DRILLING MOUNTING PLATES

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B,G,J, 267 & 280 Types			2
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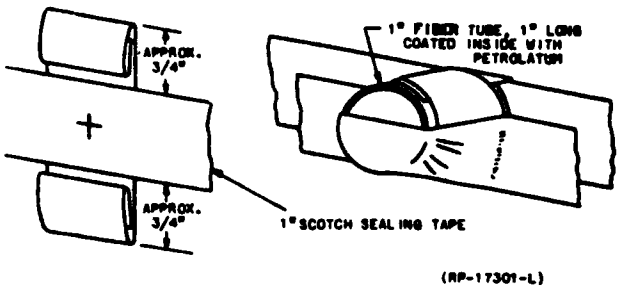
2. GENERAL

2.1 Scope

2.11 This section covers the method of drilling 1-3/4", 2" and 3-1/4" mounting plates for the addition of certain new apparatus without disconnecting the apparatus already mounted on the plate or removing the plate from the frame. It also includes information for punching 2" mounting plates for the addition of wire spring relays in the field and for punching square holes into key shelf masks of Traffic Service Positions for the addition of keys or lamps.

2.12 Tool Kits 45 and 51 are available for drilling mounting plates. The method of selecting and using the proper kit is shown with the methods of drilling mounting plates for the various apparatus in Tables 1 through 6 at the end of this section.

2.2 References to "right" and "left" in the following paragraphs apply when facing the apparatus side of the mounting plate.



ONSTRUCTION OF PROTECTION:

(1) CUT A SECTION OF FIBER TUBE ABOUT ONE INCH LONG (1" TUBE RM-584083 IS ABOUT RIGHT) AND FOUR STRIPS OF SCOTCH MASKING TAPE (CATALOG 542.1) EACH ABOUT FIVE INCHES LONG.
(2) PLACE ONE STRIP OF TAPE ON THE PANEL IN A VERTICAL POSITION OVER THE LOCATION OF THE PROPOSED DRILLING ON THE SIDE TO BE DRILLED. OVER THIS PLACE A SECOND PIECE OF TAPE IN A HORIZONTAL POSITION. ACCURATELY MARK THE DRILLING POSITION ON THE HORIZONTAL TAPE.
(3) LOOP THE VERTICAL TAPE AS SHOWN ON THE LEFT SIDE OF THE FIGURE AND ATTACH THE ADHESIVE SIDE TO THE FIBER TUBE. DRAW UP ALL SLACK IN THE TAPE. WRAP THE THIRD PIECE OF TAPE AROUND THE TUBE ON THE OUTSIDE OF THE VERTICAL PIECE OF TAPE AS SHOWN ON THE RIGHT SIDE. APPLY A HEAVY LAYER OF RM-647651 PETROLATUM ON THE INSIDE OF THE TUBE AND THE TAPE AT THE BOTTOM OF THE TUBE
(4) PLACE THE FOURTH PIECE OF TAPE ACROSS THE LOWER HALF OF THE EXPOSED END OF THE TUBE AND ATTACH THE FREE ENDS TO THE HORIZONTAL TAPE AND TO THE PANEL.

FIG. 1 LOCALLY MADE PROTECTION FOR RETAINING DRILL AND TAP CHIPS KITS 45 OR 51 ARE NOT USED (PAR. 2.4)

2.3 The positions on the 189A Mounting Plate are numbered from 1 to 169 on 1/8" centers, starting 1" from the left end of the plate and ending with 169 on the right end.

2.4 Drilling layouts not covered by this section and consisting only of round holes can be drilled on equipped mounting plates or panels without Tool Kits 45 or 51, but adjacent apparatus shall be well protected against drill chips by locally improvised protection, such as shown in Figure 1.

3. INSTALLING EQUIPMENT

3.1 The tools and material generally used for operations covered in this section are as follows:

3.11 Tools: The following tools are required in addition to Kits 45 and 51.

R-2738(2)	Bag, Connecting
Purchase Locally	Drill, No. 24, Twist
R-1285	Drill, Electric, 5/16"
R-3032	Drill, Electric, 1/2"
R-1486	File, Round, 10"
R-1491 or R-3256	Hammer
R-3655	Punch and Die, W/S Relay
R-3740	Punch, Traffic Service Position
Purchase Locally	Reamer, 7/16"
R-2806	Wrench, Rev. Ratchet & Extension
Kit 33	Vacuum Cleaner

3.12 Materials

R-1021	Brush, 1/2" Flat
Obtain Locally	Cloth, Emery, 2-0 (Par. 7.3)
RM-591862	Fiber, Sheet, Gray, 1/64"
Obtain Locally	LUBRICANTS, Oil, Cutting
RM-647651	LUBRICANTS, Petrolatum
KS-8662	PAINTS, Enamel, Gray
R-2998	PAINTS, Enamel, Tan Chromate
KS-7860	PAINTS, Spirits, Petroleum
RM-584083	Tube, Fiber, 1") Pars.
5.42.1	Tape, Sealing, Scotch, 1") 2.4,4.3

4. PRECAUTIONS

4.1 Paragraphs 4.2 to 4.8 cover the precautions to be observed for the prevention of personal injury, equipment damage and service interruptions as applied to this section. General precautions are covered in Handbook 0 and are to be observed at all times.

4.2 Although the tools specified are designed to trap the drill chips on the front and rear sides of the mounting plate, it is recommended that additional protection be placed as follows:

4.21 Equipment adjacent to position being drilled should be protected against flying drill chips.

4.22 Prevent chips from falling on equipment below and on the floor by fastening R-2738 Connecting Bags to the rear and front of the Mounting Plate. A piece of RM-591862 Fiber slid beneath the Mounting Plate and protruding both front and rear will deflect the chips into the connecting bags.

NOTE: Using the vacuum cleaner to remove the chips from the protection box after each drilling operation will eliminate almost all of the danger of falling chips and will make it easier to insert and remove drilling jigs.

4.3 When drilling adjacent to live equipment, place two layers of 542.1 sealing tape around the sides of the Det. 3 Backstops associated with the various fixtures if necessary to prevent grounding live terminals.

4.4 Jarring of equipment with consequent possible service interruptions caused by false operation of relays may be held to a minimum by using the 5/16" Electric Drill for all drills within its capacity.

4.5 Dip drill, mill, punch or counterbore in cutting oil before starting cutting operation to facilitate the operation and prevent chips from falling off the cutting tool when it is withdrawn from the drilling fixture.

NOTE: Allow excessive oil to drain from the tool to prevent oil from running down the equipment.

4.6 Reduce the pressure being applied to the drill or cutting tool as it is about to break through the work to prevent unnecessary jarring of the equipment and breakage of tools. This will also prevent the drill from being wrenched from the installer's hands, thus preventing the possibility of injury to himself as well as the equipment.

4.7 To prevent spraying of chips outside of the protection box, the drills or other cutting tools should not be withdrawn from the box while the electric drill is still revolving.

4.8 When drilling in positions close to relay or other apparatus covers, the chuck on the electric drill may come in contact with the cover if the twist drill has been shortened by repeated sharpening. In such cases the difficulty may be temporarily remedied by inserting the drill only part way into the drill chuck. Requisition new drills when the drills are shortened to less than 5-3/4" long.

5. PROCEDURE FOR DRILLING MOUNTING PLATES

5.1 See Tables 1 through 6 to properly assemble and locate the drilling fixtures on the Mounting plates and for methods of drilling and mounting plates for the particular type apparatus listed in the Index.

NOTE: Before attempting to drill the mounting plates, it is important to read the precautions listed under Paragraph 4 of this section.

6. SUPPORTING 2" FIXTURES ON 1-3/4" MOUNTING PLATES

6.1 The R-2925, R-2939 and R-2949 fixtures, which are designed for 2" plates, can be assembled on 1-3/4" flat plates only when there is a clearance of at least 1/8" above and below the plate to permit the fixtures to straddle 1-3/4" plates. The plate can be shifted to obtain these clearances. One method of obtaining these clearances is illustrated in Figure 2.

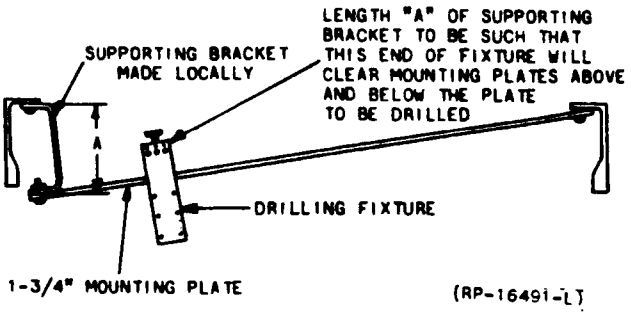


FIG. 2 METHOD OF SUPPORTING 1-3/4" MOUNTING PLATE TO PERMIT ASSEMBLY OF 2" FIXTURES (PAR. 6.1)

6.11 When these fixtures are used on 1-3/4" flat plates, a 1/8" square by approximately 1-1/8" long spacer made locally, (preferably of an insulating material such as fiber or wood,) shall be placed between each spring detail on the protection box, Det. 1, and the adjacent edges of the mounting plate in order to centralize the fixture on the plate vertically and prevent it from shifting during the drilling operations.

7. PROCEDURE FOR REMOVING FIXTURE, AND CARE OF TOOLS

7.1 Before removing the fixture from the mounting plate, vacuum the drill chips from the inside of the protection box, Det. 1. Use care in removing the back stop assembly, Det. 3, to prevent any drill chips from falling into the apparatus or wiring.

7.2 Wipe cutting oil and steel chips from mounting plate with cloth dampened with KS-7860 Petroleum Spirits.

7.3 Clean the tools before putting them away. This is especially important with respect to the R-2343 Counterbore to prevent the formation of rust on the stem of the guide which would make the removal of the guide difficult. Dismantle the counterbore as shown in Figure 3, clean the parts, and grease with petrolatum or machine

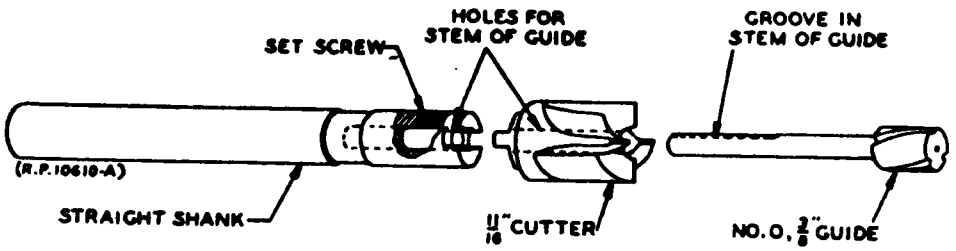


FIG. 3 PARTS OF R-2343 COUNTERBORE (PAR. 7.3)

oil before reassembling. Remove burrs which interfere with removal of cutter with emery cloth.

NOTE: Rusted counterbores which cannot be readily dismantled after lying in KS-7860 Petroleum Spirits or kerosene for a few hours should be returned to the Distributing House.

7.4 The foregoing information applies also the R-3655 and R-3740 punches. Wipe clean and cover with a coat of pertrolatum or machine oil.

8. FINISHING INSIDE OF DRILLED HOLES

8.1 Remove any metal projections (burrs) from the edges of the holes with a drill larger than the hole, a R-2443 Screwdriver or other suitable tool.

8.2 Cover bare metal exposed by drilling and cutting operations (except holes for bushings) with one coat of KS-8662 Gray Enamel or R-2998 Tan Chromate Enamel.

9. PUNCHING HOLES FOR WIRE SPRING RELAYS

9.1 Punch rectangular holes for mounting wire spring relays with the R-3803 wire spring relay knockout punch. This tool is hydraulically operated and consists of the following parts furnished in Kit 73:

1-R-3803 Punch, Wire Spring Relay Knockout
1 Det. 1 - Knurled Nut
1 Det. 2 Punch
1 Det. 3 Stud
1 Det. 4 Die Guide
1 Det. 5 Die

Also Included in Kit 73:

1-R-3848 1/2" Punch
1-R-3843 Shipping Case

9.2 Additional Tool Required:

1-R-3032 1/2" capacity Electric Drill
1-R-3241 Hydraulic Conduit Punch Set
1-R-2792 General Use Wrench Set to include use of 1-R-2806 Handle, 1-R-2819 Det. 1 7/16" Socket, 1-R-2459 Extension 5".
1-R-2887 Wrench, O.E., 7/16"

9.3 Following is a step-by-step procedure for punching rectangular holes for wire spring relays. Figure 4 shows the complete assembly.

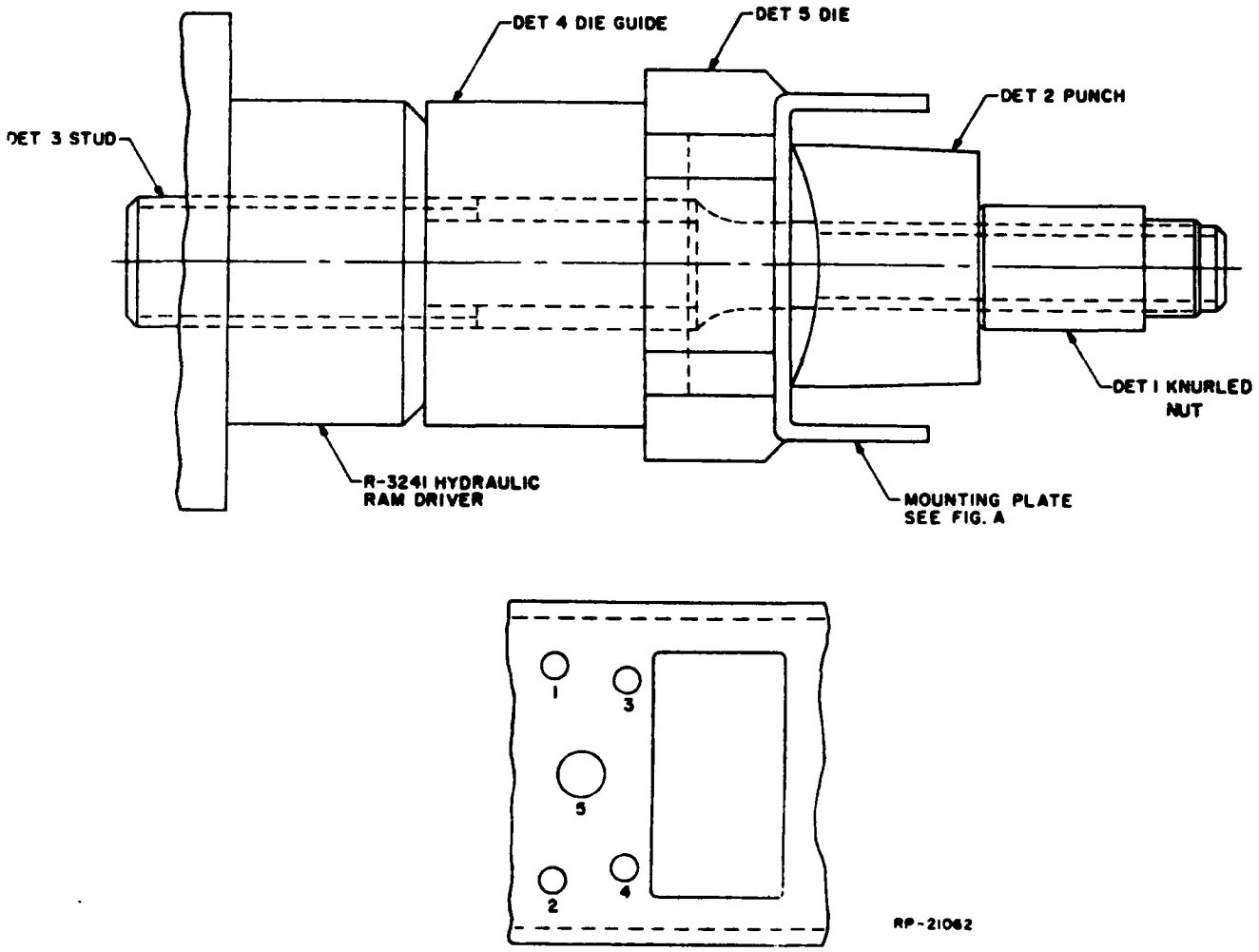


FIG. 4 ASSEMBLY OF R-3803 PUNCH (PAR. 9.3)

9.301 Locate and drill 1/4 inch hole in mounting plate.

9.302 Knock out 1/2 inch hole with No. 730 1/2 inch Greenlee punch.

NOTE: Some difficulty may be encountered in removing 1/2 inch blank from die. This may be overcome by taping on stud head until blank is disengaged.

CAUTION: Care should be taken when removing blank from stud, since the edges of material are sharp and could cause a serious accident. Therefore, protect fingers when removing 1/2 inch blank.

9.303 Locate Det. 5 Die on wiring side of mounting plate in position desired to be punched out.

9.304 Drill four holes through Det. 5 with No. 24 drill using Det. 5 as a template.

9.305 Screw Det. 3 Shaft into Greenlee ram.

NOTE: Remove all shafts from ram before inserting Det. 3.

9.306 Slip Det. 4 Shaft and Punch Guide onto Det. 3 Shaft with .250 relief up.

9.307 Insert Det. 5 Die onto Det. 4. Small opening on top.

9.308 Insert assembly into 1/2 inch hole on wiring side of mounting plate.

9.309 Insert Det. 2 Punch onto Det. 3 Shaft.

9.310 Secure above with Det. 1 knurled Nut.

NOTE: Some difficulty may be encountered while threading and unthreading by hand. It may become necessary to use a wrench. Operator should support ram until the punch and die have engaged mounting plate.

CAUTION: Canvas should be draped on equipment side of frame over and under punch to protect working equipment.

9.311 Apply pressure until Det. 2 punch completes the cutting operation.

NOTE: Never force punch if there is undue resistance in the punch, release valve and see if you have properly assembled punch.

9.312 After hole has been punched, the Punch and Nut can be pulled through work.

9.313 Continue to apply pressure until Det. 5 die may be removed from assembly.

9.314 Release pressure remove nut punch and blank by tapping lightly with Det. 4 shaft and punch guide.

CAUTION: When operating at other than floor level secure hand pump to ladder in order to prevent personnel accidents.

10. PUNCHING HOLES FOR TRAFFIC SERVICE POSITIONS

10.1 The R-3753 Punch was developed for punching .656" square holes for the addition of keys in the keyshelf of Traffic Service Position systems. It can be hydraulically or manually operated and consists of the following details (see Figure 5):

1 Det. 1 - Guide, Pilot Hole (not shown)
1 Det. 2 - STUD
1 Det. 3 - STUD and Die Guide
1 Det. 4 - Punch
1 Det. 5 - Nut Coupling
1 Det. 6 - Die
1 Det. 7 - Nut, Special

10.2 The outline below and Figure 5 will be helpful in assembly and operation of this tool.

10.21 Place Det. 1 pilot hole guide into an adjacent keyhole (it will be necessary to remove a key in order to use guide and drill 3/8" pilot hole.

NOTE: If there is a problem of obtaining proper centering of pilot hole with stud and punch, it will be necessary to enlarge 3/8" hole.

10.22 The hole is punched through the keyshelf mask only. See Figure 5 for assembly of R-3753 punch used hydraulically or manually.

10.23 Assemble Det. 3 and Det. 6 with relief on Det. 6 inserted into Det. 3.

10.3 Hydraulic Punching

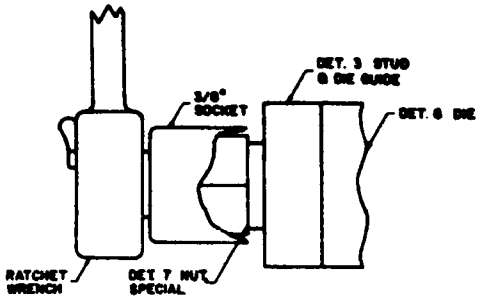
10.301 If hydraulically operated, install stud 3/8" thread Det. 2 into R-3241 Hydraulic punch set rammer.

10.302 Install long, short and medium bushings on rammer.

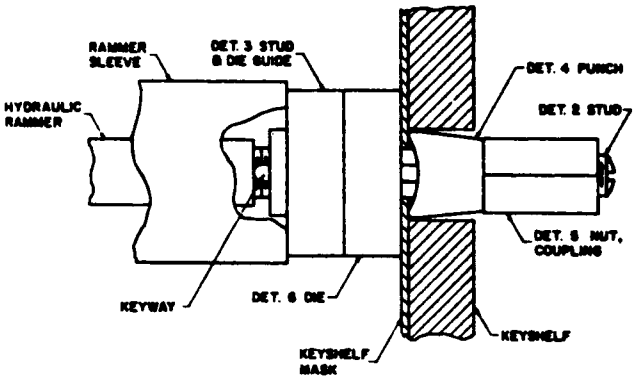
10.303 Slide Det. 3 and 6 on stud with die opening away from bushing.

10.304 Insert assembly from the top into the 3/8" pilot hole. See Figure 5.

10.305 Place Det. 4 Punch over the stud making sure that is engages the key bolt in Det. 2 stud.



ASSEMBLY FOR MANUAL PUNCHING



ASSEMBLY FOR HYDRAULIC PUNCHING

FIG. 5 ASSEMBLY OF R-3753 PUNCH (PARS. 10.1, 10.2, 10.22, 10.34, 10.4)

10.306 Thread Det. 5 nut, finger-tight onto the stud and continue until nut is tight against punch.

10.307 Position Det. 3 and 6 parallel to existing keyhole for proper alignment.

10.308 A few strokes of the hydraulic punch will cut through mark.

NOTE: Never force punch if there is undue resistance in the punch, release valve and see if you have properly assembled punch.

10.309 After the hole has been punched, the Det. 4 Punch, can be pulled through work.

→ Arrowed lines indicate new or changed information.

Vertical lines at side of Paragraphs indicate requirements.

ATTACHMENT
Tables 1 to 6 on Pages 7 to 12.

Reason for Reissue
(1) To remove information on R-3655 Punch and Die (Paragraphs 9.1-9.215) and add information on R-3803 Wire Spring Relay Knockout Punch (Paragraphs 9.1-9.314).

10.310 File any burrs that may exist after punching hole.

10.4 Manual Punching

10.41 It may be desired to use punch manually. See Figure 5.

10.42 Attach Det. 7 to assembly in place of hydraulic rammer.

10.43 Thread Det. 7 nut finger tight onto stud and continue tightening with either an adjustable wrench or proper rachet handle and socket.

NOTE: At no time should it be necessary to force punch into metal. Stop operation and see if the punch is assembled properly.

10.44 Clean tools as covered in Paragraph 7.1 through 7.4, Section 54, Handbook 30.

11. PROCEDURE FOR INSERTING HARD RUBBER BUSHINGS IN DRILLED HOLES

11.1 Insert hard rubber bushings in drilled holes, as required.

11.11 To insert the bushings, use the R-2790 or R-2791 Bushing Holder. Slip the busing over the turned down portion of the holder, place the bushing in position over the hole to be bushed, hole the busing holder perpendicular to the mounting plate and drive the bushing into the hole by lightly tapping the end of the holder with a hammer until bushing is flush with the mounting plate.

12. VERIFICATION ITEMS

12.1 The numbers in parentheses refer to the associated paragraphs in this section unless otherwise indicated.

12.11 Metal projections removed (Paragraph 8.1).

12.12 Bare metal exposed by drilling and cutting operations covered with protective finish (Paragraph 8.2).

12.13 Rubber bushings in holes, as required (Paragraph 11.1).

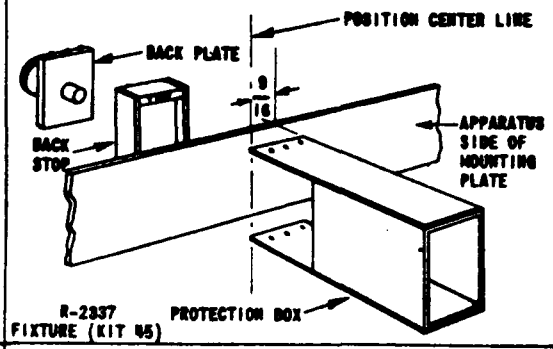
Superintendent, Installation and Equipment Standards Engineering

Replaces Section 54 dated 12-17-64.

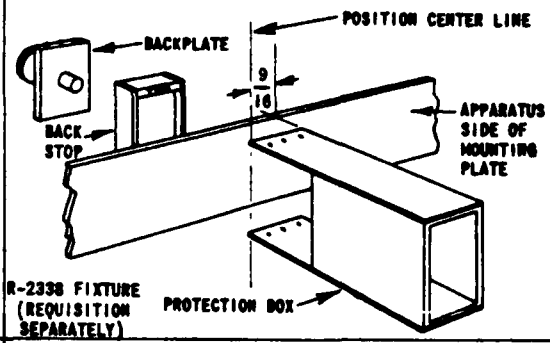
FOR DRILLING

SELECT ONE OF THE FOLLOWING

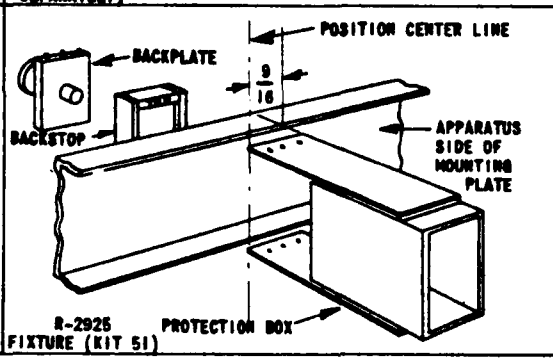
1A FOR 1-3/4" FLAT MTG. PLATE



1B FOR 3-1/4" FLAT MTG. PLATE

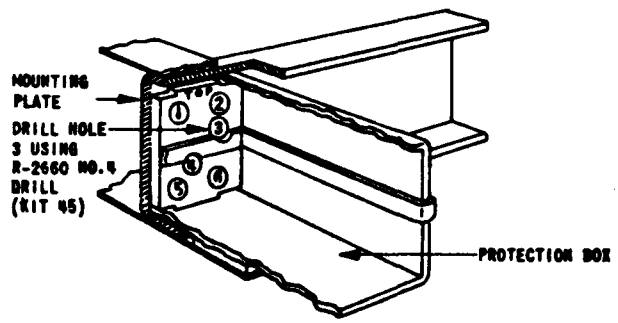


1C FOR 2" FLAT OR CHANNEL MTG. PLATE



2

INSERT R-2339 DRILLING JIG (KIT 45) INTO PROTECTION BOX



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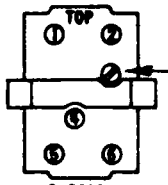
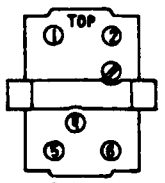


4

DRILL HOLES 1,2,4,5,&6 USING THE R-2660 NO. 4 DRILL

REMOVE DRILL CHIPS WITH VACUUM CLEANER

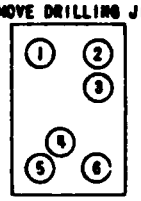


5

REMOVE DRILLING JIG

ENLARGE HOLES 1,2, 5 & 6 USING R-2345 3/8" DRILL (KIT 45)

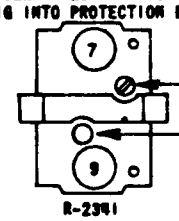
REMOVE CHIPS WITH VACUUM CLEANER



6

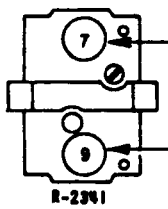
INSERT R-2341 DRILLING JIG INTO PROTECTION BOX

PIN SHOULD ENGAGE IN HOLE 4



7

REMOVE CHIPS WITH VACUUM CLEANER



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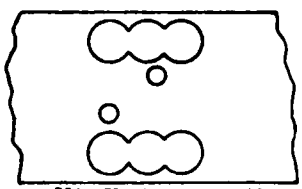


TABLE 1. DRILLING OF 1-3/4", 2", 3-1/4" FLAT OR 2" CHANNEL MOUNTING PLATES FOR THE FOLLOWING TYPE APPARATUS:

INDUCTORS - 85,111
RELAYS - A,E,F,H,L,N,R,S,T, 235,236
REPEATING COILS - 66,103
RESISTORS - 40
VARISTORS - 27

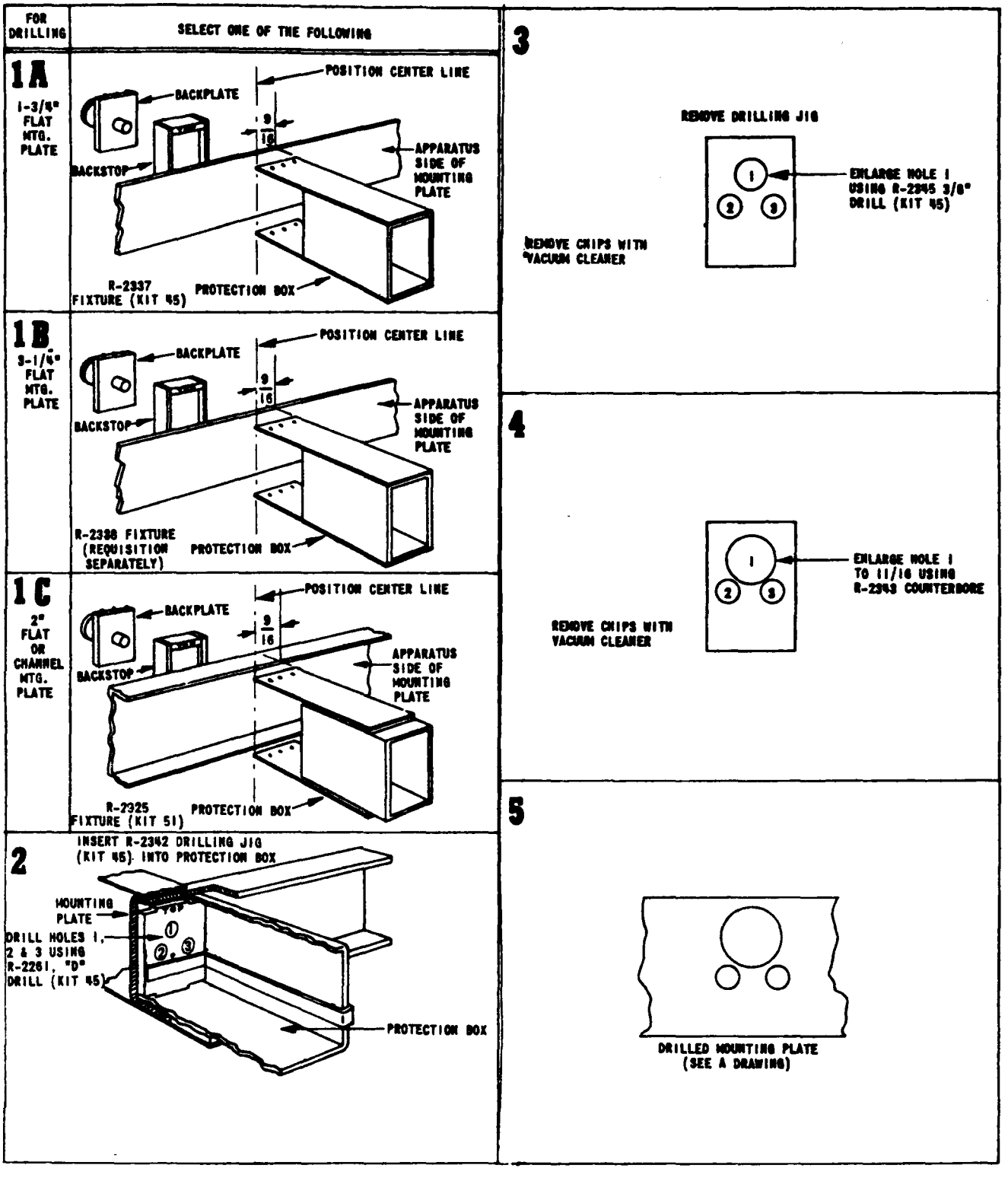


TABLE 2 DRILLING OF 1 3/4", 2", 3-1/4" FLAT OR 2" CHANNEL MOUNTING PLATES FOR THE FOLLOWING TYPE APPARATUS:

CAPACITORS - 66
INDUCTORS - 114
RELAYS - B, G, J, 267, 280
REPEATING COILS - 142

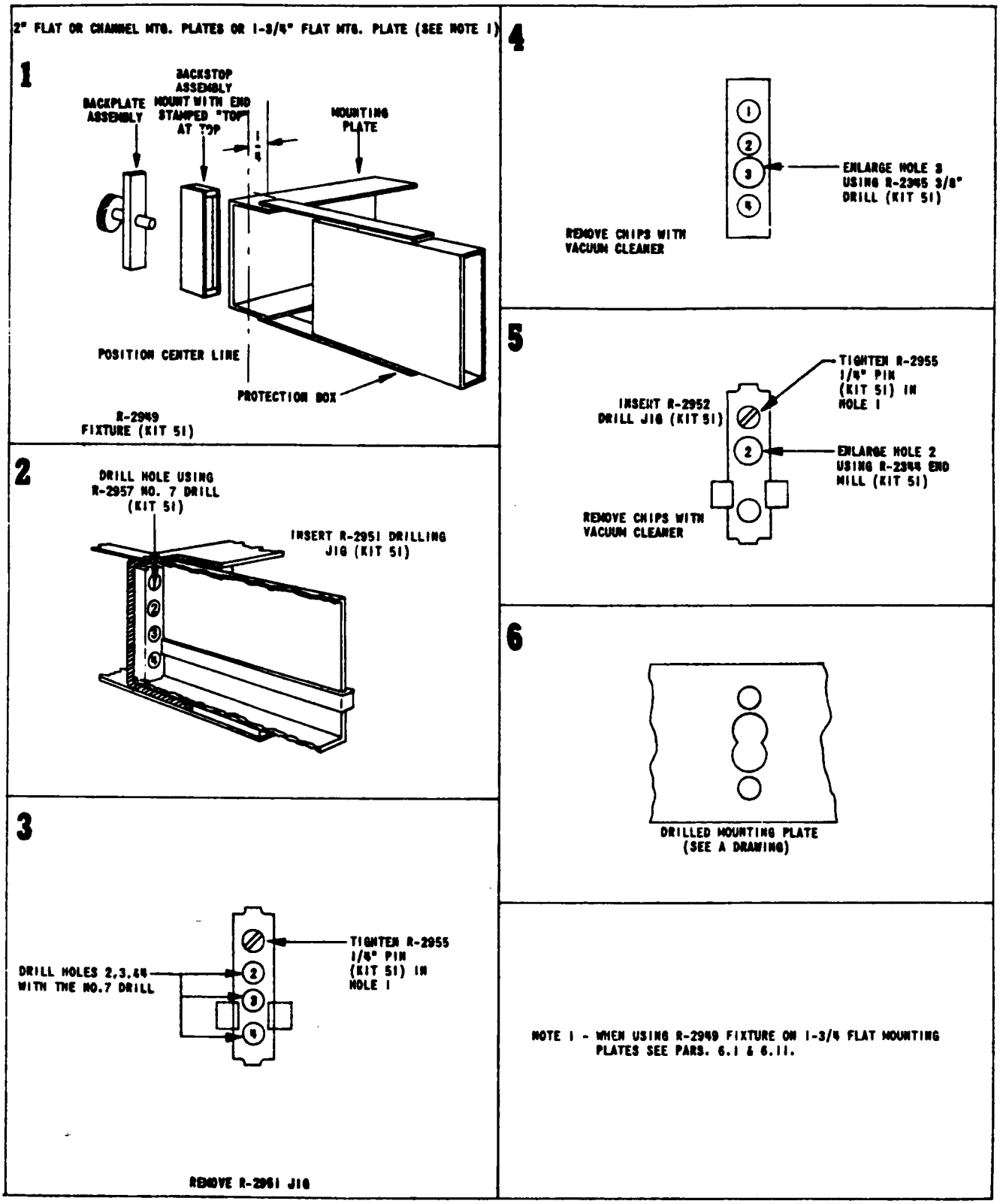
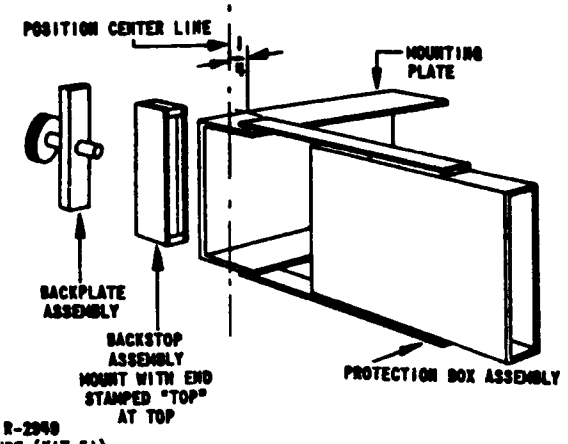


TABLE 3. DRILLING OF 1-3/4", 2" FLAT OR 2" CHANNEL MOUNTING PLATES FOR THE FOLLOWING TYPE APPARATUS:

NETWORKS - 177

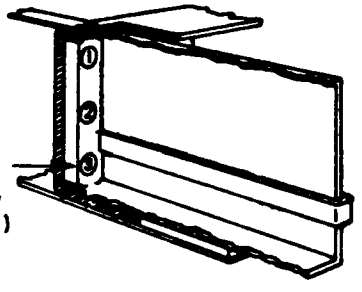
1 2" FLAT OR CHANNEL PLATES OR 1-3/4" FLAT PLATES (SEE NOTE 1) 3-1/4" FLAT (SEE NOTE 2)



R-2949 FIXTURE (KIT 51)

2

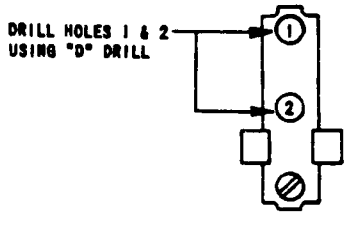
INSERT R-2953 DRILLING JIG



DRILL NO. 3 HOLE USING R-2661 NO "D" DRILL (KIT 51)

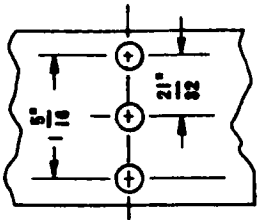
3

TIGHTEN R-2956 5/16" PIN IN HOLE 3



REMOVE CHIPS WITH VACUUM CLEANER

4



DRILLED MTG. PLATE (SEE A DRAWING)

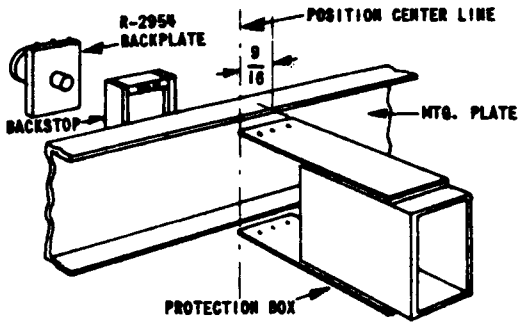
NOTES: 1 - WHEN DRILLING 1-3/4" MTG. PLATES SEE PARS. 6.1 & 6.11.

2 - WHEN DRILLING 3-1/4" MTG. PLATES FOR 18 OR 19 TYPE RESISTORS, NO JIG IS FURNISHED. LAYOUT HOLES ON MOUNTING PLATE, ACCORDING TO VIEW 4 ABOVE, ASSEMBLE R-2338 FIXTURE OVER LOCATION, AND DRILL USING THE R-2661 NO "D" DRILL IN EITHER KIT 45 OR KIT 51.

TABLE 4. DRILLING OF 1-3/4", 2" FLAT OR 2" CHANNEL MOUNTING PLATES FOR THE FOLLOWING TYPE APPARATUS:

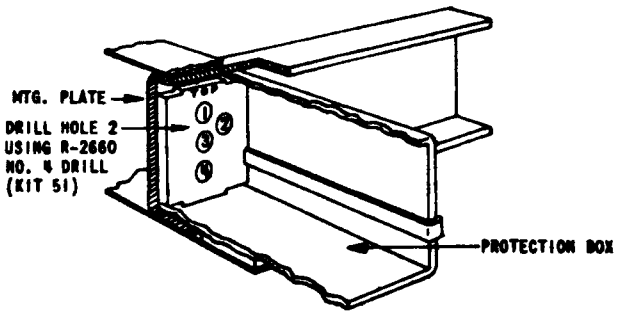
RESISTORS - 18, 19

1 FOR 2" FLAT OR CHANNEL MTG. PLATES OR 1-3/4" FLAT MTG. PLATE (SEE NOTE 1)



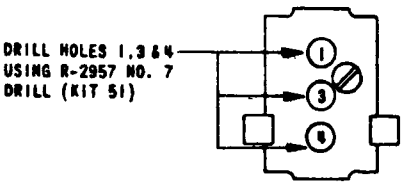
R-2925
FIXTURE (KIT 51)

2 INSERT R-2950 DRILLING JIG



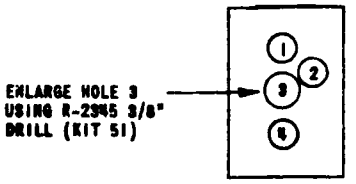
TIGHTEN DET. 4 SCREW IN HOLE 2

3



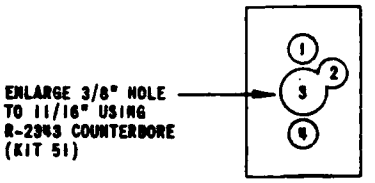
REMOVE CHIPS WITH
VACUUM CLEANER

4 REMOVE R-2950 DRILLING JIG

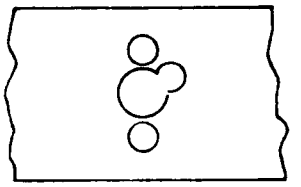


REMOVE CHIPS WITH
VACUUM CLEANER

5



6



DRILLED MOUNTING PLATE
(SEE A DRAWING)

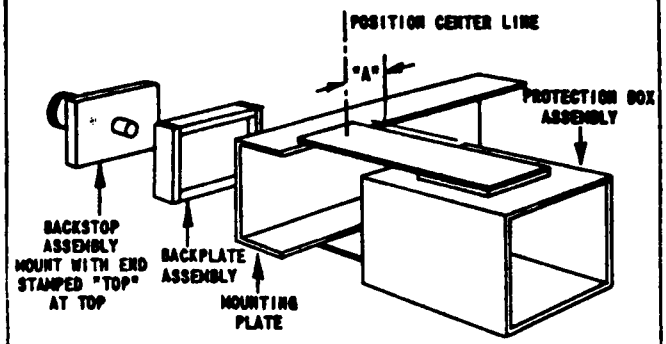
NOTE 1 - WHEN DRILLING 1-3/4" FLAT MTG. PLATES, SEE PARS. 6.1 & 6.1L. HOWEVER, IF A KIT 45 IS ALSO AVAILABLE, THE R-2337 FIXTURE CAN BE USED WITH THE R-2950 JIG IN KIT 51.

TABLE 5. DRILLING OF 1-3/4", 2" FLAT OR 2" CHANNEL MOUNTING PLATES FOR THE FOLLOWING TYPE APPARATUS:

CAPACITORS - 437

BEFORE STARTING THIS OPERATION OBTAIN DRAWING A-750390

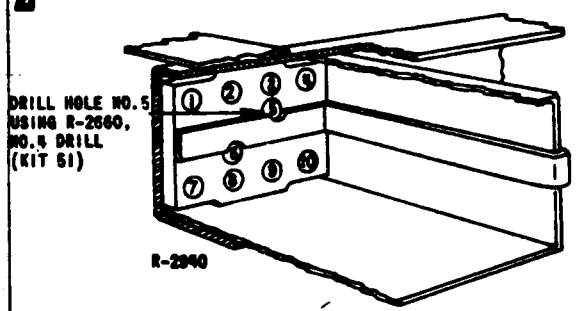
1 FOR 1-3/4" FLAT MTG. PLATES (SEE NOTE 1) AND 2" FLAT & CHANNEL MTG. PLATES



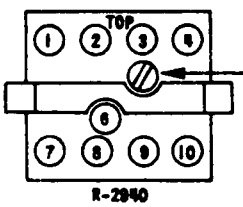
LAYOUT OF HOLES ON A-750390 FIG. NO.	DIMENSION "A"
1 & 27	11/16"
2	5/8"
3 & 28	13/16"
4	3/4"
5 & 8	15/16"
6	7/8"
7 & 29	1"

(SEE NOTE 2)

2 INSERT R-2940 DRILLING JIG



3



4 REFER TO JOB DRAWINGS AND A-750390 FOR PROPER FIGURE NUMBER. THEN PROCEED AS FOLLOWS:

FOR FIGURES 1,2,3 4,27 OR 28	DRILL HOLES 2,3,4,6,8, 9 & 10 USING NO.4 DRILL
FOR FIGURES 5,6,7, 8 OR 29	DRILL HOLES 1,2,3,4,6,7, 8,9 & 10 USING NO.4 DRILL

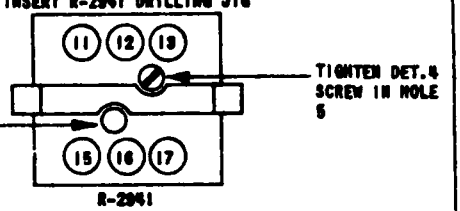
REMOVE CHIPS WITH VACUUM CLEANER, THEN REMOVE R-2940 JIG

5

FOR FIGURES 1,2,3, 4,27 OR 28	ENLARGE HOLES 2,3,4,6,8,9 & 10 USING R-2345 3/8" DRILL (KIT 51)
FOR FIGURES 5,6,7, 8 OR 29	ENLARGE HOLES 1,2,3,4,7, 8,9 & 10 USING R-2345 3/8" DRILL (KIT 51)

REMOVE CHIPS WITH VACUUM CLEANER

6 INSERT R-2961 DRILLING JIG



7 PROCEED ACCORDING TO THE FOLLOWING FIGURE NUMBER

FOR FIGURES 1,2 OR 27	DRILL HOLES 12,13,16 & 17 USING R-2344 END MILL (KIT 51)
FOR FIGURES 3,4,5,6, 7,8,28 OR 29	DRILL HOLES 11,12,13,15, 16 & 17 USING R-2344 END MILL (KIT 51) (SEE NOTE 3)

REMOVE CHIPS WITH VACUUM CLEANER

NOTES:

1. WHEN DRILLING 1-3/4" FLAT MOUNTING PLATES, SEE PARS. 6.1 AND 6.11.
2. SINCE THE R-2939 FIXTURE IS DESIGNED TO ACCOMMODATE RELAYS WHICH MOUNT ON 1-3/4" HORIZONTAL CENTERS, IT MAY BE TOO WIDE TO MOUNT SUFFICIENTLY CLOSE TO ADJACENT APPARATUS WHEN USED FOR RELAYS MOUNTING ON 1-1/8" OR 1-1/2" CENTERS. IN SUCH CASES IT MAY BE NECESSARY TO LOOSEN OR REMOVE THE INTERFERING PIECE OF APPARATUS.
3. FOR FIGURE NUMBERS 7,8 AND 29, SLOTS PRODUCED IN ACCORDANCE WITH THE ABOVE MAY BE FROM 5/64" TO 1/8" TOO SHORT ON THE LEFT END - 5/64" FOR FIGURE NUMBERS 8 AND 29 AND 1/8" FOR FIGURE NUMBER 7. IN THESE CASES REMOVE THE R-2939 FIXTURE AND ENLARGE THE SLOTS AS NESSARY WITH THE R-1486 10" ROUND FILE

   CAUTION: EXTRA PRECAUTIONS SHALL BE TAKEN AS NECESSARY TO PREVENT THE STEEL FILINGS FROM FALLING INTO THE EQUIPMENT.

TABLE 6. DRILLING OF 1-3/4", 2 " FLAT OR 2" CHANNEL MOUNTING PLATES FOR THE FOLLOWING TYPE APPARATUS:

RELAYS - U, UA, UB, Y, 271