

DRILLING HOLES IN MASONRY AND SETTING
EXPANSION SHIELDS AND ANCHORS

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2. GENERAL

2.1 Scope

2.11 This section covers the specific requirements and installing procedures for drilling holes in masonry with the electric impact drill, carbide tipped drills driven by a 1/2" electric drill, and with star drills and hammer. It also includes information for installing expansion shields and anchors.

3. INSTALLING EQUIPMENT

3.1 Floor Drilling

3.11 The R-3438 Electric Impact Drill, contained in Kit 66, will normally be provided only for jobs requiring a substantial number of holes. The kit contains 5/8" bits for setting expansion shields in the floor on standard installations. A 7/8" bit can be ordered for drilling of floors on hardened installations or where battery supports are installed. (Operating instructions for the R-3438 tool are contained inside the Kit 66 case).

CAUTION: Do not attempt to drill through reinforcing rods with the R-3438 Electric Impact Drill. When the special percussion type drill bit hits a reinforcing rod for any period of time, the carbide tip will break off. The presence of reinforcing rod can be detected by binding of the drill and an accompanying squealing noise. Inspection of the bit will ordinarily show a very smooth mark where the bit contacted the rod during rotation. When rods are encountered, use either a twist drill with the R-3032 Electric Drill or move the location of the hole the necessary distance to miss the rod.

3.12 Since Kit 66 has been standardized for limited use, reference to the R-3032 Electric Drill is retained in this section for drilling when Kit 66 may not be available. If hard aggregate is encountered in the floor when using the R-3032 Drill a star drill in hand chuck can be used to remove the obstruction.

3.2 Wall and Column Drilling

3.21 The R-3032 Electric Drill is to be used for drilling in columns and walls. A star drill in hand chuck may be needed in some cases to assist the R-3032 Drill through hard aggregate.

3.3 Ceiling Drilling

3.31 A star drill in hand chuck will normally be used for ceiling drilling.

NOTE: Reference to the R-3123 Electric Hammer (contained in Kit 36) is being removed from this section, however, if the hammer is available and need arises it may be used except as follows:

- (a) Do not drill hollow tile since the hammer tends to crack or shatter tile.

- (b) Do not use the hammer in buildings containing Broad Band Carrier, Radio-Relay or Television equipment, type 216A Vacuum Tubes or any other equipment containing quartz crystals since the vibration of the tool may damage this equipment.

If the hammer is used, the star drills should be checked in the R-2336 Drill Gauge before drilling with them.

3.4 Kits

No. 33 Vacuum Cleaner Kit
No. 66 Masonry Drilling Kit

3.5 Additional Tools

R-3032 Drill, Electric, 1/2"
R-3033 Drill Stand, Motor
R-3029 Drill, Masonry, Carbide Tipped, Spiral Fluted, 7/8" (See Par. 4.45)
R-2983 Drill, Masonry, Carbide Tipped, Worm Fluted, 5/8" (See Par. 4.42)
R-3002 Drill, Masonry, Carbide Tipped, Worm Fluted, 1/2"
R-2837 Set, Setting Tool and Masonry Drill (See Pars. 3.31 and 3.32)
R-3055 Goggles, Safety, All Plastic
R-1831 Tool, Setting, Loxin Bolt

Rent Drill, Electric, 3/4" capacity
Locally or larger (Par. 4.18)

3.51 R-2837 Setting Tool and Masonry Drill Set: With the exception of the R-3032 Electric Drill and R-3033 Stand, needed, when using the 1/2" and 5/8" size drills, the R-2837 set contains all the tools required for drilling 3/8", 1/2" and 5/8" holes in masonry using carbide tipped drills, including the hand tools required for breaking through hard spots in concrete, and for setting the expansion shields shown in Figure 5 and the expansion anchors shown in Figure 9. This set is primarily intended for use on new installations and on large additions of sizes normally requiring the use of a 102 kit

3.52 Smaller jobs, not provided with Masonry Drilling Kit 66 or the R-3032, 1/2" capacity electric drill and R-3033 drill stand, will normally use star drill points in the hand drill chuck.

4. DRILLING HOLES IN MASONRY

4.1 General

CAUTION: Wear R-3055 All Plastic Safety Goggles, when drilling holes in masonry. When drilling in locations such as ceilings or walls above eye level, cover the ventilating holes in the frame of the goggles temporarily with scotch tape. (Listed in Handbook 250, Section 0 as item 542.1).

4.11 Prevent spreading of dust by using a vacuum cleaner where available. Play the hose around the hole being drilled and remove dust from completed hole with the 1/2" rubber tube attachment

in Vacuum Cleaner Kit (see Note). When a cleaner is not available, a wet sponge or rag may be used to collect dust.

NOTE: The R-2927 Vacuum Cleaner attachment, included in Kit 33, which connects to the R-1085 1/2" Rubber Tube will be found helpful in picking up dust from the bottom of a hole.

4.111 When the R-2826 Vacuum Cleaner is being used for picking up cement or concrete dust in connection with masonry drilling operations, the filter cones must be frequently replaced to prevent overheating and a subsequent burnout of the motor since the cement dust tends to clog the filter, preventing proper ventilation of the parts.

4.12 Before drilling floors or walls below the ground level, consult the telephone company as to the probability of drilling into the waterproofing, as authorized in Section 20B2 of Handbook 30, and as to the procedure to be followed if the waterproofing is punctured.

4.121 In other than telephone company buildings, particularly on PBX installations in privately owned buildings, the telephone company should also be consulted as to the location of gas, water, etc. pipes and conduits containing electrical circuits to eliminate possible accident hazard and equipment damage.

4.13 When holes are to be drilled in walls or partitions, tape a small cardboard box just below the hole to prevent any plaster or cement dust from falling on the floor or in equipment.

4.14 When drilling holes in linoleum covered concrete floors, drill before removing the linoleum. With this procedure the center of the hole is more easily marked and a more accurately located and dimensioned hole will result.

4.15 Holes in marble or terrazzo can be made either with carbide tipped masonry drills or with standard twist drills used in an electric drill. Water may be used as a lubricant to protect the edges of the twist drills. Use 11/16" twist drill, R-1163, for 3/8" shields or 9/16" twist drill, R-1150, for 1/4" shields.

4.151 Use a center punch or a star drill in the R-2421 Hand Drill Chuck for breaking the outside layer of glazed surfaces of tile when drilling holes in such material with carbide tipped drills.

CAUTION: Take care not to strike the punch or drill chuck hard enough to crack the tile.

4.16 When expansion shields are installed any length of time prior to the erection of the frames, or when the installation of the shields is delayed after the holes are drilled, the shields or holes should be protected from filling up with dust or dirt by means of masking tape or other suitable material.

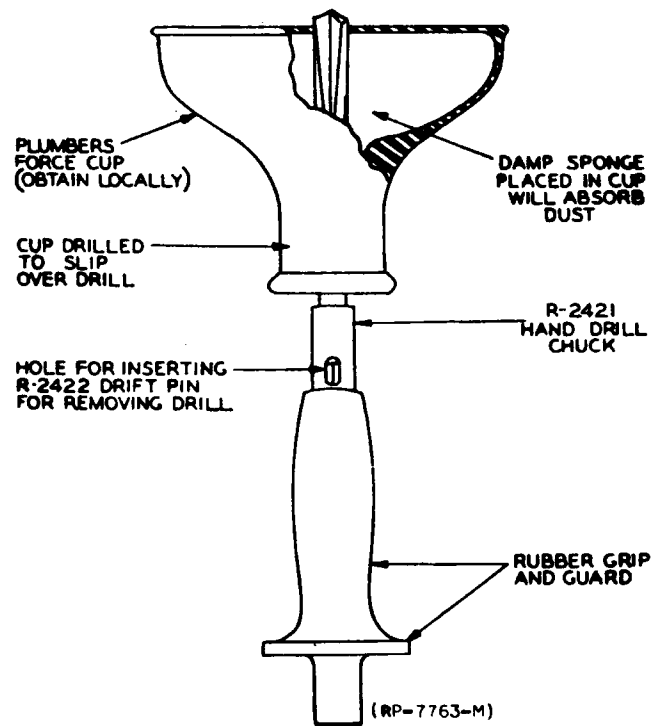


FIG. 1 METHOD OF CATCHING CHIPS WHEN DRILLING CEILINGS (PARS. 4.17, 4.171)

4.17 When drilling ceilings, a plumber's force cup used as shown in Figure 1 will prevent chips and dust from falling on adjacent equipment.

4.171 Although Figure 1 shows a plumber's force cup being used with a star drill, the cup can be used also with wood bits, or the larger sizes of twist drills in hand operated tools.

4.18 When necessary to drill larger than 7/8" diameter holes in masonry, as occasionally required for Loxin shields, 5/8" - 11, for threaded rods in ceilings, or for any other purpose, rent locally a 3/4" or larger, heavy duty portable electric drill. The use of the 1/2" electric drill for such work would quickly burn out the armature of the drill.

NOTE: Ceiling inserts will normally be provided by the telephone company throughout the area in which the equipment is to be installed.

4.2 Depth and Diameter of Holes

4.21 Holes in masonry for expansion shields and anchors shall be of such depth as will permit the shields or anchors to be fully inserted in the hole.

(a) Where plaster is over the surface, the hole shall be deep enough to permit the shield or anchor to be installed approximately flush or underflush with the surface of the concrete. (Not the surface of the plaster).

Outside Diam. and Length of Shield	Stock No.	Diam. and Thread of Stud or Screw	Hole Size		Star	Drills		Notes
						Carbide	Tipped	
			Diam.	Depth		Straight & Spiral Flutes	Worm Flutes	
1/2" x 1-1/4"	P-407254	1/4" - 20	1/2"	1-1/4"	R-1460	R-2708	R-3002	1
5/8" x 1-1/2"	P-428519	3/8" - 16	5/8"	1-1/2"	R-1463	R-2855	R-2983	1 & 3
5/8" x 2"	P-428486	3/8" - 16	5/8"	2"	R-1463	R-2855	R-2983	1, 2 & 3
7/8" x 2-1/2"	P-40B416	1/2" - 13	7/8"	2-1/2"	-	R-3029	-	1, 2 & 4
1" x 2-1/2"	P-409044	5/8" - 11	1"	2-1/2"	Purchase	1" Drill	Locally	
1" x 3"	P-426603	5/8" - 11	1"	3"	Purchase	1" Drill	Locally	2

NOTE 1: The details used with expansion shields for fastening equipment to the floor are illustrated in Sections 17 (Earthquake Protection), 19A and 30.

NOTE 2: The P-428486, P-40B416 and P-426603 shields are specified for earthquake areas.

NOTE 3: The 7/8" Drill is to be used only to enlarge the 1/2" Hole which must be drilled first.

FIG. 2 TABLE OF EXPANSION SHIELDS AND CORRESPONDING DRILLS
(PARS. 3.31 AND 4.23)

(b) The diameter of the holes shall be such that, when expanded, the shields or anchors will adequately support the load intended.

(c) It is advisable to wrap several layers of tape around the shanks of star or carbide tipped masonry drills to serve as a guide or marker to indicate the depth of the hole being drilled.

4.22 When using the R-2824 setting tool for expanding shields in linoleum covered surfaces, the top of the shield may be somewhat above the surface of the concrete depending upon the thickness of the linoleum.

4.23 The diameters of the carbide tipped masonry drills furnished in the R-2837 set are such as will normally provide the correct size holes for the proper expansion of shields and Ackerman-Johnson anchors. See Figure 2 for drill sizes and depth of holes required for expansion shields.

4.24 When expansion shields cannot be inserted in holes without tapping with a hammer or similar tool, or they fit so loose that the shields cannot be properly expanded, it is a good indication that the drills used in making the holes were either under or oversize.

4.3 Using Carbide Tipped Masonry Drills

4.31 A sufficient number of carbide tipped drills in the 3/8", 1/2" and 5/8" sizes are furnished in the R-2837 set to provide for drilling all the holes on an average installation. When drills become dull, new drills should be requisitioned from Installation Stockkeeping, and the old drills returned for reconditioning rather than attempting to sharpen the drills on the job. It is recognized that in some cases, where the aggregate, pebbles, etc., in the concrete is exceptionally hard, the use of star drill may be advisable. However, with properly conditioned carbide tipped drills, the number of cases where a star drill is required will be kept to a minimum.

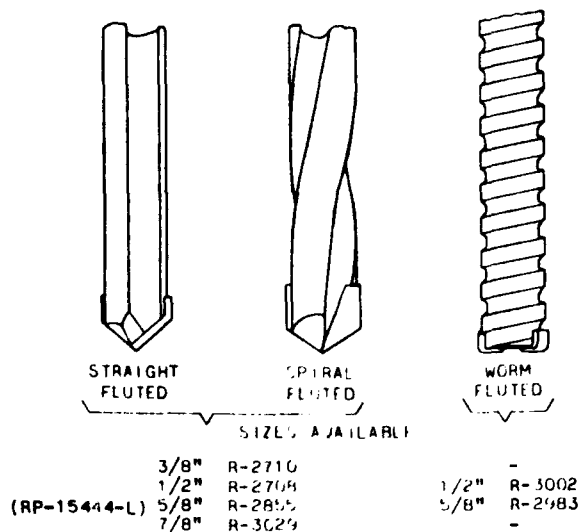


FIG. 3 TYPES OF CARBIDE TIPPED MASONRY DRILLS (PAR. 4.32)

4.32 There are three types of carbide tipped drills available as illustrated in Figure 3. The "straight" and "spiral" fluted drills require more pressure than the "worm fluted" drills and are normally used with the electric drill mounted in a drill stand. The "worm fluted" drills are intended for use only where it is impracticable to use a drill stand for obtaining high pressure, such as where drilling in concrete walls and where the use of impact tools is prohibited.

4.321 When using worm fluted drills it will be necessary to drill a centering hole or make a slight impression in the surface to be drilled to prevent the worm fluted drill from "walking". Use a standard straight or spiral fluted drill for this purpose.

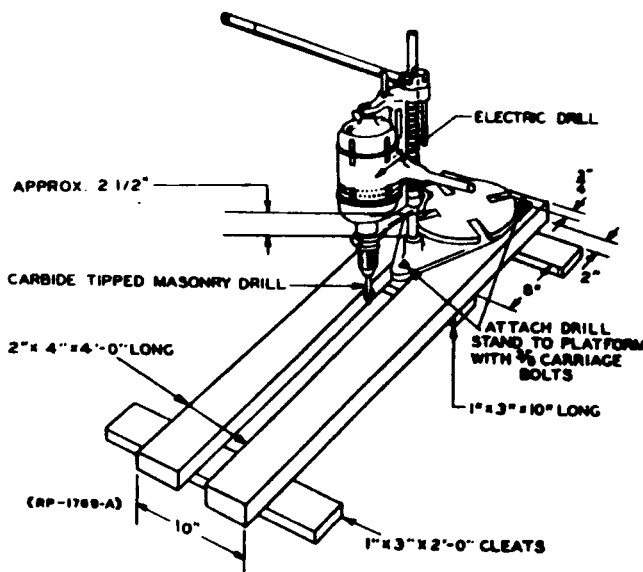


FIG. 4 USE OF DRILL STAND FOR DRILLING CONCRETE FLOORS USING CARBIDE TIPPED DRILLS (PAR. 4.34)

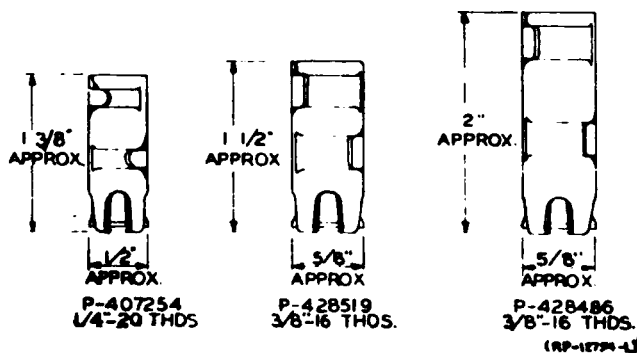


FIG. 5 TYPES OF SHIELDS WHICH CAN BE SET WITH THE R-2824 TOOL (PARS. 3.31, 5.21)

4.33 When using carbide tipped masonry drills in conjunction with a 1/2 inch electric drill and drill stand, the following points should be observed.

- Considerable pressure (as much as possible without stalling the motor) is to be applied. Attempting to drill without sufficient pressure simply dulls the cutting edges without doing any appreciable cutting.
- No water, oil or other liquid is required on the drill.
- Never let the drill point dull beyond a regrind take-off of .005 inch.
- If the drill strikes a pebble or other hard aggregate, use a star drill to break the hard surface of such impediments. This will speed up drilling and preserve the accuracy of the hole.

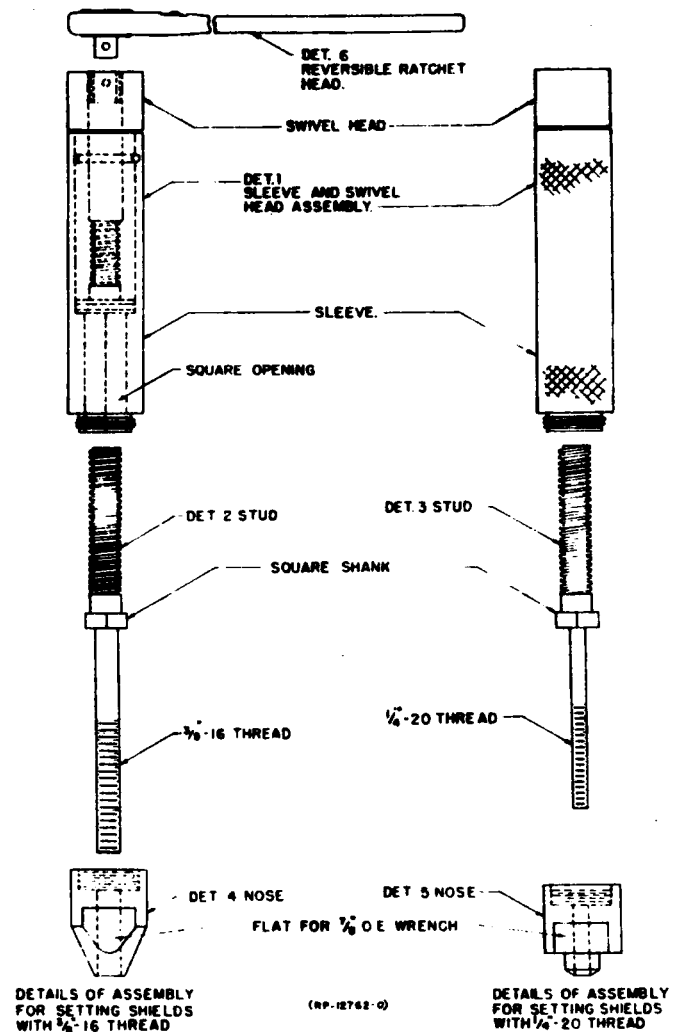
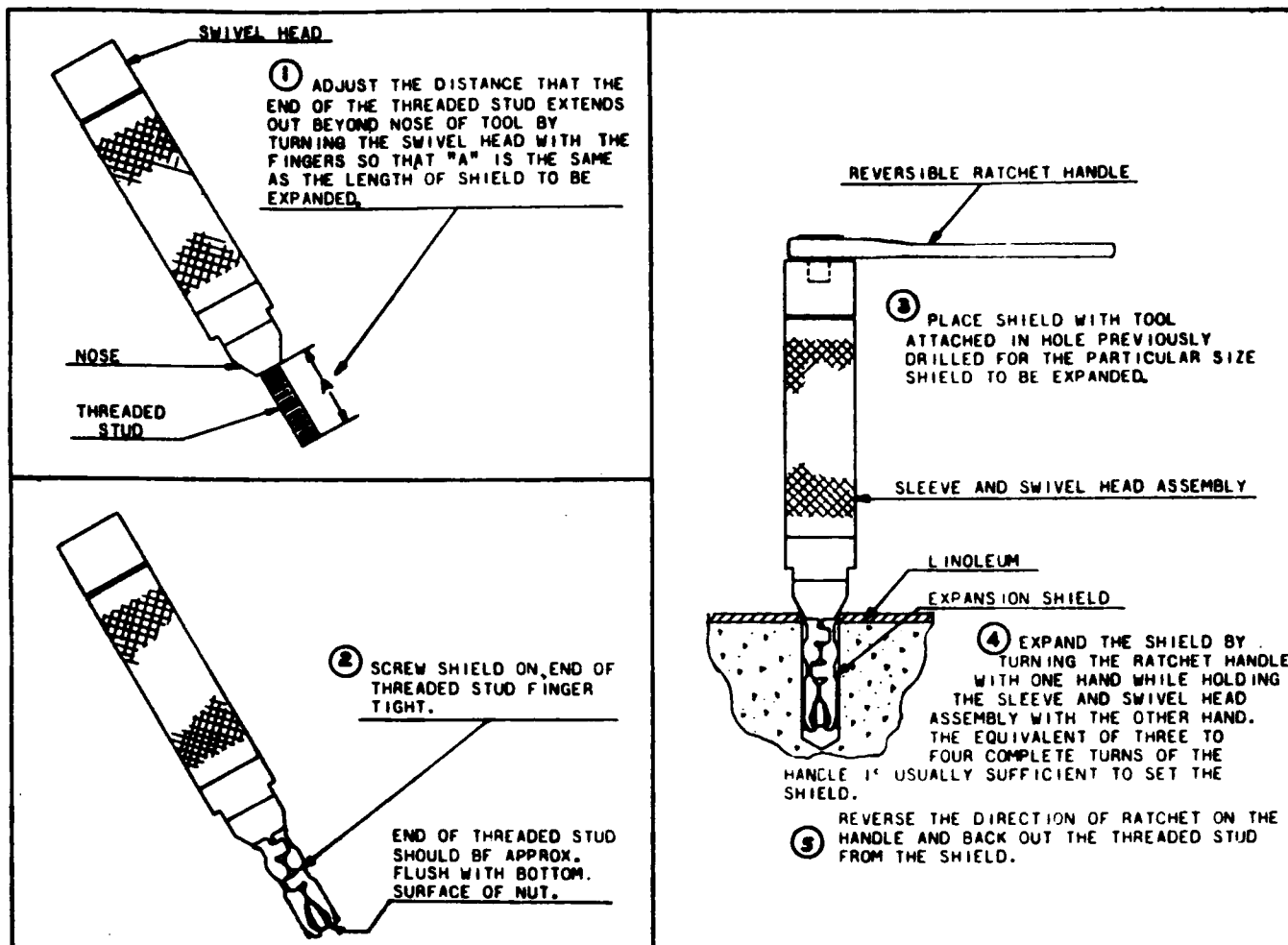


FIG. 6 DETAILS OF R-2824 TOOL (PARS. 5.21, 5.2111)

4.34 A convenient method of applying pressure to the electric drill is shown in Figure 4. The drill stand is mounted on a platform and two men are used for the drilling operation, one to stand on the base of the stand to aid in holding the assembly down, and the other to stand on the platform and operate the lever.

4.35 For drilling 7/8 inch diameter holes first drill a 1/2 inch or 5/8 inch diameter hole using the carbide tipped drills furnished in the R-2837 set, then enlarge the hole to 7/8 inch using the R-3029 7/8 inch spiral fluted masonry drill obtained from Installation Stockkeeping.

NOTE: 7/8 inch holes will be required for 3/8 inch - 16 toggle bolts and P-40B416, 1/2 inch - 13 expansion shields. The P-40B416 expansion shields are used in earthquake and disaster protection areas. The 3/8 inch - 16 toggle bolts are normally used for securing heavy equipment to hollow tile or hollow cinder block walls.



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FIG. 7 USE OF R-2824 TOOL FOR SETTING EXPANSION SHIELDS
(PAR. 5.2121)

5. SETTING EXPANSION SHIELDS AND ANCHORS

5.1 Types and Sizes

5.11 The types and sizes of expansion shields and anchors used shall be in accordance with information shown on drawings furnished the job or contained in the job specifications.

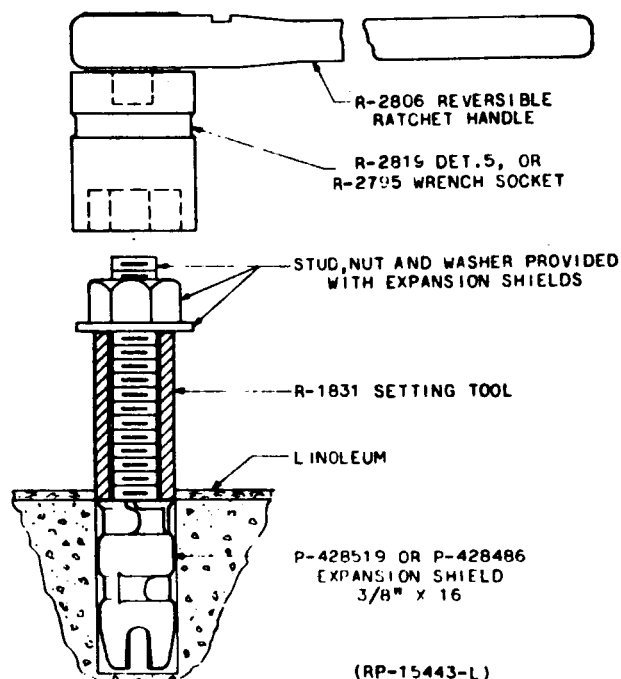
5.12 The types and sizes of expansion shields and anchors normally furnished and for which drilling and setting tools are available and method information provided in this section, are shown in Figures 2 and 9.

5.13 Where drawings specify shields or anchors other than those mentioned above and for which proper size drills and expanding tools are not provided, the tools should be purchased locally. In such cases a J.I.M., listing the drawing on which the

items are specified, should be forwarded to the Engineer of Installation for record purposes.

5.2 Expansion Shields

NOTE: Occasionally spots may be found in cinder filled floors where there is only a comparatively thin shell of concrete over the cinders. Since a pulling rather than a driving action is required to expand shields, these shields can be expanded and will hold satisfactorily in cinder filled floors even though the thickness of the concrete is much less than the length of the shield. When using the R-2824 setting tool, the shield is attached to the tool before it is inserted in the floor. This eliminates the possibility of the shield dropping through the hole into the cinder fill as may occur when using certain other methods of expanding the shield.



NOTE: THE SHIELD MAY TEND TO TURN IF THE HOLE IS SLIGHTLY OVERSIZE. IN SUCH CASES EXERT SIDE PRESSURE ON THE STUD TO CAUSE THE SHIELD TO BIND IN THE HOLE.

FIG. 8 USE OF R-1831 SETTING TOOL (PAR. 5.221)

5.21 Using R-2824 Setting Tool

NOTE: The R-2824 tool is provided for expanding or setting the expansion shields shown in Figure 5. Two removable threaded studs and associated nose details are provided with the tool, one set for use with shields threaded $1/4"$ - 20, the other for the shields threaded $3/8"$ - 16. See Figure 6.

5.211 Changing Stud and Nose Details of R-2824 Tool

5.2111 The assembly of the R-2824 tool for setting expansion shields threaded either $1/4"$ - 20 or $3/8"$ - 16 is shown in Figure 6. When changing the stud and nose details, as is required for the different thread size shields, proceed as follows:

(a) Hold the sleeve and swivel head assembly in one hand and, using a $7/8"$ open end wrench, remove the nose piece of the tool.

(b) Turn the swivel head of the tool by hand until the square shank on the threaded stud is clear of the sleeve. Then turn the stud with one hand while holding the sleeve and swivel head assembly with the other hand and remove the stud.

(c) Assemble the other threaded stud and nose piece following the reverse order outlined above. Be sure that the square shank on the stud is in line with the square opening in the sleeve before drawing the stud up into the sleeve and swivel head assembly.

(d) Exercise care not to cross the threads when assembling the nose piece and be sure that the nose is tight against the sleeve, otherwise it will tend to back off when removing the tool after expanding a shield. Use the $7/8"$ open end wrench for tightening the nose piece.

5.212 Setting the Shields

5.2121 Adjust the length of the threaded stud beyond the nose of the tool to agree with the length of the shield to be set, and proceed as outlined in Figure 7.

5.2122 Do not expand the shield more than actually needed. Normally the equivalent of three to four complete turns of the ratchet handle is sufficient. It is not necessary to expand the shield to the point where the knurled sleeve and swivel head assembly tends to turn in the hand.

5.2123 It is permissible to use an Electric Impact Wrench such as the R-3113, and the $3/8"$ male x $1/2"$ female adapter that is included with the R-2824 to set loxins. Do not expand the shield more than actually needed.

5.22 Using the R-1831 Setting Tool

5.221 The tool is placed over the stud, between the washer and the shield, and the shield expanded by turning the nut on the stud several turns. See Figure 8.

5.3 Expansive Anchors

5.31 The expansive anchors shown in Figure 9 are those generally used for fastening light weight apparatus such as conduit fastenings, clocks, alarm equipment, etc., to solid masonry walls.

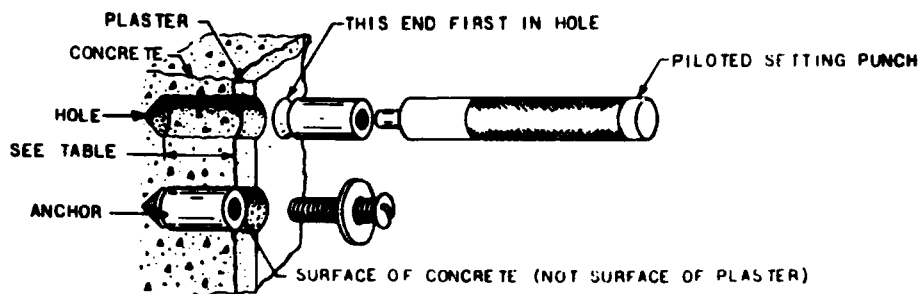
5.32 Information relative to the installation of expansive anchors is shown in Figure 9.

5.4 Determining Properly Set Shield or Anchor

5.41 While the use of the R-2824 setting tool will normally insure a properly expanded shield, the results obtained when using other methods may not be as positive. If there is any question as to whether either a shield or anchor has been properly expanded, particularly in walls and ceilings, test it as follows:

5.42 Place a bushing or several washers (with holes larger than the diameter of the shield or anchor) over the shield or anchor and insert a screw or a bolt (or stud with nut attached), into the threaded nut.

5.43 Tighten the screw, nut or bolt with a suitable wrench or screwdriver. If the shield or anchor can be easily withdrawn from the hole as the parts are tightened it has not been securely set and should be further expanded.



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TYPE	STOCK NO.	THREAD SIZE	HOLE SIZE		DRILLS			SETTING PUNCH
			DIA.	DEPTH	STAR	CARBIDE TIPPED		
						STRAIGHT AND SPIRAL FLUTED	WORM FLUTED	
ACKERMAN JOHNSON	P-400162	.190"-32	3/8"	5/8" TO 3/4"	R-2534	R-2710		R-2535
	P-400164	1/4"-20	1/2"	13/16" TC 15/16"	R-1460	R-2708	R-3002	R-2752
STAR "TAMP IN"	4010	.190"-24	3/8"	5/8" TO 3/4"	R-2534	R-2710		R-2535
	4012	.216"-24	1/2"	7/8" TO 1"	R-1460	R-2708	R-3002	R-2752
	4015	1/4"-20	1/2"	7/8" TO 1"	R-1460	R-2708	R-3002	R-2752

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NOTES: 1. STAR "TAMP IN" ANCHORS HAVE STAMPING ON BOTTOM TO INDICATE THREAD SIZE - "10" INDICATING .190"-24, "12" INDICATING .216"-24 AND "15" INDICATING 1/4"-20.

2. WRAP TAPE ON SHANK OF DRILL AS DRILLING DEPTH GAUGE.

FIG. 9 INSTALLING ACKERMAN-JOHNSON AND STAR "TAMPIN" ANCHORS (PARS. 3.51, 5.31)

5.5 Removing Bolts from Concrete Floors

5.51 The standard 3/8" bolt can be removed from a concrete floor as follows:

5.511 Drive a 1/2" cold chisel between the shield and the concrete on four sides. Apply the cane shaped pinch bar, R-2384, to the bolt threads or under a nut on the bolt and pry the bolt out of the floor.

5.6 Tightening Nuts, Bolts and Studs Associated With Expansion Shields, Anchors and Toggle Bolts

5.61 The below tightening (loading) torque of wall and ceiling Loxin inserts, as covered per ED-1A210-11, shall apply to outside contractors as well as Western Electric installers.

5.62 The setting torque requirements and tightening (loading) torque requirements for nuts/bolts associated with Loxin Shields in concrete see as follows:

Diameter of bolt with which Loxin Shield is used	Setting Torque (Ft.-Lb.)	Nut/Bolt Tightening/Loading Torque (Ft.-Lb.)
5/8"	75	75
1/2"	50	50
3/8"	25	25
1/4"	10	10

5.63 The preceding requirements apply to wall and ceiling inserts only. They may be applied (but are not mandatory) to any floor secured "Loxin". However, they shall be superseded by systems drawings where applicable.

5.64 The R-3687 or the R-4235 Torque Wrench may be used to meet these torque requirements.

5.65 Never hoist from a Loxin insert. The only concrete inserts that should be used to hoist from, are concrete cast-in-place type.

5.66 This paragraph when used in conjunction with Loxin in concrete, shall apply only to floor inserts and not ceiling or wall inserts. "Nuts, bolts and studs associated with expansion shields, anchors and toggle bolts should be drawn up snug. Excessive tightening may strip the threads in the shields, as well as damage the buildings."

5.67 Excessive tightening shall be defined as any torque value exceeding more than 30% of the recommended torque given in paragraph 5.62.

5.68 The 500 lbs. maximum safe load capacity for 5/8" Loxin's as outlined in Section 10 and 1A of Handbook 30 is still applicable.

6. VERIFICATION ITEMS

6.1 The numbers in parentheses refer to the associated paragraphs in this section.

(a) Correct type and thread size of shield or anchor used in locations specified. (5.11)

(b) Tops of shields or anchors approximately flush or slightly underflush with surface of floor, wall or ceiling. (Applies to the surface of the concrete and not the plaster in the case of plaster covered surfaces) (4.21 and Figure 9).

(c) Shields or anchors properly expanded. (4.21, 5.41, 5.43).

→ Arrowed lines indicate new or changed information.

[Vertical line at side of paragraphs indicates requirements.

Assistant Manager
Common Installation Engineering

Reason for Reissue:

Revise paragraph 4.12
Add paragraph 5.2123
Include paragraphs 5.61, 5.62,
5.63, 5.64, 5.65, 5.66, 5.67,
and 5.68 which were formerly
in Section TI-9 dated 10-20-69.