

# NASA TECHNICAL MEMORANDUM

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FOR SURFACE-MOUNTED FLAT CONDUCTOR CABLE  
USED IN COMMERCIAL AND RESIDENTIAL WIRING

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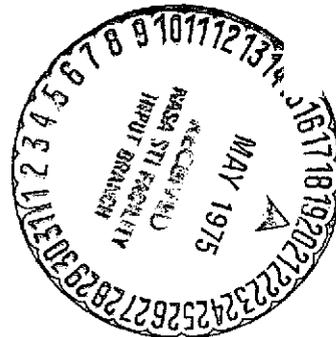
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INSTALLATION PROCEDURE FOR SURFACE-MOUNTED  
FLAT CONDUCTOR CABLE USED IN COMMERCIAL  
AND RESIDENTIAL WIRING

By James R. Carden  
Electronics and Control Laboratory

March 1975



**NASA**

*George C. Marshall Space Flight Center  
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## TABLE OF CONTENTS

	Page
I. INTRODUCTION	1
II. TOOLING AND HARDWARE REQUIREMENTS	2
III. SYSTEM INSTALLATION	2
Vertical Wall Cable Routing and Transition	2
Receptacle Box Assembly Installation	3
Back Channel Installation	4
Flat Conductor Cable Routing	8
Interconnecting Receptacles to Flat Cable	9
Make Flat Cable-to-Round Wire Transition Connections	13
Install Cable Riser Cover	16
Install Baseboard Cover	18
Front Cover Splice	20
Outside Corner Mold Installation	21
Inside Corner Installation	22
End Cap Installation	22
Install Receptacle Assembly Cover	23
Replacement of Receptacle	24

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## ILLUSTRATIONS

Figure		Page
1	Interconnect Cover Mounting Bracket	3
2	Receptacle Box Assembly	4
3	Marking Back Channel to Length	5
4	Back Channel on 3/8" Plywood Spacer	5
5	Removing Cable Retainer Lip	6
6	Back Channel Inside Corner	7
7	Back Channel Outside Corner	7
8	Dispensing of Flat Conductor Cable	8
9	Separate Conductors for Connections	9
10	Notching Edge Insulation for Crimp	9
11	Making Crimp to Conductor	10
12	Insulating Connections with Mylar Wrap	11
13	Securing Cable, Mylar Wrap, and Connections in Box	12
14	Flat Conductor Cable Fold for Wall Exit	13
15	Termi-foil Crimp Installed to Round Wire Leads	14
16	Round Wire to Flat Cable Transition	15
17	Inserting Cable Riser Cover Behind Connector Plate Tabs	16
18	Cable Riser Cover Secured in Place	17
19	Marking Baseboard Front Cover to Length at Receptacle Box	18
20	Snapping Front Cover to Back Channel	19
21	Void Between Front Cover Ends for Splice	20
22	Front Cover Splice in Place	20

## ILLUSTRATIONS (continued)

Figure		Page
23	Outside Corner Before Corner Mold	21
24	Outside Corner After Corner Mold	21
25	Inside Corner	22
26	Without End Cap Installed	22
27	With End Cap Installed	23
28	Securing Receptacle Cover	23

## TECHNICAL MEMORANDUM X-64916

### INSTALLATION PROCEDURE FOR SURFACE MOUNTED FLAT CONDUCTOR CABLE USED IN COMMERCIAL AND RESIDENTIAL WIRING

#### I. INTRODUCTION

As a spin-off of aerospace technology, the National Aeronautics and Space Administration (NASA) is applying flat conductor cable (FCC) technology to commercial and residential surface-mounted wiring. Development of such a system is being accomplished at Marshall Space Flight Center (MSFC) under NASA's Technology Utilization Program. It is through this program that space developed technology is transferred to industry and the public sector.

This procedure is preliminary in nature due to the many design refinements yet to be made in the system. However, it was prepared for and does cover the flat conductor cable surface-mounted baseboard system that was installed in the Yonkers, New York apartment complex and the conference room installation at MSFC. It is a step-by-step procedure, with supporting hardware, photos, and tooling list that is required to make a similar surface-mounted flat conductor cable baseboard installation.

## II. TOOLING AND HARDWARE REQUIREMENTS

A. Survey the area to be wired and determine the general material requirements.

B. Assemble the materials and the necessary tooling to accomplish the job. Listed below are the required tools:

1. Large scissors
2. End cutters
3. Pocket knife
4. Small electric saw, Mitre saw, and/or hacksaw
5. Coarse file
6. Side cutter pliers
7. Screw driver (small and medium)
8. Electricians tape
9. Putty knife
10. Hammer
11. Chisel
12. 1/4" drill motor and drills
13. Amp crimping tools 69288-1 and 49935

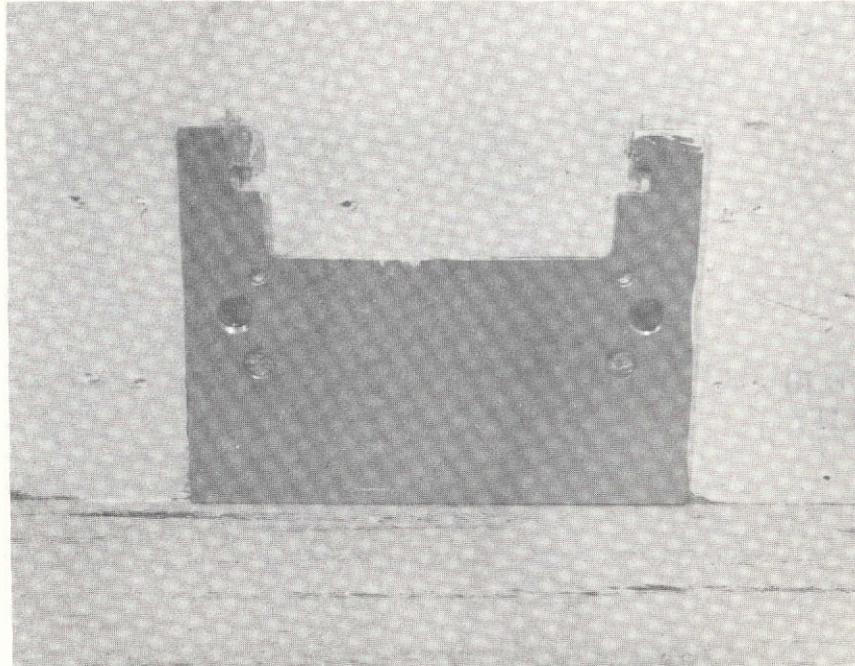
## III. SYSTEM INSTALLATION

A. Clean all wall and floor mounting surfaces. Surface preparation, in most cases, can be done with a putty knife; however, large depositions of mortar or other irregular surfaces may require a hammer and/or chisel.

### Vertical Wall Cable Routing and Transitions

1. Mark flat cable-to-round wire transitions and vertical entry locations where routed into the baseboard.

2. Attach the interconnect cover mounting bracket to the wall in the marked location as in Figure 1. The bracket rests against the floor and is attached to the wall. Three fasteners are sufficient but should be fastened to the studs and the floor plate if being attached to a drywall.



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Figure 1. Interconnect Cover Mounting Bracket

### Receptacle Box Assembly Installation

Note: The receptacle box assembly will include the receptacle box with cable clamps, receptacle mounting angles, and Sierra receptacle with pigtail-type leads which have crimp-on connections. The entire assembly is bench mounted and ready to install.

1. Mark receptacle locations. Chalk or pencil is recommended. If on a drywall, care should be taken to locate it over the studs to assure that it can be properly secured.

2. As in Figure 2, secure receptacle box assembly to the wall by sitting in an upright position on the floor and against the wall where marked. The assembly will be mechanically fastened to the wall. The type fastener will depend on the wall construction; however it is recommended that either a hollow wall anchor, nylon masonry anchor, or drywall screw be used. Three fasteners are recommended to secure each assembly.

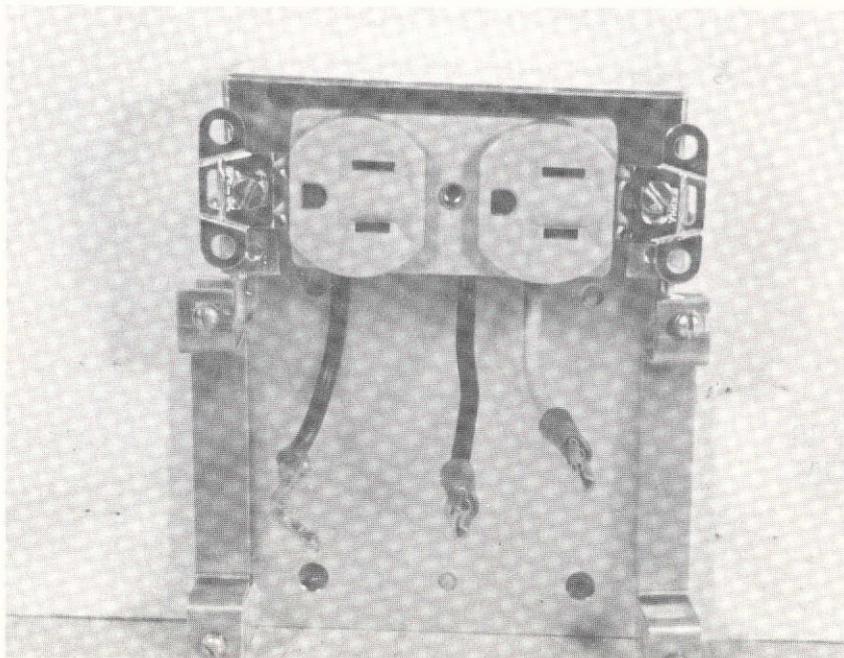


Figure 2. Receptacle Box Assembly

#### Back Channel Installation

1. After all the receptacle box assemblies and interconnect cover mounting brackets are properly secured in place, the baseboard back channel is installed.

2. Select a length of back channel placing it all the way in the corner or against the receptacle box as in Figure 3 and mark for cutting to final length. Marking should be done at the edge of the receptacle boxes and at the outside corners.

Note: Marking to length at inside corner locations is difficult and should be avoided where possible.

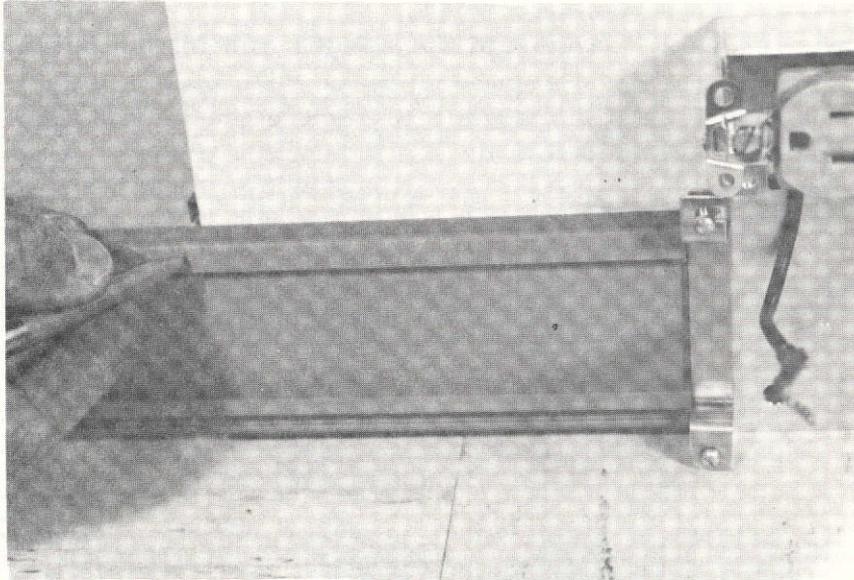


Figure 3. Marking Back Channel to Length

3. Cut back channel to final length with small portable electric saw.

4. Place a 3/8" spacer on the floor and against the wall (see Figure 4) to locate the back channel the proper distance from the floor. If the floor is unusually rough, intermittent spacers should be used but kept close enough together to avoid excessive sag.

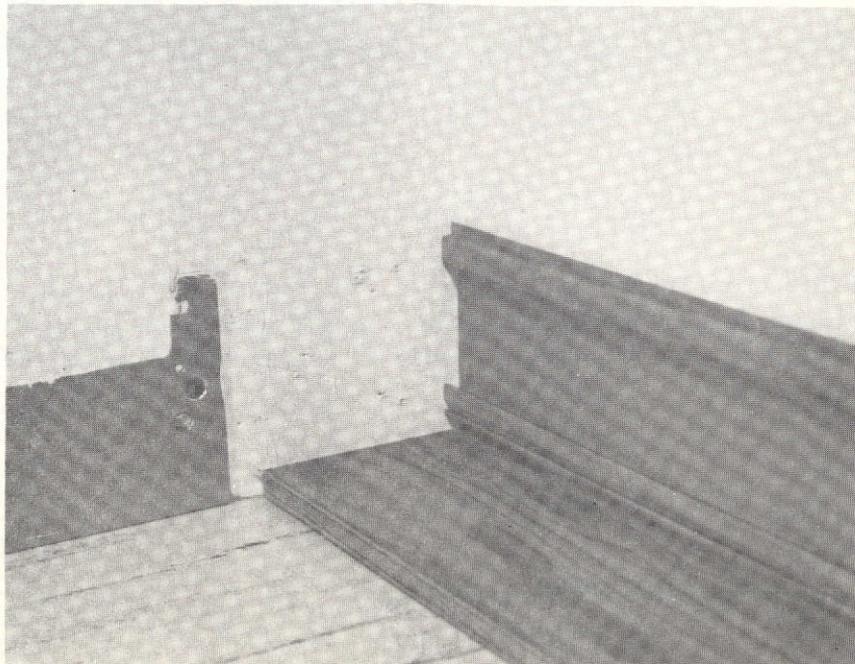


Figure 4. Back Channel on 3/8" Plywood Spacer

5. Place the back channel on the spacer and in the proper location. Drill with electric drill and secure in place with mechanical fasteners. The same low profile fasteners used to secure the receptacle box assembly should be used. If secured to a drywall, the back channel should be fastened to the studs and the floor plate. An adhesive may also be used with the mechanical fasteners.

6. Starting from the corners  $3/4 - 1 1/4$  inches of the upper and lower cable retainer lip on the back channel is removed. This is accomplished with small end cutters as in Figure 5.

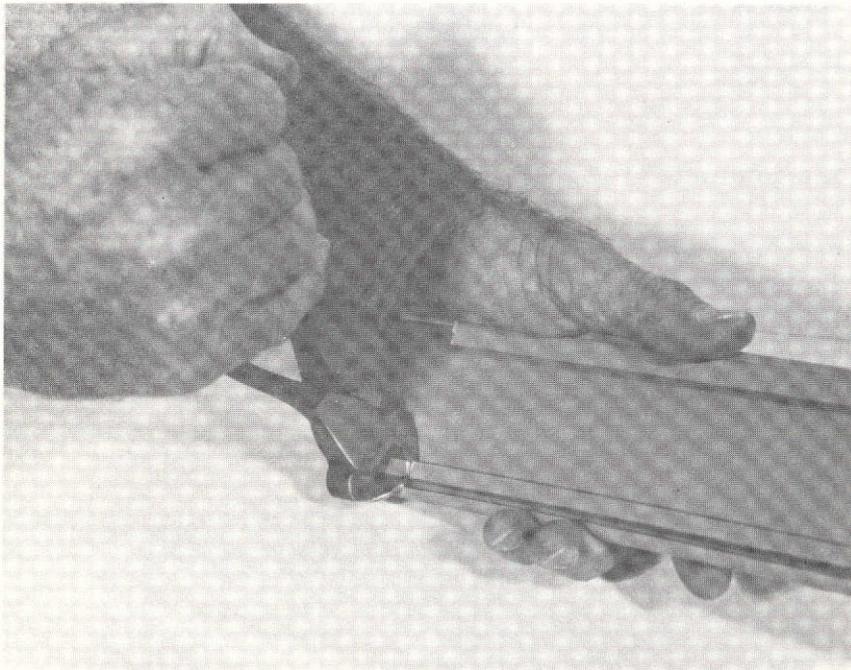


Figure 5. Removing Cable Retainer Lip

On the inside corners as in Figure 6, the removal of these retainer lips permits the flat cable to be routed around the corner easily. On the outside corners as in Figure 7 the removed material allows the corner molds to be fastened to the back channel.

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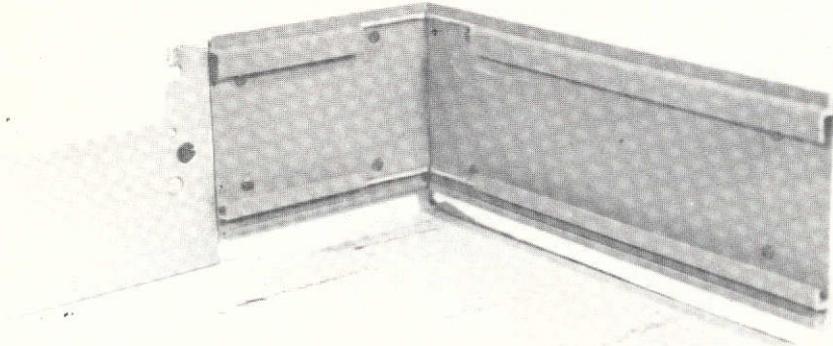


Figure 6. Back Channel Inside Corner

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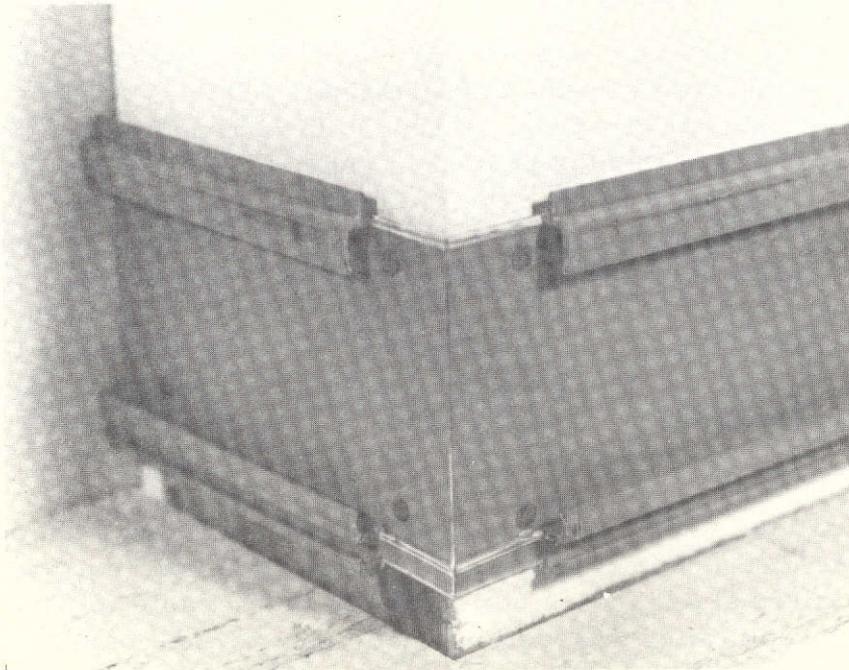


Figure 7. Back Channel Outside Corner

## Flat Conductor Cable Routing

1. Once the back channel is installed in place, the flat conductor cable is dispensed around the wall on the floor as in Figure 8.

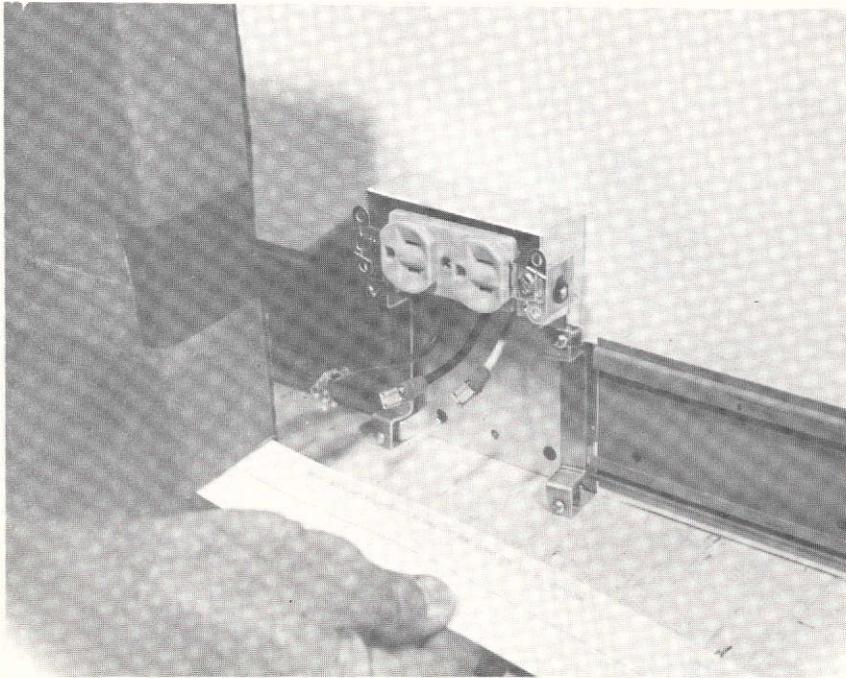


Figure 8. Dispensing of Flat Conductor Cable

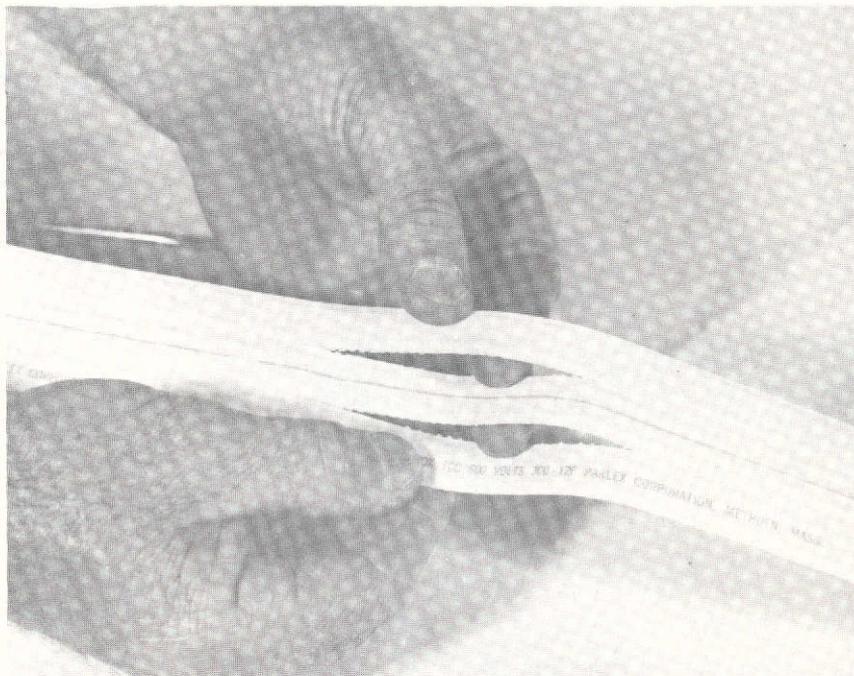
2. Starting with the end and allowing extra length for connections and folds, the cable is inserted into the back channel. This is done by placing the top edge of the cable in first and sliding it upward and behind the retainer lip. The bottom edge can then be pushed in and dropped behind the lower retainer lip thus securing it at both the top and bottom. The cable should be orientated so the short or black lead on the receptacle will connect to the top or black conductor on the cable. The safety ground will be connected to the center conductor, and the white lead will be connected to the bottom conductor. A sharp  $90^{\circ}$  bend should be made, with the hands, in the cable at all corners to assure that the cable length is adequate and to facilitate routing and putting on the covers and corner molds. Route only the number of cables needed.

Note: The cables should be routed so the outside or exposed cable will serve the receptacle where possible. If this is not possible, sufficient slack should be left in the outer cable to fold under. This would allow inspection to be made of the connection.

3. Cut cable to final length with large scissors or shears.

## Interconnecting Receptacles to Flat Cable

1. Separate the conductors along the perforation lines for 3-4 inches directly below the receptacle (see Figure 9).



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Figure 9. Separate Conductors for Connections

2. With a pocket knife or end cutters remove the insulation on one edge of each conductor for crimp-on connection (see Figure 10).

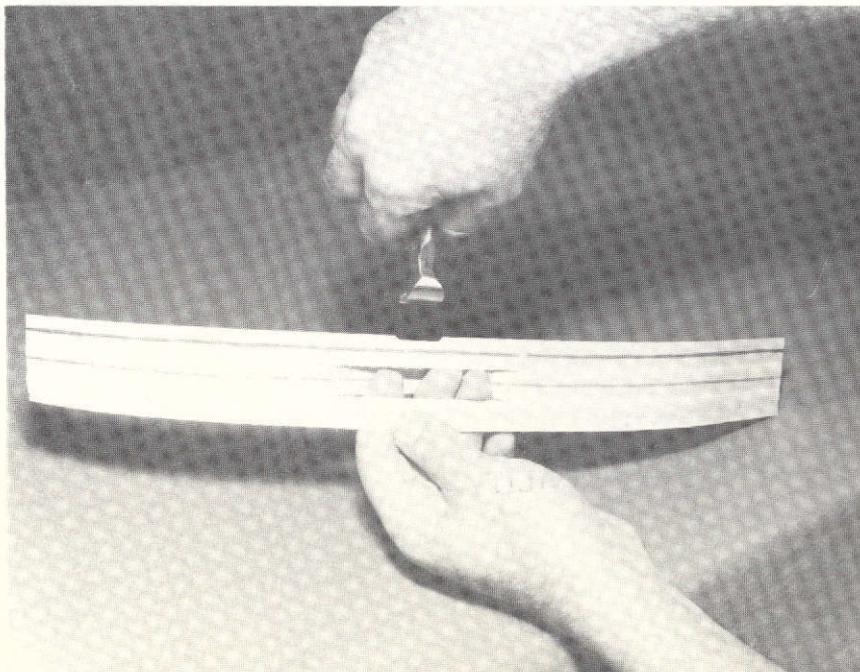


Figure 10. Notching Edge Insulation for Crimp

3. Attach AMP termi-foil P/N51943 to top and bottom conductors. With the tab pointing toward the receptacle and on the outside of the cable, fold the adjacent sides over the conductor with the thumb and fore finger. This secures the termi-foil crimp in place and is now ready for final crimping which makes actual contact with the conductor. This is done with AMP Crimping tool 69288-1 as in Figure 11. The crimping lug is already mounted to the safety ground lead. It is attached to the center conductor in the same manner as the other two conductors.

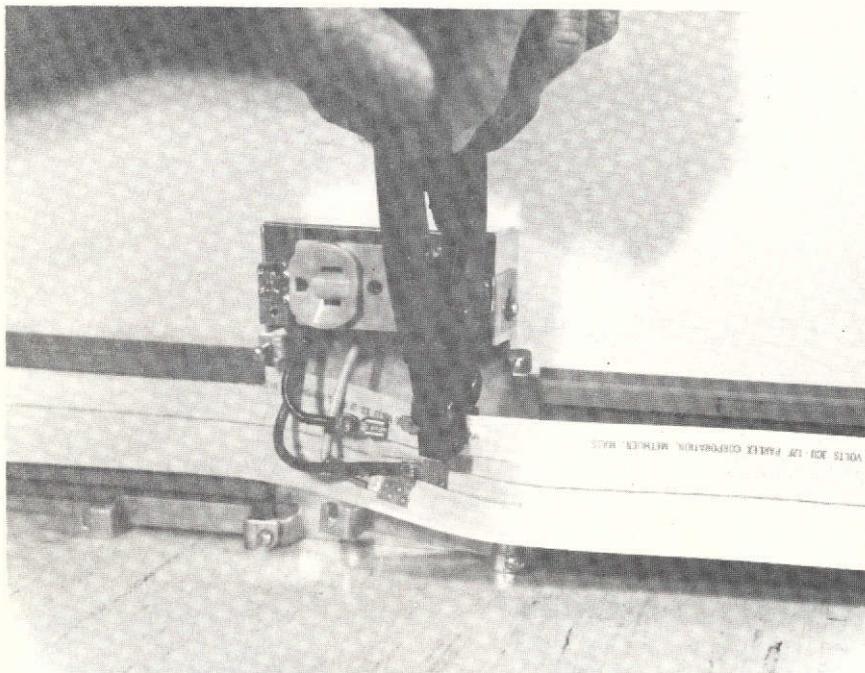


Figure 11. Making Crimp to Conductor

4. Make the top and bottom conductor connections.

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5. Install Mylar wrap insulator (see Figure 12). The end of the Mylar wrap insulator is inserted through the separated perforations in the cable going behind the middle conductor and enclosing only the top and bottom conductors.

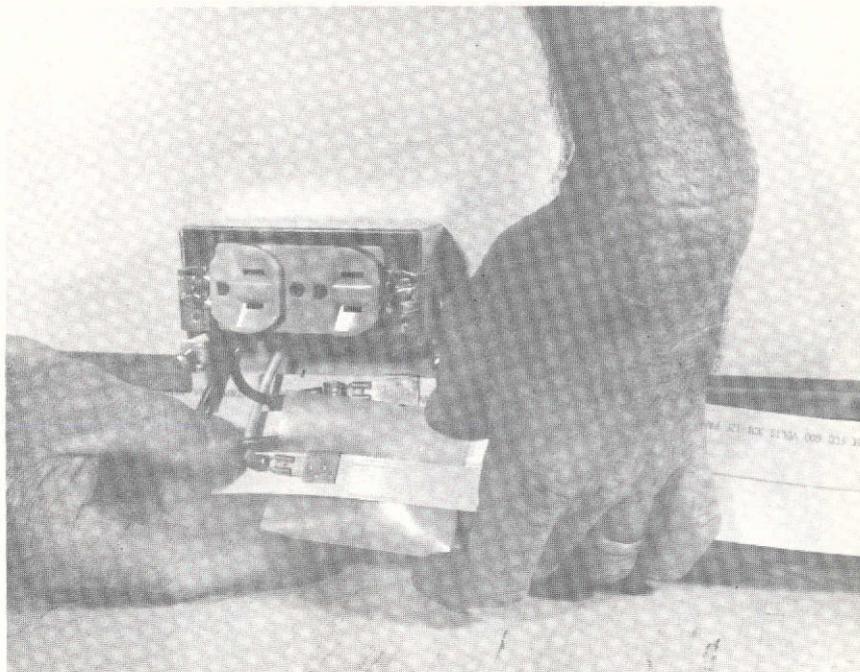


Figure 12. Insulating Connections with Mylar Wrap

The connected cable, connections, and Mylar wrap insulator is then pressed neatly back into the box.

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6. Install cable hold-down straps. This is done by rotating in position and tightening strap screws as in Figure 13.

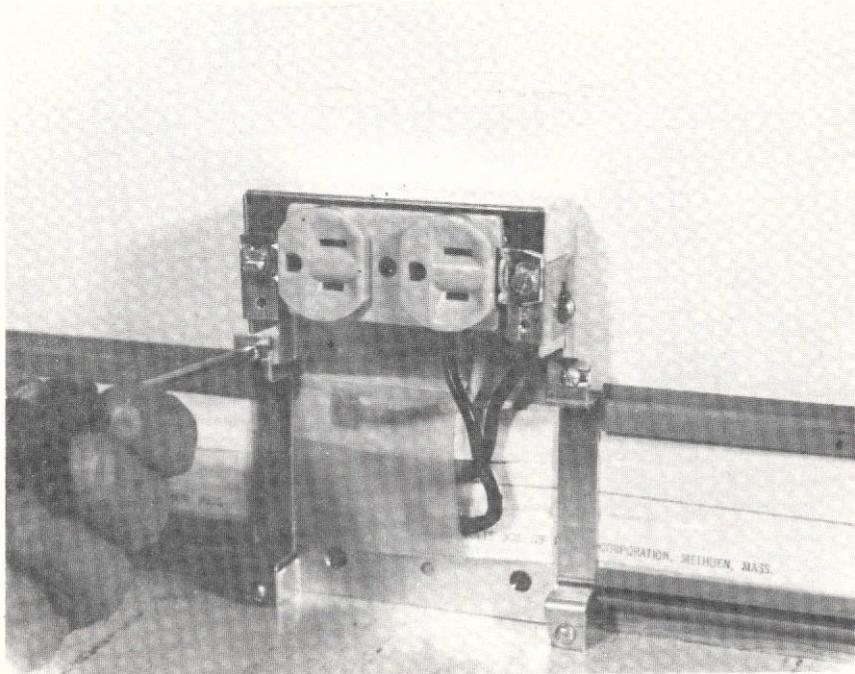


Figure 13. Securing Cable, Mylar Wrap, and Connections in Box

The end of the Mylar wrap insulator should be slid horizontally so one end will be held by the strap preventing possible exposure of the bare connections. This concludes the receptacle installation except for the cover.

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## Make Flat Cable to Round Wire Transition Connections

1. With the cable folded and routed up the wall and using the top of the box as a guide, cut the cable to length.

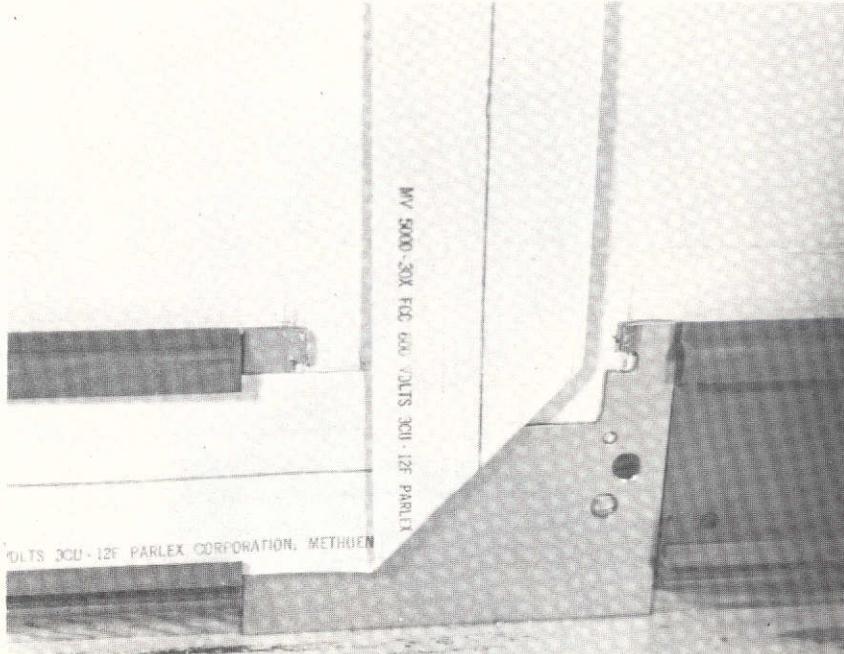


Figure 14. Flat Conductor Cable Fold for Wall Exit

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This allows sufficient length to make connections and fold connections back into the box. The conductors are perforated for separating and making the connections. To install the termi-foil crimp (AMP part number 330716) on each of the round wire leads as in Figure 15, use the AMP crimping tool (part number 49935).

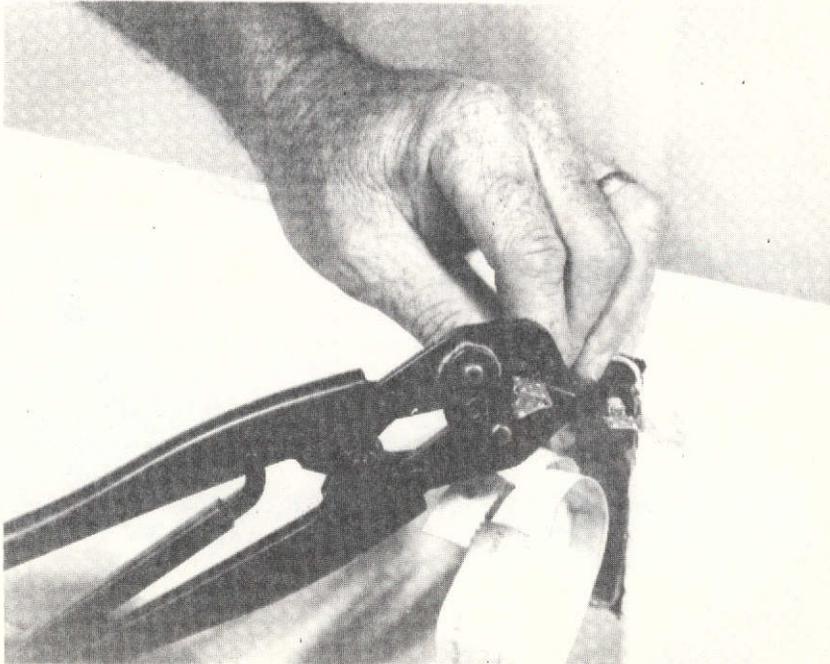


Figure 15. Termi-foil Crimp Installed to Round Wire Leads

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The terminals are then connected to the flat cable in the same manner as was the safety ground connection at the receptacle.

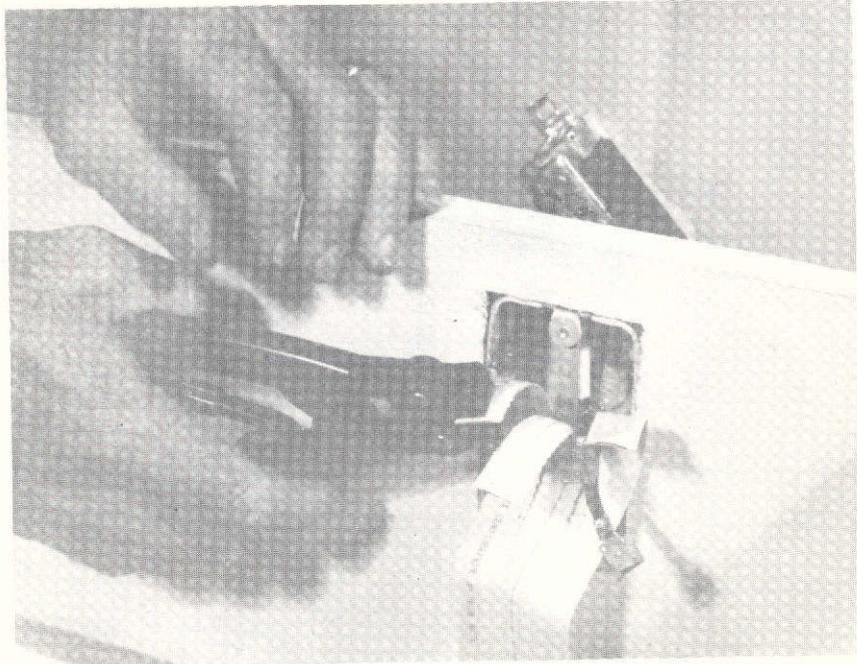


Figure 16. Round Wire to Flat Cable Transition

The connections are then taped and pressed back into the transition box.

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## Install Cable Riser Cover

1. Mark cover for cutting to length. Align screw hole in the top of the cover with screw hole in the top of the transition box and extend the cover over the plate at the bottom and mark cover for cutting to length.

2. With cable flat against the wall and directly underneath, insert the bottom of the cable riser cover behind the tabs on the top of the interconnect cover mounting bracket.

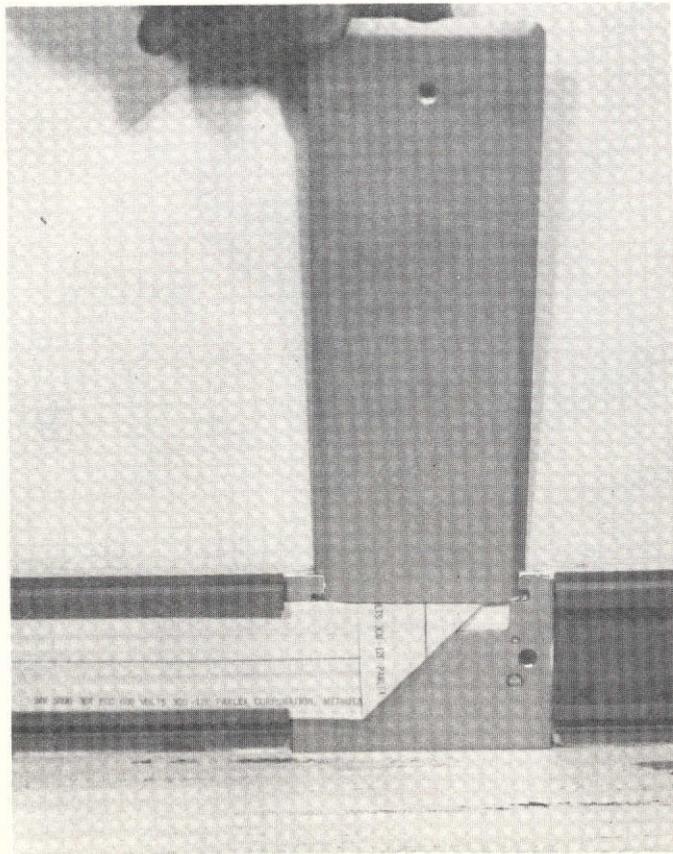


Figure 17. Inserting Cable Riser Cover Behind Connector Plate Tabs

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The cable riser cover is secured at the top with one screw in the top of the transition box as noted in Figure 18. Additional mechanical fasteners may be placed on the cover edges for longer lengths.

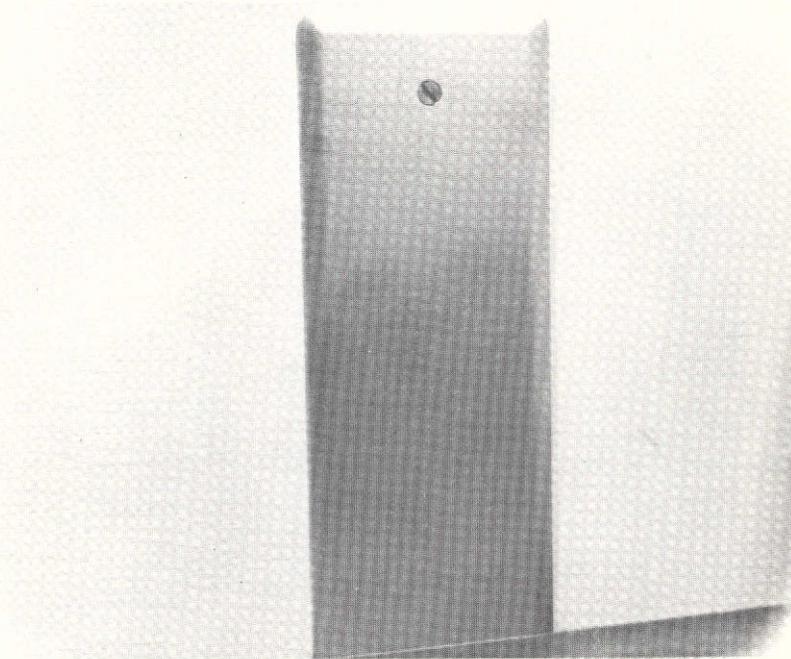


Figure 18. Cable Riser Cover Secured in Place

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## Install Baseboard Cover

1. Ascertain proper baseboard cover lengths. Butt one end of the cover against the wall at the inside corner or at the edge of the receptacle box and mark at the other end which will be at a receptacle box (see Figure 19), baseboard splice, or outside corner.

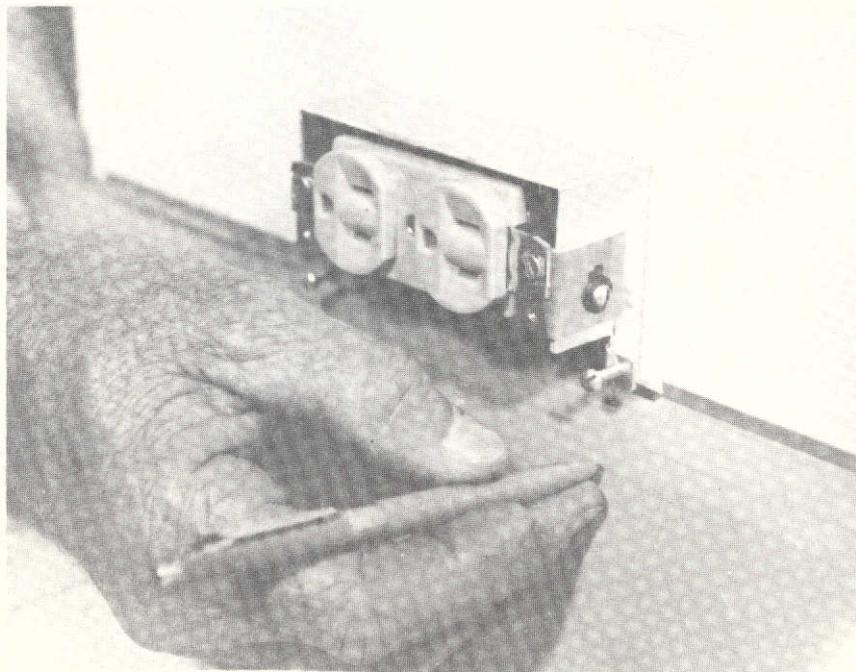


Figure 19. Marking Baseboard Front Cover to Length at Receptacle Box

2. Cut square to marked length with small electric cutoff saw, hack saw, or shear.

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3. Snap front cover to back channel as shown in Figure 20. This is done by inserting the top flange of the front cover against the wall and slightly above the back channel.

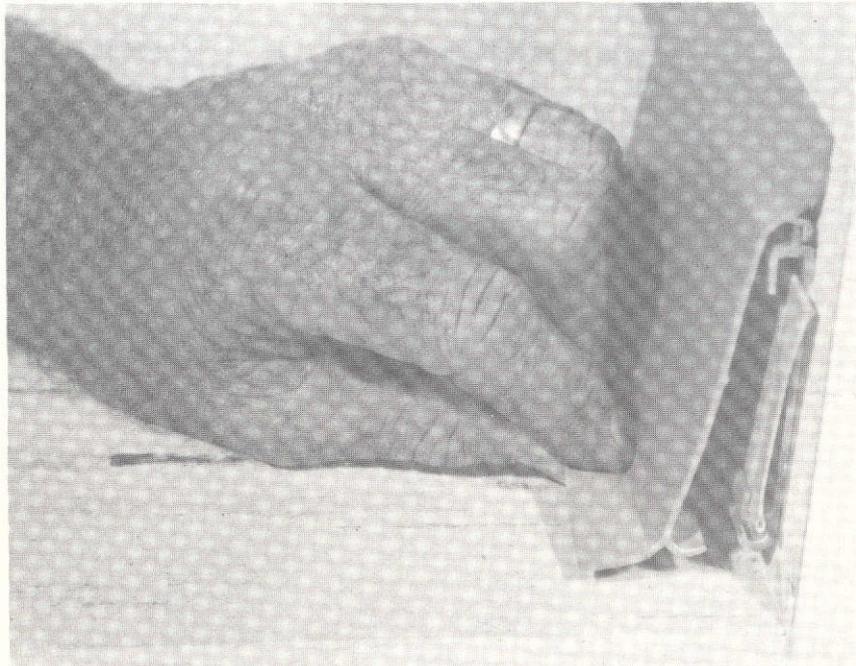


Figure 20. Snapping Front Cover to Back Channel

Press it against the wall and slide it down behind the tab on the back channel. Once the top is in place, the bottom of the front cover is pressed down against the floor and snapped horizontally in place. PVC cement may be used by spotting every 12 to 24 inches to make removal difficult.

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## Front Cover Splice

1. Front cover splices are made only where the wall length is too long for a single section of baseboard. In making a front cover splice, a void of 1-1 1/2 inches should be left between the front cover ends to allow snap-on of the front cover splice (see Figure 21).

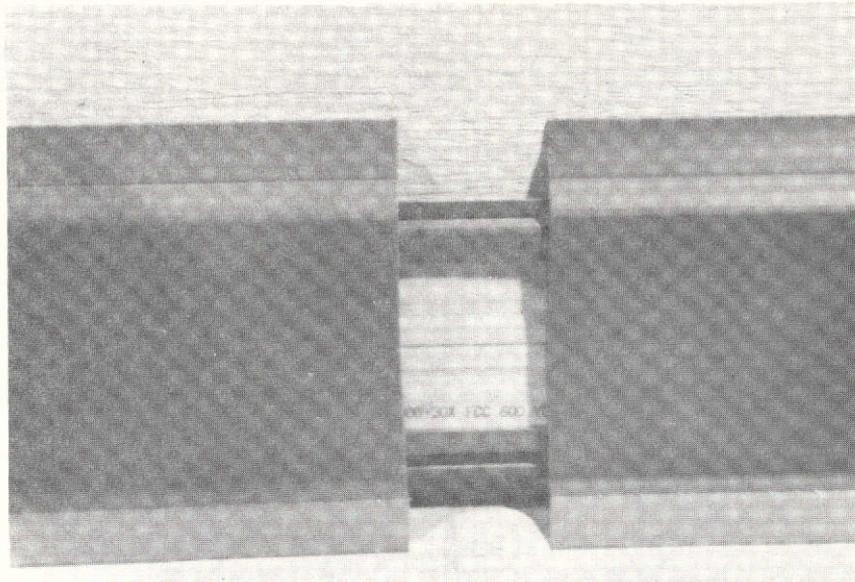


Figure 21. Void Between Front Cover ends for Splice

2. The front cover splice is snapped in place as shown in Figure 21.

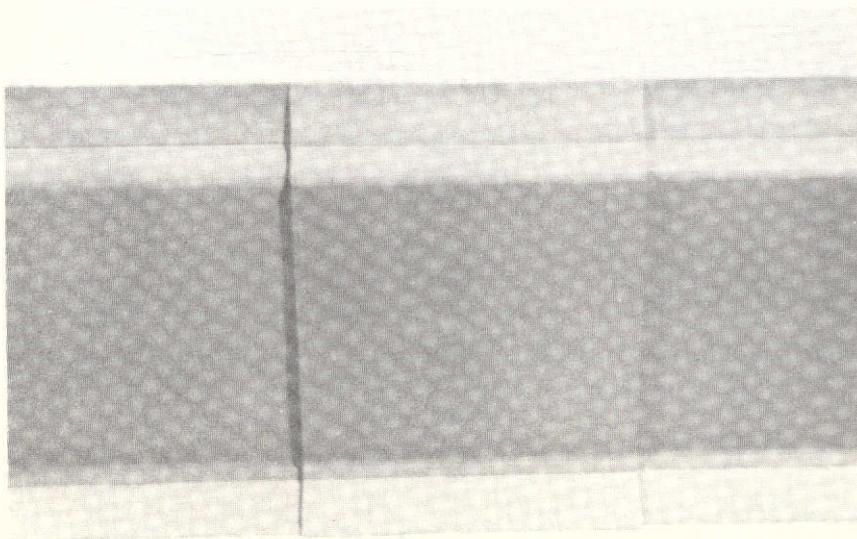


Figure 22. Front Cover Splice in Place

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## Outside Corner Mold Installation

1. The corner molds are installed in the same manner as the splice and front cover. The front cover must stop approximately 2" - 2 1/2" from the outside corners as noted in Figure 23. Figure 24 shows the outside corner mold installed. Use PVC cement to prevent easy removal.

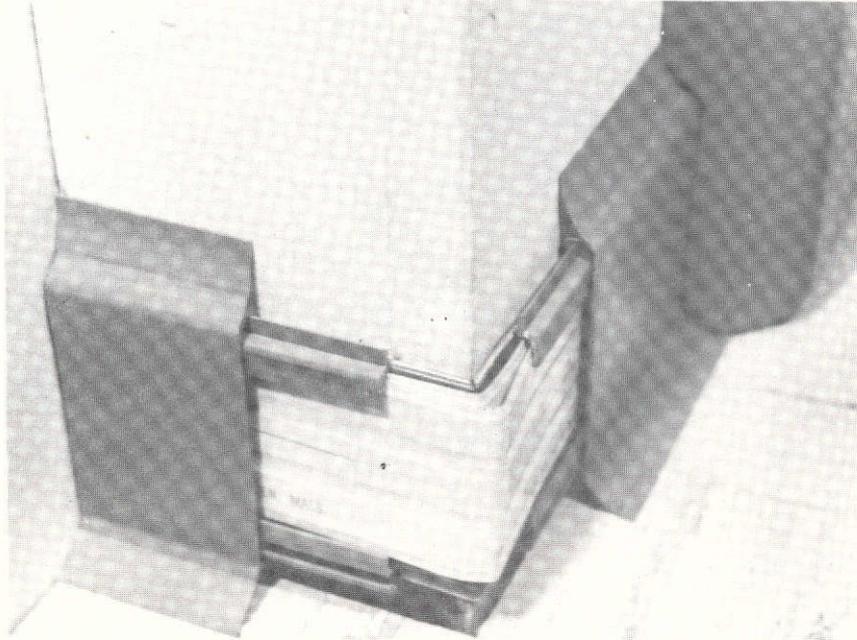


Figure 23. Outside Corner Before Corner Mold

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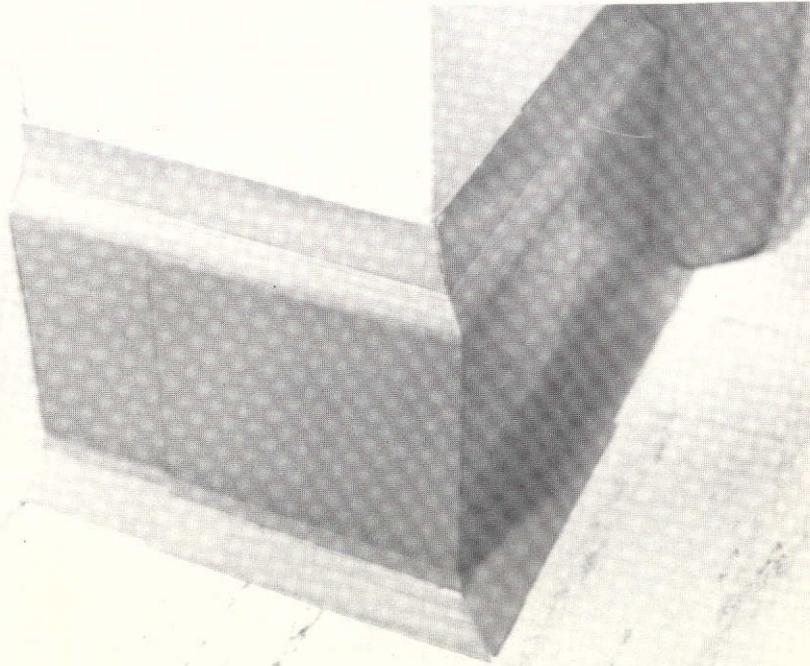


Figure 24. Outside Corner After Corner Mold

## Inside Corner Installation

Inside cornering is accomplished perimtering the front covers thus eliminating a separate inside corner mold as noted in Figure 25.

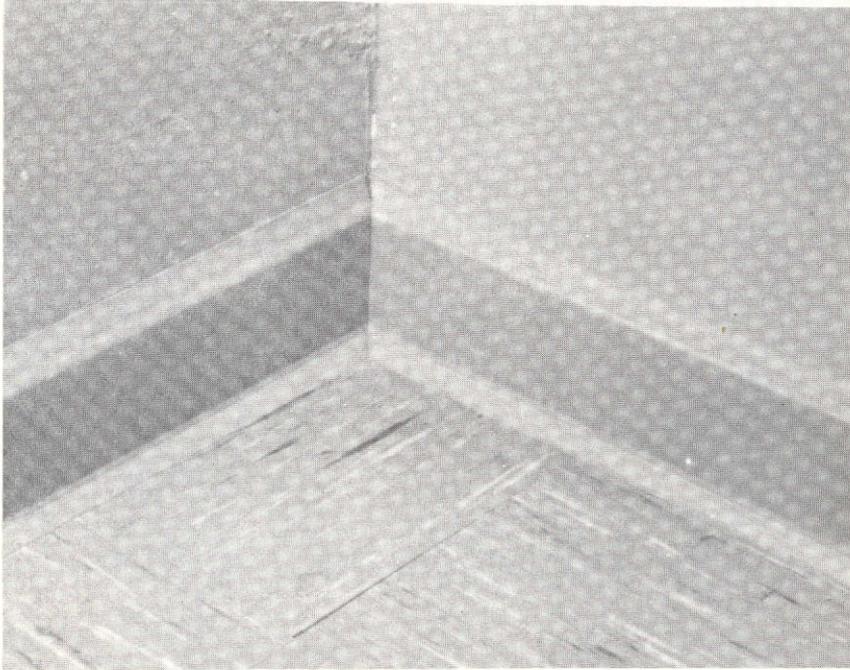


Figure 25. Inside Corner

## End Cap Installation

1. End caps consist of a left hand and a right hand. They are installed in the same manner as the front cover and the outside corners. It is hooked at the top and snapped on at the bottom. It is then moved left or right depending on whether it is a left or right hand cap.

2. The back channel should protrude 1-1 1/2 inches past the front cover thus allowing room to snap the end cap on. However, the end of the back channel should lack approximately 1/2" butting into an adjacent wall or from where end cap should stop. See Figures 26 and 27.

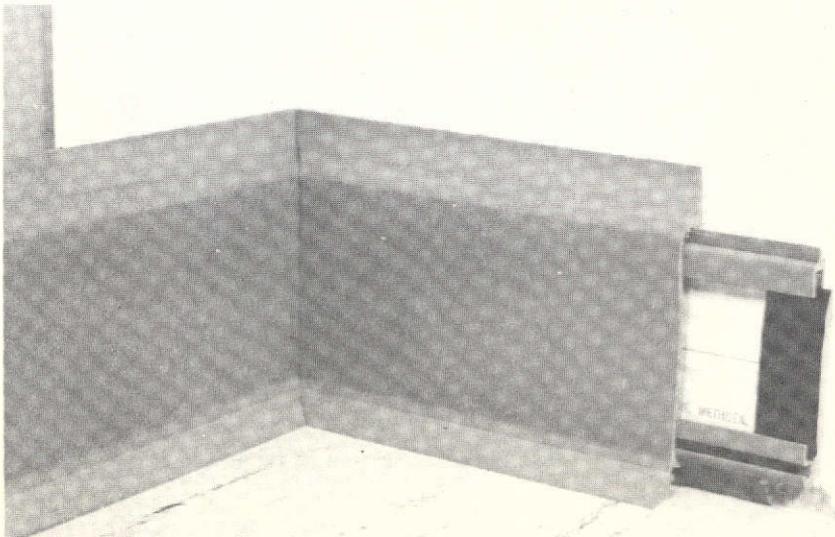


Figure 26. Without End Cap Installed

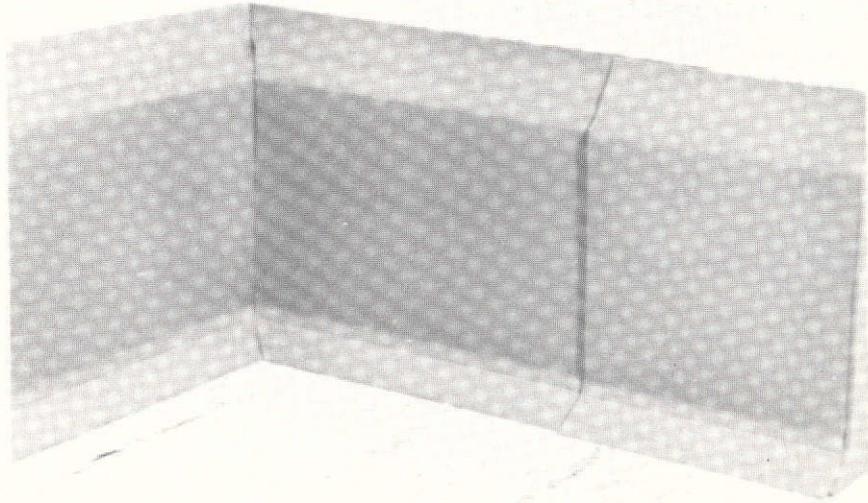


Figure 27. With End Cap Installed

For a more permanent installation an adhesive may be used.

Install Receptacle Assembly Cover

Screw in place as required.

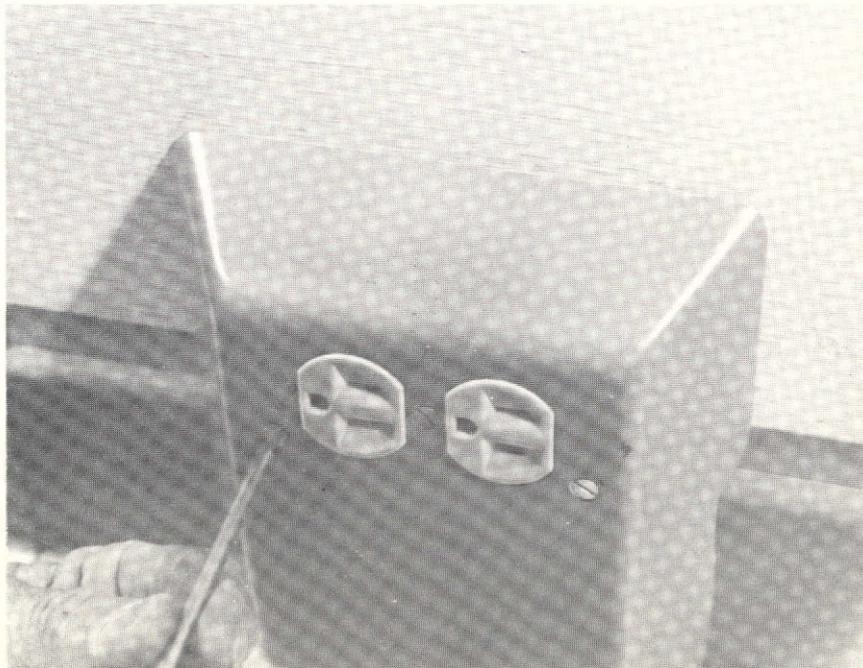


Figure 28. Securing Receptacle Cover

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### Replacement of Receptacle

1. Remove receptacle cover.
2. Remove receptacle screws.
3. Cut round wire leads as close to receptacle body as possible (if replacing with receptacles without leads).
4. Strip 3/4" insulation and mate to screws.
5. If replacing with same type Sierra receptacles, twist leads together and use wire nuts and/or tape.

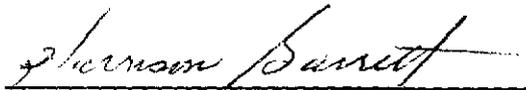
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INSTALLATION PROCEDURE FOR SURFACE MOUNTED  
FLAT CONDUCTOR CABLE USED IN COMMERCIAL  
AND RESIDENTIAL WIRING

By James R. Carden

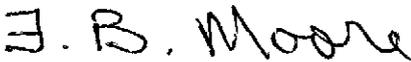
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