NOTICE OF CANCELLATION

INCH-POUND

FF-S-325
NOTICE 4
8 August 1995
SUPERSEDING
FF-S-325
NOTICE 3
5 August 1994

FEDERAL SPECIFICATION

SHIELD, EXPANSION; NAIL EXPANSION, AND NAIL, DRIVE SCREW (DEVICES, ANCHORING, MASONRY)

Federal Specification FF-S-325, dated 10 September 1957, and Amendment 3, dated 16 July 1965, are hereby canceled. Future acquisitions may refer to Commercial Item descriptions A-A-1922A, A-A-1923A, A-A-1924, A-A-1925, A-A-55614 and A-A-55615.

FF-S-325	CID
Group I	A-A-1922A
Group II	A-A-1923A
Group III	A-A-1924A
Group IV	A-A-55615
Group V	A-A-1925A
Group VIII	A-A-55614

Custodians:
Army - AR
Navy - YD
Air Force - 99

Preparing Activity
DLA-IS

(Project Number 5340-2283)

AMSC N/A

FSC 5340

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

NOTICE
OF REINSTATEMENT

INCH-POUND

FF-S-325
NOTICE 3
5 August 1994
SUPERSEDING
FF-S-325
NOTICE 2
22 February 1994
NOTE: N2 is unavailable

FEDERAL SPECIFICATION

SHIELD, EXPANSION; NAIL, EXPANSION; AND NAIL, DRIVE SCREW (DEVICES, ANCHORING, MASONRY)

FF-S-325, dated 10 September 1957, and Amendment 3, dated 16 July 1965, are hereby reinstated and may be used for acquisition.

(The referenced federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Deck, Bldg 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

Custodian:
Army - AR
Navy - YD
Air Force - 99

Preparing Activity
DLA-IS

(Project No. 5340-2208)

AMSC N/A

FSC 5340

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

NOTICE OF
VALIDATION

FF-S-325
NOTICE 1
9 April 1986

FEDERAL SPECIFICATION

SHIELD, EXPANSION; NAIL, EXPANSION; AND NAIL, DRIVE SCREW (DEVICES, ANCHORING, MASONRY)

FF-S-325 has been reviewed and determined to be valid for use in acquisition.

Custodians:
Army - AR
Navy - YD
Air Force - 99

Review activities:
Army - EA, MI
DLA - IS

Preparing activity:
Army - AR

FSC 5340

AMSC N/A

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

INTERIM AMENDMENT-3
TO
FEDERAL SPECIFICATION

SHIELD, EXPANSION; NAIL EXPANSION; AND NAIL, DRIVE SCREW (DEVICES, ANCHORING, MASONRY)

This Interim Amendment was developed by the General Services Administration, Federal Supply Service, Washington, D.C. 20406, based upon currently available technical information. It is recommended that Federal agencies use it in procurement and forward recommendations for changes to the preparing activity at the address shown above.

The General Services Administration has authorized Federal agencies to use this Interim Amendment as a valid exception to Federal Specification FF-S-325, dated September 10, 1957.

Page 1, paragraph 1.2.1, under "GROUP II", revise Type 3 to read:

"Type 3 - Tubular expansion shield anchors.

Class 1 - Single slit shield anchors with internally threaded cone expanders. (fig. 13).
Class 2 - Multiple slit shield anchors with internally threaded cone expanders. (fig. 14).
Class 3 - Multiple slit shield anchors with cone expander integral with stud. (table IX.A).

Pages 1 and 2, paragraph 1.2.1: At the end of "GROUP II" add the following:

Type 4 - Externally threaded wedge expansion bolt anchors

Class 1 - Externally threaded expansion bolt anchors (split ring or separate wedge pairs) (fig. 14A).

Class 2 - Externally threaded wedge expansion bolt anchor (fig. 14B).

Type 5 - Externally threaded cam expansion bolt anchor (fig. 14C).

Under "GROUP V, type 2" add:

Class 4 - Nylon nail anchors (fig. 25A).

At the end of "GROUP VII", add:

"GROUP VIII - Anchors, expansion (non-drilling) (see 3.2.8).

Type 1 - Expansion anchors, internally threaded, with external slits and single cone expanders (fig. 28).
Type 2 - Expansion anchors, externally threaded, with external slits and single cone expander (fig. 29).

Page 2, paragraph 1.3, after the word "inclusive" add "and XVIII.

Page 2, paragraph 2.1, under "MILITARY SPECIFICATIONS:" add:

"MIL-P-20693 - Plastic Molding Material, Polyamide Nylon, Rigid

Page 10, paragraph 3.2.2.3.1 Construction: Substitute the following paragraph heading for "Construction" :

"Classes 1 and 2 single slit and multiple slit shield anchors with internally threaded cone expanders."

Page 10: Revise paragraph numbers as follows: Change 3.2.2.3.2 to read 3.2.2.3.1.2.

Page 11: Revise paragraph numbers as follows:

Change 3.2.2.3.3 to read 3.2.2.3.1.3
Change 3.2.2.3.4 to read 3.2.2.3.1.4
Change 3.2.2.3.5 to read 3.2.2.3.1.5
Change 3.2.2.3.6 to read 3.2.2.3.1.6

Page 11, paragraphs 3.2.2.3.1.5, 3.2.2.3.1.6 (formerly 3.2.2.3.5, 3.2.2.3.6): Add the following: "classes 1 and 2" before "tubular" in these two paragraphs.

Page 11, add the following after paragraph 3.2.2.3.1.6 (formerly 3.2.2.3.6) and table IX:

"3.2.2.3.2 Class 3 multiple slit shield anchor with cone expander integral with the stud. This anchor is shown in table IX.A. As the nut is tightened, the tapered end of the externally threaded member causes the end of the sleeve to expand thus wedging the anchor in the drilled hole. The dimensional requirements are shown in table IX.A. The anchors shall withstand the pulling proof test loads specified in table IX.B, when set in concrete (4.3.2), in accordance with the recommendations of the manufacturer."

TABLE IX.A - Group II, type - ass 3 anchor dimensions.

		PROJECTING SLEEVE			PROJECTING THREAD	
Anchor size, A (Min. hole diameter required)	Thread nominal size and threads per inch UNC series	Anchor length, B	Min hole depth	For fastening material thicknesses up to	Anchor length, B (min. hole depth)	Thread projection above sleeve, C
in.		in.	in.	in.	in.	in.
.25(1/4)	10-24 or .190-24	1.375 2.25	1 1	.375 1.25	1.375	1
.3125(5/16)	1/4-20 or .250-20	1.5 2.5	1 1	.5 1.5	1.5	1
.375(3/8)	5/16-18 or .3125-18	1.875 3	1.25 1.25	.625 1.75	1.875	1
.5(1/2)	3/8-16 or .375-16	2.25 3	1.5 1.5	.75 1.5	2.25	1
.625(5/8)	1/2-13 or .500-13	2.25 4 6	2 2 2	.25 2 4	2	2
.75(3/4)	5/8-11 or .625-11	2.5 4 5.75	2 2 2	.5 2 3.75		

Other head styles than shown above are acceptable.

FF-S-325

TABLE IX.B.- Group II, type 3, class 3 anchor; proof test loads and installation information

Anchor size and drill diameter	Min. anchor depth for max. holding power	Min. edge distance and anchor spacing	Max. hole diameter for maximum holding power	Proof[a] test load
in.	in.	in.	in.	lbs
.25(1/4)	1	1.25	.287	900
.3125(5/16)	1	1.75	.349	1200
.375(3/8)	1.25	2.5	.412	1600
.5(1/2)	1.5	4	.565	2800
.625(5/8)	2	6	.690	4200
.75(3/4)	2	8	.815	5600

[a] Recommended safe working load is one-fourth proof test load.

Page 11, add the following paragraphs (3.2.2.4 and 3.2.2.5), figures and tables:

"3.2.2.4 Type 4, externally threaded expansion bolt anchors and externally threaded wedge expansion bolt anchor. (Fig. 14A and 14B). Unless otherwise specified (see 6.2), the material shall be at the option of the manufacturer. The anchors shall withstand the pulling proof test loads as specified in table IX.C, when set in concrete (see 4.3.2), in accordance with the recommendations of the manufacturer."

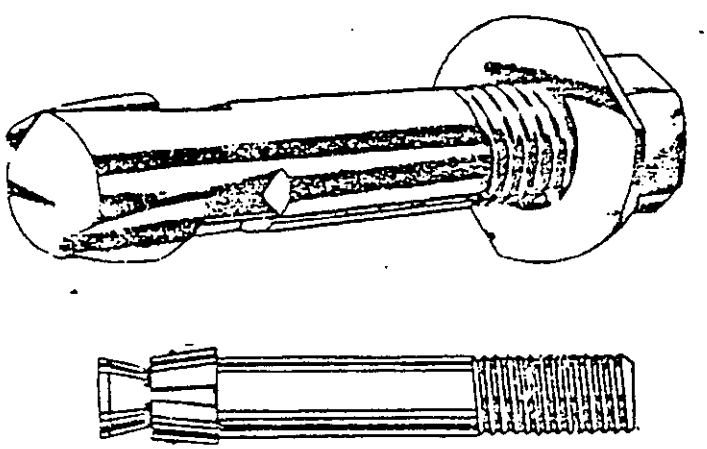


Fig. 14A, Group II, type 4, class 1 (design optional) externally threaded expansion bolt anchor (split ring or separate wedge pairs).

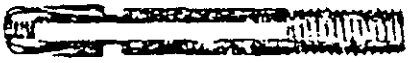


Figure 14B - Group II, type 4, class 2, externally threaded wedge expansion bolt anchor

Table IX.C - Group II, type 4 (classes 1 and 2) anchor

Shank diameter	Nominal hole dimensions			Recommended minimum imbedment	Anchor length	Tensile[a] proof test load
		Depth (class 1) (fig. 14A)	Depth (class 2) (fig. 14B)			
in.	in.	in.	in.	in.	in.	lbs.
0.25(1/4)	0.25	1.125 1.25 1.375	1.375 1.5 1.625	1. 1.125 1.25	1.25 1.75 2.75,3	1350 1450 1500
.3125(5/16)	.3125	1.125 1.25 1.375	1.375 1.5 1.625	1. 1.25 1.25	1.5 2. 3.	1800 1900 1900
.375(3/8)	.375	1.375 1.5 1.75	1.625 1.75 2.	1.125 1.25 1.5	1.5 2. 2.75,3.5,5,6	3000 3200 3689
.5(1/2)	.5	1.75 2.25 2.5	2.125 2.625 2.875	1.5 2. 2.25	2. 2.75 3.5 ,5, 6, 7	3700 4200 5065
.625(5/8)	.625	2.375 3.375 3.875	2.625 3.625 4.125	2. 3. 3.5	3.5 4.5 5, 5.5, 6, 7	6940 9560 10192
.75(3/4)	.75	3.375 3.875	3.75 4.25	3. 3.5	4. 5, 6, 7, 10	10900 17194
.875(7/8)	.875	5.	5.25	4.5	6.	19000
1.	1.	6.	6.5	5.5	8, 10, 12	22500
1.25	1.25	7.5	9.	7.	12.	37000
1.5	1.5	8.5	10.	8.	12.	52000

a/ Recommended safe working load is one-fourth proof test load.

"3.2.2.5 Type 5, (fig. 14C), externally threaded cam expansion bolt anchors. Unless otherwise specified (see 6.2), the material shall be at the option of the manufacturer. The anchor shall withstand the pulling proof test loads in accordance with table IX.D, when set in concrete (see 4.3.2)

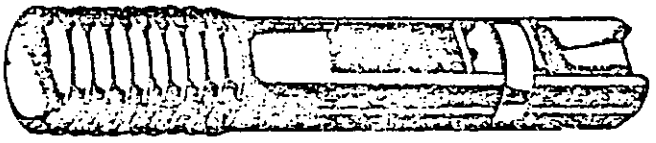


Figure 14C - Externally threaded cam expansion bolt anchor

Table IX.D - Type 5 anchors

Shank diameter	Hole diameter	Recommended minimum imbedment	anchor length	Tensile proof test load a/
in.	in.	in.	in.	lbs.
25 (1/4)	0.25	2.00	2.25	1,200
0.375 (3/8)	0.375	2.50	3.00 4.50	1,890
0.500 (1/2)	0.500	3.00	3.50 5.00	3,720
0.625 (5/8)	0.625	3.750	4.50 6.00	4,650
0.750 (3/4)	0.750	4.00	5.00 7.00	5,580
1.00	1.00	6.00	8.00 16.00	8,200

a/ Recommended safe working load is one-fourth proof test load.

Page 15, paragraph 3.2.5.2: Delete the fourth sentence and substitute the following:

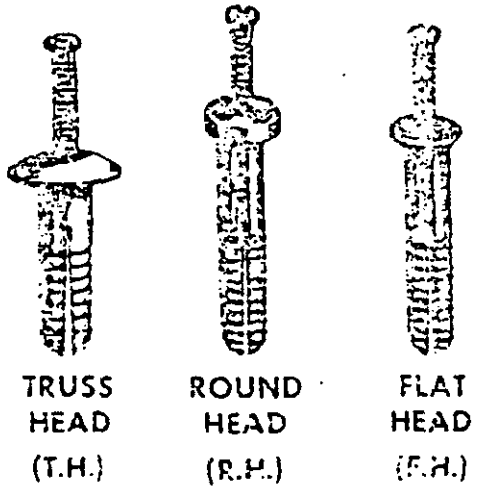
"The anchors shall be either of aluminum, steel, zinc or nylon, as specified (see 6.4)". .

ge 16, add the following paragraphs, figure and table:

"3.2.5.2.8 Class 4, nylon, nail anchors (see fig. 25A and table XIV.A). These anchors shall consist of a nylon anchor body into which a threaded steel nail is driven for anchoring. The anchor body shall be made of composition B, nylon in accordance with MIL-P-20693 or equivalent material. In view of the specialized nature of the threaded nails, they shall be supplied with the anchor body. The threaded nails shall have a slotted pan head, threads with rounded crests, and pinch tapered points.

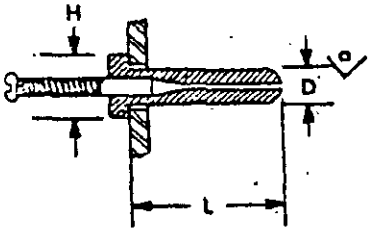
The nails shall be made of No. 1039 steel or equivalent and shall have a hardness of Rockwell C44 to 50. The nails shall be coated with a minimum 1.2 mil. (0.0012 inch) bright zinc coating followed by a chromate conversion coating. (The coating thickness shall be checked on the unthreaded shank.) The nails shall withstand a 200-hour salt spray test in accordance with method 811.1 of Fed. Test Method Std. No. 151."

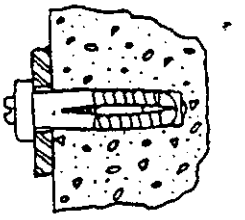
"3.2.5.2.8.1 The dimensions and head styles for nylon anchors shall be as specified in table XIV.A. When set in concrete (see 4.3.2), in accordance with the recommendations of the manufacturer, the anchors shall withstand the proof test loads specified in table XIV.A."



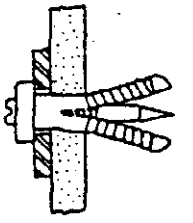
*(Other head styles than shown are acceptable)
FIGURE 25A-Group V, type 2, class 4-nylon, nail anchors

TABLE XIV.A, Group V, type 2, class 4 nylon, nail anchor (fig. 25A)





SOLID MATERIAL INSTALLATION



HOLLOW MATERIAL INSTALLATION

Anchor Body Size		Head Style (See fig 25A)	Head Diameter, H [b]	Tensile proof test load	Tensile proof test load [b]
Diameter, D [a]	Length, L				
in.	in.	in.	in.	lb.	lb.
0.1875(3/16)	1	R.H.	0.375	283	178
.1875	1.5	R.H.	.375	335	193
.1875	1	F.H	.375	283	178
.1875	1.5	F.H.	.375	335	193
.1875	1	T.H.	.5	283	178
.1875	.75	F.H.	.312	283	178
.25	1	R.H.	.4375(7/16)	261	155
.25	1.5	R.H.	.4375	320	188
.25	.75	F.H.	.4375	194	132
.25	1	F.H.	.4375	261	155
.25	1.5	F.H.	.4375	320	188
.25	1	T.H.	.5625(9/16)	261	155
.25	.75	T.H.	.5625	236	130

[a] The "D" dimension is also the size of drill to be used in the installation of the anchor.

[b] Recommended safe working load is one-fourth proof test load.

Page 18, add the following paragraphs, figures and table:

"3.2.8 Group VIII, anchors, expansion (non-drilling) .

3.2.8.1 Construction and material . These internally or externally threaded anchors shall consist of an expansion element and a single cone expander both of carbon or alloy steel at the manufacturer's option.

3.2.8.1.1 Type 1 . Internally threaded tubular expansion anchors shall have an externally slit expansion element and a single cone expander (see fig.28 and table XVIII).

3.2.8.1.2 Type 2 . Externally threaded steel stud bolt anchors shall have an integral externally slit expansion element and a single-cone expander (see fig. 29 and table XVIII).

3.2.8.2 Threads (see 3.1.2.1) . Type 1 expansion anchor threads shall end in a manner which will prevent the machine bolt from coming in contact with the cone expander at any time.

3.2.8.3 Dimensional requirements . The dimensions of the non-drilling expansion anchors shall conform to those in table XVIII for bolt sizes.

3.2.8.4 Holding power requirements . The non-drilling expansion anchors shall withstand pulling proof test loads, as specified in table XVIII when set in concrete in accordance with the manufacturer's recommendations (see 4.3.2)."

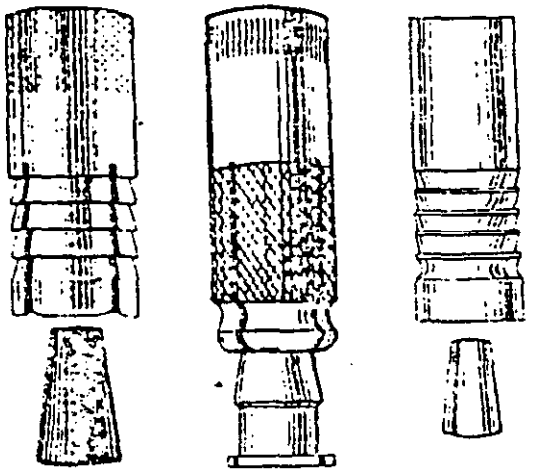


Figure 28 - Group VIII, Type 1, Expansion anchors, internally threaded

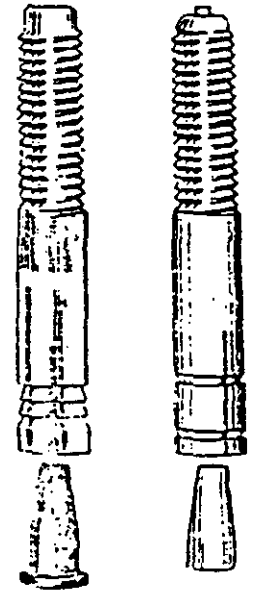


Figure 29 - Group VIII, Type 2 Expansion anchors, externally threaded

Table XVIII - Group VIII, Types 1 and 2
(Figs. 28 and 29)

Type 1 Anchors					Type 2 Anchors				
Bolt Size	Outside Diameter (Minimum)	Height (Minimum)	Minimum Depth of Thread	Proof Test Load[1]	Outside Diameter (Minimum)	Stud Height Above Concrete	Thread Length	Imbedment in Concrete (Minimum)	Proof Test Load[a]
Diameter	Inches	Inches	Inches	Pounds	Inches	Inches	Inches	Inches	Pounds
1/4	7/16	1 1/8	3/8	1,600	1/4	At the option of the manufacturer	At the option of the manufacturer	1	1,200
5/16	15/32	1 1/8	3/8	1,800	5/16			1 1/8	1,800
3/8	9/16	1 7/16	7/16	2,500	3/8			1 1/4	2,200
1/2	11/16	1 15/16	11/16	3,700	1/2			1 1/2	3,500
5/8	27/32	2 3/4	7/8	5,100	5/8			2	4,500
3/4	1	3	1 1/8	7,100	3/4			2 1/2	6,000

[a] Recommended safe working load is one-fourth proof test load.

Page 19, paragraph 4.3.2, first sentence: Delete period and add ", and XVIII"

Page 20, paragraph 5.3.1.1: Delete and substitute the following:

"5.3.1.1 Level A. The packaging of anchor devices shall be in setup boxes conforming to type I in PPP-B-676 or in folding cartons conforming to style III, type B, class a, in PPP-B-566.

Page 20, Delete paragraph 5.3.1.2 and add new paragraph as follows:

"5.3.1.2 Level B. Anchor devices shall be packaged in accordance with 5.3.1.1. Expansion shields made of steel subject to rust shall be coated with a commercial type antirust compound."

Page 20, add new paragraph 5.3.1.3 as follows:

"5.3.1.3 Level C. (domestic shipments (immediate use)). Commercial packaging is acceptable."

Page 20, paragraph 5.4.1: Delete and substitute the following: "5.4.1 Level A. "

Page 20, delete paragraph 5.4.2 and substitute new paragraph as follows:

"5.4.2 Level B. Unit packages shall be packed in a fiberboard box conforming to PPP-B-636, class-domestic."

Page 20, add new paragraph 5.4.3 as follows:

"5.4.3 Level C. (domestic shipments (immediate use)). The packaged anchoring devices shall be packed for shipment in a manner to permit their acceptance by common carriers for transportation at the lowest applicable rate by the carrier, and to afford maximum protection from normal hazards of transportation."

Page 20, delete paragraphs 5.5.1, 5.5.2 and 5.5.2.1 and substitute the following new paragraphs:

"5.5.1 Civil agencies. In addition to markings required by the contract or order, the interior packages and shipping containers shall be marked in accordance with Fed. Std. No. 123.

"5.5.2 Military activities. In addition to markings required by the contract or order, the interior packages and shipping containers shall be marked in accordance with MIL-STD-129."

Page 21, paragraph 6.1 - Add the following at the end of paragraph:

"Nylon nail anchors however, are included."

Page 22, paragraph 6.4: Change to read as follows:

"6.4 Ordering data. Purchasers should exercise any desired options offered herein and procurement documents should specify the following:

(a) Title, number, and date of this specification.
(b) Name of the anchoring device.
(c) Group, type, style (see 1.2 and 1.2.1).
(d) Size
(e) Material (see 3.1.1).
(f) Screws or bolts, diameter, length, head or nut shape.
(g) Finish required (see 3.1.3).
(h) Level of packaging and packing required (see 5.3 and 5.4).
(i) Marking required (see 5.5)".

Page 22, Delete "Notice."

Page 23, change "MILITARY INTERESTS" as follows: Army - WC; Navy - DOCKS; Air Force - 69

FF-S-325
September 10, 1957

SUPERSEDING
Fed. Spec. FF-D-200 (COM-NBS)
DEVICES, ANCHORING, MASONRY
December 19, 1955

FEDERAL SPECIFICATION

SHIELD, EXPANSION; NAIL, EXPANSION; AND NAIL, DRIVE SCREW (DEVICES, ANCHORING, MASONRY)

This specification was approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal agencies

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers threaded and unthreaded anchoring devices for attaching equipment and fixtures to an existing solid masonry. (See 6.1.)

1.2 Classification

1.2.1 *Groups, types, classes, and styles.* The anchoring devices covered by this specification shall be of the following groups, types, classes and styles, as specified:

- GROUP I—SHIELD, EXPANSION (LEAD, BOLT AND STUD ANCHORS), see 3.2.1:
  - Type 1—"Head out"—Embedded nut anchors:
    - Class 1—Single lead expansion unit anchors (fig. 1).
    - Class 2—Multiple lead expansion units anchors (fig. 4).
  - Type 2—"Nut out"—Embedded bolt and stud anchors:
    - Class 1—Single lead expansion unit anchors:
      - Style 1—Single-end expansion lead sleeve anchors (fig. 5).
      - Style 2—Double-end expansion units lead sleeve anchors (fig. 6).
    - Class 2—Multiple lead expansion units anchors:
      - Style 1—Cone units anchors (fig. 7).
      - Style 2—Disk units anchors (fig. 8).
- GROUP II—SHIELD, EXPANSION (BOLT ANCHORS), see 3.2.2.
  - Type 1—Lag bolt expansion shield anchors (fig. 9):
    - Class 1—Long shield anchors.
    - Class 2—Short shield anchors.
  - Type 2—Machine bolt expansion shield anchors:
    - Class 1—Closed-end, bottom bearing, expansion shield anchors (fig. 10).
    - Class 2—Open-end expansion shield anchors:
      - Style 1—Single-end expansion shield anchors (fig. 11).
      - Style 2—Double-end expansion shield anchors (fig. 12).
  - Type 3—Tubular expansion shield anchors.
    - Class 1—Single-slit shield anchors (fig. 13).
    - Class 2—Multiple-slit shield anchors (fig. 14).
- GROUP III—SHIELD, EXPANSION (SELF-DRILLING TUBULAR EXPANSION SHELL BOLT ANCHORS), see 3.2.3.
  - Type 1—Anchors with externally slit expansion shells and a single-cone expander (fig. 15).
  - Type 2—Anchors with internally grooved expansion shells and a double-cone expander (fig. 16).

GROUP IV—SHIELD, EXPANSION (WOOD SCREW AND LAG BOLT SELF-THREADING ANCHORS), see 3.2.4.
Type 1—Lead anchors (fig. 17).
Type 2—Fiber anchors (fig. 18).
GROUP V—SHIELD, EXPANSION (NAIL ANCHORS), see 3.2.5.
Type 1—Expansion shield nail anchors:
Class 1—Aluminum expansion shield nail anchors (fig. 19).
Class 2—Steel expansion shield nail anchors (fig. 20).
Class 3—Steel, lead banded, expansion shield nail anchors (fig. 21).
Type 2—Hollow rivet shape nail (pin) anchors:
Class 1—Aluminum nail (pin) anchors:
Style 1—Anchors with single-slit stem (fig. 22).
Style 2—Anchors with cross-slit stem (fig. 23).
Class 2—Steel nail (pin) anchors (fig. 24).
Class 3—Zinc-cast nail anchors (fig. 25).
GROUP VI—NAIL, EXPANSION (EXPANDED DRIVE-BOLTS AND DRIVE-STUDS), see 3.2.6 (fig. 26).
GROUP VII—NAIL, DRIVE SCREW (MASONRY), see 3.2.7 (fig. 27).

1.3 The sizes of masonry anchoring devices shall correspond to those in tables I to XVI, inclusive, as specified.

2. APPLICABLE SPECIFICATIONS AND STANDARDS

2.1 The following specifications and standards, of the issues in effect on date of invitation for bids, form a part of this specification:

FEDERAL SPECIFICATIONS:
FF-B-561—Bolts, Lag.
FF-B-575—Bolts, Hexagon and Square.
FF-N-105—Nails, Wire; and Staples.
FF-N-836—Nuts, Hexagon and Square.
FF-S-111—Screws, Wood, Slotted-Head.
PPP-B-566—Boxes, Folding Paperboard.
PPP-B-585—Boxes; Wood, Wirebound.
PPP-B-591—Boxes; Fiberboard, Wood-Cleated.
PPP-B-601—Boxes, Wood, Cleated-Plywood.
PPP-B-621—Boxes, Wood, Nailed and Lock-Corner.
PPP-B-636—Boxes, Fiber.
PPP-B-676—Boxes, Set-Up, Paperboard.
FEDERAL STANDARDS:
Fed. Std. No. 102—Preservation, Packaging, and Packing Levels.
Fed. Test Method Std. No. 151—Metals, Test Methods.

(Activities outside the Federal Government may obtain copies of Federal Specifications and Standards as outlined under General Information in the Index of Federal Specifications and Standards and at the prices indicated in the Index. The Index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

(Single copies of this specification and other product specifications required by activities outside the Federal Government for bidding purposes are available without charge at the General Services Administration Regional Offices in Boston, New York, Atlanta, Chicago, Kansas City, Mo., Dallas, Denver, San Francisco, Los Angeles, Seattle, and Washington, D. C.

(Federal Government activities may obtain copies of Federal Specifications and Standards and the Index of Federal Specifications and Standards from established distribution points in their agencies.)

MILITARY SPECIFICATIONS:
JAN-P-125—Packaging and Packing for Overseas Shipment—Barrier-Materials, Waterproof, Flexible.
MIL-P-116—Preservation, Methods of.
MILITARY STANDARDS:
MIL-STD-105—Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-129—Marking for Shipment and Storage.

(Copies of Military Specifications and Standards required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

3. REQUIREMENTS

3.1 Requirements, general, common to all or several anchoring devices.

3.1.1 *Materials.* Materials used in the anchoring devices shall conform to good commercial practice or to specific requirements stated in the invitation for bids.

3.1.2 *Bolts, studs, screws, and nuts.* Bolts, studs, nuts, and screws are not supplied with the anchoring devices, unless they are of specific shape or unless their delivery is called for in the invitation for bids. Bolts, studs, nuts,

and screws, when supplied, shall conform to good commercial practice. Unless otherwise specified in the invitation for bids, all bolts, studs, screws, and nuts shall conform to the requirements of the applicable Federal Specification listed in 2.1, or as otherwise specified in the invitation for bids.

3.1.2.1 *Threads.* Machine bolts, studs, screws, and nuts when specified or supplied, shall be threaded with Unified or American National threads of the coarse-thread series, classes 2A (external thread), or 2B (internal thread) and conform to good commercial practice. Threads in lag bolts and wood screws shall conform to the requirements of the Federal Specifications FF-B-561 and FF-S-111, respectively.

3.1.2.1.2 *Machine bolt heads.* When specified or supplied, machine bolts ½ inch or less in diameter shall have square heads and bolts over ½-inch hexagon heads in accordance with Federal Specification FF-B-575.

3.1.2.1.3 *Machine bolt nuts.* Nuts, when specified or supplied, shall be square for bolts and studs ½ inch or less in diameter and hexagon for bolts and studs over ½ inch in diameter in accordance with Federal Specification FF-N-836.

3.1.2.1.4 *Length.* The length of the bolts, studs, or screws, when specified, shall be stated in the invitation for bids or the thickness of the equipment or fixture to be fastened shall be stated and the contractor shall supply bolts, studs, or screws of the proper length for use with the anchors furnished.

3.1.3 *Finish.* All component parts of anchoring devices made of malleable iron or steel shall be zinc or cadmium coated. The kind of coating shall be at the manufacturer's option, unless a specific coating is named in the invitation for bids. The coatings shall conform to good commercial practices.

3.1.4 *Marking for identification.* All anchoring devices, except the types and sizes on which it is physically impractical to do so, shall be marked with the manufacturer's name or with the trade-mark of such known character that the source of manufacture may readily be determined. Each anchoring device, whenever it is advisable and possible, shall be marked with the size number or diameter of the bolt, screw, nail, or pin with which it shall be used.

3.2 Requirements applicable to specific groups of anchoring devices.

3.2.1 *Group I—Shield, expansion (lead, bolt and stud anchors).*

3.2.1.1 *Type 1, "head-out"—embedded nut anchors.*

3.2.1.1.1 *Class 1, single lead expansion unit anchors (see fig. 1 and table I).* These anchors shall consist of an internally threaded conical expander and an expansion lead sleeve which is slipped over the expander. The lead expansion sleeve, when tamped, holds the expander inside the hole in masonry.

3.2.1.1.1.1 *Expanders.* Expanders shall have a conical shape that shall assure proper expansion of the lead sleeves when calking or tamping them in masonry. Expanders shall be provided with means (fins, ribs, tongues, knurls, corrugations, etc.) for preventing their rotation when tightening the bolt, and shall have either open or closed bottoms at the manufacturer's option unless their shape is specified. Expanders may be of brass, malleable iron, steel, or hard zinc alloy at the manufacturer's or contractor's option unless their material is specified in the invitation for bids. The number of threads in the expanders shall be not less than five.

3.2.1.1.1.2 *Expansion sleeves.* Expansion sleeves shall be of lead or lead alloy, hollow cast with a seat to fit the expanders. The outer walls in the sleeves shall be either straight cylindrical or tapered with or without horizontal corrugations. Expansion sleeves may be capped, at the option of the manufacturer, by a spherical steel washer having scalloped edges which embed into the masonry when tamping the anchor in place.

3.2.1.1.1.3 *Bolts and screws (see 3.1.2).*

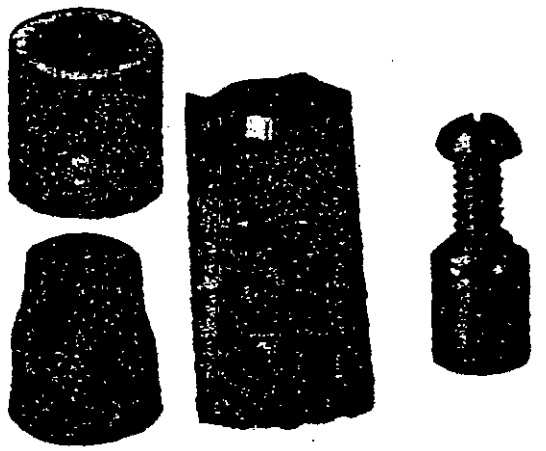
3.2.1.1.1.4 *Size designation and dimensions.* The single lead expansion unit anchors, type 1, class 1, shall be designated by the screw number or by the bolt diameter and the number of threads per inch. The overall anchor dimensions shall conform to those listed in table I.

3.2.1.1.1.5 *Holding power requirements.* The single lead expansion unit anchors, type 1, class 1, shall withstand pulling proof test loads, as specified in table I, when set in concrete (see 4.3.2). The holes for the tests shall be drilled by a masonry drill, recommended by the manu-

facturer and to a depth not less than twice the height of the anchor. (See 6.3.)

3.2.1.1.1.6 *Driver, bearing, and bushing (setting tool).* A high-carbon steel setting tool for tamping the lead sleeve in place either of a piloted type, figure 2, or of a tubular type, figure 3 (with both ends open or with one end closed), to suit the shape of the expander, shall be included with each issue package of anchors. The setting tools shall be properly heat treated.

3.2.1.1.2 *Class 2, multiple lead expansion units anchors (see fig. 4 and table II).* These anchors shall consist of two or more units, each of one expander and a lead or lead alloy sleeve, as described in 3.2.1.1.1. The expanders of low cone shape may be equipped with split flat rings for confining the lead expansion sleeves during the calking or tamping operation. The bottom expanders only in these anchors shall be threaded.



(Before installation) (Installed) Anchor with a scalloped washer

FIGURE 1.—*Shield, expansion*
("Head out"—embedded nut anchors).
Class 1. Single lead expansion unit anchors.

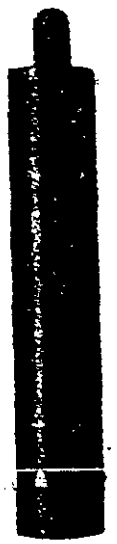


FIGURE 2.—*Piloted.*

Driver, bearing and bushing (setting tools)

FIGURE 3.—*Tubular.*

TABLE I.—*Group I, type 1, class 1*

Size			Nominal anchor dimensions		Proof test load [1]
Screw No.	Screw or bolt diameter	Threads per inch	Outside diameter, minimum	Assembled height with an expander	
	Inch		*Inches*	*Inches*	*Pounds*
6	0.138	32	¼	⅜	150
8	.164	32	5/16	½	250
10	.190	24	⅜	⅝	300
12	.216	24	7/16	¾	400
	¼	20	½	¾	500
	5/16	18	⅝	1	850
	⅜	16	¾	1¼	1,250
	7/16	14	⅞	1½	1,650
	½	13	⅞	1½	2,300
	⅝	11	1	1¾	3,700
	¾	10	1¼	2	5,500

[1] Recommended safe working load is one-fourth of the proof test load.

3.2.1.1.2.1 *Bolts (see 3.1.2).*

3.2.1.1.2.2 *Size designations and dimensions.* The multiple lead expansion units anchors, type 1, class 2, shall be designated by the bolt diameter and the number of units to be used. The overall anchor dimensions shall conform to those in table II.

3.2.1.1.2.3 *Holding power requirements.* The multiple lead expansion units anchors, type 1, class 2, shall withstand pulling proof test, as specified in table II, when set in concrete (see 4.3.2). The holes for the tests shall be drilled by a masonry drill of the size recommended by the manufacturer and to a depth not less than twice the height of the assembled anchor (see 6.3).

3.2.1.1.2.4 *Dummy stud.* A dummy stud with a threaded end, fitting the bottom (threaded) expander, shall be provided with each issue package, when specified. This dummy stud has to be used during assembling and tamping lead expansion sleeves for preventing the clogging of the lowered expanders.

3.2.1.1.2.5 *Driver, bushing (setting tool) (see fig. 5).* A tubular steel setting tool, as described in 3.2.1.1.1.6, of proper inner and outer diameters and length to suit the anchor units and the dummy bolt shall be provided with each issue package of anchors. The tool shall be properly heat treated.

3.2.1.2 *Type 2, "nut-out"—embedded bolt and stud anchors.*

3.2.1.2.1 *Class 1, single lead expansion unit anchors.* These anchors shall have a single lead expansion unit of the following styles, as specified:

3.2.1.2.1.1 *Style 1, single-end expansion lead sleeve anchors (see fig. 5 and table III).* These anchors shall consist of a hollow truncated cone expander and a cylindrical lead expansion sleeve, as specified in 3.2.1.1.1, with the exception that the expanders shall have a smooth outer surface and a plain unthreaded hole for the passage of the bolt stem. Studs, when used, shall have heads of cone shape conforming to the nest seat in the sleeve (see fig. 5 (a)).

3.2.1.2.1.2 *Style 2, double-end expansion lead sleeve anchors (see fig. 6 and table III).* These anchors shall have two opposing cone expanders with smooth outer surfaces and plain holes for the passage of the bolt or stud stems and a single lead expansion sleeve with two opposing nests for the expanders. Studs for these anchors must have their heads of the top expander shape. The materials used in these anchors shall be as specified in 3.2.1.1.1.1. Anchors with expanders of hard zinc may be of one-piece construction, where the opposing expanders are interconnected by thin ribs, collapsible during calking or tamping and completely covered by lead (see fig. 6 (a)) and are for use with bolts only.

3.2.1.2.1.3 *Bolts, studs and nuts (see 3.1.2).*

(a) Anchor with low cone expanders, equipped with retaining rings (assembled)

(b) Anchor with tall cone expanders (installed)

FIGURE 4.—*Shield Expansion.* ("Head out"—embedded nut anchors). Class 2. Multiple lead expansion units anchors.

TABLE II.—*Group 1, type 1, class 2*

Size, bolt diameter	Lead expansion units, nominal outside diameter,[2] minimum	Proof test loads [1]	
		Double unit	Triple unit [3]
Inch	*Inches*	*Pounds*	*Pounds*
¼	½	675	
5/16	⅝	1,125	
⅜	¾	1,675	
½	1	3,100	
⅝	1⅛	4,950	
¾	1⅜	7,325	7,325
⅞	1½	10,000	10,000
1	1⅝	13,250	13,250

[1] Recommended safe working load is one-fourth of the proof test load (see 6.3.1).

[2] The height of the units depends upon their design.

[3] When overloads may be expected and the concrete is of unknown quality.

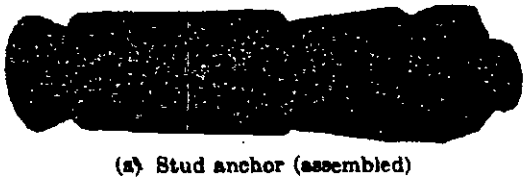
3.2.1.2.1.4 *Size designations and dimensions.* The single lead expansion unit bolt or stud anchors, type 2, class 1, shall be designated by the diameter of the bolt or stud. The overall anchor dimensions shall conform to those in table III.

3.2.1.2.1.5 *Holding power requirements.* The single lead expansion unit anchors, type 2, class 1, shall withstand pulling test loads, as specified in table III when set in concrete (see 4.3.2).

(a) Stud anchor (assembled)

(b) Bolt anchor (assembled)

FIGURE 5.—*Shield, expansion* ("Nut out"—embedded bolt or stud anchors)
Style 1. Single-end expansion sleeve.



(a) Stud anchor (assembled)

(b) Bolt anchor (one-piece construction)

FIGURE 6.—*Shield, expansion.* ("Nut out"—embedded bolt or stud anchors)
Style 2. Double-end expansion sleeve

TABLE III.—*Group I, type 2, class 1, styles 1 and 2 (figs. 5 and 6)*

Size, bolt or stud diameter	Nominal anchor dimensions		Proof test load [1]
	Outside diameter, minimum	Overall height, minimum	
Inch	*Inches*	*Inches*	*Pounds*
¼	½	¾	500
5/16	⅝	⅞	850
⅜	¾	1	1,250
½	1	1½	2,300
⅝	1⅛	1⅝	3,000
¾	1¼	1¾	3,600

[1] Recommended safe working load is one-fourth of the proof test load.

The holes for the tests shall be drilled by a masonry drill recommended by the manufacturer and to a depth not less than twice the height of the anchor (see 6.3).

3.2.1.2.1.6 *Driver, bushing (setting tool) (see 3.2.1.1.2.5).*

3.2.1.2.2 *Class 2, multiple lead expansion units anchors.* These anchors shall be of the following styles, as specified:

3.2.1.2.2.1 *Style 1, multiple lead expansion cone units anchors (see fig. 7 and table IV).* These bolt and stud anchors shall be of an identical design and construction as the multiple lead expansion units anchors, type 1, class 2, see 3.2.1.1.2, with the exception that the bottom cone expanders shall be without a thread. The embedded studs shall have heads of the cone expander's shape and use the same lead expansion sleeves as in subsequent anchor units.

3.2.1.2.2.2 *Style 2, multiple lead expansion disk units anchors (see fig. 8 and table IV).* These anchors, for bolts only, shall consist of two lead disks sandwiched between three zinc alloy or malleable iron disks, taper-shaped to facilitate the expansion of the lead disks against the hole walls. One or more of these sets may be used to suit the strength of the bolt and the requirements of the work. Malleable iron disks shall be used in anchors for bolts ⅝ inch and over.

3.2.1.2.2.3 *Bolts and nuts (see 3.1.2).*

3.2.1.2.2.4 *Size designation and dimensions.* The multiple lead expansion units anchors, type

2, class 2, styles 1 and 2, shall be designated by the bolt or stud diameter and the number of the units. Overall anchor dimensions shall conform to those in table IV.

With retaining rings (assembled)

Without retaining rings (stacked)

Anchors with low cone expanders

FIGURE 7.—*Shield, expansion.* ("Nut out"—embedded bolt anchors). Style 1. Two lead cone expansion units.

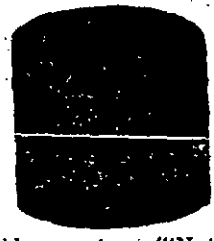


FIGURE 8.—*Shield expansion.* ("Nut out"—embedded bolt anchor). Style 2. Two lead disk expansion units.

3.2.1.2.2.5 *Holding power requirements (see 4.3.2).* The multiple lead expansion units anchors, type 2, class 2, styles 1 and 2 shall withstand pulling proof test load, as specified in table IV when set in concrete. The holes for the tests shall be drilled by a drill of the size recommended by the manufacturer and to a depth not less than twice the height of the assembled anchor (see 6.3).

3.2.1.2.2.6 *Driver, bushing (setting tool) (see 3.2.1.1.2.5).*

3.2.2 *Group II—Shield, expansion (bolt anchors).*

3.2.2.1 *Type 1, lag bolt expansion shield anchors (see fig. 9 and table V).*

3.2.2.1.1 *Construction and material.* These anchors for lag bolts shall consist of a two-piece expansion shield which opens at the bottom and spreads out into a cone when the lag bolt is tightened. The shields may be made of zinc alloy or malleable iron at the option of the manufacturer or contractor, unless the material is specified in the invitation for bids.

3.2.2.1.1.1 *Shield body.* Each shield body shall consist of two semi-cylindrical hollow sections interlocked at the top by ears or lugs. The bore of the shield shall be tapered and have an internal thread for about two-thirds of its distance from the bottom. The thread shall fit that in the specified lag bolt to be

TABLE IV.—*Group I, type 2, class 2, styles 1 and 2 (figs. 7 and 8)*

Size, bolt or stud diameter	Style 1, cone unit anchors			Style 2, disk unit anchors			
	Expansion units [1] outside diameter, minimum	Proof test load [2]		Nominal		Proof test load [2]	
		Double unit	Triple unit	Outside diameter, minimum	Height of a unit, minimum	Single set	Double set
Inch	*Inches*	*Pounds*	*Pounds*	*Inches*	*Inches*	*Pounds*	*Pounds*
1/4	1/2	675	----------	1/2	5/8	500	675
5/16	5/8	1,125	----------				
3/8	5/8	1,675	----------	3/4	5/8	1,250	1,675
1/2	1	3,100	----------	1	3/4	2,300	3,100
5/8	1 1/8	4,950	----------	1 1/8	3/4	2,800	4,950
3/4	1 5/8	----------	7,325	1 3/8	7/8	----------	6,400
7/8	1 1/2	----------	10,000	1 1/2	7/8	----------	7,200
1	1 5/8	----------	13,250	1 3/4	1	----------	8,000

[1] The height of units depends upon their design.

[2] Recommended safe working load is one-fourth of the proof test load (see 6.3.1).

used in the shield. The outer walls of the shield sections shall have circular ribs for better gripping and holding action of the shield. The average thickness of the thinnest wall sections shall be not less than one thirty-second of an inch.

3.2.2.1.2 *Class and dimensions.* Unless otherwise specified, the lag bolt expansion shield anchors of class 1, long shields, as per dimensions given in table V, shall be supplied.

3.2.2.1.3 *Lag bolts.* Lag bolts shall not be supplied with the shields unless their delivery is called for in the invitation for bids, in which case the specifications of the lag bolts shall conform to those in the Federal Specification FF-B-561.

3.2.2.1.4 *Holding power requirements.* The lag bolt expansion shield anchors shall withstand pulling proof test loads, as specified in table V, when set in concrete (see 4.3.2) in accordance with the manufacturer's recommendations.

3.2.2.2 *Type 2, machine bolt expansion shield anchors.*

3.2.2.2.1 *Class 1, closed-end, bottom bearing, expansion shield anchors (see fig. 10 and table VI).*

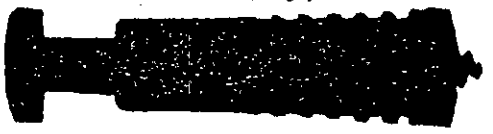


FIGURE 9.—*Shield, expansion, anchor (lag bolt).*

3.2.2.2.1.1 *Construction.* These anchors for machine bolts shall consist of an expansion shield and an expander nut inserted inside the shield. The shield and its expander nut shall be made in such a manner that the nut shall climb the thread of the bolt and expand the shield as soon as the bolt, while being tightened, reaches and bears against the shield bottom. The shield body and the expander nut may be of alloy zinc, brass, steel, or malleable iron at the option of the manufacturer or contractor, unless their material is specified in the invitation for bids.

3.2.2.2.1.2 *Shield body.* The shield body shall be of closed-bottom cylindrical shape either of one piece or of two interlocked and banded together semicylindrical sections. The one-piece shield body shall have two diametrically located longitudinal slits including the shield mouth. The outer surface of the shield bodies shall have circular ribs for better holding and gripping action.

3.2.2.2.1.3 *Expander nut.* The expander nut shall be of a truncated pyramid cone (with two opposite side-lugs), or ellipsoid shape. The expander nut shall fit the proper grooves, slits or a seat in the shield body so that it will be forced to climb the anchor bolt, when it is being tightened, and to expand the shield body. The expander nut shall be threaded, as specified in 3.1.2.1, and contain not less than five full threads.

TABLE V.—*Group II, type 1, classes 1 and 2 (fig. 9)*

Size, diameter of lag bolt	Nominal shield dimensions			Proof test loads [1]			
		Minimum length		Malleable iron shields		Zinc shields	
	Outside diameter, minimum	Class 1, long shield anchors	Class 2, short shield anchors	Long shields	Short shields	Long shields	Short shields
Inches	*Inches*	*Inches*	*Inches*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
1/4	7/16	1 1/2	1	200	160	500	400
5/16	1/2	1 3/4	1	480	380	1,000	800
3/8	5/8	2 1/2	1 3/4	960	640	1,600	1,300
7/16	5/8	2 3/4	2	1,250	950		
1/2	3/4	3	2	1,600	1,300	2,800	2,100
9/16	7/8	3 3/8	2	1,725	1,400		
5/8	1 1/8	3 1/2	2	1,850	1,500		

[1] Recommended safe working load is one-fourth of the proof test load.

3.2.2.2.1.4 *Machine bolts (see 3.1.2).*

3.2.2.2.1.5 *Dimensional requirements.* The dimensions of the closed-bottom expansion shield anchors shall conform to those given in table VI for the specified bolts.

3.2.2.2.1.6 *Holding power requirements.* The closed-end expansion shield anchors shall withstand pulling proof loads as specified in table VI, when set in concrete (see 4.3.2) in accordance with the manufacturer's recommendations.

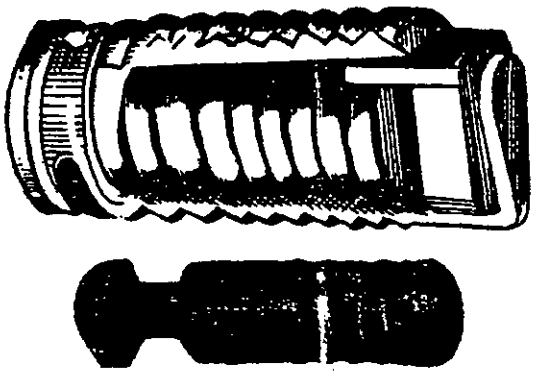


FIGURE 10.—*Shield, expansion, anchor (machine bolt).* Class 1. Closed end, bottom bearing shield. ●

TABLE VI.—*Group II, type 2, class 1 (fig. 10)*

Bolt diameter	Nominal shield body dimensions		Proof test load [1]
	Minimum diameter	Minimum length	
Inch	*Inches*	*Inches*	*Pounds*
¼	7/16	1	700
5/16	9/16	1	800
⅜	⅝	1¾	960
7/16	¾	2	1,160
½	⅞	2¼	1,400
⅝	1	2½	1,960
¾	1¼	3½	2,300
⅞	1½	4	2,520
1	1⅝	4½	2,700

[1] Recommended safe working load is one-fourth of the proof test load.

3.2.2.2.2 *Class 2, open-end expansion shield anchors.*

3.2.2.2.2.1 *Style 1, single-end expansion shield anchors (see fig. 11 and table VII).*

3.2.2.2.2.1.1 *Construction and material.* These anchors for machine bolts shall consist of an expansion shield and an expander nut. The shield body shall expand into a cone shape when the expander nut is drawn up during the tightening of the bolt. The shield body and the expander nut may be made of alloy zinc, brass, malleable iron, or steel at the option of the manufacturer or contractor, unless the material is specified in the invitation for bids.

3.2.2.2.2.1.2 *Shield body.* The shield body shall be of two or more sections forming a hollow cylinder. These sections at the bolt end shall be either interlocked by ears and lugs or held together by a steel band or wire. The opening formed by the sections shall envelop the expander nut. The shield outer walls shall have ribs or corrugations for better holding and gripping action.

3.2.2.2.2.1.3 *Expander nut (see 3.2.2.2.1.3).*

3.2.2.2.2.1.4 *Machine bolts (see 3.1.2).*

3.2.2.2.2.1.5 *Dimensional requirements.* The dimensions of the open-end expansion shield

FIGURE 11.—*Shield, expansion, anchor (machine bolt).* Style 1. Single-end expansion shield anchor.

TABLE VII.—*Group II, type 2, class 2, style 1 (fig. 11)*

Bolt diameter	Nominal shield body dimensions			Proof test loads [1]
	Minimum diameter	Minimum length		
		Short [2]	Regular	
Inch	*Inches*	*Inches*	*Inches*	*Pounds*
¼	7/16	1¾	1½	800
5/16	½	1⅝	1⅝	1,100
⅜	11/16	1½	2	1,450
½	⅞	2	2½	1,850
⅝	1	2½	2¾	2,400
¾	1⅛	2¾	3¼	3,000
⅞	1½	--------	4½	3,700
1	1⅝	--------	5	4,400

[1] Recommended safe working load is one-fourth of the proof test load.

[2] For use in firm masonry only.

anchors with single-end expansion shall conform to those given in table VII for the specified bolts.

3.2.2.2.2.1.6 *Holding power requirements.* The open-end expansion shield anchors with single-end expansion shall withstand pulling proof test loads, as specified in table VII, when set in concrete (see 4.3.2) in accordance with the manufacturer's recommendations.

3.2.2.2.2.2 *Style 2, double-end expansion shield anchors (see fig. 12 and table VIII).*

3.2.2.2.2.2.1 *Construction and material.* These anchors for machine bolts shall consist of a longitudinally split two-piece cylindrical expansion shield and of two expanders. The halves of the shield body shall spread apart when the machine bolt is tightened and draws the expanders close together. The shield body and expanders may be made of alloy zinc, brass, malleable iron or steel at the manufacturer's option, unless the material is specified in the invitation for bids.

3.2.2.2.2.2.2 *Shield body.* The two semi-cylindrical body sections shall be held together by one or more spring steel bands or wires fully embedded into the shield body. The shield bore shall suit the shape of the expanders.

3.2.2.2.2.2.3 *Expanders.* The expanders shall be either of a truncated pyramid, conical, or ellipsoid shape and fit the nests in the shield body. The top expander shall have a plain bore for the passage of the bolt stem, whereas the lower expander shall be threaded to fit the machine bolt to be used and shall have not less than five full threads. The conical-shape expanders shall be provided with means (lugs, wedges, etc.), properly fitted to the shield body, to prevent their rotation when tightening the anchor bolt and thus to assist the expansion of the shield body.

3.2.2.2.2.2.4 *Machine bolts (see 3.1.2).*

3.2.2.2.2.2.5 *Dimensional requirements.* The dimensions of the double-end expansion shield anchors shall conform to those in table VIII for the specified bolts.

3.2.2.2.2.2.6 *Holding power requirements.* The double-end expansion shield anchors shall withstand pulling proof loads, as specified in table VIII, when set in concrete (see 4.3.2) in accordance with the manufacturer's recommendations.

FIGURE 12.—*Shield, expansion, anchor (machine bolt).* Style 2. Double-end expansion shield anchor.

TABLE VIII —*Group II, type 2, class 2, style 2 (fig. 12)*

Bolt diameter	Nominal shield body dimensions		Proof test load[1]
	Minimum diameter	Minimum length	
Inch	*Inches*	*Inches*	*Pounds*
¼	½	1¼	1,100
5/16	9/16	1⅝	1,450
⅜	11/16	2	1,750
½	⅞	2½	2,200
⅝	1	2¾	3,250
¾	1⅛	3½	4,600
⅞	1½	4	5,850
1	1⅝	4½	6,700

[1] Recommended safe working load is one-fourth of the proof test load.

3.2.2.3 *Type 3, tubular expansion shield anchors.*

3.2.2.3.1 *Construction.* These anchors for bolts and screws shall consist of a tubular expansion shield and a hollow, internally threaded, truncated cone expander. The shields shall have either one full length side slit or several partial length slits to permit their expansion and embedding in masonry when hammer driven over the cone expanders and later under the working (tension) loads.

3.2.2.3.2 *Class I, tubular, single-slit, expansion shield anchors (see fig. 13 and table IX).* These anchors for bolts and screws of 3/16 and ¼-inch size shall be made of steel, whereas anchors for larger bolts shall have the shields of hard zinc and the cone expanders of steel. The shields shall be longitudinally slit for full length and shall have the bottom edges tapered inside and outside for proper centering and expanding when set under hammer blows over the cone expanders. Unless specified, the

cone expanders shall have either open or closed bottoms at the manufacturer's option and not less than five full threads.

3.2.2.3.3 *Class 2, tubular, multiple-slit, expansion shield anchors (see fig. 14 and table IX).* These anchors shall be made completely of brass of a composition at the manufacturer's option. The shields shall have six slits, equidistantly and diametrically located, and shall have outer shield surfaces knurled at the slit ends for facilitating the expansion of the shields and for better gripping action under working loads. The cone expanders shall have not less than five full threads.

3.2.2.3.4 *Bolts and screws (see 3.1.2).*

3.2.2.3.5 *Dimensional requirements.* The dimensions of the tubular expansion shield anchors shall conform to those in table IX for the specified bolts and screws.

3.2.2.3.6 *Holding power requirements.* The tubular expansion shield anchors shall withstand pulling proof test loads, as specified in table IX, when set in concrete (see 4.3.2) in accordance with the manufacturer's recommendations.

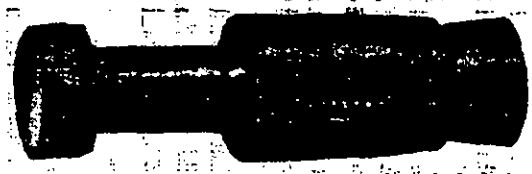


FIGURE 13.—*Shield, expansion, anchor (tubular).* Class 1. Single-slit shield anchor.

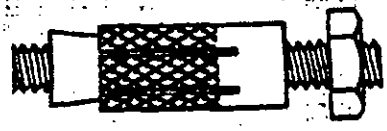


FIGURE 14.—*Shield, expansion, anchor (tubular).* Class 2. Multiple-slit shield anchor.

TABLE IX.—*Group II, type 3, classes 1 and 2 (figs. 13 and 14)*

Bolts and screws		Nominal anchor dimensions				Proof test load [1]
		Class 1		Class 2		
Diameter (screw No.)	Threads per inch	Outside diameter (minimum)	Overall height with expander (minimum)	Outside diameter (minimum)	Overall height with expander (minimum)	
		Inch	*Inches*	*Inch*	*Inch*	*Pounds*
5/16 (#10)	24	5/8	7/8	5/16	3/4	300
1/4	20	5/8	7/8	3/8	3/4	500
5/16	18	5/8	1 5/8			850
3/8	16	5/8	1 5/8			1,250
1/2	13	3/4	1 3/4			2,300
5/8	11	1	2 1/8			3,700

[1] Recommended safe working load is one-fourth of proof load.

3.2.3 *Group III—Shield, expansion (self-drilling tubular expansion shell bolt anchors).*

3.2.3.1 *Construction and material.* These anchors for machine bolts shall consist of a tubular expansion shell and a solid truncated, single or double, cone expander, both of carbon or alloy steel at the manufacturer's option. The tubular expansion shells shall have cut teeth on one end for use as a hollow drill for drilling the anchor nest in the masonry, and the other end shall be internally threaded for anchoring the machine bolt. The shell body shall be provided with means (grooves or slits) for tearing the shell body apart when forcing it over the cone expander and setting it in masonry.

3.2.3.1.1 *Type 1, self-drilling tubular expansion shell anchors with an externally slit expansion shell and a single-cone expander (see fig. 15 and table X).* These anchors shall be specified either with their threaded end flush with the shell edge for installation with a handtool (see fig. 15 (a)), or with an unthreaded chucking

cone, above the threaded end, for installation with an air or electric impact hammer (see fig. 15 (b)). This chucking cone may be specified, in addition, with an annular breakoff groove at its base for breaking off the cone when flush mounting is required (see fig. 15 (c)), or with a drilled hole for a passage of a wire or hook (see fig. 15 (d)). The outer surface of the tubular shell at the toothed end shall have three or more peripheral grooves and four equidistantly and diametrically located milled (not cut through) slits for facilitating the drilling of the hole and the expansion of the anchor shall by splitting it when setting the shell in masonry over the cone expander. When specified, the ¼-inch anchors may be supplied with stud bolts having a head of the expander shape and 1¾, 2, or 2¾ inches long (see fig. 15 (e)).

(a) (b) (c) (d) (e)

FIGURE 15.—*Shield, expansion (self-drilling tubular expansion shell bolt anchors).* Type 1. Externally slit expansion shells with single cone expanders.

3.2.3.1.2 *Type 2, self-drilling tubular expansion shell anchors with an internally grooved expansion shell and a double-cone expander (see fig. 16 and table X).* The expansion shell shall be tapered from the toothed end to a point just below the internally threaded end, but leaving the threaded and toothed ends of the same outside diameter. The shell shall be equipped with two lugs located inside the shell body just below its threaded part, for attaching an

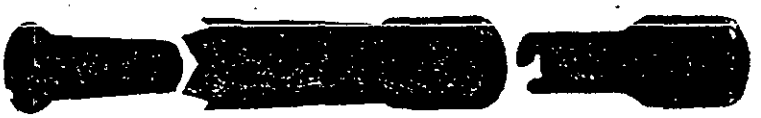


FIGURE 16.—*Shield, expansion (self-drilling tubular expansion shell bolt anchors).* Type 2. Internally grooved expansion shell with double cone expander and a drill adapter.

TABLE X.—*Group III, types 1 and 2 (figs. 15 and 16)*

Bolt diameter	Type 1 anchors			Type 2 anchors			Minimum depth of thread
	Outside diameter (minimum)	Height (minimum)	Proof test load [1]	Outside diameter (minimum)	Height (minimum)	Proof test load [1]	
Inches	*Inches*	*Inches*	*Pounds*	*Inches*	*Inches*	*Pounds*	*Inches*
¼	13/32	1⅛	1,600				⅜
9/16	15/32	1⅛	1,800				13/32
⅜	9/16	1 5/16	2,500				9/16
½	11/16	1 13/16	3,700				¾
⅝	⅞	2⅜	5,100				15/16
¾	1	3	7,100	1	4½	7,200	1⅛
⅞	1⅛	4	7,800	1¼	5¼	10,000	1 5/16
1				1⅜	6	13,200	1½
1⅛				1½	6½	16,700	1¾
1¼				1 11/16	7	21,200	1⅞

[1] Recommended safe working load is one-fourth of the proof test load.

adapter, supplied with each issue package and for use with a rock drill when drilling the anchor nest in the masonry. The shell body shall have four internal grooves diametrically and equidistantly located about half way up the shell body from its toothed end. These grooves are for facilitating the splitting and expansion of the anchor shell when forcing it over the cone expander during the setting of the anchor in the masonry. The cone expanders shall be of double truncated shapes, as shown in figure 16. The tall upper cone is for tearing the anchor shell along the grooves and forcing the split parts against the masonry while the lower cone will curl the toothed ends deep into the masonry.

3.2.3.2 *Threads (see 3.1.2.1).* The threads shall end in a manner which will prevent the machine bolt from coming in contact with the cone expander at any time.

3.2.3.3 *Dimensional requirements.* The dimensions of the self-drilling tubular expansion shell anchors shall conform to those in table X for the bolts specified.

3.2.3.4 *Holding power requirements.* The self-drilling tubular expansion shell anchors shall withstand pulling proof test loads, as specified in table X, when set in concrete (see 4.3.2) in accordance with the manufacturer's recommendations.

3.2.4 *Group IV—Shield, expansion (wood screw and lag-bolt self-threading anchors).*

3.2.4.1 *Type 1, wood screw and lag bolt lead anchors (see fig. 17 and table XI).*

3.2.4.1.1 *Anchor body.* The body in these anchors shall be of lead or lead alloy cast in tubular lengths with a tapered hole to permit the screws to form their own threads, and with or without a countersunk head, as specified. The anchor walls shall be split longitudinally up to the head for facilitating the insertion and expansion of the anchors in the drilled holes and shall have full or semicircular ribs for better gripping and holding action in masonry.

3.2.4.1.2 *Screws (see 3.1.2).*

3.2.4.1.3 *Size designations and dimensions.* The sizes of wood screw lead anchors shall be designated by the screw size (screw number or diameter) and the length of the anchor. The overall dimensions of the anchors shall conform to those given in table XI for the specified sizes.

3.2.4.1.4 *Holding power requirements.* The wood screw lead anchors shall withstand pulling proof loads as stated in table XI, when set in masonry (see 4.3.2) in accordance with the manufacturer's recommendations.

FIGURE 17.—*Shield, expansion (wood screw and lag bolt self-threading anchors).* Type 1. Lead anchors.

TABLE XI.—*Group IV, type 1 (fig. 17)*

Size of wood screw (number and diameter in inches)	Lead anchors		Proof test loads [1]		
	Nominal outside diameter	Lengths	Anchor lengths (in inches)		
			¾	1	1½
	Inch	*Inches*	*Pounds*	*Pounds*	*Pounds*
6 (0.138)	¼	¾-1-1½	80	88	100
8 (0.164)	¼	¾-1-1½	88	122	192
10 (0.190)	5/16	¾-1-1½	100	160	540
12 (0.216)	5/16	¾-1-1½	104	196	624
14 (0.242)	⅜	1-1½-2	192	360	800
16 (0.268)	⅜	1-1½-2	----------	380	900
18 (0.294)	⅜	1-1½-2	----------	412	940

[1] Recommended safe working load is one-fourth of the proof test load.

3.2.4.2 *Type 2, fiber anchors (see fig. 18 and table XII).*

3.2.4.2.1 *Anchor body.* The anchor bodies shall be made of fibrous material, heavily braided around a lead core of a tubular shape. The fibrous material shall be treated for water resistance and against dry rot, fungus growth, or attacks by insects. The treating compound shall serve as a binder when the braided fibers are compressed into an anchor shape. The finished anchors shall be of straight cylindrical shape, smooth, free from excess of impregnating compound, odor, loose fibers, and shall not be tacky to the touch.

3.2.4.2.2 *Wood screws and lag bolts (see 3.1.2).*

3.2.4.2.3 *Size designations and dimensions.* Fiber anchors shall be designated by wood screw number (or diameter) or by the lag bolt diameter and by the length of the anchor. The overall dimensions of the anchors shall conform to those in table XII for the specified sizes.

3.2.4.2.4 *Holding power requirements.* Wood screw and lag bolt fiber anchors shall withstand pulling proof load, as specified in table XII, when set in concrete (see 4.3.2) in accordance with the manufacturer's recommendations.

FIGURE 18.—*Shield, expansion (wood screw and lag bolt self-threading anchors).* Type 2. Fiber anchors.

TABLE XII.—*Group IV, type 2 (fig. 18)*

Wood screws and lag bolts (number and diameter)	Fiber anchors, nominal dimensions		Proof test loads,[1] length of thread engagement (inches)			
	Diameter	Lengths	¾	1	1½	2
Inch	*Inch*	*Inches*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
5 (0.125)	9/64	⅝-¾-1	180	240	.....	.....
6 (0.138)						
7 (0.151)	13/64	¾-1-1¼-1½	195	260	390	.....
8 (0.164)						
9 (0.177)	3/16	¾-1-1¼-1½	215	285	425	.....
10 (0.190)						
12 (0.216)	7/32	1-1¼-1½-2	.....	375	560	750
14 (0.242) (¼" lag bolt)	¼	1-1¼-1½-2	.....	425	640	850
16 (0.268)	9/32	1-1½-2	.....	475	710	950
20 (0.320) (5/16" lag bolt)	⅜	1½-2-2½	.....	.....	920	1,225
⅜" lag bolt	7/16	1½-2-2½	.....	.....	1,100	1,440
7/16" lag bolt	½	2-2½-3	.....	.....	.....	2,000
½" lag bolt	⅝	2-2½-3	.....	.....	.....	2,500

[1] Recommended safe working load is one-fourth of the proof test load.

3.2.5 *Group V—Shield, expansion (nail anchors).*

3.2.5.1 *Type 1, expansion shield nail anchors.* These anchors shall consist of a common nail and a tubular expansion shield made of sheet metal. The shields shall be flanged at the outer end and slit or split longitudinally to permit their insertion through the fixture into the hole, previously drilled in the masonry, and their expansion there when the nail is hammered home.

3.2.5.1.1 *Class 1, aluminum expansion shield nail anchors (see fig. 19 and table XIII).* These nail anchors shall have their expansion shields of sheet aluminum, formed into a tubular shape with a closed bottom, a flanged mouth opening and the tube and the flange slit at diametrically opposed locations.

3.2.5.1.2 *Class 2, steel expansion shield nail anchors (see fig. 20 and table XIII).* These nail anchors shall have their expansion shields of a butt tube form with a flange at the outer end.

The shield body shall be corrugated either full length or partially, at the manufacturer's option, for facilitating its expansion in the masonry when the nail is being hammered in.

3.2.5.1.3 *Class 3, steel, lead banded, expansion shield nail anchors (see fig. 21 and table XIII).* These nail anchors shall have their expansion shields of two semicylindrical sheet steel sections of two diameters, flanged at both ends and held together by a lead or lead alloy band. The lead band shall be crimped at the small diameter (drive-in) end of the shield thus permitting easy insertion and expansion of the shield in masonry.

3.2.5.1.4 *Nails.* Suitable nails shall be supplied with the anchors. When so specified, the nails shall conform to Federal Specification FF-N-105.

3.2.5.1.4.1 *Double-head nail.* Double-head nails shall be supplied only when specified in the invitation for bids.

3.2.5.1.5 *Finish.* Unless the kind of a finish is specified, all steel parts in the expansion shield nail anchors shall be either galvanized (zinc coated) or cadmium plated and aluminum shields anodized at the manufacturer's option. The applied finish shall be in accordance with good commercial practice.

3.2.5.1.6 *Dimensional requirements.* The dimensions of nail anchors shall conform to those given in table XIII for the specified sizes.

3.2.5.1.7 *Holding power requirements.* All nail anchors shall withstand pulling proof loads, as specified in table XIII, when set in masonry (see 4.3.2) in accordance with the manufacturer's recommendations.

FIGURE 19.—*Shield, expansion, nail anchor (aluminum).*

FIGURE 20.—*Shield, expansion, nail anchor (steel).*

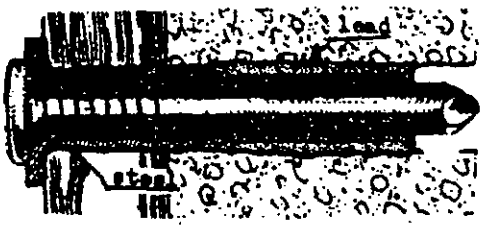


FIGURE 21.—*Shield, expansion, nail anchor (steel, lead banded).*

TABLE XIII.—*Group V, type 1, classes 1, 2, and 3 (figs. 19, 20, and 21)*

Expansion shield, nail anchors, nominal		Proof test load [1]
Diameter	Length	
Inch	*Inches*	*Pounds*
3/16	3/8	240
	1 1/4	400
1/4	1	800
	1 1/4	1,000
	1 1/2	1,200
5/16	1 1/4	1,000
	1 3/4	1,200
	2 1/4	1,400
	2 3/4	1,600
3/8	2	1,600
	3 1/4	2,000
1/2	2 1/4	2,000
	3 1/2	2,400

[1] Recommended safe working load is one-fourth of the proof test load.

3.2.5.2 *Type 2, hollow rivet shape nail (or pin) anchors.* These nail anchors shall consist of a nail or a pin and of an anchor of a hollow rivet shape. The anchor shall have a bore through the head into the stem until it reaches the slit or slits in the drive-in end of the stem. The nails (or pins) when set in the bore and hammered home shall expand the slitted end of the anchor stem and thus embed the anchor in the prepared hole in masonry. The anchors shall be either of aluminum, steel, or zinc, as specified. The nail shall be of carbon steel wire and the pins, when used, of corrosion-resisting (stainless) steel. Unless specified, the composition of the materials used in anchors, nails and pins shall be at the manufacturer's option.

3.2.5.2.1 *Class 1, aluminum, hollow rivet, nail anchors.*

3.2.5.2.1.1 *Style 1, aluminum, nail anchors with a single-slit stem (see fig. 22 and table XIV).* These anchors shall consist of a plain nail and a roundhead aluminum rivet drilled part way through its head into the stem with the drive-in end of the stem slit longitudinally to meet the drilled hole.

3.2.5.2.1.2 *Style 2, aluminum, nail (pin) anchors with a cross-slit stem (see fig. 23 and table XIV).* These anchors are similar to the style 1 anchors with the exception that the stem is drilled within ⅛-3/16 inch of its drive-in end which is cross-slitted to meet the drilled hole.

3.2.5.2.2 *Class 2, steel, nail (pin) anchors (see fig. 24 and table XIV).* These anchors shall consist of a plain nail (or pin) and a steel anchor, as described in 3.2.5.2. The head (outer end) of the anchor shall be either of a countersunk (fig. 24 (a)), of a round with slabbed (fig. 24 (b)) or threaded (fig. 24 (c)) kind, as specified. The slit drive-in end shall be tapered and have not less than three circumferential beads for better holding and gripping action.

3.2.5.2.3 *Class 3, zinc cast, nail anchors (see fig. 25 and table XIV).* These anchors shall consist of a threaded nail and a hollow, tubular shape, anchor. The anchor shall be cast of hard zinc, have a flat fillister head, a tubular stem longitudinally slit halfway from the drive-in end and three or four cylindrical beads at the drive-in end for better gripping and holding action.

3.2.5.2.4 *Nails and pins.* All anchors shall be supplied with proper nails or pins. Nails shall be plain or threaded at the manufacturer's option.

3.2.5.2.5 *Finish.*

3.2.5.2.5.1 *Anchors.* Unless otherwise specified, the finish of the aluminum hollow rivet anchors shall be at the manufacturer's option and shall conform to good commercial practice. The steel hollow rivet anchors shall be cadmium plated and conform to good commercial practice.

3.2.5.2.5.2 *Nails.* Unless otherwise specified, the anchor nails shall be zinc coated (galvanized) or cadmium plated at the manufacturer's option and shall conform to good commercial practice.

3.2.5.2.6 *Dimensional requirements.* The dimensions of hollow rivet shape anchors shall conform to those given in table XV for the sizes specified.

3.2.5.2.7 *Holding power requirements.* Hollow rivet anchors shall withstand pulling proof loads, as specified in table XIV, when set in masonry (see 4.3.2) in accordance with the manufacturer's recommendations.

FIGURE 22.—*Shield, expansion (aluminum hollow rivet shape nail (pin) anchors).* Style 1. Anchor with a single-slit stem.

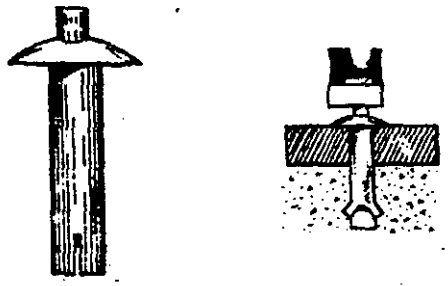


FIGURE 23.—*Shield, expansion (aluminum hollow rivet shape nail (pin) anchors).* Style 2. Anchor with a cross-slit stem.

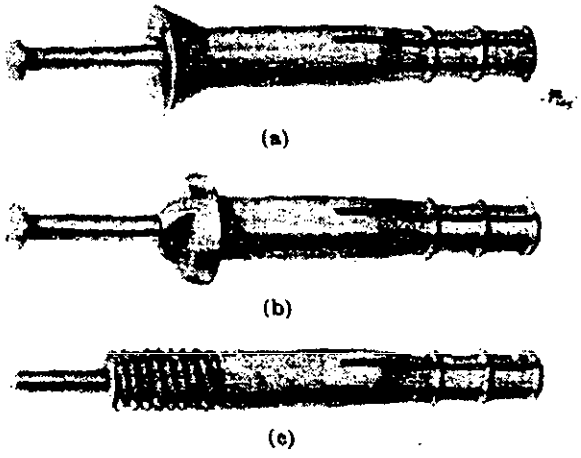


FIGURE 24.—*Shield, expansion (steel hollow rivet shape nail (pin) anchors).*

FIGURE 25.—*Shield, expansion (zinc-cast hollow rivet shape nail (pin) anchors).*

TABLE XIV.—*Group V, type 2, class 1 (styles 1 and 2), classes 2 and 3 (figs. 22, 23, 24, and 25)*

Nominal anchor diameter	Hollow rivet shape nail (pin) anchors					
	Class 1, style 1. Class 3		Class 1, style 2		Class	
	Stem length	Proof test load [1]	Stem length	Proof test load [1]	Stem length	Proof test load [1]
Inch	*Inches*	*Pounds*	*Inches*	*Pounds*	*Inches*	*Pounds*
5/16	7/8 1 1/4	240 400	3/4-1-1 1/8-1 1/4-1 3/8-1 1/2-1 5/8	100		
1/2	1 1 1/4 1 1/2	800 1,000 1,200	3/4-1-1 1/8-1 1/4-1 3/8-1 1/2-1 5/8	200	1-1 1/4-1 1/2-1 3/4-2	1,200
5/8	1 1/4 1 3/4 2 1/4 2 3/4	1,000 1,200 1,400 1,600				
3/4	2 3 1/4	1,600 2,000				
7/8	2 1/4 3 1/2	2,000 2,400				

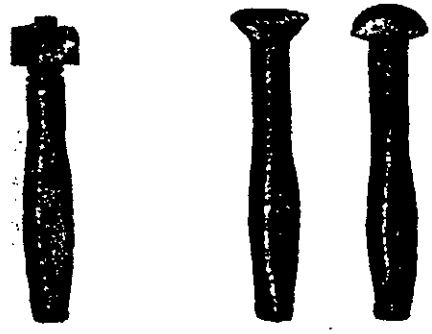
[1] Recommended safe working load is one-fourth of the proof test load.

3.2.6 *Group VI—Nail, expansion (expanded drive-bolts and drive-studs).*

3.2.6.1 *Material and construction.* Expanded drive-bolts and drive-studs shall be made of heat-treated alloy steel stock. The stems shall be partially slit lengthwise and the slit halves expanded along this slit to assure their spring-like gripping and holding action when the bolt or stud is driven into a proper size hole in masonry. The expanded drive-bolts shall be supplied either with countersunk heads or with round heads as specified, and the drive-studs with the outer end threaded.

3.2.6.1.1 *Dimensional requirements.* The dimensions of the expanded drive-bolts and drive-studs shall conform to those given in table XV for the specified sizes.

3.2.6.1.2 *Holding power requirements.* The expanded drive-bolts and drive-studs shall withstand pulling proof loads, as specified in table XV, when set in masonry (see 4.3.2) in accordance with the manufacturer's recommendations.



Drive-stud Drive-bolts

FIGURE 26.—*Nail, expansion (expanded drive-bolts and drive-studs).*

TABLE XV.—*Group VI (fig. 26)*

Diameter	Nominal stem lengths		Proof test	
	Drive-bolts	Drive-studs	Depth of embedment	Test load [1]
Inch	*Inches*	*Inches*	*Inches*	*Pounds*
3/16	1, 1¼, 1½, 2, 2½	1¼	¾	480
¼	1¼, 1½, 2, 2½, 3, 3½	1½, 2	1	925
5/16	1½, 2, 2½, 3		1½	1,600
⅜	2, 2½, 3, 3½, 6	2½, 3, 3½, 6	1¾	2,600
½	3, 3½, 4, 6	3½, 4, 6	2 7/16	5,000

[1] Recommended safe working load is one-fourth of the proof test load.

3.2.7 *Group VII—Nail, drive screw (masonry).*

3.2.7.1 *Construction and material.* Masonry nails shall be made of carbon steel, case-hardened, with a cone pilot point, a high pitch, multiple-start thread, and of general shape as shown in figure 27.

3.2.7.2. *Dimensional requirements.* The dimensions for masonry nails shall conform to those given in table XVI for the specified sizes.

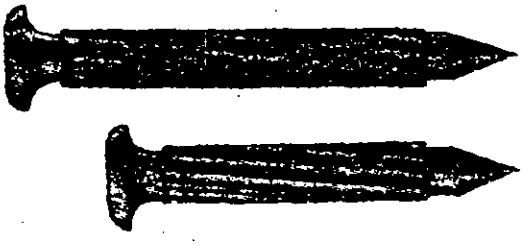


FIGURE 27.—*Nail, drive screw (masonry nails).*

TABLE XVI.—*Group VII (fig. 27)*

Size	Threaded part, diameter	Length	Proof test load [1]
Inch	*Inch*	*Inches*	*Pounds*
3/32	0.125	¾	
⅛	.156	¾	
5/32	.188	1	240
3/16	.215	1¼	400
¼	.268	1½	1,200
5/16	.330	2	1,300

[1] Recommended safe working load is one-fourth of the proof test load.

3.2.7.3 *Holding power requirements.* The masonry nails shall withstand pulling proof loads as specified in table XVI when set in masonry (see 4.3.2) in accordance with the manufacturer's recommendations.

3.3 **Workmanship.** The workmanship shall be compatible with the kind of anchoring device specified. These devices shall be free from injurious defects such as rust, scale, fins, or any other defect which may affect their handling and serviceability.

4. SAMPLING, INSPECTION, AND TEST PROCEDURES

4.1 **Lot.** Unless otherwise specified, a lot of anchoring devices for masonry shall consist of not more than 5,000 units of the same group, type, class, and style made of identical material, produced under essentially the same conditions, and presented at one time for inspection in connection with the same contract or order.

4.2 **Inspection.**

4.2.1 *Sampling for dimensional and workmanship requirements.* Unless otherwise specified, a representative random sample shall be selected by the Government inspector from each lot of anchoring devices offered for governmental inspection. This sampling shall be based on the Accepted Quality Level (AQL) approximately 4.0 percent defective as specified in table XVII.

4.2.2 *Visual inspection for material, dimensional, marking, and workmanship requirements.* Each unit in the selected sample shall be measured or visually inspected for compliance with the specified material, dimensional, marking,

TABLE XVII.—*Sampling for dimensional and workmanship inspection (acceptable quality level (AQL), approximately 4 percent, defectives)*

Number of units in a lot	Number of units in a sample	Acceptance number (defectives)	Rejection number (defectives)
40 or under	3	0	1
41 to 110	7	1	2
111 to 300	35	3	4
301 to 500	50	4	5
501 to 800	75	6	7
801 to 1,300	110	8	9
1,301 to 3,200	150	11	12
3,201 and up	225	17	18

NOTE.—The above table specifies a single sampling procedure. Alternate double or multiple sampling procedures or alternate Acceptable Quality Levels, as specified in military standard MIL-STD-105, for different classes of defects may be specified at the discretion of the procuring agency.

and workmanship requirements. If the number of defective units in the sample is less than or equal to the acceptance number in table XVII for the size of the lot under inspection, the lot represented by the sample shall be accepted insofar as the material, dimensional, marking, and workmanship requirements are concerned. If the number of defective units is equal to or greater than the rejection number shown in table XVII for size of the lot under inspection, the lot represented by the sample shall be rejected.

4.2.2.1 When the checking of the dimensions of bolt heads and threads is specified, it shall be done by means of suitable gages or measuring instruments. Unless otherwise specified, the manufacturer shall make available to the inspector the necessary inspection gages, the accuracy of which shall be certified in a manner satisfactory to the Government inspector. In case of controversy, the certification of a laboratory, acceptable to the Government, based on this specification, shall govern.

4.3 Proof load test.

4.3.1 *Sampling.* Unless otherwise specified, the following number of sample units shall be taken from the lot samples, see 4.1, and submitted to proof load test:

a. Lot up to 3,000 units, 2 sample units.

b. Lot of 3,000 units and over 3 sample units.

4.3.2 The selected sample units shall be tested for compliance with the respective proof loads specified in tables I to XVI. The samples under the test shall not be removable when set in concrete of 3,000 p. s. i. compressive strength and subjected to a specified tension test load in an axial direction nor shall the concrete show any evidence of failure attributable on the anchoring device itself.

4.3.3 *Rejection.* Failure of any sample unit to pass the proof load test shall constitute the basis for the rejection of the lot from which the test units were drawn.

4.4 Reinspection and retest.

4.4.1 *Reinspection.* A rejected lot may be resubmitted for Government inspection after the contractor or the manufacturer, being informed of the reasons for rejection, has inspected each unit in the lot for the deficiency noted and has removed or reworked all nonconforming units. One reinspection only shall be permitted.

4.4.2 *Retest.* Retests shall be permitted in accordance with the applicable requirements of Federal Standard No. 151, when requested by the manufacturer or contractor. Not more than one retest is permissible.

5. PREPARATION FOR DELIVERY. (For definitions and levels, see 6.9.)

5.1 Unless otherwise specified, the preservation, packaging, packing, and marking requirements, specified herein, apply only to direct shipments to the Government.

5.1.1 The purchasing agencies should specify whether the anchoring devices should be packaged for level A (domestic (storage) or overseas) or for level B (multiple domestic shipments, handling and covered storage) or for level C (domestic, immediate use) shipments.

5.2 Preservation.

5.2.1 *Level A (overseas) and level B (domestic (storage)) shipments.* Anchoring devices not covered by anticorrosion coatings shall be coated with a rust-preventive compound con-

forming to the type P-2 and P-6 preservatives in accordance with Military Specification MIL-P-116. Preservative coating shall be dried to permit handling individually without disturbing the protective film.

5.2.2 *Level C (domestic shipments (immediate use)).* Covering of anchoring devices with antirust compounds, if used, shall be in accordance with good commercial practice.

5.3 Packaging.

5.3.1 *Issue packages.* Each issue package shall contain anchoring devices of only one group, type, class, style, and size along with a leaflet with the manufacturer's installation instructions. When required, a driver (setting tool), a dummy stud, or a drill adaptor shall accompany each issue package.

5.3.1.1 *Level A (overseas) and level B (domestic (storage)) shipments.* The packaging of anchoring devices shall be in setup boxes conforming to type I of Federal Specification PPP-B-676 or in folding cartons conforming to style III, type B, class a, of Federal Specification PPP-B-566.

5.3.1.2 *Level C (domestic shipments (immediate use)).* Commercial packaging is acceptable.

5.3.2 *Intermediate packaging.* Unless otherwise specified in the invitation for bids, the issue packages shall be packed in intermediate containers before packing for shipment.

5.3.2.1 *Level A (overseas) and level B (domestic (storage)) shipments.* The intermediate packaging of anchoring devices shall be done in fiberboard containers conforming to Federal Specification PPP-B-636, compliance symbol W5s or better. Containers shall be waterproofed by sealing with tape in accordance with the appendix to Federal Specification PPP-B-636.

5.3.2.2 *Level C (domestic shipments (immediate use)).* Commercial packaging is acceptable.

5.4 Packing.

5.4.1 *Level A (overseas) and level B (domestic (storage)) shipments.*

5.4.1.1 *Anchoring devices packaged in waterproofed intermediate containers (as specified in 5.3.2.1).* The packaged anchoring devices shall be packed in unlined shipping containers conforming to Federal Specifications PPP-B-591, PPP-B-621, PPP-B-636, PPP-B-585, PPP-B-601 (for overseas or domestic shipments), as specified. The gross weight of boxes shall not exceed 150 pounds.

5.4.1.2 *Anchoring devices packaged in non-waterproofed intermediate containers.* The anchoring devices shall be packed in wood boxes conforming to Federal Specifications PPP-B-585, PPP-B-601, or PPP-B-621 (overseas shipments), as specified. The gross weight of boxes shall not exceed 150 pounds. The boxes shall be lined with sealed barrier material conforming to Military Specification Jan-P-125.

5.4.2 *Level C (domestic shipments (immediate use)).* The packaged anchoring devices shall be packed for shipment in a manner to permit their acceptance by common carriers for transportation at the lowest applicable rate by the carrier, and to afford maximum protection from normal hazards of transportation.

5.5 Marking.

5.5.1 *Issue packages.* Unless otherwise specified, the issue packages of the subject commodities shall be marked with the name of the anchoring devices, group, type, class, style, and size, the material from which they are made, the quantity contained therein, the trade-mark and the name of the contractor or manufacturer.

5.5.2 *Shipping containers.* Unless otherwise specified, shipping containers shall be marked with:

Federal Specification Symbol: FF-S-325.
Name of the article.
Group, type, class, style, and size.
Bolt diameter and length (if supplied).
Bolt head or nut shape (if supplied).
Material and finish.
Quantity contained (number).
Contract or order number.
Manufacturer's name.
Contractor's name (if not the same as manufacturer's).
Consignee's name and address.
Gross weight.

5.5.2.1 *Military markings.* In addition to any special marking required by the contract or order, containers shall be marked in accordance with Military Standard MIL-STD-129.

6. NOTES

6.1 Restriction of scope. Neither power-driven anchoring devices nor plastic screw anchors are included in this specification.

6.2 Intended use.

6.2.1 *Group I, lead expansion bolt and stud anchors.*

6.2.1.1 *Type 1, "head-out"—embedded nut anchors.* These anchors are nonremovable, without destruction of them, when set into a drilled hole in masonry. They are used where the equipment or fixture may be dismantled frequently and where any protrusions in the walls or floors are objectionable after the equipment or the fixture have been removed.

6.2.1.2 *Type 2, "nut-out"—embedded bolt or stud anchors.* These anchors are also nonremovable, without destruction of them, when once set in a drilled hole in masonry. They are used where the equipment is set in place permanently and where the presence of protruding bolt and stud ends is not objectionable after the removal of the equipment or of the fixture.

6.2.1.3 *Types 1 and 2, class 1, single-expansion units anchors.* These anchors are used where overloads are not expected, and may be used in a relatively shallow hole if the masonry is of sound quality.

6.2.1.4 *Types 1 and 2, class 2, multiple-expansion units anchors.* These anchors are used wherever overloads up to the strength of the bolt may be expected or where the masonry is of unknown or doubtful grade. The use of multiple expansion unit anchors is always preferable as the holding power increases with the depth of the hole (see 6.3.1).

6.2.2 *Group II, expansion shield bolt anchors.*

6.2.2.1 *Class 1, closed-end, bottom bearing, expansion shield anchors.* These anchors are for use where the attachment of equipment or fixture is achieved without abutting the anchors. They may, therefore, be used with hanger rods and eyebolts. The closed-end, bottom bearing, expansion shield anchors are preferred for use in masonry of shallow depth or thickness. The shields may be removed, when necessary.

6.2.2.2.2 *Class 2, open-end expansion shield anchors.*

6.2.2.2.2.1 *Style 1, single-end expansion shield anchors.* These anchors are used where the outer end of the expansion shield may abut the fixture or the equipment being attached. They are suitable for use in sound masonry where a conelike expansion of the shield is not objectionable.

6.2.2.2.2.2 *Syle 2, double-end expansion shield anchors.* These anchors are for use in masonry where parallel expansion and full and even pressure on the sides of the drilled hole are desired.

6.2.2.2.2.3 *Class 3, styles 1 and 2, tubular expansion shield anchors.* These anchors are used for permanent setting in sound masonry and in shallow holes without any foreseeable overloads.

6.2.3 *Group III, self-drilling tubular expansion shell bolt anchors.* These anchors are for permanent setting in sound masonry. Their construction eliminates the necessity of using special masonry drills, as each anchor drills its own hole in masonary.

6.2.4 *Group IV, wood screw and lag bolt anchors.*

6.2.4.1 These anchors are made of materials (lead or fiber) soft enough to permit the screw to cut its own thread and tough enough to withstand specified loads without danger of stripping the thread. They are used in stone, brick, concrete, marble, etc., and are set permanently in previously drilled holes. Lead anchors should not be used where overloads or vibration may be expected. Fiber anchors should not be used in waterlogged masonry nor out of doors in semitropical and tropical zones. The length of the anchors should be not less than the length of the threaded part in the screws and lag bolts to be used.

6.2.5 *Group V, nail anchors.*

6.2.5.1 These anchors are used where the fixtures have to be attached without cracking or chipping the fixture or the masonry, or where small holes are important. These anchors are passed through the fixture into a previously drilled hole in the masonry and set in place by driving their nails home. Nail anchors should not be used near the edge of brick or masonry unless the direction of the expansion is at right angles to the edge or opening.

6.2.7 *Group VI, expanded drive-bolts and drive-studs.*

6.2.7.1 Expanded drive-bolts and drive-studs are used as anchor bolts or studs when driven in a hole of a proper diameter and depth. Their holding power depends upon the springiness in their split and expanded stems and the strength of the masonry. The studs may be driven flush with the masonry surface after the removal of the fixture or equipment. Expanded drive-bolts and drive-studs should not be used where loads of intermittent character may be expected.

6.2.8 *Group VII, masonry nails.*

6.2.8.1 Masonry nails are used for attaching light fixtures. When used in concrete, brick, or other hard masonry they require a hole of a proper diameter and of about two-thirds of the length of the nail. They may be hammered directly into soft masonry, as for example, mortar, cinder blocks, etc.

6.3 **Installation.** All anchoring devices shall be set in masonry in accordance with the instructions of their manufacturers. The holes shall be of the recommended diameter and depth and shall be drilled by the drills recommended by the manufacturer of the particular anchor. The drilled holes shall be left rough, not reamed, and free from any drill dust.

6.3.1 *Lead expansion (tamped) bolt and stud anchors, group I, of multiple (double or triple) expansion units.* These bolt anchors may be embedded in holes of a depth equal at least to four times the unit height in order to take advantage of the full strength of the bolt material in case of an accidental overload.

6.4 **Ordering data.** Purchasing agencies should state:

Federal Specification symbol, title and date.
Name of the anchoring device.
Group, type, class, style.
Size.
Material and finish.
Screws or bolts (when required), diameter, length, head or nut shape.
Quantity.
Whether proof load tests are required. (Optional on nonmilitary orders.)
Level of packaging and packing.

and should exercise any desired option offered herein (see 3.2.1.1.1.1, 3.2.1.1.1.2, 3.2.2.1.1, 3.2.2.1.2, 3.2.2.1.3, 3.2.2.2.1.1, 3.2.2.2.2.1.1, 3.2.2.2.2.2.1, 3.2.2.2.3.2, 3.2.3.1.1, 3.2.4.1.1, 3.2.5.1.4, 3.2.5.1.4.1, 3.2.5.1.5, 3.2.5.2, 3.2.5.2.2, 3.2.5.2.4.1, 3.2.5.2.4.2, 4.1, 4.2, 4.2.1, 4.3.1, 5.1, 5.2, 5.3.2, 5.5.1 and 5.5.2).

6.5 **Transportation description.** The proper transportation description applicable to the masonry anchoring devices:

ANCHORS, BUILDING, IRON, STEEL, ZINC OR BRASS

Carload, minimum, 40,000 pounds.
Truckload, minimum, 36,000 pounds.

6.6 It is believed that this specification adequately describes the characteristics necessary to secure the desired material, and that normally no samples will be necessary prior to award to determine compliance with this specification. If, for any particular purpose, samples with bids are necessary, they should be specifically asked for in the invitation for bids, and the particular purpose to be served by the bid sample should be definitely stated, the specification to apply in all other respects.

6.7 Illustrations of anchoring devices shown in this specification are for the convenience of the purchasers and are not intended to preclude the purchase of devices which are otherwise in accordance with the requirements of this specification.

6.8 Federal specifications do not include all types, classes, styles, sizes, etc., of the commodities indicated by the titles of the specifications, or which are commercially available, but are intended to cover the types, etc., which are suitable for Federal Government requirements.

6.9 Federal Standard No. 102 should be referred to for definitions and applications of the various levels of packaging protection for supplies and equipment.

6.10 This specification supersedes the following GSA Specifications: GSA 576, July 3, 1942; GSA 584, September 19, 1942; and GSA 684, August 28, 1945.

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