

GGG-P-781E
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SUPERSEDING
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FEDERAL SPECIFICATION

PULLER, MECHANICAL

PULLER ATTACHMENT, MECHANICAL, AND PULLER SET, MECHANICAL

This specification is 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 mechanical pullers, puller attachments, puller adapters, and puller sets which are commonly used for pulling bearings, and gears.

1.1.1 Federal specification coverage. Federal specifications do not cover all varieties of the commodity indicated by the title of the specification, or which are commercially available, but are intended to cover only those generally used by the Federal Government.

1.2 Classification.

1.2.1 Types, classes, and styles. Pullers, puller attachments, and puller adapters shall be of the following types, classes, and styles, as specified (see 6.1), for puller sets (see 3.6).

Pullers, mechanical:

Type I - Gear and bearing

Class 1 - Two-jaw, external

Style A - Single end grip

Style B - Double end grip

Class 2 - Three-jaw, external

Style A - Single end grip

Style B - Double end grip

Class 3 - Two-jaw, external and internal

Class 6 - Two-jaw, light-duty, external

Class 7 - Two- and three-jaw, external, combination

Type II - Bearing, three-jaw, double end grip, aircraft electrical accessories

Type III - Slide hammer

Class 1 - Bearing, two-jaw, internal

Class 2 - Gear and bearing, two- and three-jaw, external and internal

Style A - Light-duty

Style B - Heavy-duty

Class 3 - Bearing race, three-jaw, internal

Type IV - Bearing, clutch pilot

Type V - Steering gear arm

FSC 5120

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

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Type VI - Steering wheel, three-arm, mechanical, ring type

Type VII - Gear end bearing

Type VIII - Gear and pulley

Type IX - Impulse coupling, two-jaw

Puller attachment, mechanical

Type XI - Bearing, internal

Type XII - Bearing, external

Puller adapter, mechanical

Type XIII - Gear and bearing

Class 1 - Male and female thread

Style A - With 5/8 - 18 UNF-2B tapped hole

Style B - With 1 - 14 UNS-2B tapped hole

Style C - With 1-1/2 - 12 UNF-2B tapped hole

Class 2 - Female thread

Style A - With 5/8 - 18 UNF-2B tapped hole

Style B - With 1-14 UNS-2B tapped hole

Class 3 - Spacer

Class 4 - Step plate

Class 5 - Leg cap

2. APPLICABLE DOCUMENTS

2.1 Government documents. The following documents, of the issues in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein:

Federal Specification:

GGG-W-636 - Wrenches (Box, Open End and Combination)

Federal Standard:

FED-STD-H28 - Screw-Thread Standards for Federal Services

(Activities outside the Federal Government may obtain copies of Federal specifications, standards, and Commercial Item Descriptions as outlined under General Information in the Index of Federal Specifications, Standards and Commercial Item Descriptions. The Index, which includes cumulative bimonthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.)

(Single copies of this specification, and other Federal specifications and Commercial Item Descriptions required by activities outside the Federal Government for bidding purposes are available without charge from General Services Administration Business Service Centers in Boston, MA; New York, NY; Philadelphia, PA; Washington, DC; Atlanta, GA; Chicago, IL; Kansas City, MO; Fort Worth, TX; Houston, TX; Denver, CO; San Francisco, CA; Los Angeles, CA; and Seattle, WA.)

(Federal Government activities may obtain copies of Federal standardization documents and the Index of Federal Specifications, Standards and Commercial Item Descriptions from established distribution points in their agencies.)

2.2 Non-Government publications. The following documents form a part of this specification to the extent specified herein. Unless a specific issue is identified, the issue in effect on date of invitation for bids or request for proposal shall apply.

American National Standard Institute (ANSI):

ANSI B18.2B107-17M - Gages, Wrench Opening, Reference

(Application for copies should be addressed to the American National Standards Institute, 11 West 42nd Street, New York, NY 10036.)

American National Standards Institute (ANSI)/American Society of Quality Control (ASQC):

ANSI/ASQC Z1.4 - Sampling Procedures and Tables for Inspection by Attributes

(Application for copies should be addressed to the American Society for Quality Control, P.O. Box 3005, 611 E. Wisconsin Avenue, Milwaukee, WI 53201-4606.)

American Society for Testing and Materials (ASTM):

ASTM A 29/A29M - Specification for Steel Bars, Carbon, Alloy, Hot-Wrought and Cold-Finished, Standard Quality

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103-1187.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

3. REQUIREMENTS

3.1 Illustrations. The illustrations herein are descriptive and not restrictive and are not intended to preclude the purchase of pullers otherwise conforming to this specification.

3.2 Material. The chemical composition of the materials and the heat treatment employed shall be such as to produce pullers and attachments complying with the requirements specified hereinafter for each type, class, style, and size. All forgings and castings shall be of uniform quality and free from all defects and imperfections which may affect their serviceability and durability.

3.3 Screw-threads. All screw-threads and threads of mating parts specified herein shall be in accordance with the applicable requirements of FED-STD-H28 and be National Standard "V" threads.

3.4 Interchangeable parts. All parts having the same manufacturer's part number shall be constructed to definite standards, tolerances, and clearances in order that such parts may be completely interchangeable and may be replaced or adjusted without requiring modification.

3.4.1 Tolerance. When no tolerances are specified herein, a tolerance of ± 10 percent will be allowed.

3.4.2 Nuts and screws. Nuts and screws, when used, shall be of good-quality steel and shall be assembled in a manner that excessive looseness and play will not develop under hard usage. The screws shall be of sufficient strength to resist breakage and deformation under the test load of the applicable table when the pullers are tested, as specified in 4.5.1.

3.5 Marking for identification.

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3.5.1 Pullers and attachments (mechanical). The pullers and attachments shall be marked in a plain and permanent manner with the manufacturer's name or with a trademark of such known character that the source of manufacture may be readily determined.

3.5.2 Type XIII, puller attachments: forcing screw, thread size adapting, mechanical. Each type XIII puller adapters shall be legibly stamped with the following information: Manufacturer's number and thread size.

3.5.3 Carrying case. When carrying cases are specified (see 6.1), they shall be provided with an identification permanently and legibly marked with the following information on the outside of the cover of the carrying case:

Name of article.
Type, class, style, and size.
Federal Specification GGG-P-781.
Manufacturer's name or trademark.

3.5.3.1 Part number. The manufacturer's part number shall be identical with the manufacturer's production drawing number including applicable dash number if the drawing is tabulated and covers more than one part.

3.6 Puller sets, gear and bearing (for shipboard use only). When gear and bearing puller sets are required for Naval shipboard use, they shall be furnished as "limited" and "complete" sets, as specified (see 6.1).

3.6.1 Limited set. A limited set shall consist of the following:

- 1 Type I puller, class 1, style A, size 3 with 2 spare bolts and 2 spare nuts.
- 1 Type I puller, class 1, style A, size 5 with 2 spare bolts and 2 spare nuts.
- 1 Type VII puller, size 1, with two 6-3/4 inch legs and two 15-3/4 inch legs.
- 1 Type XII puller attachment, size 2.
- 1 Type XII puller attachment, size 3.
- 2 Type XIII adapter, class 1, style A, size 1.
- 2 Type XIII adapter, class 1, style A, size 2.
- 2 Type XIII adapter, class 1, style A, size 7.
- 2 Type XIII adapter, class 1, style A, size 9.
- 2 Type XIII adapter, class 3, spacer, size 3.
- 2 Type XIII adapter, class 3, spacer, size 4.
- 2 Type XIII adapter, class 3, spacer, size 5.
- 1 Single end box wrench, 1-inch, 12-point, heavy-duty type XVIII, class 2 in GGG-W-636, with 11 inch ($\pm 1/4$ inch) long extension handle.

3.6.2 Complete set. The complete set shall consist of the limited set plus the following:

- 1 Type I puller, class 1, style A, size 8, with 2 spare bolts and 2 spare nuts.

- 1 Type VII puller, size 3, with two 4-1/2 inch legs, two 9-1/2 inch legs, two 16-1/2 inch legs and two 22-1/2 inch legs.
- 1 Type XIII puller adapter, class 3, spacer, size 1.
- 1 Single end box wrench, for 1-1/2 inch, 12 point in addition to the single end box wrench, 1 inch, 12 point specified in 3.6.1, type XVIII, class 2 in GGG-W-636.

3.7 Test loads. Pullers shall withstand the minimum test load specified herein for the pullers without failure of any part or parts of the puller. Failure shall be interpreted to be either breakage or deformation set to such an extent that the puller loses its hold or grip or is otherwise rendered incapable of maintaining the load specified herein (see 4.5.1).

3.7.1 Type I, gear and bearing. The type I puller shall consist essentially of a head or yoke, forcing screw, straps, cap screws, and jaws. All parts, with the exception of the cap screws and straps to be heat treated to resist breakage or deformation. The pullers shall be designed to allow free movement with a minimum of clearance between working parts.

NOTE: When testing type I pullers, the puller screw is to be extended approximately 1/2 its overall length.

3.7.1.1 Head or yoke. The head or yoke shall be drop forged, cast, or machined from high-grade alloy steel and have a threaded hole centrally located for engaging the thread of the forcing screw. The threaded hole shall conform to UN Class 2B standards. The jaws shall be assembled direct to the head or yoke or by means of straps or hinges.

3.7.1.2 Forcing screw. The forcing screw shall be a high-grade alloy steel. The head of the screw shall be hexagonal-shaped, as indicated in Table I, and of a size suitable for accepting a standard size wrench. The pressure end of the screw shall be turned below the root diameter of the thread. At the option of the manufacturer, the pressure end of the screw shall be either a 60° point for load application in the shaft center, or a small 60° centering point extending from a flat end pressure screw. The extended (or screwed down) length of the forcing screw, underneath the head or yoke, shall be equal to or greater than the short reach dimension "B" shown in Table I, or the "B" reach dimension shown in Tables II and III as applicable to the class and style specified. The threads shall conform to UN Class 2A standards.

Table I. Type I, classes 1, 2, and 7; style A puller, mechanical, gear and bearing, two- and three-jaw combination, external, single and grip

Size 2/	Nominal dimensions 1/					Testing	
	Spread range A (inches)	Long reach (min.) B (inches)	Short reach (min.) B (inches)	Screw head across flats D (inches)	Screw thread (nominal) (min.) E (inches)	Test load (min.) (pounds)	Jaw spread (inches)
2	0 - 4	3-1/4	2-1/2	1/2	3/8-24 UNF	4,000	2-1/2
3	0 - 6	5-1/2	3-1/4	5/8	9/16-20 UN	10,000	5
4	0 - 9	8-3/4	5	3/4	11/16-18 UNS	14,000	6
5	0 - 12	11	7-1/2	7/8	13/16-16 UN	20,000	9
6	0 - 14	14	9-1/2	1-1/4	1-14 UNS	35,000	9
7	0 - 16	18-1/2	9-1/2	1-3/8	1-14 UNS	50,000	9
8	0 - 18	15-5/8	11-1/2	1-3/8	1-1/4-12 UNF	50,000	10
9	0 - 20	22	11-1/2	1-3/8	1-1/4-12 UNF	50,000	10

1/ See 4.3.2.1 for methods of measuring.

2/ Class 7 in sizes 2, 3, 4, and 5 only.

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3.7.1.3 Jaws. The jaws shall be forged from high-grade alloy steel. The gripping ends of the jaws shall be designed and constructed to prevent slippage from the gear or bearing pulled at any setting within the capacity of the puller.

3.7.1.4 Class 1, two-jaw, external. Class 1 pullers shall have parallel alignment of the assembled jaws.

3.7.1.4.1 Puller attachments or adapters. Puller attachments or adapters when specified (see 6.1) shall be in accordance with 3.5.2, 3.8.2, 3.9.1, 3.9.2, 3.9.5, and 3.9.6.

3.7.1.4.2 Style A, single end grip. The style A puller shall be similar to Figure 1 and shall conform to Table I for the size specified (see 6.1).

3.7.1.4.3 Style B, double end grip. The style B puller shall be similar to Figure 2 and shall conform to Table II for the size specified (see 6.1).

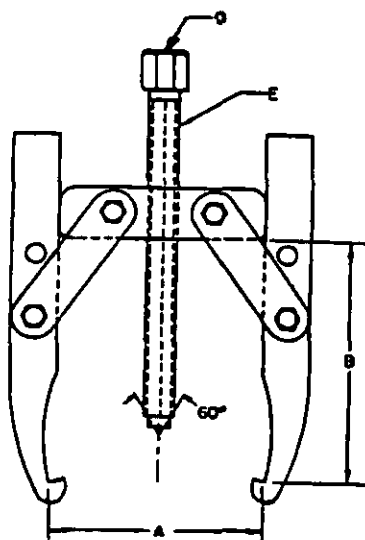


Figure 1. Type I, class 1, style A, puller, mechanical, gear and bearing, two-jaw, external, single end grip. (See Table 1 for size specification.)

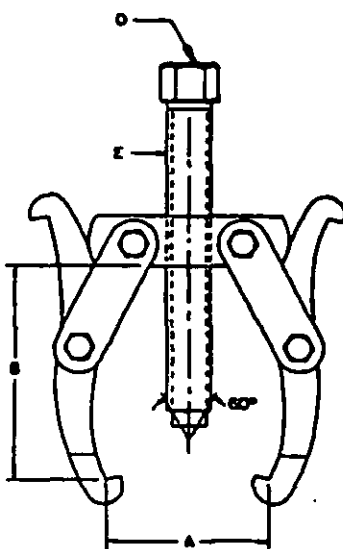


Figure 2. Type I, class 1, style B, puller, mechanical, gear and bearing, two-jaw, external, double end grip. (See Table 1 for size specification.)

Table II. Type I, classes 1, 2, and 7, style B puller, mechanical, gear and bearing, two- and three-jaw, external, double end grip

Size	Spread range A (inches)	Reach B (min.) (inches)		Screw head (across flats) D (inch)	Forcing screw thread (inches)	Testing	
		Short	Long			(min.) (pounds)	Jaw spread (inches)
0	0 - 4	2-1/2	3-1/4	1/2	3/8 - 24 UN	4,000	2-1/2
1	0 - 6	3-1/4	5-1/2	5/8	9/16 - 20 UN	10,000	5
2	0 - 9	5	8-3/4	3/4	11/16 - 18 UNS	14,000	6

3.7.1.5 Class 2, three-jaw, external. Class 2 pullers shall have the assembled jaws equally spaced around the periphery of the head or yoke.

3.7.1.5.1 Style A, single end grip. Style A pullers shall be similar to Figure 3 and shall conform to Table I for the size specified (see 6.1).

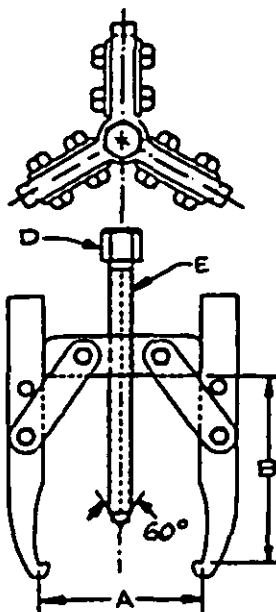


Figure 3. Type I, class 2, style A, puller mechanical, gear and bearing, three-jaw, external, single end grip. (See Table I for size specification.)

3.7.1.5.2 Style B, double end grip. The style B puller shall be similar to Figure 4 and shall conform to Table II for the size specified (see 6.1).

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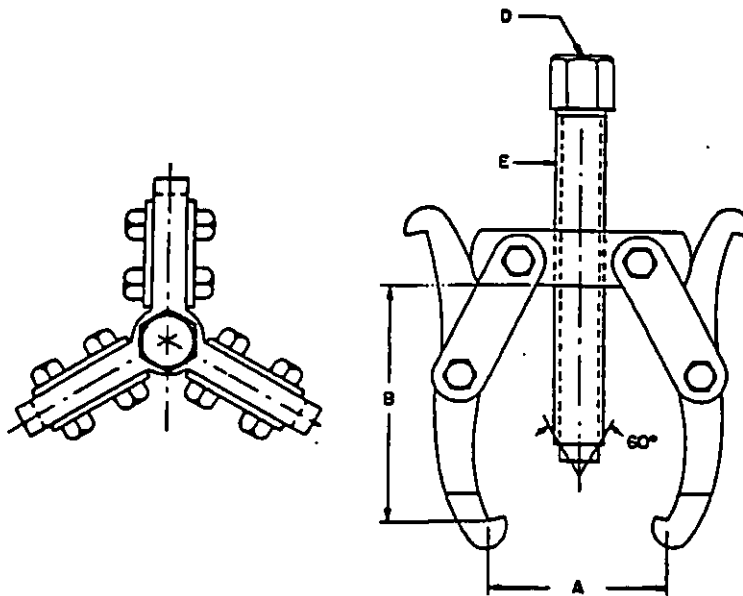


Figure 4. Type I, class 2, style B, puller, mechanical, gear and bearing, three-jaw, external, double end grip. (See Table II for size specification.)

3.7.1.6 Class 3, two-jaw, external and internal. Class 3 pullers shall be suitable for use on external pulling operations and easily reversible for internal pulling operations. In addition to the parts specified in 3.7.1, the puller shall be provided with a suitable spring locking arrangement and a forcing screw point protector or a removable point. The parts shall be of high-grade steel properly heat treated to resist breakage or deformation.

3.7.1.6.1 Spring locking arrangement. The spring locking arrangement shall be designed to adjust and lock the jaws to the job and be capable of holding the jaws in position under the applicable test load.

3.7.1.6.2 Forcing screw point protector. The forcing screw point protector shall be provided with a hole to receive and protect the forcing screw point.

3.7.1.6.3 Class 3 puller. The class 3 puller shall be similar to Figure 5 and shall conform to Table III for the size specified (see 6.1).

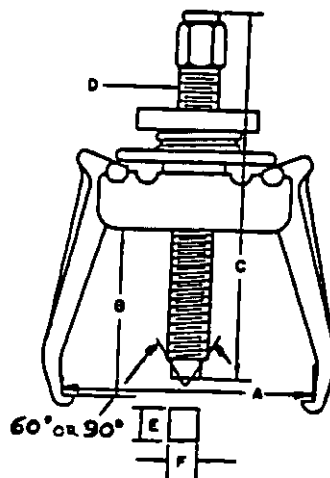


Figure 5. Type I, class 3, puller, mechanical, gear and bearing, two-jaw, external and internal. (See Table III or size specification.)

Table III. Type I, class 3, style puller, mechanical, gear and bearing, two-jaw, external and internal

Size	Spread range A		Reach (min)	Screw length	Screw Thread UNF	Point protector		Test load (min.) (pounds)
	External (inches)	Internal (inches)	B (inches)	C (inches)	D (inches)	Length E (inch)	Diameter F (inch)	
1	0 - 4-1/2	1-1/2 - 4	2-7/8	6-3/4	5/8 - 18	1/2 - 5/8	7/16 - 1/2	10,000
2	0 - 8-1/2	2-1/2 - 7-1/2	5-1/2	9-3/4	3/4 - 16	1/2 - 5/8	7/16 - 9/16	20,000
3	0 - 14	3-1/2 - 9-1/4	9-1/2	15	*1 - 14	5/8 - 13/16	7/16 - 5/8	30,000

*UNS-2A

3.7.1.7 Class 6, two-jaw, light-duty, external. The class 6 pullers shall be suitable for use in close quarters pulling small gears, pulleys, and bearings. The puller shall be furnished with one pair of short jaws or one pair of long jaws, or both, as specified (see 6.1). The puller shall also be furnished with a standard detachable center point or a small detachable center point, or both, as specified (see 6.1). The puller shall be adjustable to the applicable spread in Table IV by means of an adjusting cone nut at the top of the jaws.

3.7.1.7.1 Adjusting cone nut. The adjusting cone nut shall be of a high grade steel properly heat treated to resist breakage and deformation. The adjusting cone nut shall be externally tapered for adjusting the jaws to the work, shall be internally threaded to engage the thread on the forcing screw, and shall be knurled or serrated on the flat of the outer face.

3.7.1.7.2 Forcing screw. The head of the forcing screw shall be either hexagon shaped or provided with a tee-handle drive. The forcing screw shall have American Standard V-thread and a 60° point. The forcing screw length (beneath the yoke) shall be equal to, or slightly greater than, the reach. (The reach is the distance from the bottom of the yoke to the gripping surface of the jaw.)

3.7.1.7.3 Class 6 puller. The class 6 pullers shall be similar to Figure 6 and shall conform to Table IV for the spread range and minimum test loads.

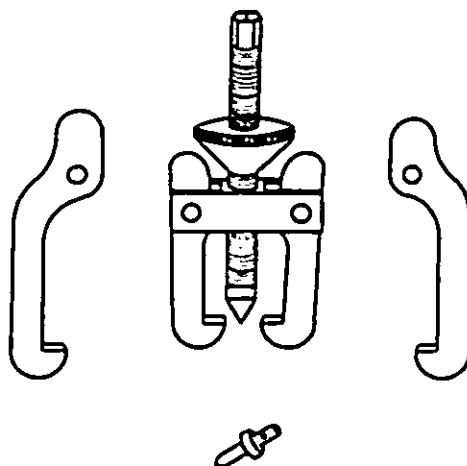


Figure 6. Type I, class 6, puller, mechanical, gear and bearing, two-jaw, light duty, external. (See Table IV for size specification.)

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Table IV. Type I, class 6, puller, mechanical, gear and bearing, two-jaw, light-duty, external

	Spread range (outside pulling) (inches)	Test load (min.) (pounds)
Short jaws	0 - 1-1/2	1,000
Long jaws	0 - 3	1,500

3.7.1.8 Class 7, two-jaw/three-jaw, external, combination. The class 7 pullers shall be designed to be used as either a two-jaw or three-jaw combination puller, as shown in Figures 7a and 7b, and shall conform to Table I for the style A size specified (see 6.1) and Table II for the style B size specified.

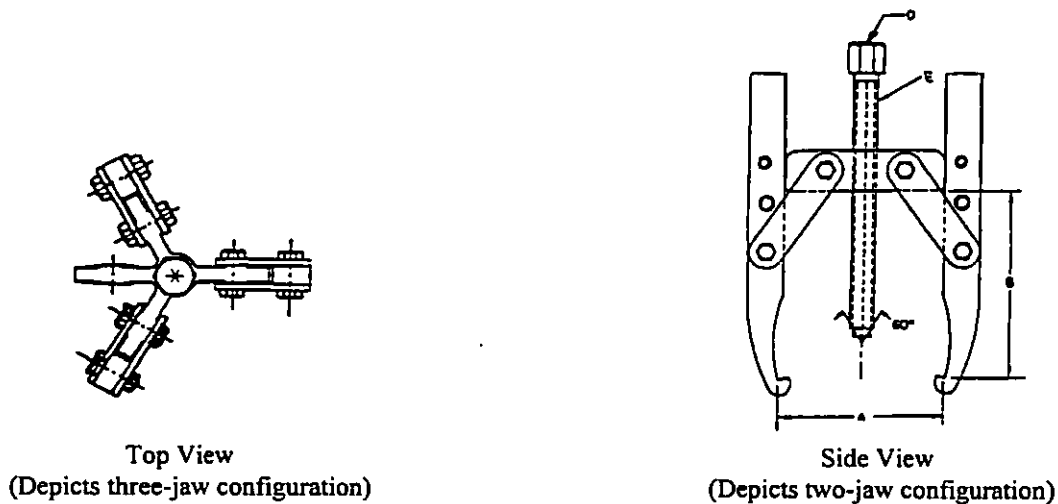


Figure 7a. Type I, class 7, style A puller, mechanical, gear and bearing, two-jaw/three-jaw external, combination. (See Table I for size specification.)

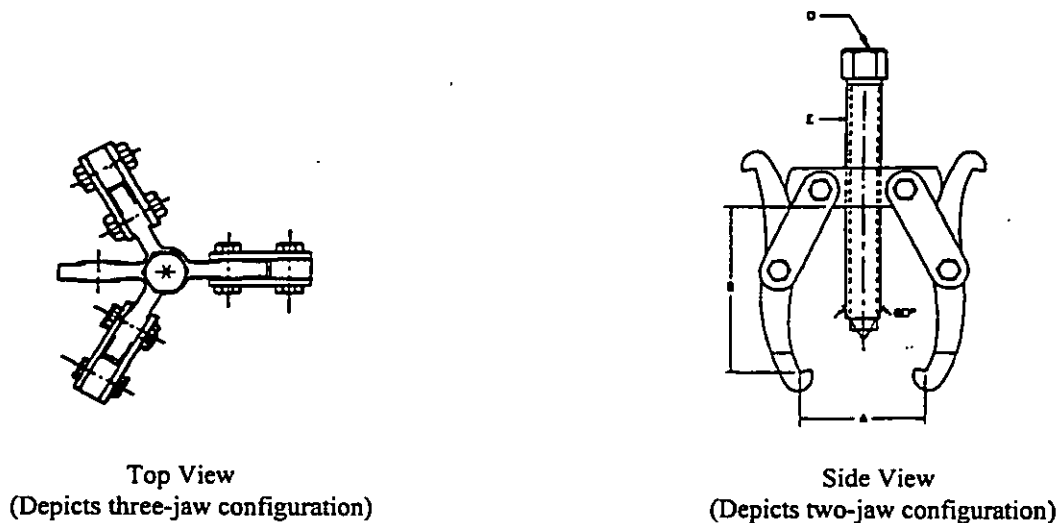


Figure 7b. Type I, class 7, style B puller, mechanical, gear and bearing, two-jaw/three-jaw external, combination. (See Table II for size specification.)

3.7.2 Type II, bearing, three-jaw, double end grip, aircraft electrical accessories. The type II pullers shall be in accordance with 3.7.1, 3.7.1.1, 3.7.1.3, and 3.7.1.5, except for the forcing screw design.

3.7.2.1 Forcing screw. The forcing screw shall be of a high grade alloy steel. The head of the screw shall have a tee-handle drive. The pressure end of the screw shall be provided with a live center.

3.7.2.2 Live center. The live center shall be constructed of a high grade steel, properly heat treated to resist breakage or deformation. The live center shall be attached to the forcing screw in such a manner as to maintain free motion within the live center throughout the entire range of the pulling loads (see Table V). The live center shall be provided with a 60° angle point.

3.7.2.3 Shaft protector. At the option of the manufacturer, a shaft protector may be furnished in lieu of the live center (see 3.7.2.2). The shaft protector shall be made from a high grade steel, properly heat treated to resist breakage or deformation. It shall provide protection from the forcing screw to the shaft to which the puller is applied throughout the entire range of the pulling loads (see Table V). The shaft protector shall be attached to the puller by chain or other suitable means to prevent loss and shall be provided with a small 60° angle centering point.

3.7.2.4 Type II pullers. The type II pullers shall be similar to Figure 8 and shall conform to Table V for the size specified (see 6.1).

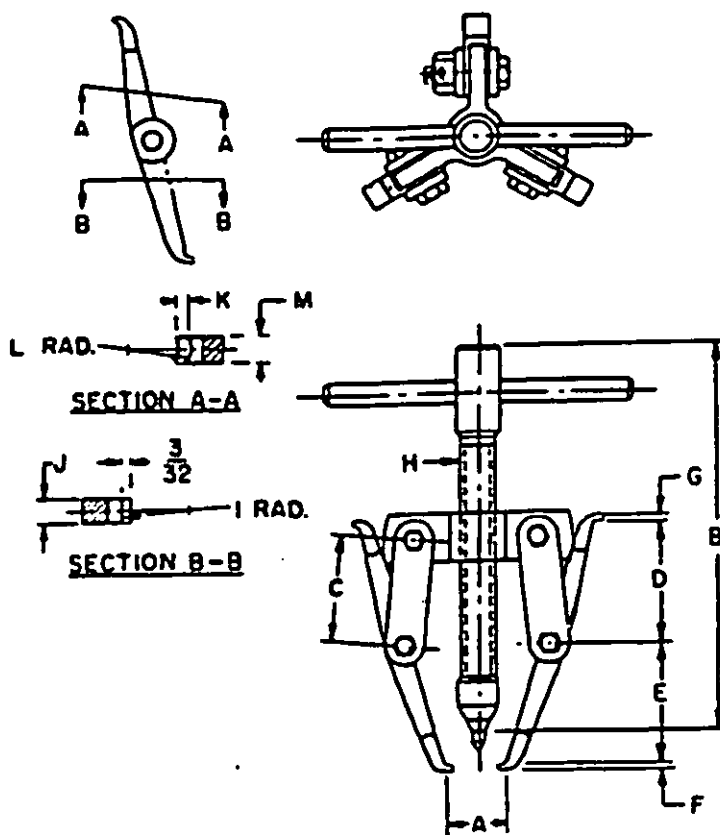


Figure 8. Type II, puller, mechanical, bearing, three-jaw, double end grip, aircraft electrical accessories.
(See Table V for size specification.)

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Table V. Type II, puller, mechanical, bearing, three-jaw, double end grip, aircraft electrical accessories

Size	Speed range A				Dimensions					
	Small end		Large end		B	C	D	E	F	G
	min.	max.	min.	max.						
1	1/2	3/4	3/4	1-1/8	3-7/8	1.125	1.218	1.218	0.020	0.050
2	1-1/8	1-3/4	1-3/4	2-1/2	6	1.875	2.125	2.078	0.062	0.094

Size	Dimensions						Test load (min.)	
	H Thread	Radius I	J	K	Radius L	M	Small end	Large end
1	5/16-24 UNF-2A	5/16	1/4	3/32	7/16	1/4	325	500
2	9/16-20 UNF-2A	11/16	3/8	1/8	15/16	3/4	825	3,300

Tolerances on

Decimals ± 0.033 Fractions $\pm 1/64$

3.7.2.5 Finish. The type II puller jaws may be finished with aluminum paint at the option of the manufacturer.

3.7.3 Type III, slide hammer. The type III pullers shall consist essentially of a yoke, jaws conforming to 3.7.1.3, for material and gripping end design, a slide hammer, and a slide rod. The parts shall be properly heat treated to resist breakage or deformation. The pullers shall be designed to allow free motion with a minimum of clearance between the working parts.

3.7.3.1 Yoke. The yoke shall be of a high grade alloy steel and provided with a threaded hole, centrally located, to engage the threaded end of the slide rod. The jaws shall be assembled directly to the yoke.

3.7.3.2 Slide hammer. The slide hammer shall be of a high grade steel, cylindrical in cross section, and of a size and length to assure maximum operation. The slide hammer shall be of a design to facilitate a comfortable and secure handgrip. A smooth hole shall be provided in the center of the hammer to assure free movement on the slide rod.

3.7.3.3 Slide rod. The slide rod shall be of a high grade steel with a permanent means of keeping the slide hammer on the rod, such as a hexagon head, upset ball as shown in Figure 10, or other suitable means. The slide rod shall be of a suitable length to assure use of the slide hammer. The slide rod shall be threaded on the end to engage the yoke.

3.7.3.4 Class 1, bearing, two-jaw internal. The class 1 pullers shall have an adjusting bar with parallel alignment of the assembled jaws, shall be similar to Figure 9 and shall conform to Table VI for the size specified (see 6.1).

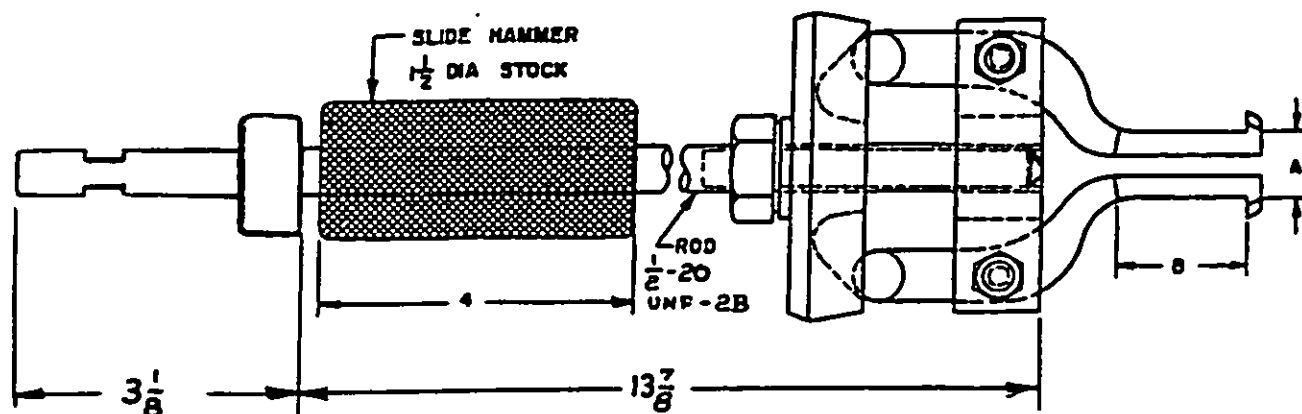


Figure 9. Type III, class 1, puller, mechanical, slide hammer, bearing, two-jaw, internal.
(See Table VI for size specification.)

Table VI. Type III, class 1, puller, mechanical, slide hammer, bearing, two-jaw, internal

Size	Spread range A (inches)	Reach (max.) B (inches)	Test load (min.) (pounds)	Test ring (I.D.) (inches)
1	1/2 - 1-1/2	3/4	1,000	1
2	7/8 - 2	7/8	1,000	1
3	1/2 - 1-7/8	1-3/4	1,000	1

3.7.3.4.1 Adjusting bar. The adjusting bar shall be of a high grade steel capable of resisting breakage or deformation. The bar shall be designed to provide adjustment of the jaws to the work by means of a thumbscrew or nut and adjusting yoke.

3.7.3.5 Class 2, gear and bearing, two-jaw/three-jaw, external and internal.

3.7.3.5.1 Style A, light duty. The style A puller shall be furnished with individual two-jaw/ three-jaw yokes and shall be adjustable to the applicable spread range specified in Table VII by means of an adjusting cone at the top of the jaws. When the two-jaw yoke is used, the assembled jaws shall have parallel alignment. The assembled jaws used with the three-jaw yoke shall be equally spaced around the periphery of the yoke.

3.7.3.5.1.1 Adjusting cone. The adjusting cone shall be of a high grade steel properly heat treated to resist breakage or deformation. The cone shall be externally and internally tapered for adjusting both the external and internal jaws to the work by inverting the cone. The cones shall be internally threaded to engage the threaded end of the slide rod and knurled or serrated on the flat surface of the outer face.

3.7.3.5.1.2 Type III, class 2, style A pullers. The type III, class 2, style A pullers shall be similar to Figure 10, conform to Table VII, and withstand a minimum test load of 5,000 pounds.

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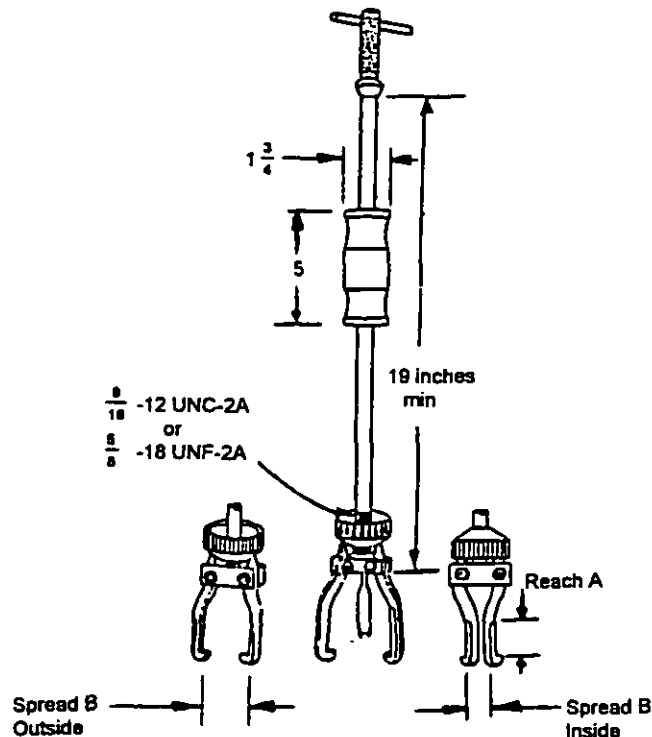


Figure 10. Type III, class 2, style A, puller, mechanical, slide hammer, gear and bearing, two-jaw/three-jaw, external and internal, light duty. (See Table VII for jaw specification.)

Table VII. Type III, class 2, style A, puller, mechanical, slide hammer, gear and bearing, two-jaw/three-jaw, external and internal, light duty

Jaw	Reach A (inches)	Spread B (inches)							
		two-jaw				three-jaw			
		Inside		Outside		Inside		Outside	
		(min.)	(max.)	(min.)	(max.)	(min.)	(max.)	(min.)	(max.)
1	1-1/4	3/4	2-3/8	-	-	1	2-3/4	-	-
2	1-7/8	1-1/4	3-1/2	1	4-1/2	1-1/2	4-1/4	1-1/2	4-1/2
3	2-3/4	1-1/2	4-1/2	3/4	5	1-1/2	4-3/4	1	4-1/2
4	4-7/8	2-3/4	5-1/2	3/4	7-1/2	3-1/4	6-1/4	1	6-1/4

3.7.3.5.2 Type III, class 2, style B, heavy duty. The style B pullers, in addition to the requirements specified in 3.7.3, shall consist of a suitable locking arrangement and spreader arrangement. The parts shall be of a high grade steel properly heat treated to resist breakage or deformation. The puller shall be similar to Figure 11, have specifications equal to Table VII jaw 4, and withstand a minimum test load of 10,000 pounds.

3.7.3.5.2.1 Yoke. The style B puller shall be furnished with either a combination yoke or individual two- and three-jaw yokes.

3.7.3.5.2.1.1 Combination yoke. The combination yoke shall be designed to permit two- or three-jaw assembly. The two-jaws, when assembled, shall hang in parallel alignment and the three-jaws, when assembled, shall hang equally spaced around the periphery of the yoke.

3.7.3.5.2.2 Slide rod. The style B slide rod shall be threaded 5/8-18 UNF x 3 inch minimum length to engage the yoke.

3.7.3.5.2.3 Locking arrangement. The locking arrangement shall be capable of locking the external jaws at the desired range.

3.7.3.5.2.4 Spreader arrangement. A suitable means shall be incorporated into the design of the puller for use in spreading the external and internal pulling assembly.

3.7.3.5.2.5 Type III, class 2, style B. The type III, class 2, style B puller shall be similar to Figure 11 and shall meet Table VII jaw 4 specifications.

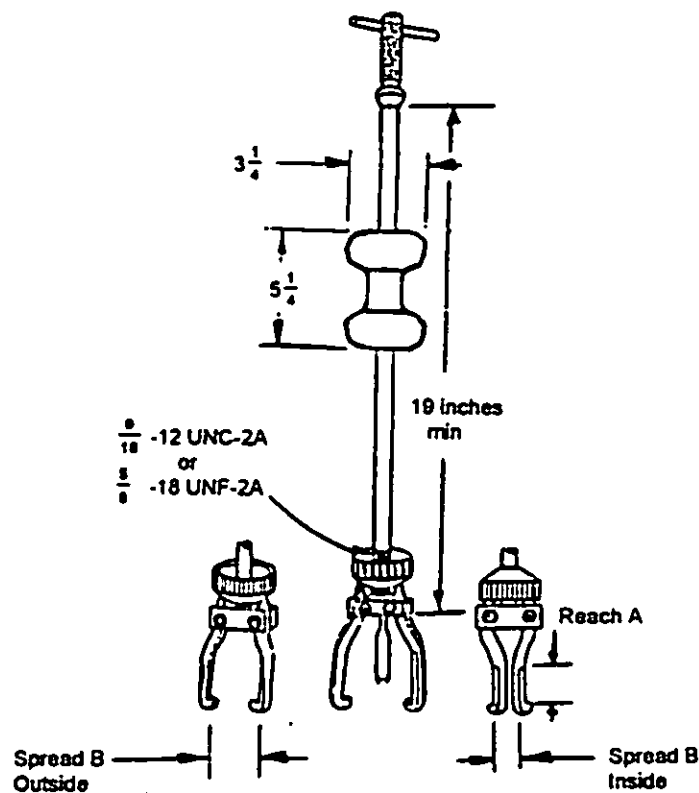


Figure 11. Type III, class 2, style B, puller, mechanical, slide hammer, gear and bearing, two- and three-jaw, external and internal, heavy duty. (See Table VII jaw 4 for reach and spread specifications.)

3.7.3.6 Class 3, bearing race, three-jaw, internal. The class 3 pullers shall be adjustable over an internal spread range of 2-7/8 up to and including 5 inches by means of an expansion plug behind the three-flanged jaws and shall withstand a minimum test load of 5,000 pounds.

3.7.3.6.1 Expansion plug. The expansion plug shall be of a high grade steel properly heat treated to resist breakage or deformation. The plug shall be externally tapered, internally threaded to engage the thread on the slide rod, and shall have suitable means provided for securing it to the slide rod.

3.7.3.6.2 Type II, class 3. Type II, class 3 puller shall be similar to Figure 12.

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Figure 12. Type III, class 3, puller, mechanical, slide hammer, bearing race, three-jaw, internal.

3.7.4 Type IV, bearing, clutch pilot. The type IV pullers shall consist essentially of a body, head, yoke screw, forcing nut, and jaws. The pullers shall be designed to allow free movement with a minimum of clearance between the working parts.

3.7.4.1 Body. The body shall be of a high grade steel, of a U-shape suitable for using in close quarters. The inside height of the body shall be not less than the combined length of the assembled head yoke and jaws. The top and base of the body shall be machined parallel.

3.7.4.2 Head yoke. The head yoke shall be of a high grade forged alloy steel and shall have a threaded hole, centrally located, suitable for accepting the thread of the yoke screw. A guide integral with the head yoke shall be provided for keeping the head yoke and jaws in proper parallel alignment. The jaws shall be assembled directly to the yoke.

3.7.4.3 Yoke screw. The screw shall be of a high grade steel. The head of the screw may be either machined to accept a standard size wrench, or a tee-handle drive with hexagon head. The thread on the screw shall be suitable to engage the thread of the head yoke. The design shall provide a means for centering and expanding the puller jaws.

3.7.4.4 Forcing nut. The forcing nut shall be of good quality steel and hexagonal in shape having a thread for engaging the thread in the yoke screw.

3.7.4.5 Jaws. The jaws shall be in accordance with the applicable requirements of 3.7.1.3.

3.7.4.6 Type IV pullers. The type IV pullers shall be similar to Figure 13 and shall conform to Table VIII for the size specified (see 6.1).

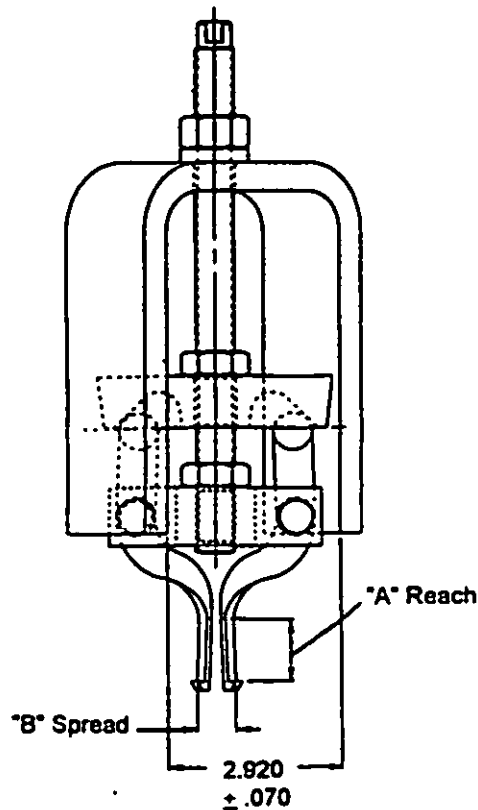


Figure 13. Type IV, puller, mechanical, bearing, clutch pilot.

Table VIII. Type IV, puller, mechanical, bearing, clutch pilot

Size	Reach A (min.) (inches)	Spread B	
		(min.) (inches)	(max.) (inches)
1	3/4	1/2	1-1/2
2	1	7/8	2

3.7.5. Type V, steering-gear arm. The type V pullers shall be in accordance with 3.7.1, 3.7.1.1, and 3.7.1.3 except for the addition of a locking bar and method of assembling jaws. The design of the pullers shall provide for suitable assembly of a locking bar capable of locking the jaws on the steering-gear arm.

3.7.5.1 Forcing screw. The screw shall be in accordance with 3.7.1.2 except for the center point which shall be 90°.

3.7.5.2 Locking bar. The locking bar shall be of a high grade steel properly heat treated to resist breakage or deformation.

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3.7.5.3 Type V pullers. The type V pullers shall conform to the dimensions shown on Figure 14.

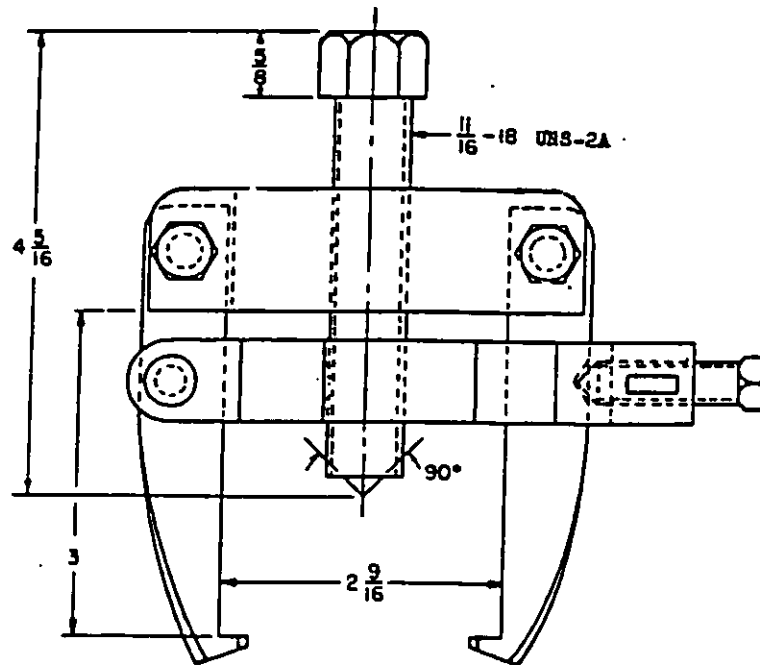


Figure 14. Type V, puller, mechanical, steering-gear arm.

3.7.6 Type VI, mechanical, ring type steering wheel, three-arm. The type VI puller shall consist essentially of a yoke, forcing screw, three-arms, point protector, and pulling ring, and shall be properly heat treated to resist breakage or deformation.

3.7.6.1 Yoke. The yoke shall be in accordance with 3.7.1.1 and 3.7.1.5.

3.7.6.2 Forcing screw. The forcing screw shall be of a high grade alloy steel. The head of the screw shall be hexagonal in shape and of a size suitable for accepting a standard size wrench. The pressure end of the screw shall be turned to the root diameter of the thread with a 60° angle.

3.7.6.3 Arms. The three-arms shall be of a high grade forged alloy steel. The arms shall be designed for direct assembly to the yoke with provisions for nesting the 5-1/4 inch inside diameter ring.

3.7.6.4 Point protector. The point protector shall be of a high grade steel suitable for protecting the center point of the forcing screw and steering wheel post.

3.7.6.5 Pulling ring. The pulling ring shall be of a high grade steel. At the option of the contractor, the pulling ring may be either hinged as shown in Figure 15 or of one-piece construction with a gap of approximately 3-1/2 inches as required to permit mounting on the wheel. The pulling ring shall be either rubber covered or provided with three rubber bushings for protecting the spokes of the steering wheel.

3.7.6.6 Dimensions. The type VI pullers shall conform to the dimensions shown on Figure 15, except that the 5-1/4 inch dimension shall have a tolerance of +3/8, -1/8 inch.

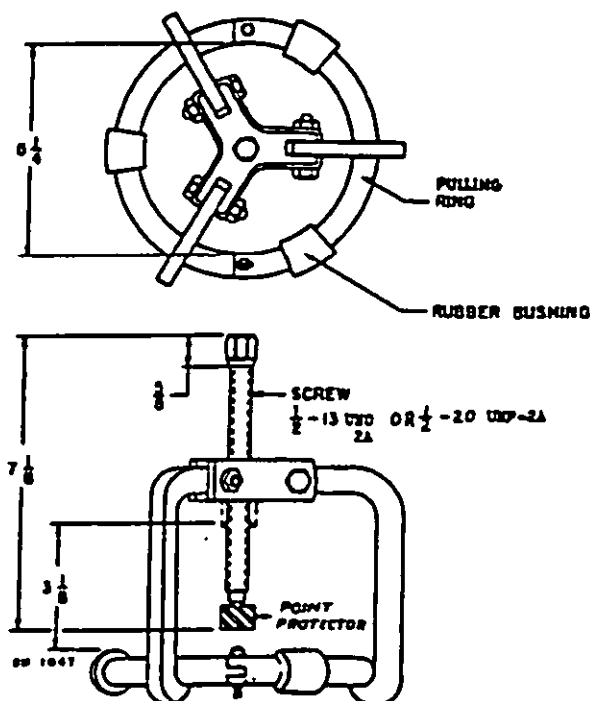


Figure 15. Type VI, puller, mechanical, ring type steering-wheel, three-arm.

3.7.7 Type VII, gear and bearing. The type VII puller shall consist essentially of a cross block, slide plates and washers, forcing screw, forcing screw nut, securing nuts or bolts, and legs. All parts shall be properly heat treated to resist breakage or deformation.

3.7.7.1 Puller attachments and adapters. The puller attachments and adapters, when required (see 6.1), shall be in accordance with 3.8 and 3.9.

3.7.7.2 Cross block. The cross block shall be of either a good quality cast or mill steel bar provided with a smooth clearance hole, centrally located, for passage of the forcing screw. Slots shall be provided at both ends of the block for adjustment of the legs. The legs shall be assembled to the cross block in parallel alignment.

3.7.7.3 Slide plates and washers. The slide plates and washers shall be of a high grade steel capable of withstanding any deformation or buckling. Slide plates shall be provided for the bottom of the cross block. The washers shall be provided for the top of the cross block.

3.7.7.4 Forcing screw. The forcing screw shall be of a high grade alloy steel and have National Standard "V" threads. The head shall be hexagonal in shape and of a size suitable for accepting a standard size wrench. The pressure end of the screw shall be turned below the root diameter of the thread and provided with a 60° angle point.

3.7.7.5 Forcing screw nut. The forcing screw nut shall be of a high grade steel threaded to engage the thread of the forcing screw.

3.7.7.6 Securing nuts or bolts. The nuts or bolts shall be of high-grade steel, and capable of withstanding any breakage or deformation.

3.7.7.7 Legs. The legs shall be of a high grade alloy steel and cylindrical or hexagonal in shape. One end of the leg shall be so designed as to be secured to the cross block by either hexagon nuts or bolts. The legs shall be furnished in pairs, of the various lengths, or multiple pairs to produce the utility range specified in Table IX. Milled flats shall be provided on the pulling end of the cylindrical legs for accepting a standard size wrench.

3.7.7.8 Type VII pullers. The type VII pullers shall be similar to Figure 16 and shall conform to Table IX of the size specified (see 6.1).

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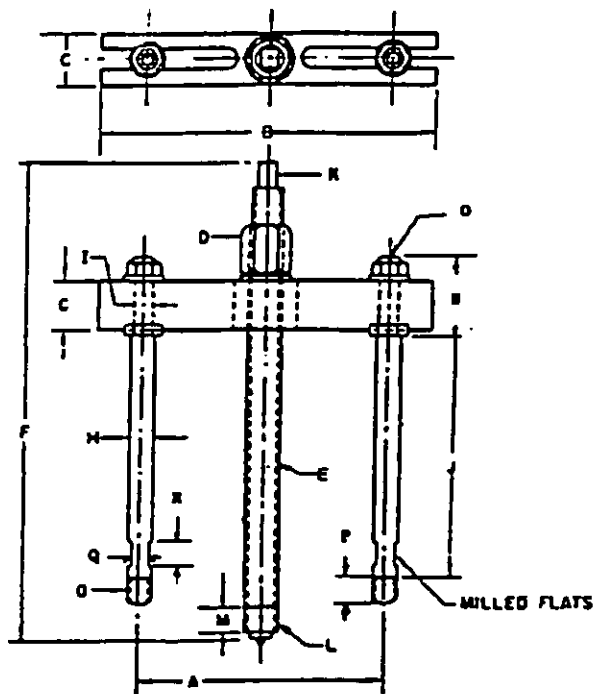


Figure 16. Type VII, puller, mechanical, gear and bearing.
(See Table IX for size specification.)

Table IX. Type VII, puller mechanical, gear and bearing

Size	Spread range	Block length	Block width	Max nut size	Forcing screw	Screw length	Leg thread 1/	Leg diameter		Leg length
	A (inches)	B (inches)	C (inches)	D (inches)	E (inches)	F (inches)	G (inches)	H (inches)	I (Inch)	J (inches)
1	2-1/8 x 7-1/4	8-1/4	1-3/8	1	3/4 - 16 UNF-2A	12	5/8 - 18 UNF-2A	5/8	1/2	6-3/4, 11-3/4, and 15-3/4
3	3-1/2 x 12-3/4	13-1/2	2	1-1/2	1 - 14 UNS-2A	13-1/4	5/8 - 18 UNF-2A	7/8	3/4	4-1/2, 9-1/2, 16-1/2, and 22-1/2
5	7 x 17	18	2-1/2	2-1/4	1-1/2 - 12 UNF-2A	17-1/4	1 - 14 UNS-2A	1-1/4	1	8, 18, and 28

Size	Forcing screw head	Thread UNF-2A	Length of thread	Test load (min.)	Length to shoulder	Thread size 1/	Length to shoulder or length of threads	Width across flats	Length of flats
	K (inch)	L (inches)	M (inch)	(pounds)	N (inches)	O (inches)	P (inches)	Q (inches)	R (inches)
1	1/2	5/8 - 18	1/2	20,000	2-15/32 ± 1/8	1/2 - 20 UNF-2A	1-1/16 ± 1/16	0.500 +0.000 -0.010	9/16 to 1-1/16
3	11/16	-	-	35,000	3-15/16 ± 7/32	3/4 - 16 UNF-2A	1 ± 1/16	0.750 +0.000 -0.010	9/16 to 1-1/16
5	1	-	-	60,000	5-1/8 ± 9/32	1 - 14 UNS-2A	1-7/16 ± 7/32	1,000 +0.000 -0.010 1,062 +0.000 -0.010	9/16 to 1-1/16

1/ Class 3A "Go Gage" may be used for inspecting threads after plating.

NOTE: Size 1: Minimum test load to be applied at 5 inch leg spacing using 6-3/4 inch legs and screw extended approximately half of overall length.

Size 3: Minimum test load to be applied at 9 inch leg spacing using 9-1/2 inch legs and screw extended approximately half of overall length.

Size 5: Minimum test load to be applied at 12 inch leg spacing using 8 inch legs and screw extended approximately half of overall length.

3.7.8 Type VIII, gear and pulley. The type VIII puller shall consist essentially of a cross block, forcing screw conforming to 3.7.7.4, and cap screws and shall be properly heat treated to resist breakage or deformation. The puller shall be capable of withstanding a minimum test load of 7,000 pounds.

3.7.8.1 Cross block. The cross block shall be of a high grade forged alloy or machined bar steel. The block shall have a threaded hole, centrally located, for engaging the thread of the forcing screw. Slots shall be provided at both ends of the cross block to provide parallel alignment and adjustment of the cap screws.

3.7.8.2 Cap screws. The cap screws shall be of a high grade quality steel.

3.7.8.3 Dimensions. The type VIII puller shall conform to the dimensions shown on Figure 17.

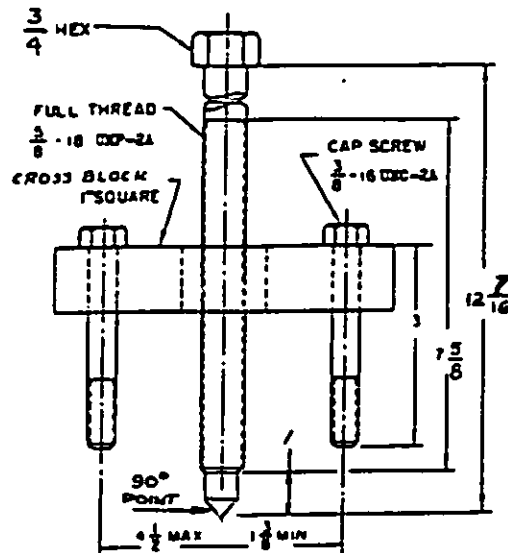


Figure 17. Type VIII, puller, mechanical, gear and pulley.

3.7.9 Type IX, impulse coupling, two-jaw. The type IX puller shall consist essentially of a cross block conforming to 3.7.8.1, forcing screw conforming to 3.7.7.4, securing nuts, washer, and jaws. All parts shall be properly heat treated to resist breakage or deformation and shall withstand a minimum test load of 1,000 pounds.

3.7.9.1 Locking nuts. The locking nuts shall be of a good quality steel, hexagonal in shape, and of a size suitable for acceptance of a standard size wrench. The nuts shall be threaded to engage the threaded end of the jaws.

3.7.9.2 Jaws. The jaws shall be of a high grade forged alloy steel. The jaws shall be so designed as to have one end secured to the cross block, and the gripping ends properly proportioned to ensure a firm grip in all pulling operations.

3.7.9.3 Dimensions. Type IX puller shall conform to the dimensions shown on Figure 18.

3.8 Puller attachment, mechanical.

3.8.1 Type XI, bearing, internal. The type XI puller attachment shall be suitable for use with type VII puller or as a slide hammer, as specified (see 6.1). The attachment shall consist essentially of a cross block in accordance with 3.7.8.1, reducing adapter, jaws, and a suitable arrangement for adjusting the jaws to the applicable spread range. The slide hammer puller shall have, in addition to the parts specified herein, a slide hammer and slide rod in accordance with 3.7.3.2 and 3.7.3.3, respectively. The parts shall be properly heat-treated to resist breakage or deformation. The attachment or puller shall be designed to allow free motion with a minimum of clearance between the working parts.

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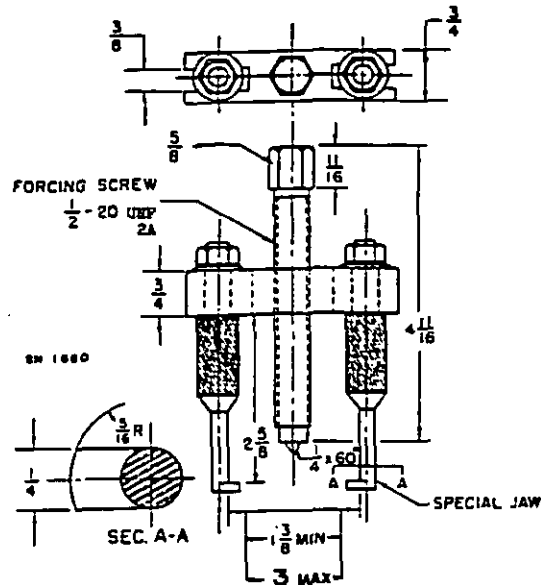


Figure 18. Type IX, puller, mechanical, impulse coupling, two-jaw.

3.8.1.1 Reducing adapter. The reducing adapter shall be of high-grade alloy steel. The head of the adapter shall have an internal thread to engage threaded end of a forcing screw or slide rod and the opposite end threaded to engage the thread in the cross block. The length of the reducing adapter from the cross block to the head, when fully threaded into the cross block, shall be of sufficient length to clear the adjusting arrangement.

3.8.1.2 Jaws. The jaws shall be of a high grade forged alloy steel. The jaws shall be so deigned as to be assembled directly to the cross block, and provision made at the top of the jaws for acceptance of the adjusting arrangement. The gripping ends shall be properly proportioned to assure a firm grip in all pulling operations.

3.8.1.3 Type XI puller attachment. The type XI puller attachment shall be similar to Figure 19 and shall conform to Table X for the size specified (see 6.1).

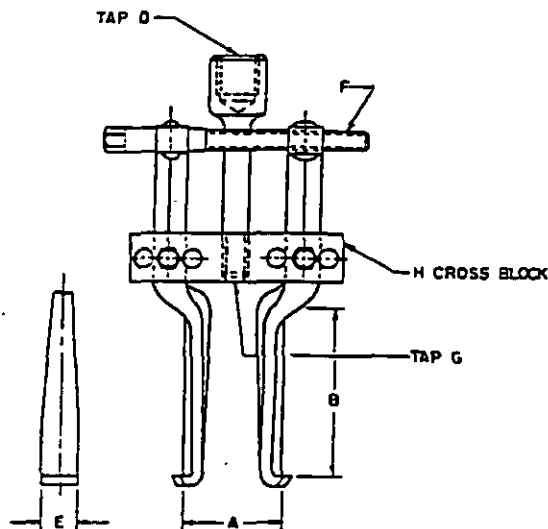


Figure 19. Type XI, puller attachment, mechanical, bearing, internal.
(See Table X for size specification.)

Table X. Type XI, puller attachment, mechanical, bearing, internal

Size	Speed range	Reach (min.)	Tap	Jaw width	Thread	Tap	Cross block	Test ring	Test load
	A (inches)	B (inches)	D (inches)	E (inches)	F (inches)	G (inches)	H (inches)	I.D. (inches)	minimum (pounds)
1	1-1/2 - 5	2	1-14 UNF-2B	13/16	7/16-14 UNC-2A	5/8-18 UNF-2	1-1/4 SQ	2-3/4	7,000
2	1-1/2 - 6	4	1-14 UNF-2B	1-1/8	7/16-14 UNC-2A	5/8-18 UNF-2B	1-1/4 SQ	2-3/4	7,000
3	1-1/2 - 7	5-1/4	1-14 UNF-2B	1	7/16-14 UNC-2A	5/8-18 UNF-2B	1-1/4 SQ	2-3/4	7,000
5	3 - 9	6	1-1/2-12 UNF-2B	2	5/8-18 UNF-2A	1-14 UNS-2B	1-1/4 SQ	4-1/4	12,000

3.8.2 Type XII, bearing, external. The type XII puller attachment shall be suitable for use with type I, class I, and type VIII pullers and shall consist essentially of a top and bottom block, cap screws or studs, and nuts. The parts shall be properly heat treated to resist breakage or deformation and designed to allow free movement with a minimum of clearance between the working parts.

3.8.2.1 Blocks, top and bottom. The blocks shall be of a high grade forged alloy steel and be so designed as to have the semicircular knife edges and the tapped holes in proper alignment when the top and bottom blocks are assembled.

3.8.2.2 Cap screws or studs. The cap screws or studs shall be of a high grade steel. The head of the screw shall be hexagonal in shape. Thread size is specified in Table XI. Nut must be threaded to match cap screw or stud.

3.8.2.3 Nuts. The nuts shall be of a high grade steel and threaded to engage the thread of the cap screws or studs.

3.8.2.4 Dimensions. Type XII puller attachment shall be similar to Figure 20 and shall conform to the dimension of Table XI.

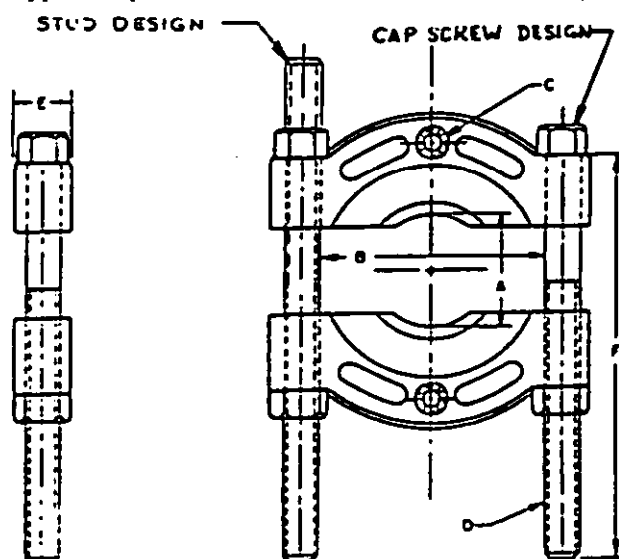


Figure 20. Type XII, puller attachment, mechanical, bearing, external.
(See Table XI for size specification.)

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Table XI. Type XII, puller attachment, bearing external

Size	Spread range (min.)	Inside width (min.)	Tap UNF-2B	Thread UNF-2A	Thick-ness (min.)	Length of screw (min.)	Test ring	Test load	Test spread
	A (inches)	B (inches)	C (inches)	D (inches)	E (inches)	F (inches)	OD (inches)	min (pounds)	at A (inches)
2	1/2 - 4-5/8	4 - 3/8	5/8 - 18	5/8 - 18	15/16	8	4-1/4	50,000	2
3	1/2 - 5-3/4	6	5/8 - 18	3/4 - 16	1-1/4	9-3/4	5-3/4	70,000	3
4	1/2 - 9	6	5/8 - 18	3/4 - 16	1-1/4	13	5-3/4	70,000	3
5	5/8-8	7-1/8	7/8 - 14 UNF-2B	7/8 - 14 UNF-2A	1-3/8	13-1/2	7-1/4	80,000	5
6	3/4 - 13-5/8	10-1/4	1-1/4-UNS	1-1/8 - 12	1-3/4	19	8-3/4	90,000	6-1/2

3.9 Puller adapter mechanical.

3.9.1 Type XIII, gear and bearing. The type XIII adapter shall be designed for use with either type I, class 1, or type VII pullers where applicable, and shall be of a steel conforming to the chemical requirements of ASTM A29/A29M. Classes 1 and 2 puller adapters shall be heat treated; classes 3, 4, and 5 shall be case hardened.

3.9.2 Class 1, male and female thread. The class 1 adapter shall be hexagonal in shape and have an internal threaded hole to engage the forcing screw and an external thread to engage the thread of the object to be pulled.

3.9.2.1 Style A, with 5/8-18 UNF-2B tapped hole. The style A adapter shall be similar to Figure 21 and shall conform to Table XII for the size specified (see 6.1).

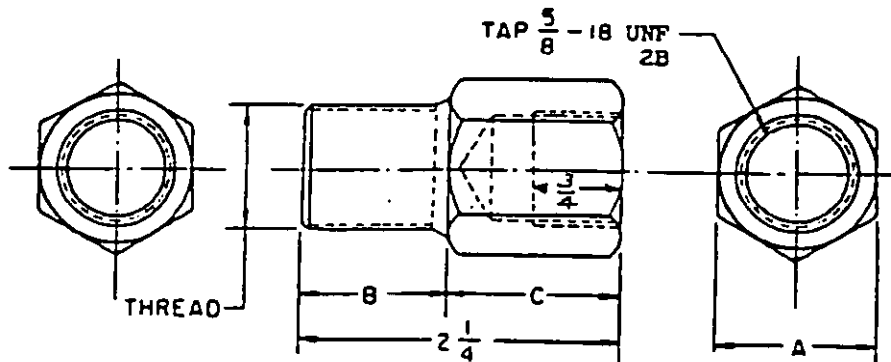


Figure 21. Type XIII class 1, style A puller adapter, forcing screw thread size adapting, mechanical, gear and bearings, male and female thread with 5/8 - 18 UNF-2B tapped hole. (See Table XII for size specification.)

Table XII. Type XIII class 1, style A puller adapter, forcing screw thread size adapting, mechanical, gear and bearings, male and female thread with 5/8 - 18 UNF-2B tapped hole

Size	Dimensions, inches			
	Thread	A	B	C
1	1/4 - 20 UNC-2A	7/8 - 1	3/4 - 1-1/8	1-1/8 - 1-1/2
2	5/16 - 18 UNC-2A	1	3/4	1-1/2
3	7/16 - 20 UNF-2A	1	3/4	1-1/2
4	3/8 - 16 UNC-2A	1	3/4	1-1/2
5	3/8 - 24 UNF-2A	1	3/4	1-1/2
6	1/2 - 20 UNF-2A	1	3/4	1-1/2
7	1/2 - 13 UNC-2A	1	3/4	1-1/2
8	9/16 - 18 UNF-2A	1	3/4	1-1/2
9	5/8 - 11 UNC-2A	1	1	1-1/4
10	3/4 - 16 UNF-2A	1	1	1-1/4
11	3/4 - 10 UNC-2A	1	1	1-1/4
12	7/8 - 14 UNF-2A	1	1	1-1/4
13	7/8 - 9 UNC-2A	1	1	1-1/4
14	1 - 14 UNS-2A	1-1/8	1	1-1/4
15	1-1/8 - 12 UNF 2A	1-1/4	1	1-1/4
16	1/8 - 27 NPT	1	1	1-1/4
17	1/4 - 18 NPT	1	1	1-1/4
18	3/8 - 18 NPT	1	1	1-1/4
19	1/2 - 14 NPT	1	1	1-1/4
20	M6 X 1.0	1	3/4	1-1/2
21	M8 X 1.0	1	3/4	1-1/2
22	M8 X 1.25	1	3/4	1-1/2
23	M10 X 1.25	1	3/4	1-1/2
24	M10 X 1.5	1	3/4	1-1/2
25	M12 X 1.25	1	3/4	1-1/2
26	M12 X 1.75	1	3/4	1-1/2
27	M14 X 1.5	1	3/4	1-1/2
28	M14 X 2.0	1	3/4	1-1/2
29	M16 X 1.5	1	1-1/8	1-5/8
30	M16 X 2.0	1	1-1/8	1-5/8
31	M20 X 1.5	1	1-1/8	1-5/8
32	M20 X 2.5	1	1-1/8	1-5/8

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3.9.2.2 Style B, with 1-14 UNS-2B tapped hole. The style B adapter shall be similar to Figure 22 and shall conform to Table XIII for the size specified (see 6.1).

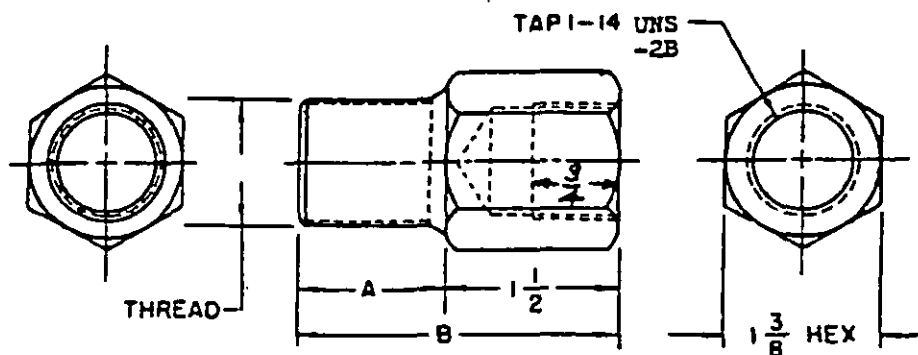


Figure 22. Type XIII, class 1, style B puller adapter, mechanical, gear and bearing, male and female thread with 1-14 UNS-2B tapped hole.

Table XIII. Type XIII, class 1, style B puller adapter, mechanical, gear and bearing, male and female thread with 1-14 UNS-2B tapped hole

Size	Dimensions, inches			
	Thread	Hex	A	B
1	5/8 - 11 UNC-2A	-	1	2-1/2
2	3/4 - 16 UNF-2A	-	1	2-1/2
3	3/4 - 10 UNC-2A	-	1	2-1/2
4	7/8 - 14 UNF-2A	-	1-1/4	2-3/4
5	7/8 - 9 UNC-2A	-	1-1/4	2-3/4
6	1-1/8 - 8 UNC-2A	-	1-1/4	2-3/4
7	1-1/8 - 12 UNF-2A	-	1-1/4	2-3/4
8	1-1/8 - 7 UNC-2A	-	1-1/4	2-3/4
9	1-1/4 - 12 UNF-2A	-	1-1/2	3
10	1-1/4 - 7 UNC-2A	-	1-1/2	3
11	1-1/4 - 12 UNF-2A	-	1-1/2	3
12	1-1/4 - 6 UNC-2A	-	1-1/2	3
13	M16 x 1.5	1-1/4	1-1/8	3
14	M16 x 2.0	1-1/4	1-1/8	3
15	M18 x 1.5	1-1/4	1-1/8	3
16	M20 x 1.5	1-1/4	1-1/8	3
17	M20 x 2.5	1-1/4	1-1/8	3
18	M22 x 1.5	1-1/4	1-1/8	3
19	M24 x 2.0	1-1/4	1-1/8	3
20	M24 x 3.0	1-1/4	1-1/8	3

3.9.2.3 Style C, with 1-1/2 - 12 UNF-2B tapped hole. The style C adapter shall conform to the dimensions shown in Figure 23.

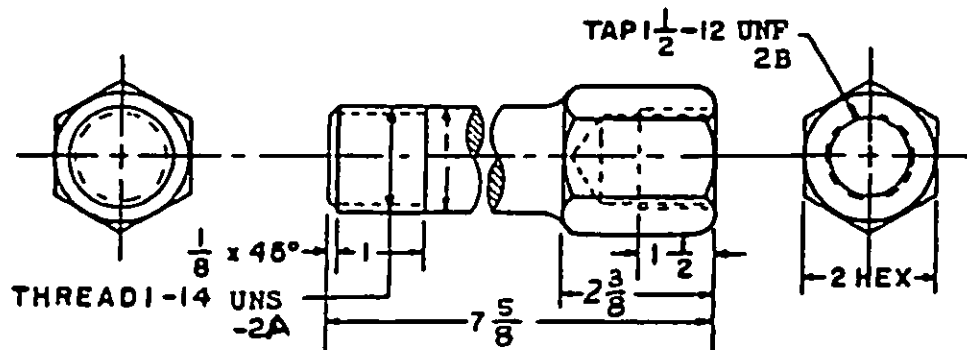


Figure 23. Type XIII, class 1, style C puller adapter, mechanical, gear and bearing, male and female thread with 1-1/2 - 12 UNF-2B tapped hole.

3.9.3 Class 2, female thread. The class 2 adapter shall be hexagonal in shape and have one end threaded to engage the thread of shafts or pulling legs, and the opposite end threaded to engage the thread of the forcing screw or pulling legs.

3.9.3.1 Style A, with 5/8 - 18 UNF-2B tapped hole. The style A adapter shall be similar to Figure 24 and shall conform to Table XIV for the size specified (see 6.1).

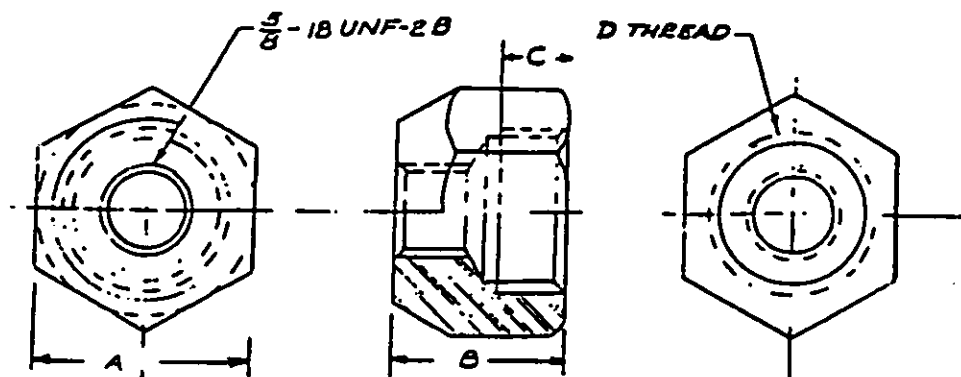


Figure 24. Type XIII, class 2, style A, puller adapter, mechanical, gear and bearing, female thread with 5/8 - 18 UNF-2B tapped hole.

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Table XIV. Type XIII, class 2, style A, puller adapter, mechanical, gear and bearing, female thread with 5/8 - 18 UNF-2B tapped hole

Size	Hex size	Overall length ^{1/}	Thread depth (min.)	Thread
	A (inches)	B (inches)	C (inches)	D (inches)
1	7/8	1-1/8	3/8	1/2 - 20 UNF-2B
2	1	1-1/8	through	5/8 - 18 UNF-2B
3	1-1/8	1-9/16 - 1-5/8	5/8	3/4 - 16 UNF-2B
4	1-1/8	1-1/8 - 1-9/16	7/16	3/4 - 10 UNC-2B
5	1-1/8	1-1/8 - 1-9/16	7/16	13/16 - 16 UN-2B
6	1-1/4	1-1/8 - 1-11/16	5/8	7/8 - 14 UNF-2N
7	1-1/4	1-1/4 - 1-11/16	1/2	7/8 - 18 UNS-2B
8	1-3/8	1-1/8 - 1-11/16	5/8	1 - 14 UNS-2B
9	1-1/2	1-1/4 - 1-11/16	5/8	1-1/8 - 12 UNF-2B
10	1-5/8	1-1/2 - 1-13/16	3/4	1-1/4 - 12 UNF-2B
11	1-5/8	1-13/16 - 2-1/8	3/4	1-1/4 - 7 UNC-2B
12	1-7/8	1-13/16 - 2-1/8	1-1/16	1-1/2 - 12 UNF-2B
13	2	1-13/16 - 2-1/8	7/8	1-1/2 - 6 UNC-2B
14	1	1-5/8	3/8	M6 x 1.0
15	1	1-5/8	3/8	M8 x 1.25
16	1	1-5/8	3/8	M10 x 1.5
17	1	1-5/8	3/8	M12 x 1.75
18	1	1-5/8	7/16	M14 x 2.0
19	1	1-5/8	3/4	M16 x 2.0
20	1	1-5/8	3/4	M20 x 2.5

^{1/} If two dimensions are given for the overall length, either one is acceptable.

3.9.3.2 Style B, with 1 - 14 UNS-2B tapped hole. The style B adapter shall be similar to Figure 25 and shall conform to Table XV for the size specified (see 6.1).

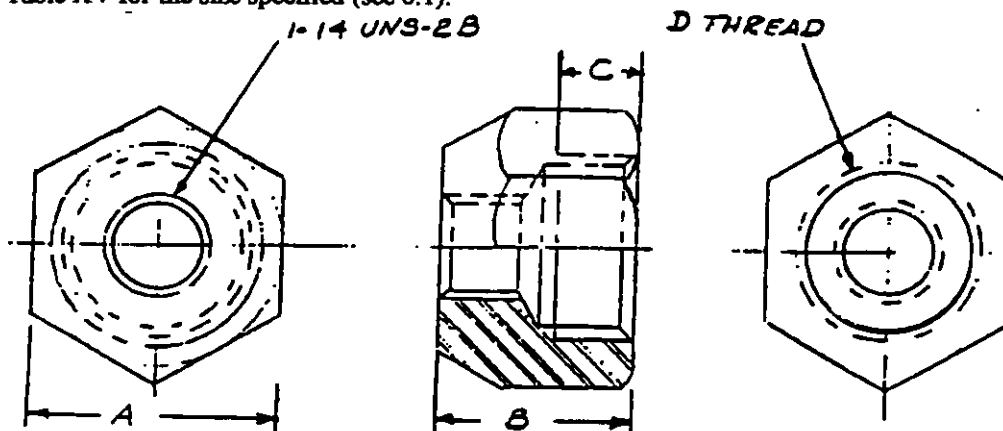


Figure 25. Type XIII, class 2, style B, puller adapter, mechanical, gear and bearing, female thread with 1 - 14 UNS-2B tapped hole.

Table XV. Type XIII, class 2, style B, puller adapter, mechanical, gear and bearing, female thread with 1 - 14 UNS-2B tapped hole

Size	Hex size	Overall length ^{1/}	Thread depth (min.)	Thread
	A (inches)	B (inches)	C (inch)	D
1	1-1/2	2	through	1 - 14 UNS-2B
2	1-5/8	2 - 2-1/8	7/8	1-1/8 - 12 UNF-2B
3	1-3/4	2-1/8 - 2-1/4	7/8	1-1/4 - 12 UNF-2B
4	1-3/4	2-1/4 - 3	7/8	1-1/4 - 18 UNEF-2B
5	1-3/4	2-1/8 - 2-1/4	3/4	1-1/4 - 7 UNC-2B
6	1-7/8	2-1/8 - 2-1/4	7/8	1-1/2 - 12 UNF-2B
7	1-7/8	2-1/8 - 2-1/4	11/16	1-1/2 - 7 UNC-2B

^{1/} If two dimensions are given for the overall length, either one is acceptable.

3.9.4 Class 3, spacer. The class 3 adapter shall be provided with a male and female center. The centers shall be on a horizontal plane and at a right angle to the faces of the spacer and shall be similar to Figure 26 and conform to Table XVI for the size specified (see 6.1).

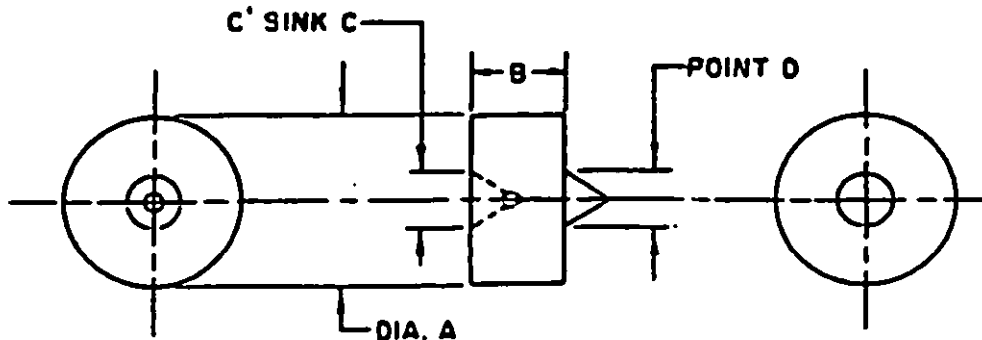


Figure 26. Type XIII, class 3, puller adapter, mechanical, gear and bearing, spacer.

Table XVI. Type XIII, class 3, puller adapter, mechanical, gear and bearing, spacer

Size	Dimensions			
	Diameter A (inches)	Length B (inch)	CTSK C (inches x degrees)	Point D (inches x degrees)
1	1-1/2	3/4	25/64 x 60	7/16 x 60
2	1-1/4	3/4	25/64 x 60	3/8 x 60
3	1	3/4	25/64 x 60	5/16 x 60
4	3/4	3/4	9/32 x 60	1/4 x 60
5	5/8	5/8	9/32 x 60	1/4 x 60
6	5/8	5/8	7/32 x 60	3/16 x 60

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3.9.5 Class 4, step plate. The class 4 puller adapter shall be designed to have a center hole with one end countersunk and the outer diameter turned and flanged, concentric with the center, for use on shafts with internal holes. Class 4 pullers shall be similar to Figure 27 and shall conform to Table XVII for the size specified (see 6.1).

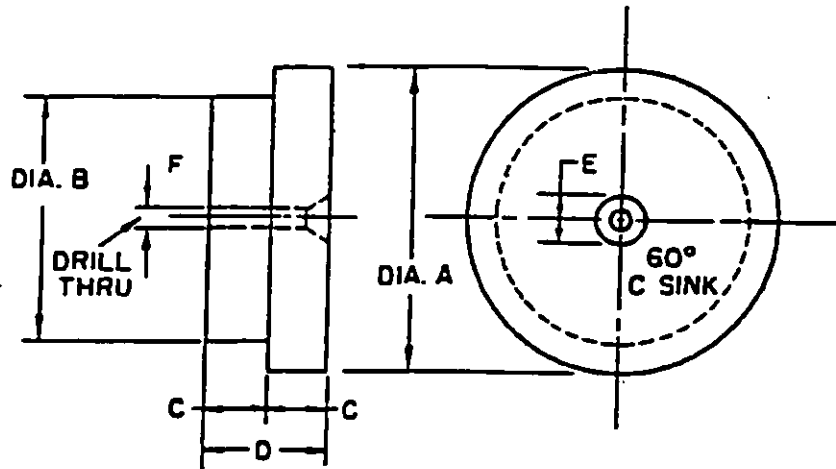


Figure 27. Type XIII, class 4, puller adapter, mechanical, gear and bearing, step plate.

Table XVII. Type XIII, class 4, puller adapter, mechanical, gear and bearing, step plate

Size	Dimensions					
	A (inches)	B (inches)	C (inch)	D (inch)	E (inch)	F (inch)
1	1	3/4	1/4	1/2	1/4	9/64
2	1-1/8	7/8	1/4	1/2	1/4	9/64
3	1-1/4	1	1/4	1/2	1/4	9/64
4	1-3/8	1-1/8	1/4	1/2	1/4	9/64
5	1-5/8	1-1/4	3/8	3/4	3/8	1/4
6	1-3/4	1-3/8	3/8	3/4	3/8	1/4
7	1-7/8	1-1/2	3/8	3/4	3/8	1/4
8	2	1-5/8	3/8	3/4	3/8	1/4
9	2-1/8	1-3/4	1/2	1	3/8	1/4
10	2-3/8	1-7/8	1/2	1	3/8	1/4
11	2-1/2	2	1/2	1	3/8	1/4
12	2-5/8	2-1/8	1/2	1	3/8	1/4
13	2-3/4	2-1/4	1/2	1	3/8	1/4
14	2-7/8	2-3/8	1/2	1	3/8	1/4
15	3	2-1/2	1/2	1	3/8	1/4
16	3-1/4	2-3/4	1/2	1	3/8	1/4
17	3-1/2	3	1/2	1	3/8	1/4

3.9.6 **Class 5, leg cap.** The class 5 adapter shall be hexagonal in shape and have an internal thread in one end to engage the thread of the leg and the opposite end faced at a right angle to the horizontal axis of the internal thread. The threaded hole shall be of a sufficient depth to allow the face of the leg cap to bear against the shoulder of the leg. The class 5 adapter shall be similar to Figure 28 and shall conform to Table XVIII for the size specified (see 6.1).

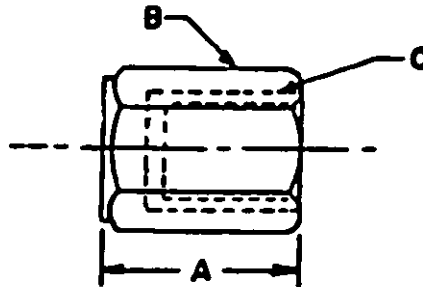


Figure 28. Type XIII, class 5, puller adapter, mechanical gear and bearing, leg cap.

Table XVIII. Type XIII, class 5, puller adapter, mechanical, gear and bearing, leg cap

Size	Dimensions		
	Length A (inches)	Hexagon B (inch)	Thread C
1	1-1/2	1	5/8 - 18 UNF-2B
2	1-1/2	1-1/8	5/8 - 18 UNF-2B
3	1-3/4	1-3/8	1 - 14 UNS-2B
4	2	1-1/2	1 - 14 UNS-2B

3.10 **Carrying case.** When carrying cases are specified (see 6.1), each case shall accommodate all components and assemblies applicable to the type, class, style, size, or set specified. The case shall be made of sufficiently heavy sheet steel or molded plastic that it will not sag or distort due to the weight of the components and provided with a sheet steel or molded plastic, hinged cover. The case shall be provided with one or more handles and adequate hardware for holding down the cover (if metal) shall have a durable coat of paint or enamel.

3.11 **Finish.**

3.11.1 **Surface.** All pullers and puller attachments shall be substantially free from pits, nodules, burrs, cracks, and other detrimental defects. Surfaces not usually ground or buffed shall have a surface finish conforming to the best manufacturing practices.

3.11.2 **Coating.** The coating shall be adherent, smooth, continuous, and free from uncoated areas, pits, blisters, nodules, and any other defects which would interfere with the protective value and serviceability. Each case shall be coated inside and outside by the electrostatic paint process or with a primer and not less than one coat of high quality enamel. Forcing screws shall be coated with an oxide coating or with manganese phosphate or zinc plate. All components, except cases and forcing screws, of puller and puller attachments shall have one of the following coatings:

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3.11.2.1 Chromium plate. The finish shall be electrodeposited metals consisting of nickel followed by chromium with the minimum thickness being 0.0002-inch nickel and 0.0001-inch chromium.

3.11.2.2 Zinc plate. The coating shall be electrodeposited zinc not less than 0.0005 inch thick and shall be subjected to a chemical or electrochemical chromating.

3.11.2.3 Hot phosphating. The coating shall consist of a heavy chemically produced phosphate followed with a coating of rust preventive oil.

3.11.2.4 Oxide coating. The coating shall consist of a heavy chemically produced oxide followed with a coating of rust-preventive oil.

3.12 Metric products. Products manufactured to metric dimensions will be considered on an equal basis with those manufactured using inch-pound units, provided they fall within the tolerances specified and all other requirements of this document are met. If a product is manufactured to metric dimensions and those dimensions exceed the tolerances specified in the inch-pound units, a request should be made to the specification preparing activity for change to this document.

3.13 Workmanship. Workmanship shall be of the highest grade throughout and equal in every respect to commercial practice. Pullers, puller attachments, and puller adapters shall be free from rust, fins, burrs, external sharp edges, corners, or surfaces, and defects which may impair their serviceability or durability.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure that supplies and services conform to prescribed requirements.

4.1.1 Component and material inspection. In accordance with 4.1 above, the supplier is responsible for insuring that components and materials used were manufactured, tested, and inspected in accordance with the requirements of referenced subsidiary specification and standards to the extent specified, or, if none, in accordance with this specification.

4.2 Sampling procedures. Unless otherwise specified, sampling for inspection shall be performed in accordance with ANSI/ASQC Z1.4.

4.3 Examination

4.3.1 Visual examination. The end items shall be examined for the defects listed in Table XIX. The lot size shall be expressed in terms of pullers. The inspection level shall be II and the acceptable quality level (AQL), expressed in terms of defects per hundred units, shall be 1.5 for major and 4.0 for total (major and minor combined) defects.

4.3.2 Dimensional examination. The end items shall be examined for any nonconformance with capacity and dimensional requirements. The lot size shall be expressed in terms of pullers. The sample unit shall be one puller. The inspection level shall be S-4 and the AQL, expressed in terms of defects per hundred units, shall be 1.0.

4.3.2.1 Nominal dimensions. The nominal dimensions shown in Table I shall be measured as follows:

4.3.2.1.1 Spread range "A". The spread range shall be measured between the gripping ends as shown in Figure 1 (or 3 except that the jaws need not be parallel). When measuring the largest of the spread range dimensions (see "A" in Table I), the jaws may be spread to where the gripping surface begins to move upward from the working surface of the jaw end.

4.3.2.1.2 Long reach (min.). The long reach dimension shall be measured with the jaws parallel to each other as shown in Figure 1; however, the jaws shall be assembled in the longest reach position.

4.3.2.1.3 Short reach (min.) "B". The short reach dimension "B" shall be measured with the jaws parallel as shown in Figure 1.

4.3.2.1.4 Forcing screw. The forcing screw shall be screwed down to its deepest position to determine if the extended length is equal to (or greater than) dimension "B" (see 3.7.1.2) in the short reach position. The diameter of the forcing screw "E" shall be measured to determine conformance with H-28 and the applicable size in Table I, except that larger nominal diameters are acceptable.

4.4 Testing. Each sample unit shall be tested in accordance with 4.5.

4.5 Test procedures.

4.5.1 Load test. Test of pulling strength shall be conducted to determine conformance with the loads specified in section 3. The test shall be conducted on a hydraulic press or by any other methods approved by the inspector. The test load shall be applied through the forcing screw to give a direct pull on the jaws and other assembled parts of the puller. Nuts and bolts at pivot points of jaw assemblies shall be tight. The forcing screw thread shall be lubricated while applying load during test. With the minimum load applied, there shall be no buckling or deformation on any part of the pullers, puller attachments, or puller sets, nor reveal any permanent set, indicating that the elastic limit has been exceeded.

4.5.1.1 Pullers and puller sets. The minimum load specified for each type, class, style, and size shall be applied with the puller adjusted to the maximum rated reach, and spread, with the forcing screw advanced one-third its length through the bridging member, except where these testing dimensions are shown in the respective tables. The test ring specified in Table VI shall be used in testing type III, class 1 pullers.

4.5.1.2 Puller attachments.

4.5.1.2.1 Type XI bearing, internal. The minimum load specified herein shall be applied with the puller attachment adjusted to maximum rated reach and spread range specified by test ring I.D. of Table X.

4.5.1.2.2 Type XII bearing, external. The minimum load specified herein shall be applied with the puller attachment adjusted to its spread range specified by test ring O.D. of Table XI.

4.6 Inspection of preparation for delivery requirements. An inspection shall be made to determine that the preservation, packaging, packing, and marking comply with the requirements in section 5 of this specification. Defects shall be scored in accordance with Table XIX. The lot size shall be the number of shipping containers in the end item inspection lot. The inspection level shall be S-2 and the AQL, expressed in terms of defects per hundred units, shall be 4.0.

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Table XIX. Classification of preparation for delivery defects

Examine	Defect
Marking (exterior and interior)	Omitted; incorrect; illegible; improper size, location, sequence, or method of application
Materials	Any component missing, damaged, or not as specified
Workmanship	Inadequate application of components such as incomplete closure of container flaps, loose strapping, inadequate stapling Distortion of container
Contents	Number per container is more or less than required Net weight exceeds requirements

5. PREPARATION FOR DELIVERY

5.1 Preservation, packaging, packing, and marking. Preservation, packaging, packing, and marking shall be in accordance with PPP-P-40. The level of preservation, packaging, packing, and marking shall be as specified in the contract or purchase order.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful but is not mandatory.)

6.1 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of this specification.
- b. Type, class, style, and size if applicable, of item required (see 1.2).
- c. If carrying case is required (see 3.5.3 and 3.10).
- d. Whether "limited" or "complete" sets are required (see 3.6).
- e. If puller attachments or adapters are required, type, class, style, and size of attachment and adapters and the puller for which it is intended (see 3.7.1.4.1 and 3.7.7.1).
- f. Whether pullers should be furnished with one pair of short jaws or one pair of long jaws or both (see 3.7.1.7).
- g. Whether puller should be furnished with standard detachable center point, small detachable center point, or both (see 3.7.1.7).
- h. When puller attachment should be used with type VII puller or used as a slide hammer (see 3.8.1).
- i. Level of preservation, packaging, and packing required (see 5.1).
- j. Marking, if other than specified.

6.1.1 Repair parts. When repair parts are required, the following shall be specified:

- a. The manufacturer's name or trademark of the puller, puller attachment, puller adapter and puller sets for which the part is required.
- b. Quantity and proper name or description of part required.
- c. The type, class, style, and size of puller, puller attachments, puller adapters, and puller sets for which the part is required.

- d. Any other data applicable to the puller, puller attachment, puller adapter, or puller set which will assist in identifying proper repair parts.

MILITARY INTERESTS:

Custodians:

Navy - SH
Air Force - 84

Review Activities:

Navy - YD
Air Force - 85

User Activities:

Navy - AS, OS, MC, CC
Air Force - SG, SU, TG

MILITARY COORDINATING ACTIVITY:

Air Force - 84

Preparing Activity:

GSA-FSS