The resistance of D underground wire is 92Ω per loop mile.

3.05 D underground wire is available on reels containing lengths totaling 5,000 feet and 10,000 feet.

BURIED PLANT

PROTECTION OF BURIED SERVICE WIRE FROM GROUND LEVEL TO PROTECTOR

CONTENTS	PARAGRAPH

1. GENERAL

1.01 This practice provides procedures for protecting aluminum shielded buried service wire on buildings before it enters the protector or building. See Figure 1.

1.02 This practice is being reissued to clarify the application and the type of materials required. **All copies of CTSP 490-500-436, Issue 1, 1972, should be removed from the file and destroyed.**

1.03 Service wire protection can be used in conjunction with a fuseless or fused protector or where no protector is required.

2. TOOLS AND MATERIALS

2.01 All or part of the following tools and materials will be required:

a. Tools:

(1) Masonry drill or push drill.

(2) Screwdriver.

(3) Hacksaw.

b. Materials:

(1) Five foot plastic house and building riser with offset, CTS #20-79-002-3, see Figure 2.

(2) Screws or toggle bolts.

(3) Fuseless or fused protector.

3. PROCEDURES

3.01 When a protector is used on the exterior of the building, proceed as follows:

a. Install the protector.

b. Determine the length of the plastic riser required. The length should be the distance between the protector and the ground level plus 7 inches.

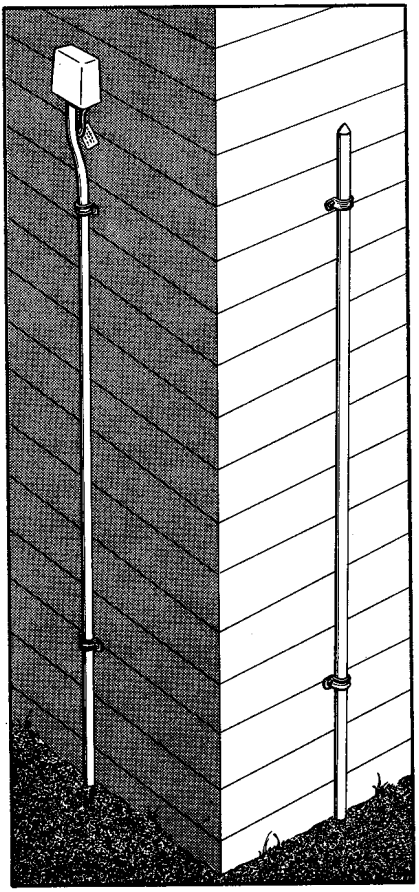


FIGURE 1. House and Building Riser Typical Installations

Distribution C D E F

c. Cut off the straight end of the plastic riser with a hacksaw if necessary.

d. Dig down 7 inches into the ground where the wire emerges.

e. Drill holes where the clamps are to be installed, approximately one foot below the protector and one foot above ground level. Both clamps should be used.

f. Slip the plastic riser over the service wire and other wires if any. The offset must be on top.

g. Squeeze the top end of the riser and slip it along with the wires into the protector bottom after removing and discarding the rubber grommet if any. See Figure 3. On some protectors that have a soft rubber base, it might be necessary to enlarge the opening sufficiently to allow the end of the riser to slip into the protector. Approximately 3/4 of one inch of the riser should protrude into the protector.

h. Secure the riser to the building with the plastic clamps. Backfill hole.

i. Terminate the wires, then pass any wire that must leave the protector and the riser through the slotted opening at the top of the riser. Provide a drip loop before entering the building. Attach a ground wire warning tag to the ground wire at this location. See Figure 4.

3.02 When more than one protector is served from buried service wires, all the wires can be brought up inside one riser then exit out the slot in the top of the riser to the other protectors. A maximum of 3 wires, any combination, are to be placed in a riser.

3.03 When a protector is not required or it is to be installed indoors proceed as follows:

a. Determine the length of the plastic riser required. The length should be the distance between the protector and the ground level plus 6 inches.

b. Cut off the offset end of the plastic riser with a hacksaw if necessary.

c. Dig down 7 inches into the ground where the wire emerges.

d. Drill holes where clamps are to be installed, approximately one foot below the protector and one foot above ground level. Both clamps should be used.

e. Slip the plastic riser over the service wire and other wires if any. The straight end must be on top.

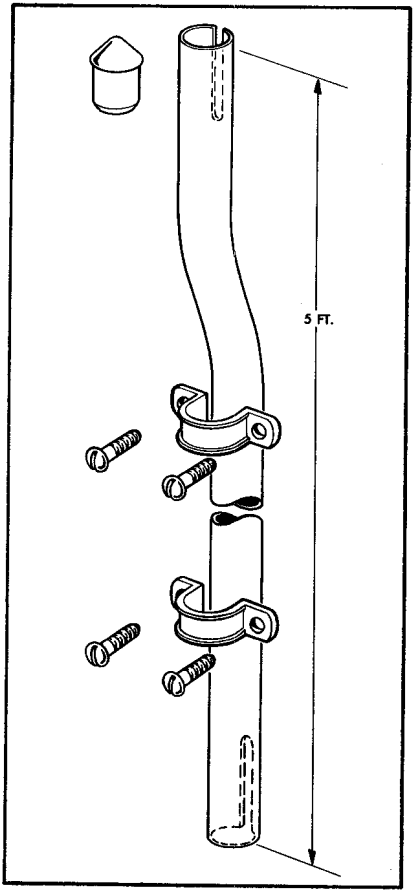


FIGURE 2. Plastic House and Building Riser with Clamps and Plug

f. Pass wires out of slot in the top of the riser, tape and pass directly into the building. Be sure entrance hole is drilled sloping in an upward direction going into building.

g. Insert plug into top of riser and secure riser to the building with clamps. Backfill hole. See Figure 5.

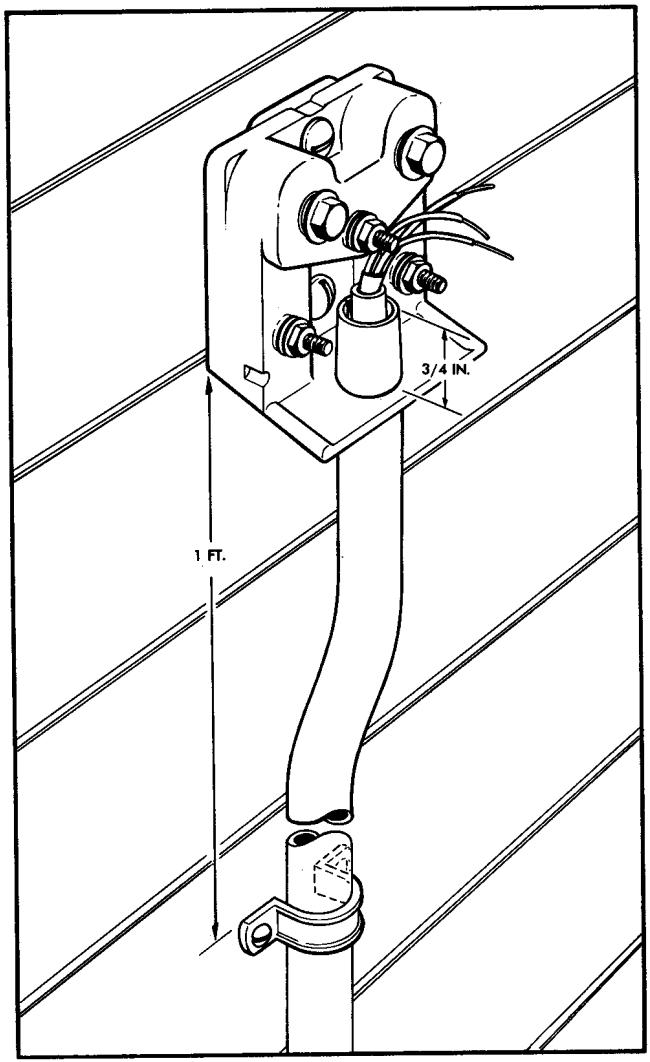


FIGURE 3. Plastic Riser Entering into Protector
(Drawing 1 of 2)

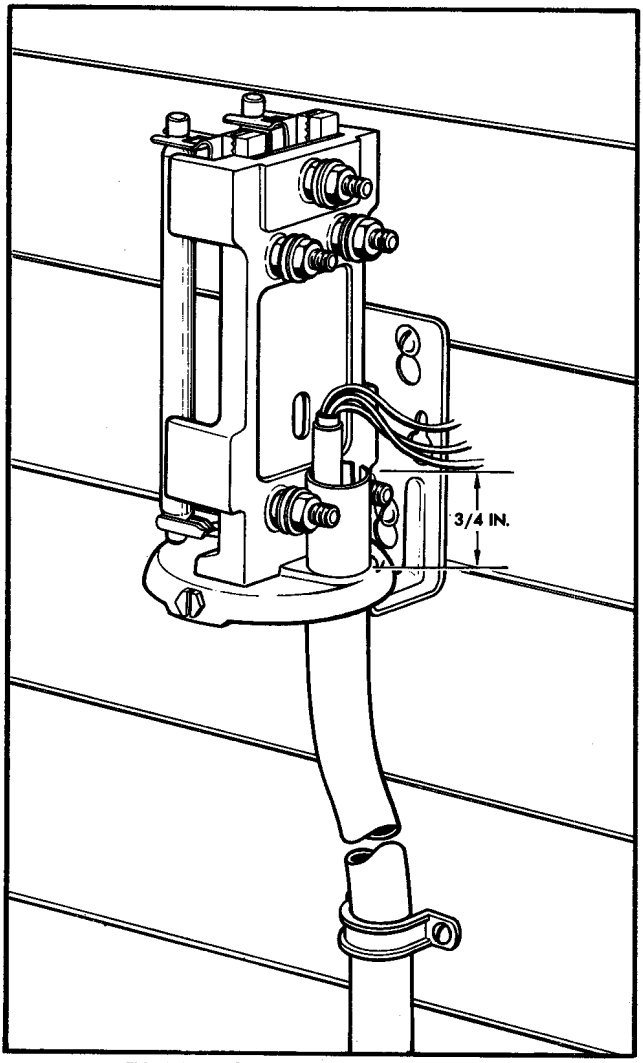


FIGURE 3. Plastic Riser Entering into Protector
(Drawing 2 of 2)

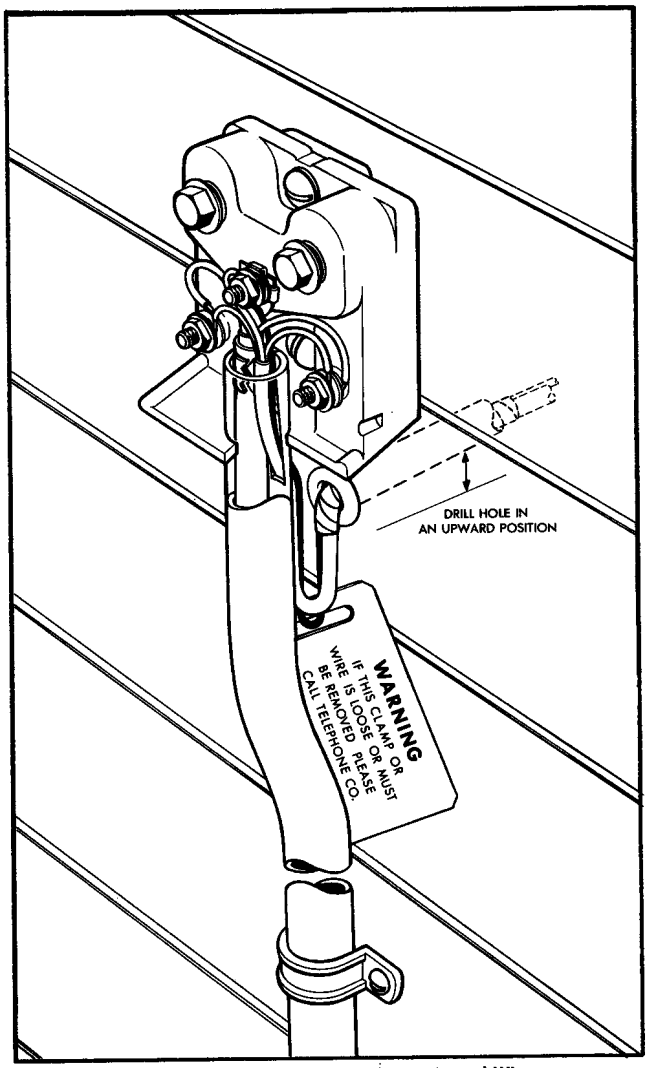


FIGURE 4. Protector and Riser with Terminated Wires (Drawing 1 of 2)

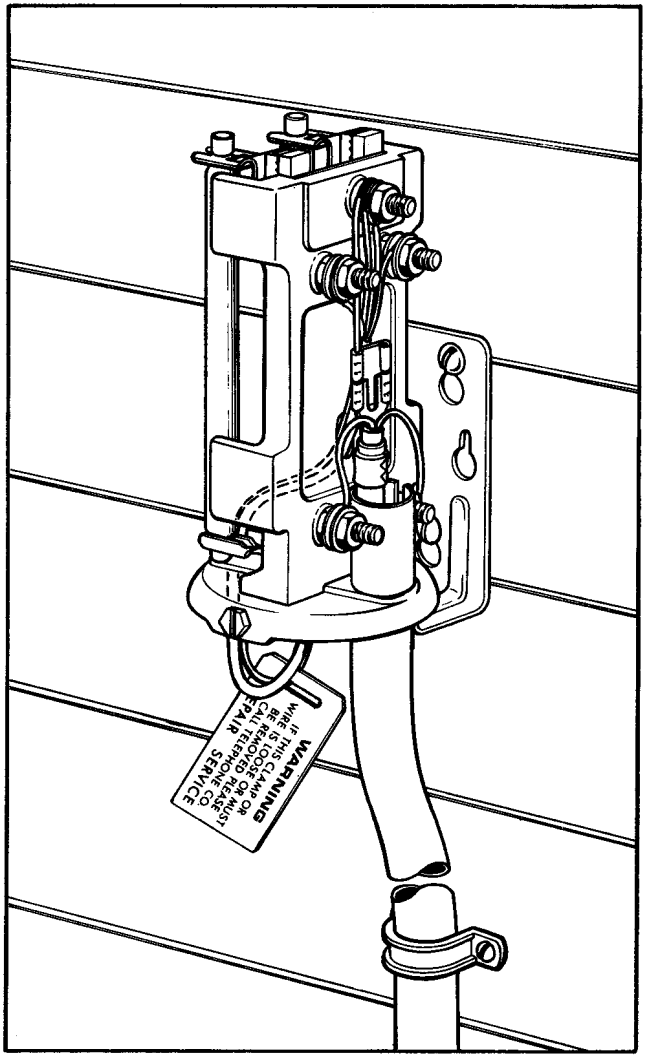


FIGURE 4. Protector and Riser with Terminated Wires (Drawing 2 of 2)

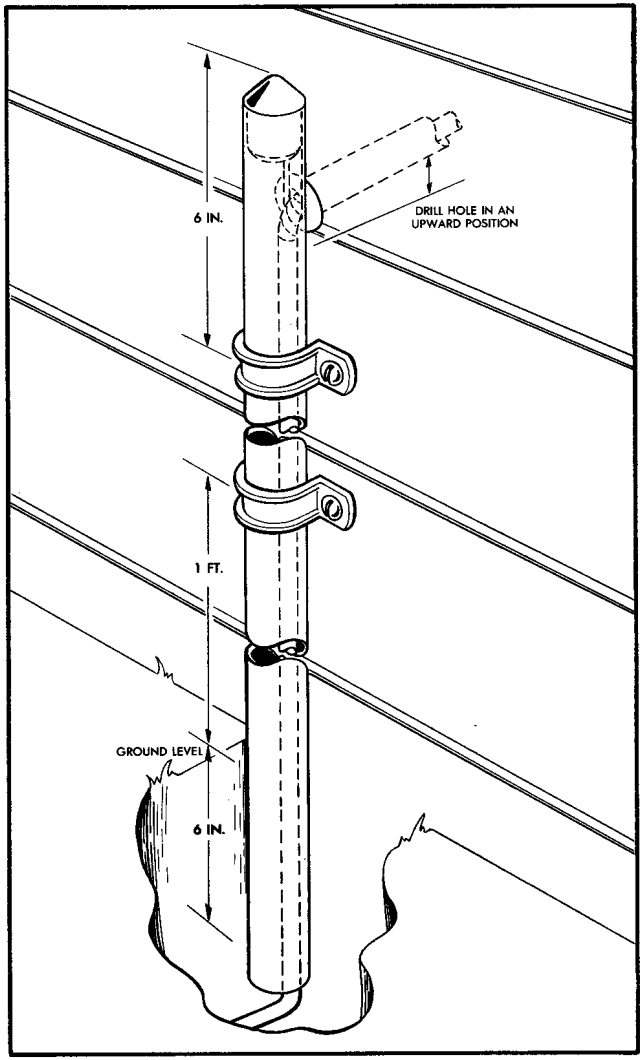


FIGURE 5. House and Building Riser No Exterior Protector

700–TYPE CONNECTORS
DESCRIPTION, INSTALLATION, AND MARKING

1. GENERAL

1.01 This practice covers the description, installation, and marking of the Reliable Electric Company 700-type connector. These connectors are used in terminating outside plant cables on existing central office main distributing frames where there is a shortage of vertical frame space.

1.02 The 700-type connector will provide up to 600-pair termination on an 11' 6" vertical. Verticals should be on 8" centers. The 700-type connectors should not be mounted on frames having verticals on 6-1/2" centers.

1.03 The 700-type connectors provide features for voltage protection, current protection, testing, identification of special circuits, and disconnecting the cable pairs.

2. DESCRIPTION

2.01 The basic component of the Reliable Electric 700 connector is the 10" long 50-pair unit of molded plastic with attached fanning strips. Two 50-pair connectors are secured as a single unit by two continuous grounding-mounting bars on an aluminum supporting bar to make up the 100-pair unit. See Figure 1. They are equipped with a 101-pair stub and 100 protector units.

2.02 The connector has a factory-connected color coded stub cable consisting of tinned-copper PVC insulated conductors, mylar tape core wrapper, corrugated aluminum shield under the outer PVC sheath and factory installed gas plug near the terminated end of the stub cable.

2.03 The stub cables are available in both 22- and 24-gauge conductor sizes. The standard length of the cable is 20'. Additional lengths may be obtained in increments of 1' up to a maximum length of 100'. The stub cable is mounted for downward extension from the frame unless otherwise specified when ordered.

2.04 The color of the outer jacket of the 24-gauge cable is beige and the 22-gauge cable is slate gray.

2.05 The stub cables contain an extra pair (red-white) which is folded and tied to the cable form.

2.06 The Reliable Electric No. 1104 Protector Unit (Figure 2) with four carbon blocks and heat coils is used on circuits requiring both voltage and sneak current protection. When the six metallic pins and one plastic polarizing pin of this protector are inserted in the connector unit (Figure 3), they provide the following contact for one cable pair:

a. Tip and ring to outside plant conductor (long pins).

b. Tip and ring to central office equipment (short pins).

c. Ground (long center pin between two long pins).

d. Alarm (long center pin between two short pins).

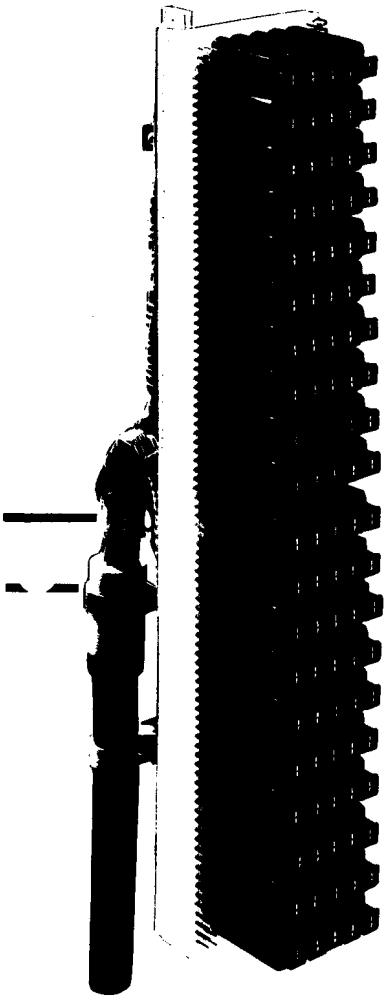


FIGURE 1. 100-Pair Connector With Stub

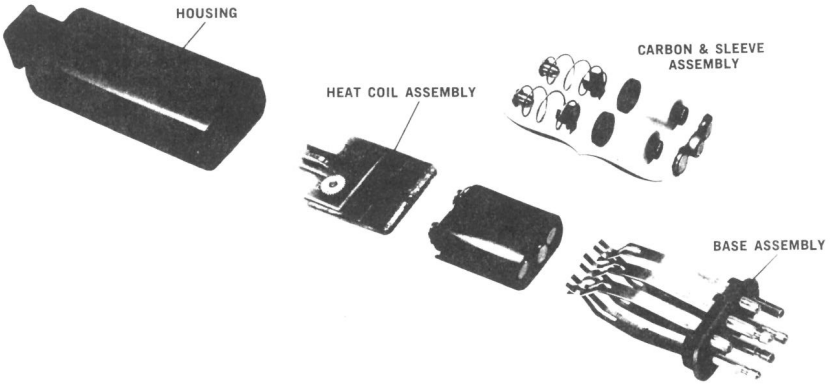


FIGURE 2. 1104 Protector Unit

2.07 The Reliable Electric No. 1100 protector unit (Figure 4) with four carbon blocks for voltage protection is used on circuits where sneak current protection is not required. When the five metallic pins and one plastic polarizing pin of this protector are inserted in the connector unit, they provide the following contact for one cable pair:

a. Tip and ring to outside plant conductor (long pins).

b. Tip and ring to central office equipment (short pins).

c. Ground (long center pin between two long pins).

2.08 The Reliable Electric No. 1101 protector unit (dummy) may be used when no protection is required. When breakdown tests are being conducted, see Table A, Note 4.

2.09 The type of protection required will be indicated in the detail plans.

2.10 When the protector units are fully inserted into the connector, the outside plant and central office equipment is connected and protection is provided. For protection purposes, ground is provided for the heat coils and carbon blocks through the grounding pin of the protector unit. Two vertically oriented copper bars are recessed at the rear of the connector panel assembly. These serve the dual function of connector ground and connector mounting to the frame supporting bar. These bars are grounded by the mounting screws securing the connector to the protector frame.

2.11 When the protector unit is pulled out to the detent position (Figure 5), the central office equipment is disconnected to isolate outside pairs for testing purposes or service denial. In this position, protection is still provided on the outside cable pair.

2.12 The protector units used on the Reliable Electric 700-type connector for circuit identification are listed in Table A.

2.13 The protector units are installed on the connector in 20 horizontal rows with 5 protector units in each row.

2.14 The molded plastic panel of the Reliable Electric 700-type connector is equipped with 100 groups of six pin-grip type terminals and one polarizing jack. Four of these terminals provide contact for tip and ring connections. One terminal provides a ground connection and one provides an alarm connection.

2.15 Electro-tin plated line terminals project through the connector panel to the front for convenient test points. To protect workmen against high voltage during a breakdown test, a Reliable Electric No. 1105 RGT terminal guard should be placed over the wire wrap terminals on the front of the connector.

2.16 Codes for the basic Reliable Electric 700-type connectors and protector units are listed in Table B.

3. PRECAUTIONS

3.01 Store the Reliable Electric 700-type connector in a dry location. Do not leave these units on loading docks or outside where they may be exposed to the weather.

3.02 When unpacking the connector, open the carton on the side marked "OPEN FROM THIS SIDE".

3.03 Do not bend the cable stub in a radius of less than 5".

3.04 Do not bend the cable stub in a 5" radius more than twice at the same general location.

3.05 Do not remove the packing material from the connector until it is ready for installation on the protector frame.

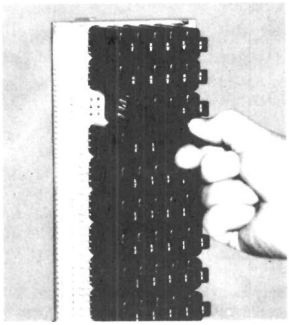


FIGURE 3. Installing Protector Units Into Connector Block

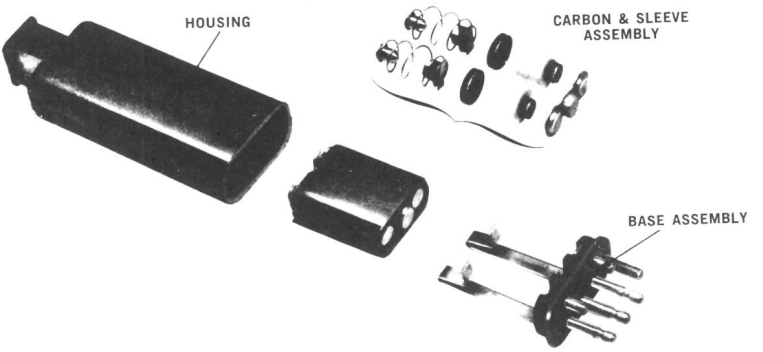


FIGURE 4. 100 Protector Unit

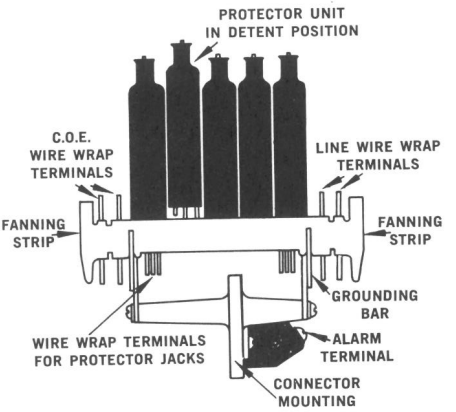


FIGURE 5.

TABLE A – PROTECTOR UNIT COLOR CODE CIRCUIT IDENTIFICATION

Code	Cap Color	Protector Blocks (2 Each)	Circuit Identification
1100 B	Black	P-6082 and P-5841	Standard Circuit
1101 GY	Gray	None (dummy) (Note 1)	Standard Circuit
1104 B	Black	P-6082 and P-5841 (Note 2)	Standard Circuit
1100 R	Red	P-6082 and P-5841	Special Circuit
1101 R	Red	None (dummy) (Note 1)	Special Circuit
1104 R	Red	P-6082 and P-5841 (Note 2)	Special Circuit
1100 Y	Yellow	P-6082 and P-5841	PBX Battery
1101 Y	Yellow	None (dummy) (Note 1)	PBX Battery
1104 Y	Yellow	P-6082 and P-5841 (Note 2)	PBX Battery
1100 Gn	Green	P-6082 and P-5841	Denied Circuit
1101 Gn	Green	None (dummy) (Note 1)	Denied Circuit
1104 Gn	Green	P-6082 and P-5841 (Note 2)	Denied Circuit
1102 Gn	Green	P-6082 and P-5841 (Note 3)	Denied Circuit
1105 R	Red	None (dummy) (Note 4)	Breakdown Test

Note 1: Connects field side thru to C.O. equipment without protection

Note 2: Equipped with P-13984 resettable heat coils P-6082 carbon blocks and P-5841 insulator-carbon blocks

Note 3: Protector module without central office pins

Note 4: Protector stenciled "Breakdown Test Do Not Disturb"

TABLE B – CONNECTOR CODES

Code	Stub * Cable Size	Protector Unit Code	Type Protection
700A1A-100	24-gauge, 101-pair	1100	500 Volts
700A1C-100	24-gauge, 101-pair	1104	500 Volts & Sneak Current
700A1D-100	24-gauge, 101-pair	1101	None (dummy)
700B1A-100	22-gauge, 101-pair	1100	500 Volts
700B1C-100	22-gauge, 101-pair	1104	500 Volts & Sneak Current
700B1D-100	22-gauge, 101-pair	1101	None (dummy)
700C1A-100	None	1100	500 Volts
700C1C-100	None	1104	500 Volts & Sneak Current
700C1D-100	None	1101	None (dummy)

* (1) Indicate length of stub if over 20 feet.

(2) Specify on order if cable is to be mounted for upward extension from frame.

4. INSTALLATION OF RELIABLE ELECTRIC 700–TYPE CONNECTORS

4.01 To modify the verticals of a protector frame for installing the 700-type connector, the Reliable Electric Company will provide an adapter bar drilled and tapped ready for mounting with the necessary mounting screws; the adapter must be ordered separately as follows: (QUANTITY), ADAPTER, RELIABLE, SCB.

4.02 To install the adapter on the vertical, proceed as follows:

NOTE: The adapters are placed on the RIGHT hand side of the verticals as determined by the workman facing the verticals.

a. Remove the headboard brackets at the top of the frame.

b. Align the unthreaded holes in the adapter with the mounting holes in the frame vertical. Starting with the bottom hole, use the 12-24 screws furnished and bolt the adapter to the vertical. Place the adapter bar with the 7-1/8" offset at the top of the vertical.

c. Raise the headboard by reattaching the headboard bracket to the top of the adapter bar using the existing 12-14 screws. If no adapter bar is located at the end of a headboard section, a Reliable SCB, MDF DESIGNATION STRIP, ADAPTER can be bolted to the top of the frame at the point where the copper ground bar is attached. Attach the headboard bracket using the existing 12-14 screws.

4.03 In locations where there is a cable vault, install the 700 type connectors on the adapter as follows:

a. Mark the cable number and pair count of each stub on a linen tag or glass tape and attach to the stub cable before it is placed into the cable vault or splice location. If this in not done, regular cable identification procedures will be required to identify each connector before splicing.

b. Remove the connector from the shipping carton. Route the stub cable into the cable vault. Remove any cable twist that may be present. Install the 12-24 screws (furnished with the connector) in the threaded holes on the left-hand side of the adapters. Starting at the bottom, hook the ear-shaped mounting brackets on the connector over the screws in the adapter (Figure 6). Place all of the connectors on the vertical. Tighten the screws before starting the next vertical. Dress the stub cable.

4.04 Position and secure the stub cables laterally across the transverse arms with waxed cotton twine or 12-type distributing rings.

4.05 A bond wire is extended from the stub cable shield to the mounting bracket. When the connector is bolted to the frame, electrical continuity is provided between the shield of the stub cable and ground to reduce electrical noises in the cable.

4.06 In locations where there is no cable vault, the connectors are mounted in the same manner as described in paragraphs 4.03 and 4.04, except that the stubs are taken to the top of the frame and are then taken on cable racks to the splice locations.

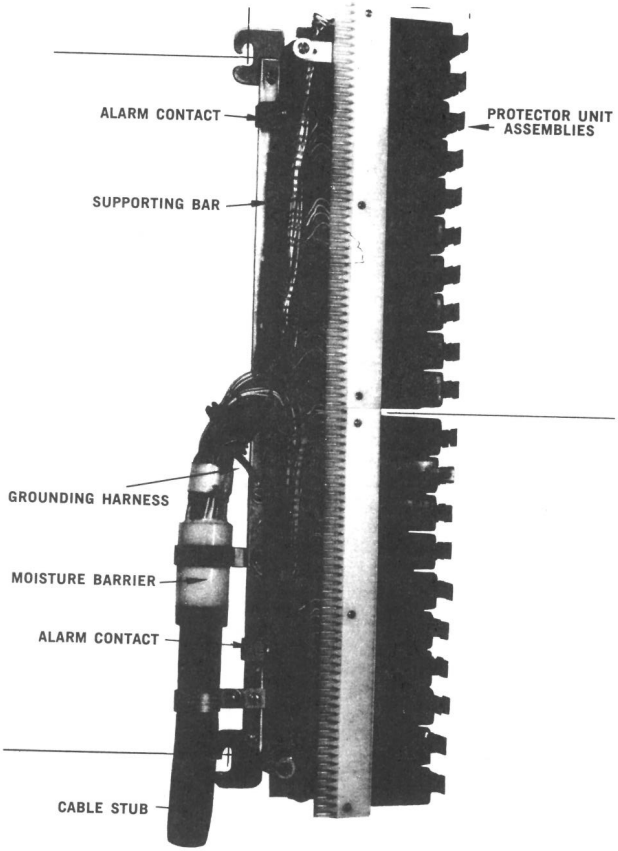


FIGURE 6. Stub and Mounting Bracket Arrangement

5. TESTING PROTECTOR UNITS

5.01 The primary purpose of this test is to remove carbon dust which may have accumulated in the .0035" gap between the protector blocks and to detect defective protector units. This test should be performed prior to splicing the stub cables to the entrance cables.

5.02 Connect the following components as shown in Figure 7 to perform the protector unit test:

a. A 7-1/2 watt, 120 volt frosted light bulb.

b. Two 90-volt KS-7890 dry batteries.

c. A light bulb socket.

d. A test probe (411A tool).

e. Cross-connecting wire.

5.03 Touch the test probe to each tip and ring on the cross-connecting terminals. The test probe should remain in contact for one second or longer. If a carbon condition exists, the light bulb will illuminate. The flow of the current should burn out the carbon and the lamp will then be extinguished. If the lamp remains illuminated, remove the protector unit and replace with a new protector unit. Test the new protector unit.

NOTE: Do not attempt to repair a defective protector unit. Return defective units for repair in accordance with local instructions.

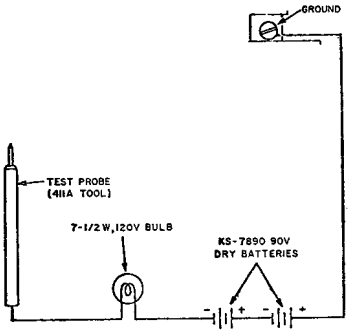


FIGURE 7. Circuit For Testing Protector Unit

6. MARKING

6.01 Factory-stenciled numbers on the face of the connector will identify protector modules associated with each cable pair.

6.02 Cable numbers are marked on 700-type connectors with adhesive backed number plates E-5293–G cable designation card (red numerals on aluminum background). Cable numbers should be placed below the first numbered pair of each 100 pair connector. If colored circuit designation plates are required on the space specified for the cable number, place the number on the next available space below that point.

6.03 Sensitive circuits are designated and protected by using blank adhesive number plates stamped with the required color designation.

7. TEST CORDS

7.01 A four conductor two-way test cord, Reliable Electric Model No. 1130A (12' in length) or No. 1130B (18' in length) is available for testing individual cable pairs or the associated central office equipment. The connector-end plug is inserted into the individual connector

jack position (protector removed) of the line under test. The connector-end plug consists of the housing and base plug of a protector unit. Twin plugs on the opposite end of the cord (5/8" centers) are provided as required for connecting into test trunk jacks.

7.02 Reliable Electric test cord Model No. 1131A (12' in length) or No. 1131B (18' in length) equipped with the necessary plugs is available for making Varley loop tests to locate grounded or crossed cable pairs.

GROUNDING HARNESSES
DESCRIPTION

1. GENERAL

1.01 This practice provides information on the various Type GH Grounding Harnesses and the GHT-1 Grounding Harness Compression Tool. This practice is reissued to delete reference to the Type GH-4 grounding harness, to add the Type GH-8 grounding harness and ordering information for the grounding harnesses and compression tool.

1.02 Type GH grounding harnesses are used for grounding and interconnecting shields of plastic insulated, plastic jacketed wires and cables.

2. ORDERING INFORMATION

2.01 Use the following catalog numbers when ordering grounding harnesses and/or the compression tool through local purchasing channels:

a. Type GH-1 Grounding Harness: CTS #90-51-001-0.

b. Type GH-2 Grounding Harness: CTS #90-51-002-0.

c. Type GH-3 Grounding Harness: CTS #90-51-003-8.

d. Type GH-7 Grounding Harness: CTS #90-51-007-1.

e. Type GH-8 Grounding Harness: CTS #90-51-006-2.

f. Type GHT-1 Grounding Harness Compression Tool: CTS #74-88-471-9.

3. GROUNDING HARNESSES

3.01 Type GH-1: Used for grounding the shields of direct buried cables at pedestal and pole mounted terminals. Consists of a tinned, Termi-foil connector crimped to one end of a No. 14 AWG solid tinned copper conductor insulated with green PVC. The overall length is 16-1/2 inches. The stripped end of the conductor is placed to the grounding connector provided in the terminal. See Figure 1.

3.02 Type GH-2: Used for interconnecting the shields of cables that have encapsulated or taped splices. Consists of two tinned Termi-foil connectors crimped to a No. 14 AWG tinned strand copper conductor insulated with green PVC. The overall length is 20 inches. See Figure 2.

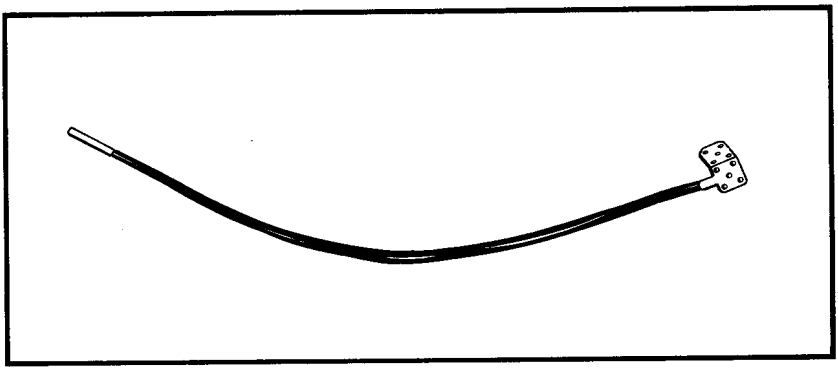


FIGURE 1. Type GH-1 Grounding Harness

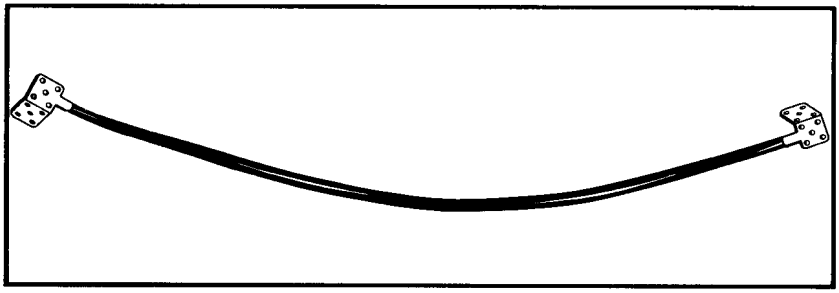


FIGURE 2. Type GH-2 Grounding Harness

3.03 Type GH-3: Used for interconnecting and grounding the shields of aerial cables where ready access type enclosures are used. Consists of two tinned Termi-foil connectors and a tinned spade clip, all crimped to a No. 14 AWG tinned stranded copper conductor insulated with green PVC. The spade clip is attached to the terminal frame by means of a terminal frame bolt. The spade clip to one Termi-foil is 7-1/2 inches long; the spade clip to the other Termi-foil is 21 inches long. See Figure 3.

3.04 Type GH-7: Used for interconnecting the shield of buried service wire to the grounding connector at station protectors. Consists of a tinned Termi-foil connector crimped to one end of a No. 14 AWG solid tinned copper conductor insulated with green PVC. The spade end of the harness wire and the ground wire (connected to ground rod, water system, etc.) are connected directly to the station protector lug. The overall length of the grounding harness is 3 inches. See Figure 4.

3.05 Type GH-8: Used for interconnecting the shields of APFSP cables in buried splices. Consists of four tinned Termi-foil connectors crimped to No. 14 AWG tinned stranded copper conductors insulated with green PVC. The overall length is 6 inches. See Figure 5.

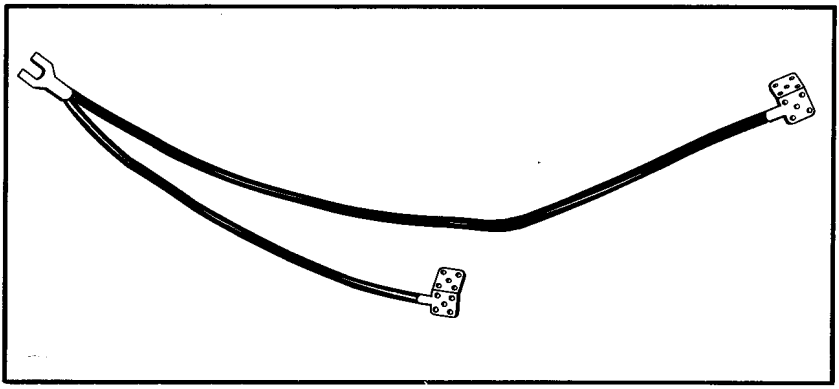


FIGURE 3. Type GH-3 Grounding Harness

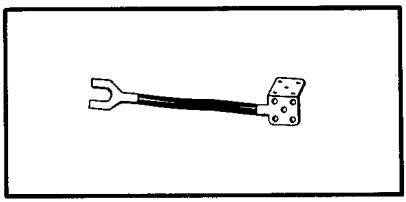


FIGURE 4. Type GH-7 Grounding Harness

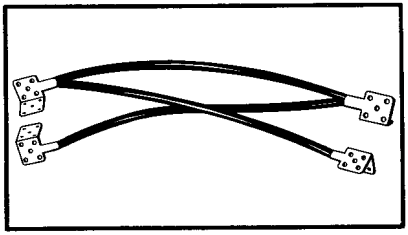


FIGURE 5. Type GH-8 Grounding Harness

4. COMPRESSION TOOL

4.01 The Type GHT-1 grounding harness compression tool is used to connect the grounding harness to the shield. The tool is equipped with a special ratchet and will not release until the proper compression pressure is reached at the connection. See Figure 6.

NOTE: The use of pliers or similar tools in place of the compression tool is not recommended.

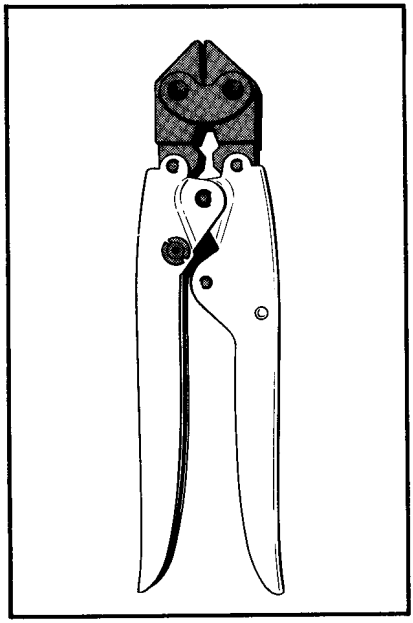


FIGURE 6. Type GHT-1 Compression Tool

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