

PROTECTING AND REPAIRING WIRING
PROTECTING SKINNERS, APPARATUS TERMINALS AND LIVE LEADS

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1.	<u>GENERAL</u>	1.3	<u>Arrangement of Tools</u>
1.1	<u>Scope of Section</u>	1.31	Prior to starting operations covered by this section the tools and other items required should be arranged at the work location so as to minimize fatigue and inconvenience when handling.
1.11	This section covers requirements and methods for the protection of skimmers, apparatus terminals and live leads.	1.4	<u>Verification</u>
1.12	The requirements covered in this section shall be followed except as modified by applicable specifications and drawings.	1.41	Items for the verification of the equipment installed by the operations covered in this section are listed in Paragraph 4 of this section.
1.13	Each figure in this section illustrates only conditions to which reference is made in the text and is not to be considered as covering the requirements for other conditions that may be involved.	1.411	The items marked "(P)" in this section are so designated to denote that the equipment should be verified before it becomes inaccessible or before a portion of the work becomes indiscernible, due to following installing operations.
1.2	<u>Precautions Against Personal Injury, Equipment Damage and Service Interruptions</u>	1.412	The verification items in this section may also be used as a self-check guide when performing operations covered by this section.
1.21	General precautions to be taken against personal injury, equipment damage and service interruptions are covered in Handbook 0 and are to be observed at all times, as they apply to the operations being performed. Specific precautions, when applicable, are included in this section with the associated method.		

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2. INSTALLING EQUIPMENT

The tools and supplies required for the operations covered in this section are listed below and are in addition to those listed in other sections of this handbook that apply to connecting operations.

2.1 Tools

R-1682 Scissors, Electrician's, 5"

2.2 Supplies

R-1021 Brush 1/2", Stiff
 RM-583101 Fiber, Sheet, 1/64"
 RM-644743 Lacquer, Cellulose Acetate
 RM-646793 Solvent, Shellac
 (R-4343)
 RM-591127 Tape, Friction 3/4"
 R-3359 Tape, PVC 1/2"
 R-3428 Tape, PVC 3/4"
 R-3455 Shellac, White
 KS-7851 Varnish Impregnated Sleeving

RM-581228 Black No. 7 (.148" I.D.)
 3 Ft. Lg.
 RM-621804 Black No. 8 (.133" I.D.)
 3 Ft. Lg.
 RM-581229 Black No. 9 (.118" I.D.)
 3 Ft. Lg.
 RM-628431 Black No. 10 (.107" I.D.)
 3 Ft. Lg.
 RM-628413 Black No. 13 (.076" I.D.)
 3 Ft. Lg.
 RM-628436 Black No. 14 (.068 I.D.)
 1-1/4" Lg. (500 Pcs./Box)
 RM-681514 Black No. 14 (.068 I.D.)
 2-3/4" Lg. (100 Pcs./Box)
 RM-628437 Black No. 18 (.044" I.D.)
 3 Ft. Lg.
 RM-628411 Red No. 8 (.133 I.D.)
 3 Ft. Lg.
 RM-581590 Yellow No. 0 (.328 I.D.)
 3 Ft. Lg.
 RM-581510 Yellow No. 9 (.118" I.D.)
 3 Ft. Lg.
 RM-581592 Yellow No. 11 (.095" I.D.)
 3 Ft. Lg.

Sleeving Flexible Vinyl Gray

R-3726 Det. 1 1/2" I.D. x 12" Lg.
 R-3726 Det. 2 7/8" I.D. x 12" Lg.

Wax Impregnated Cotton Sleeve

P-365046 Black (.040" I.D.) 1-1/2" Lg.
 (500 Pcs./Box)
 P-368775 Black (.070" I.D.) 1-1/2" Lg.
 (500 Pcs./Box)
 P-40C391 Black (.040" I.D.) 2-3/4" Lg.
 (500 Pcs./Box)

Tube, PVC Rigid Gray

RM-587082 1/4" I.D. x 23" Lg.
 RM-552458 1/2" I.D. x 32" Lg.
 RM-552417 3/4" I.D. x 33" Lg.
 RM-552448 1" I.D. x 36" Lg.
 RM-552452 1-1/2" I.D. x 29" Lg.

3. REQUIREMENTS AND METHODS3.1 General

3.1.1 All wires whether formed or loose shall be protected where there is a possibility of them coming in contact with sharp edges of cable brackets, wiring supports, or other parts of the equipment framework, regardless of the type of wire used. Wires shall also be protected where there is a possibility of them contacting and abrading (rubbing) on movable parts of equipment.

3.1.1.1 (PVC) Insulated Wires (such as BG, BH, BU and BY) and (PE) Insulated Wires (such as type BF and shielded pairs of 750 and 760 Type Cables) (TFE) Insulated Wires (such as those of KS-19195 and KS-19224 Cables) and (DACBL) Insulated Wires (such as Type "M" Cables) shall be protected against contact with the metalwork, when secured to cable brackets, wiring supports or other parts of the framework not having an approved protective finish such as No. 483.

NOTE: A protective finish such as the 483-D is the type generally furnished on fanning rings, jumper rings, "L" type cable brackets used on Nos. 1 and 4 Crossbar and Crossbar Tandem equipment, and the cable brackets on No. 5 Crossbar frames. This finish is also used on the snap-on "U" shaped cable brackets at relay rack and similar bays, and the form support bars (commonly called "towel bar supports") used to support the forms of switch-board cables that turn off the cable rack directly to the apparatus.

- 3.112 Polyvinyl Chloride insulated wires having an outer covering of lacquered cotton (PVC-CL) such as BG or BW, which are generally designated SW1, D2 or D3 on wiring drawings, that is, wiring which is run and dressed against a mounting plate, does not require protection except where there is danger of the wire(s) coming in contact with sharp edges of metal framework or other parts.
- 3.113 Rubber or neoprene insulated wires (such as KS-15141, KS-15143 KS-21095 and similar types of flexible wire) shall be protected against contact with the metalwork and material (twine clamps, nylon ties or clips) used to secure the wires to cable brackets, wiring supports, or other parts of the framework, whether or not a protective finish is provided. (Refer to Section 225 for proper protection).
- 3.12 At KS-15660 Wiring Supports: Where loose wiring or switchboard cable leads come in contact with the mounting screw for the KS-15660 (plastic) Wiring Support used on relay racks, no protection is required.
- 3.2 Protection Materials
- 3.21 Materials used for protecting forms, terminals, skinner leads, etc. are gray friction tape, PVC adhesive tape, varnish impregnated sleeving, wax impregnated sleeving, fiber sheets and preformed fiber details, refer to Paragraph 2.2.
- 3.3 Protection Methods
- 3.31 Protection of Sewed Forms: Refer to Section 225 of this Handbook for the methods and requirements applicable to sewed forms.
- 3.32 Protection of Skinners and Loose Wiring: Where groups of skinner or loose wiring requires protection from contact with framework or other types of metalwork, one of the following methods should be utilized.
- 3.321 Wherever practicable and the metalwork area involved is small, apply one layer of PVC or friction tape half-lapped around the metalwork. The friction tape must be coated with shellac. The protection shall extend at least 1/2" beyond each side of the protected area.
- 3.322 Groups of skinner or loose wiring leads may be protected by applying friction or PVC tape around the wiring evenly, tightly and with at least a half-lap, the last two turns of PVC tape does not require shellacking.
- 3.323 Groups of skinners or loose wiring leads may be protected by wrapping a cut piece of sheet fiber around the wiring or metalwork. The fiber must be secured in place to the extent that it cannot move or slide freely away from the area requiring protection.
- 3.324 Groups of skinners or loose wiring may be protected by wrapping a section of slit PVC tubing around the wiring or metalwork. The slit tubing must be secured in place as described in Paragraph 3.323.
- 3.325 Skinners or loose wiring may be protected by running the leads thru a section of flexible vinyl sleeving prior to the termination of the leads. Secure the sleeving in place when necessary to eliminate any movement away from the protected area.
- 3.33 Face Equipment in Switchboards: Protection of skinners to jacks, lamps, keys and similar face equipment in switchboards from the steel uprights should be provided in accordance with the methods and requirements covered in Handbook 30, Section 30A.
- 3.34 Terminal Strips at Horizontal Side of Distributing Frames: Where cables are run parallel to the transverse arms and fanning rings are not used at the cable butts, a fiber detail (P-449759) or a piece of 1/64" fiber should be placed between the cable butt and the transverse arm to prevent the wires from touching the metalwork as covered in Handbook 8, Section 340.
- 3.35 Protection of PVC Insulated Wires: Where individual skinner leads or several leads in a group require protection from metalwork, the KS-7851 Varnish Impregnated Sleeving should be utilized in accordance with the following:
- (a) When more than one skinner lead terminates at an individual terminal and requires protection, enclose these leads within an individual piece of sleeving.

- (b) Select an appropriate sleeve size from the table in Figure 1.
- (c) Cut the sleeving so that it extends at least 1/2" beyond each side of the area being protected from the metalwork.
- (d) The KS-7851 Sleeves shall be applied so they do not slide freely beyond the protected area. If sleeve does slide freely, apply at least 1-1/2 laps of PVC tape to retain the sleeve in position.

NO. OF LEADS	WIRE GAUGE AND KS-7851 SLEEVES			
	20 GA	22 GA	24 GA	26 GA
1	No. 14	No. 18	No. 18	No. 18
2	No. 10	No. 10	No. 11	No. 13
3	No. 10	No. 10	No. 11	No. 13
4	No. 7	No. 8	No. 9	No. 10

FIG. 1 LEADS REQUIRING SLEEVE PROTECTION (PAR. 3.35B)

3.4 Protecting Shielded Cable and Wire

3.41 For protection of shielded cable and wire refer to Section 700 of this Handbook.

3.5 Protecting Apparatus Terminals

3.51 Terminals of apparatus whose design permits movement, such as floating contact terminals shall have a clearance of not less than 1/32 inch, when measured in their most adverse position, otherwise sleeve or tape protection is required.

3.52 When it is necessary to protect apparatus terminals from short circuits with adjacent terminals, the terminal and connections (whether soldered or solderless wrapped) shall be sleeved with varnish impregnated sleeving. The sleeving should be applied as shown in Figs. 4 and 5. In sleeving it is necessary to slip the sleeve over the wire prior to lead termination.

3.53 Protection of apparatus terminals is generally not required unless the wiring and the equipment arrangement do not permit sufficient separation between the terminals serving critical leads such as the case of battery and ground feeders or other critical leads connected to adjacent terminals. Protection may also be required when a critical lead is connected to a terminal adjacent to framework or mounting plate drilling. This protection, when required, is usually specified on wiring diagrams or equipment drawings as part of the design considerations. However, unusual wiring conditions, such as the use of a number of 20 gauge wires connected to closely spaced terminals which would make it difficult to maintain proper clearance between adjacent terminals, might require protection although not specified on wiring diagrams or other job papers.

3.54 Where required, protect apparatus terminals with varnish impregnated sleeving per KS-7851. Refer to the table in Figure 2, if necessary, to determine the diameter of the sleeving required. Use a single sleeve over all skinners or surface wiring lead ends connected to a particular terminal, where possible, and place the sleeving over the lead ends before connecting.

KS-7851 BLACK SLEEVING	NUMBER OF LEADS AT TERMINAL				
	NO.	SIZE	I.D.	24 GA.	22 GA.
LEADS FROM SEWED FORMS					
RM-628431	10	.106"	1,2 or 3	1	1
RM-581229	9	.118"	2 or 3	1 or 2	1 or 2
RM-621804	8	.133"	-	2 or 3	2 or 3
RM-581228	7	.148"	-	-	3
SURFACE WIRING					
RM-621804	8	.133"	1,2 or 3	-	-

FIG. 2 SIZE OF SLEEVING REQUIRED FOR THE PROTECTION OF APPARATUS TERMINALS (PAR. 3.52)

3.541 At Apparatus With Sewed Forms: Cut the sleeving to the length required to cover the terminal and extend approximately 1/8" beyond the end of the terminal as illustrated in Figure 3.

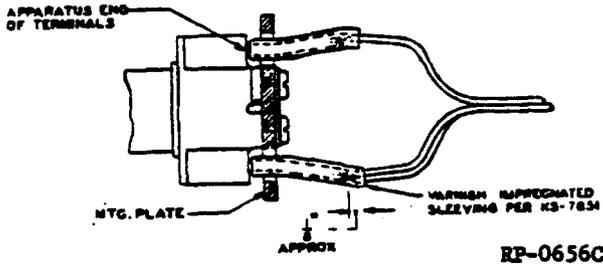


FIG. 3 SLEEVED TERMINALS - APPARATUS WITH SEWED FORMS (PAR. 3.541)

3.542 At Surface Wired Apparatus: Cut the sleeving to the length required to cover the terminal without extending beyond the end of the terminal. The sleeve when in position should be flush or slightly underflush with the end of the terminal as illustrated in Figure 4.

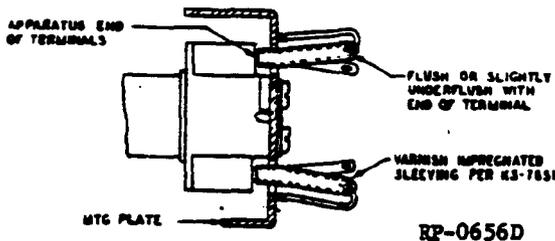


FIG. 4 SLEEVED TERMINALS - APPARATUS WITH SURFACE WIRING (PAR. 3.542)

3.543 11A Resistance Lamps: The inner or line terminals of the No. 11A resistance lamps should be sleeved when two or more lamps are mounted adjacent to each other, and the outer terminals are strapped between adjacent lamps with straight strap wire in the terminal notches. Place the sleeving in accordance with the type of wiring used as covered in Paragraph 3.541 or 3.542.

NOTE: Protection on the terminals of 11B and 11C resistance lamps is not required since these lamps are not provided with notched strapping terminals.

3.55 80 and 105 Type Resistors: When the terminals of 80 and 105 type resistors project through metal panels or mounting plates they should be protected with 5/8 pieces of No. 14 (RM-628436) sleeving. Since the sleeving in this case is required to provide protection between the mounting nut and the adjacent terminals, it should be pushed back to the base of the terminal. It is not required to extend over the soldered connection.

3.6 Protecting Pigtail Apparatus

3.61 The wire terminals (pigtails) of apparatus such as KS-13368 Capacitors, KS-13490 and 106 type resistors and 400 type diodes, when they are supported by their pigtail connections, should be protected with KS-7851 Varnish Impregnated Sleeving as illustrated in Figs. 5 or 6 and there is less than 1/16" clearance between:

- (a) The pigtail lead and metal surfaces (panel, framework, covers, cans, etc.)
- (b) The pigtail lead and any terminal to which it does not connect.
- (c) The pigtail lead and any other bare pigtail lead or bare wire connected to a different terminal.
- (d) The pigtail lead and enamelled wire of inductors or other apparatus.

3.611 Pigtail leads should be sleeved whenever there are possibilities that they may come in contact with other bare leads, terminals, or metal due to normal installation or maintenance activity. On shop wired apparatus, consideration of these possibilities is reflected by the application of sleeving at apparatus where this is deemed necessary. On job wired apparatus, consideration should be given to these possibilities, particularly when the pigtail lead sizes are 24 gauge or smaller and when the pigtail lengths are such as to permit easy displacement.

3.612 When one end of a pigtail apparatus is connected to an equipment terminal and the opposite axial lead is connected directly to a loose wire or cable lead, this splice (axial lead to wire) shall be insulated with a KS-7851 Varnish Impregnated Sleeve. This sleeve shall be cut long enough to completely cover the axial lead and splice area, and must also fit snugly over the area to eliminate the possibility of sliding free.

3.613 On some transistors, the collector, base and emitter leads are spaced approximately 3/64" apart at the plane of the base. In such cases where the spacing is an integral part of the design of the component, the 1/16" clearance requirements of Paragraph 3.61 is waived for the spacing of the pigtail leads emerging from the base.

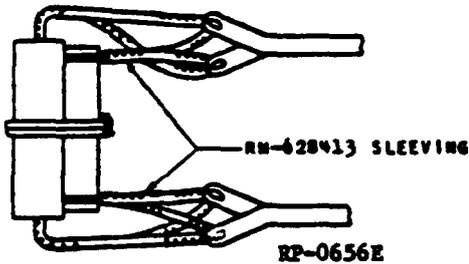
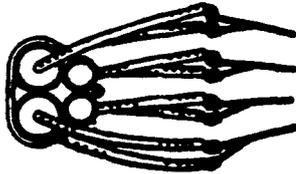


FIG. 5 PROTECTING LEAD-IN WIRES OF PIGTAIL APPARATUS (PAR. 3.61)

3.7 Protecting Live Leads

3.71 The skinner ends of all unconnected live leads in equipped or unequipped circuits shall be protected individually by an approved sleeving or with tape applied separately to each lead with a half lap.

NOTES:

1. SLEEVING MAY BE PARTIALLY SLIT AND SLID BACK ON LEAD TO ALLOW SUFFICIENT CLEARANCE FOR MAKING CONNECTION.
2. END OF SLEEVING SHOULD PROJECT APPROXIMATELY 1/8 INCH BEYOND END OF TERMINAL WITH SLIT ORIENTED TOWARDS SIDE OR BOTTOM OF APPARATUS.

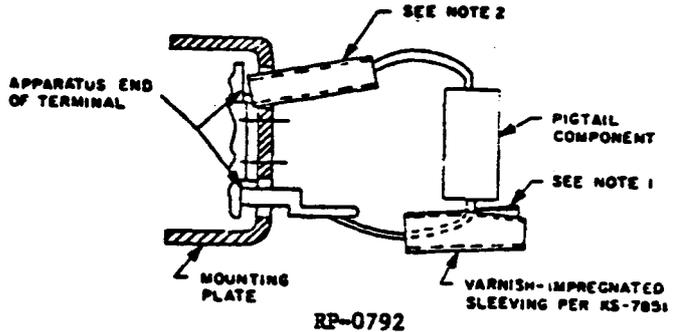


FIG. 6 SLEEVING OF PIGTAIL LEAD CONNECTIONS TO APPARATUS TERMINALS (PAR. 3.61)

3.711 All leads connected to a live circuit at one end are to be considered as live leads, except common ground leads.

3.712 Live leads are generally designated by the symbol L on the associated wiring diagrams when optional wiring or equipment is portrayed or when leads are to be multiplied to other circuits in a partly equipped unit or frame.

3.713 When a live lead is multiplied through a number of circuits or circuit parts, protection as described above, shall be used at all unequipped circuits, although, initially the leads at these circuits may be unconnected at both ends. The protection is placed initially so that it will be unnecessary to add such protection later, as individual circuits are equipped.

3.714 When equipping part of the wired only portion of multicircuit units, live leads in the first unequipped circuits shall be protected. Also, when removing equipment from one or more circuits of the unit, the live leads shall be protected in the new first unequipped circuit.

3.715 All live leads associated with wiring to be connected by the installer, run in the roof, piling rail or any component of the switchboard above the keyshlf shall be protected by the installer.

3.716 When it can be established in the shop that portions of local cables in switchboard keyshelves such as those associated with calculagraphs, operator and supervisory jacks, etc. require connection of some leads in a particular arm or branch of the local cable by the installer, the shop will omit protection on any live leads in the particular arm. The installer shall provide protection on the live leads in such cases.

3.72 Application of Sleeving or Tape to Ends of Skinners: Sleeving should be used, if possible, when more than a few leads require protection since their application requires considerably less time to place and to remove than taping of the individual skinner ends. Use the following as specified:

Leads for Soldered Connections

P-365046 (1-1/2" long) for No. 22 gauge or smaller leads

P-368775 (1-1/2" long) for No. 20 gauge or larger leads

Leads for Solderless Wrapped Connections

P-40C391 (2-3/4" long) for 22 gauge or smaller leads

3.721 Leads at Soldered Type Terminals: Place the sleeving over the end of each live lead so that it extends at least 1/4" beyond the end of the bare wire and extends a minimum of 1/4" over the insulated portion of the skinner. Bend the sleeved end of the skinner approximately at the center of the sleeve as shown in Figure 7.

3.722 Leads at Solderless Wrap Type Terminals: Place the sleeving over the end of each live lead so that it extends at least 1/4" beyond the end of the bare wire and extends a minimum of 1/2" over the insulated portion of the skinner. Bend the sleeved end of the skinner approximately 1/4" from the end of the sleeve located at the insulated part of the skinner as shown in Figure 7.

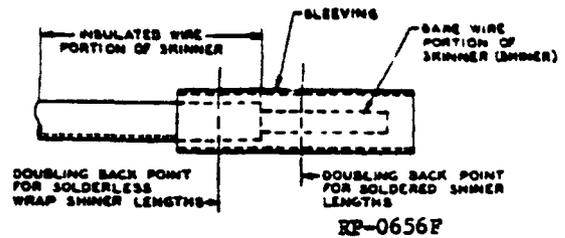


FIG. 7 SLEEVING SKINNER ENDS OF UNCONNECTED LIVE LEADS (PARS. 3.721, 3.722)

3.723 Use Friction Tape (RM-591127) to protect the live leads when sleeving is not available and only a few leads are involved. Apply one wrapping of tape around each individual live lead with a half lap so that it overlaps the insulation a minimum of 1/4" and extends at least 1/4" beyond the end of the bare wire. Apply a light coat of Orange Shellac Varnish (RM-646482) to the tape in all cases.

NOTE: Although the use of Gray Plastic Adhesive Tape (KS-14090) is also authorized and may be used in place of friction tape by the Shop, its use for field application is presently restricted to treatment of shielded wire and cable butts.

3.73 Storage of live leads: when the protected live leads are to be folded back and sewed to the forms as specified for the disposition of unequipped wiring, at least one stitch of the sewing twine should be placed over the exposed sleeves to prevent them from protruding from the sewed form and to lessen the hazard of accidental dislodgement of the sleeving.

NOTE: When sleeved leads are enclosed in fiber tubes, sewing twine is not required to hold the sleeves in place.

4. VERIFICATION

VERIFICATION ITEMS AND BRIEF STATEMENT OF REQUIREMENTS	REFERENCE	
	PAR. NO.	FIG. NO.
4.1 <u>General</u>		
4.11 All wires require protection if there is a possibility of contacting a sharp edge or a movable part.	3.11	
4.12 PVC, PE, TFE and DACBL Insulated Wires protected when secured to metalwork with an unapproved protective finish.	3.111	
4.13 PVC-CL Wire such as BG or BW to be protected when in contact with sharp metalwork.	3.112	
4.14 Rubber or neoprene flexible wire to be protected from twine, clamps, nylon ties when secured to cable brackets, etc.	3.113	
4.2 <u>Protection Methods</u>		
4.21 Where practicable, insulate metalwork with PVC or friction tape - 1/2" beyond each side.	3.321	
4.22 Skimmers and loose wiring requiring protection.	3.322	
a) PVC or friction tape half-lapped.		
b) Sheet fiber around wire or metalwork - secure.	3.323	
c) Slit fiber tubing over leads - secure	3.324	
d) Run leads thru flexible vinyl sleeving - secure.	3.325	
4.23 Skimmers to face equipment in switchboards. Protect per Handbook 30, Section 30A	3.33	
(P) 4.24 At distributing frames where horizontal terminal strips are served by one cable (no fanning rings) fiber detail (P-449759) or 1/64" cut fiber placed between cable butt and transverse arm.	3.34	
4.25 Protect PVC Insulated Wire:	3.35	
a) Several leads terminating at single terminal - use single piece of sleeving.	3.35a	
b) Use sleeving and extend 1/2" beyond each side of protected area.	3.35c	
c) Sleeving does not slide freely - secure	3.35d	
4.3 <u>Apparatus Terminals</u>		
4.31 Protect floating terminals when clearance in most adverse position is less than 1/32"	3.51 3.52,	4,5
4.32 Protect apparatus terminals from short circuits per Figs. 4 or 5.	3.53	
4.33 Sleeving proper type and size.	3.54	2
4.34 Sleeving properly applied - 1/8" beyond end	3.541	3

VERIFICATION ITEMS AND BRIEF STATEMENT OF REQUIREMENTS (CONT'D)		REFERENCE	
		PAR. NO.	FIG. NO.
4.35	At surface wire apparatus - per Fig. 4 or 6.	3.542	4
4.36	Required on inner or live terminals of 11A Resistance Lamps.	3.543	
4.37	Required on terminals of 80 and 105 Type Resistors when projecting through metal plates.	3.55	
4.4	<u>Pigtail Apparatus</u>		
4.41	Protection required when axial lead is used as a means of support and clearance is less than 1/16" between:	3.61a	5,6
a)	Metal surfaces	3.611	
b)	Adjacent Terminals		
c)	Other bare pigtail leads.		
4.42	Leads connected directly to pigtail leads to be insulated - cover axial lead and splice area, fit snug.	3.612	
4.5	<u>Live Leads</u>		
(P) 4.51	Unconnected live ends individually protected where required.		
4.511	All unconnected live lead ends, except those of common ground leads, protected individually in both equipped and unequipped circuits. If one end of lead is connected to a live circuit the unconnected end is considered "live".	3.71 3.711	
4.512	In case of live leads multiplied through a number of circuits or circuit parts, all unconnected ends at unequipped circuits should be protected, although initially the leads may be unconnected at both ends.	3.713	
4.513	When part of the wired only portion of multicircuit units have been equipped, live leads should be protected in first unequipped circuit. Also if equipment has been removed from one or more circuits of the unit, live leads in the new first unequipped circuit should be protected.	3.714	
4.514	Live leads associated with wiring to be connected by installer run above keyshelf of switchboard should be protected by installer.	3.715	
4.515	When portions of local cables in switchboard keyshelves are connected by the installer, all live leads in cable should be protected by installer.	3.716	
(P) 4.52	Sleeving or tape used as required - Protected individually with sleeving. Friction tape permitted when sleeving is not available and only a few leads involved.	3.72 3.723	
(P) 4.53	Sleeving proper type and size.		

VERIFICATION ITEMS AND BRIEF STATEMENT OF REQUIREMENTS (CONT'D)		REFERENCE	
		PAR. NO.	FIG. NO.
(P) 4.531	Leads for soldered connections: P-365046 sleeving on 22 gauge or smaller diameter wires; P-368775 sleeving on 20 gauge or larger diameter wires.	3.72	
(P) 4.532	Leads for solderless wrapped connections: P-40C391 sleeving on 22 gauge or smaller diameter wires.	3.72	
(P) 4.54	Sleeving, where used, properly applied.		
(P) 4.541	Leads at soldered type terminals: Overlapping end of insulation 1/4" minimum and extending 1/4" minimum beyond end of bare wire. Sleeved end bent back at about the center of the sleeve.	3.721	7
(P) 4.542	Leads at solderless wrap type terminals: Overlapping end of insulation 1/2" minimum and extending 1/4" minimum beyond end of wire. Sleeved end bent back at about 1/4" from the end of the sleeve located at the insulated part of the skinner.	3.722	7
(P) 4.55	Tape, where used, properly applied and shellacked - One wrapping of friction tape applied with half lap to overlap insulation 1/4" minimum and extending 1/4" minimum beyond end of bare wire. Tape shellacked.	3.723	
4.56	Where leads are sewed back in form at least one stitch of sewing should be placed over exposed sleeves.	3.73	

No arrowed lines due to extensive revisions

Vertical lines at side of Paragraph indicates requirements.

Engineering Planning Manager
Common Installation and Services

Reason for Reissue:
To update and revise requirements.