

GGS-P-781D

February 20, 1969

SUPPLEMENTING

Int. Fed. Spec. GGS-P-00731c(GSA-FSS)

January 11, 1965 and

Fed. Spec. GGS-P-781a

November 7, 1958

FEDERAL SPECIFICATION

PULLER, MECHANICAL

PULLER ATTACHMENT, MECHANICAL, AND PULLER SET, MECHANICAL

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 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 titles of the specifications, or which are commercially available, but include 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 3.5):

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.

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

Type VII. Gear and bearing.

Type VIII. Gear and pulley.

Type IX. Inertia 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.

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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 Specifications and standards. The following specifications and standard, of the issues in effect on date of invitation for bids, or request for proposal, form a part of the specification to the extent specified herein:

Federal Specifications:

QQ-S-637 - Steel Bars, Carbon, Cold finished (Standard Quality, Free Machining).
 GGG-W-636 - Wrenches (Box, Open-End and Combination).

Federal Standard:

Fed. Std. No. 123 - Marking for Domestic Shipment (Civilian Agencies).

(Activities outside the Federal Government may obtain copies of Federal Specifications, Standards, and Handbooks 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, D. C., 20402.)

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

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

Military Specification:

MIL-H-15424 - Hand Tools; Packaging 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.)

2.2 Other 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:

National Bureau of Standards (NBS) Handbook:

H28 - Screw-Thread Standards for Federal Services.

(Application for copies should be addressed to the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402.)

Uniform Freight Classification Rules.

(Application for copies should be addressed to the Official Classification Committee, 1 Park Ave. at 33rd St., New York, N.Y., 10016.)

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National Motor Freight Classification Rules.

(Application for copies should be addressed to the National Classification Board, 1616 P St., N.W., Washington, D. C. 20036.)

3. REQUIREMENTS

3.1 Illustrations. The illustrations shown herein are for the convenience of identification and are not intended to preclude the purchase of pullers and attachments which are otherwise in accordance with 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, free from all defects and imperfections which may affect their serviceability and durability.

3.3 Screw-threads. All screw-threads specified herein shall be in accordance with the applicable requirement of H2B.

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 plus or minus 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.

3.5.1 Pullers and attachments, (mechanical). 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 or 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, 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 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).

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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.
- 1- Type XIII adapter, class 3, spacer, size 3.
- 1- Type XIII adapter, class 3, spacer, size 4.
- 1- 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 ($\pm 1/4"$) 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).

3.8.1 Type I, gear and bearing. 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.

3.8.1.1 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 jaws shall be assembled direct to the head or yoke or by means of straps or hinges.

3.8.1.2 Forcing screw. The forcing screw shall be of a high-grade alloy steel. The head of the screw shall be either square or 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 30° point for load application in the shaft center, or a small 60° centering point extending from a flat ended 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.

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

Size	Nominal dimensions ^{1/}					Testing ^{2/}	
	Spread range	Long reach (Min.)	Short reach (Min.)	Screw head across flats	Screw ^{2/} thread (Nominal) (Min.)	Test load (Min.)	Jaw spread
^{4/}	A	B	B	D	E		
	<u>Inches</u>	<u>Inches</u>	<u>Inches</u>	<u>Inches</u>	<u>Inches</u>	<u>Pounds</u>	<u>Inches</u>
2	0-4	3-1/4	2-1/4	1/2 sq.	3/8	2,500	2-1/2
3	0-8	6	3-1/4	5/8 sq. ^{5/}	9/16	8,000	5
4	0-10	9	5	3/4 sq. ^{5/}	11/16	14,000	6
5	0-12	11	7-1/2	7/8 sq. ^{5/}	13/16	20,000	9
6	0-14	14	8-1/2	1-1/4 Hex.	1	35,000	9
7	0-16	15-1/2	9-1/2	1-3/8 Hex.	1	35,000	9
8	0-18	15-5/8	11-1/2	1-3/8 Hex.	1-1/4	60,000	10
9	0-20	22	11-1/2	1-3/8 Hex.	1-1/4	60,000	10

^{1/} See 4.3.2.1 for methods of measuring.

^{2/} The forcing screw shall be of either National Form or Bittress form.

^{3/} While testing, the forcing screw shall be extended approximately 1/2 its overall length.

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

^{5/} Square or hex.

3.8.1.3 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 being pulled at any setting within capacity of the miller.

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

3.8.1.4.1 Puller attachments or adapters when specified (see 6.1), shall be in accordance with 3.5.2, 3.9.2, 3.10.1, 3.10.2, 3.10.5, and 3.10.6.

3.8.1.4.2 Style A, single end grip. Style A miller shall be similar to figure 1 and shall conform to table I for the size specified (see 6.1).

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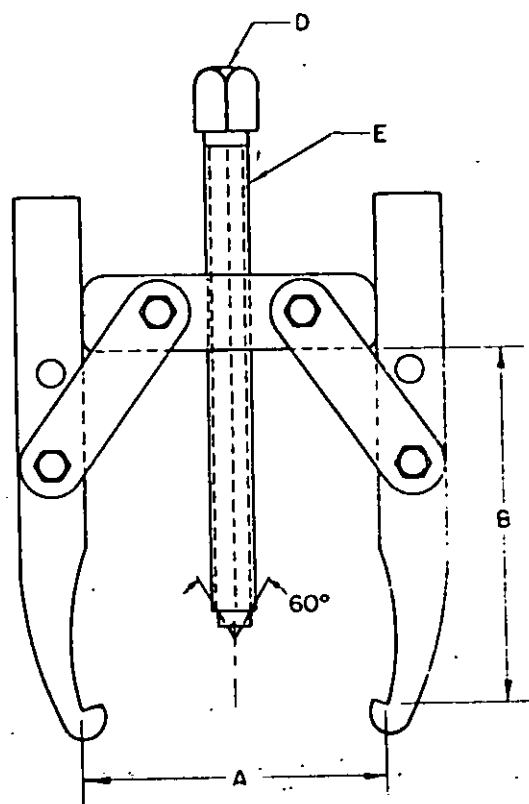


FIGURE 1. Type I, class 1, style A, puller, mechanical, gear and bearing, two-jaw, external, single end grip.

3.8.1.4.3 Style B, double end grip. Style B puller shall be similar to figure 2 and shall conform to table II for the size specified (see 6.1).

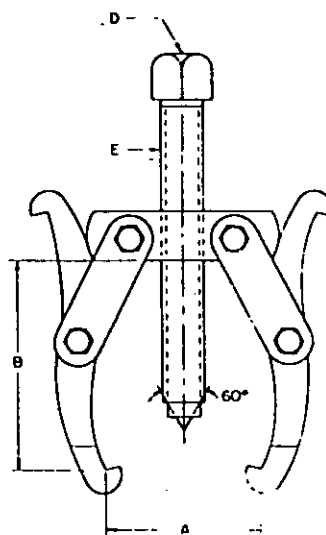


FIGURE 2. Type I, class 1, style B, puller, mechanical, gear and bearing, two-jaw, external, single end grip.

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

Size	Spread range	Reach (Min.)	Screw head (across flats)	Forcing screw thread	Test load (Min.)
	A	B	D	E	
	<u>Inches</u>	<u>Inches</u>	<u>Inch</u>	<u>Inches</u>	<u>Pounds</u>
1	0 to 6	3-1/4	5/8	9/16-20 UN-2A bitress	10,000
2	0 to 8	5-1/2	3/4	11/16-18 UNS-2A bitress	18,000

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

3.8.1.5.1 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).

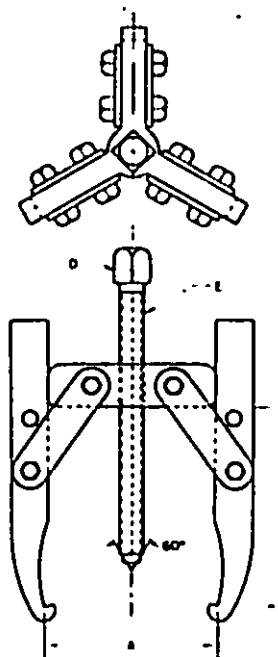


FIGURE 3. Type I, class 2, style A, puller mechanical, gear and bearing, three-jaw, external, single end grip.

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3.8.1.5.2 Style B, double end grip. Style B miller shall be similar to figure 4 and shall conform to table II for the size specified (see 6.1).

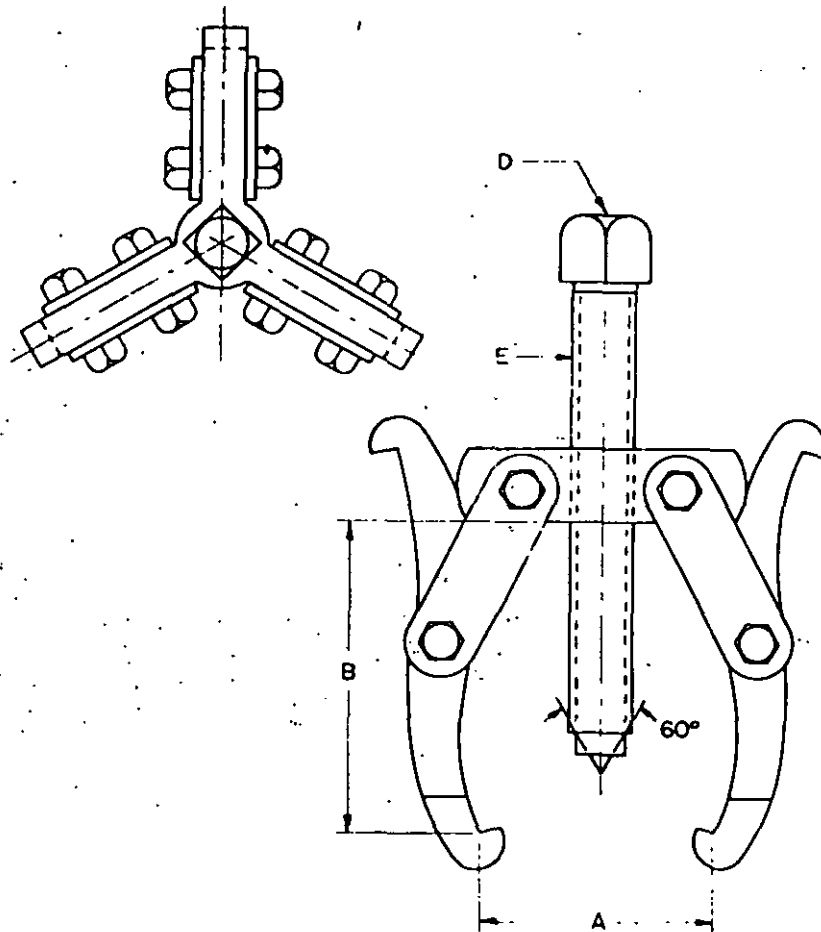


FIGURE 4. Type I, class 2, style B, miller, mechanical, gear and bearing, three-jaw, external, double end grip.

3.8.1.6 Class 3, two-jaw, external and internal. Class 3 millers shall be suitable for use on external and easily reversible for internal milling operations. In addition to the parts specified in 3.8.1, the miller shall be provided with a suitable spring locking arrangement and a forcing screw point protector. The parts shall be of high-grade steel properly heat treated to resist breakage or deformation.

3.8.1.6.1 Spring locking arrangement. 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.

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

3.8.1.6.3 The class 3 miller shall be similar to figure 5 and shall conform to table III for the size specified (see 6.1).

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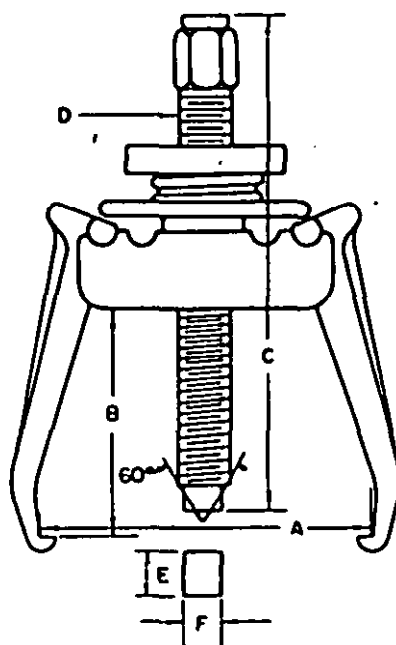


FIGURE 5. Type I, class 3, puller, mechanical, gear and bearing, two-jaw, external and internal.

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

Size	Spread range A		Reach (min.)	Screw length	Screw thread UNF-7A	Point protector		Test load (min.)
	External	Internal	B	C	D	Length E	Diameter F	
	<u>Inches</u>	<u>Inches</u>	<u>Inches</u>	<u>Inches</u>	<u>Inches</u>	<u>Inch</u>	<u>Inch</u>	<u>Pounds</u>
1	0 to 4-1/2	1-1/2 to 4	2-7/8	6-3/4	5/8-19	5/8	7/16	10,000
2	0 to 8-1/2	2-1/4 to 7	5-1/2	9-3/4	3/4-14	5/8	7/16	20,000
3	0 to 14	3-1/2 to 9-1/4	9-1/2	15	1-14	5/8	7/16	30,000

*UNF-2A

3.8.1.7 Class 6, two-jaw, light-duty, external. 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 thread in table IV by means of an adjusting cone nut at the top of the jaws.

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3.8.1.7.1 Adjusting cone nut. The adjusting cone nut shall be of 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.

3.8.1.7.2 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 bottom of yoke to the gripping surface of the jaw).

3.8.1.7.3 Class 6 puller shall be similar to figure 6 and shall conform to table IV for the spread range, and minimum test loads.

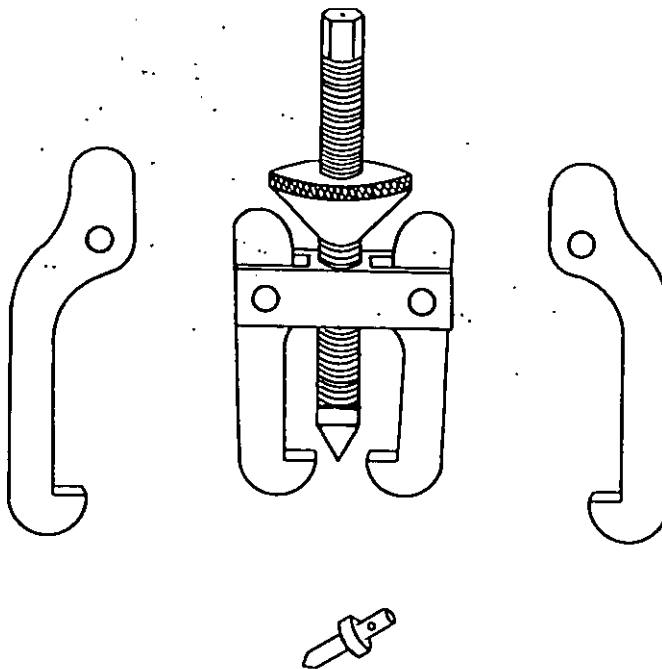


FIGURE 6. Type I, class 6, puller, mechanical, gear and bearing, two-jaw, light-duty, external.

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

	Spread range (outside) pulling)	Test load (minimum)
	<u>Inches</u>	<u>Pounds</u>
Short jaws	0 to 1-1/2	1,000
Long jaws	0 to 3	1,500

3.8.1.3 Class 7, two- and three-jaw, external, combination. Class 7 pullers shall be designed to be used as either a two-jaw or three-jaw combination puller as shown in figure 7 and shall conform to table I for the size specified (see 6.1).

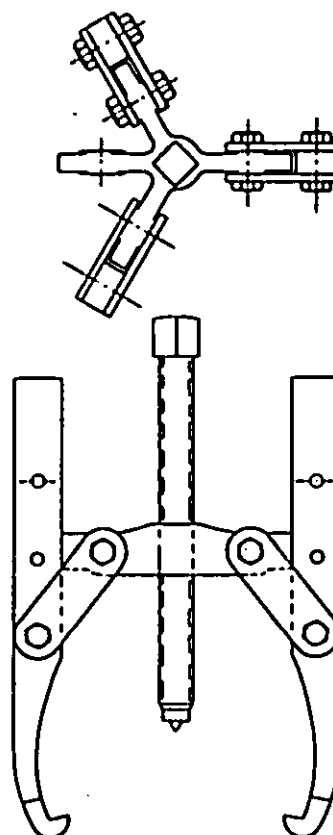


FIGURE 7. Type I, class 7, puller,
mechanical, gear and bearing,
two- and three-jaw external,
combination.

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3.8.2 Type II, bearing, three-jaw, double end grip, aircraft electrical accessories. Type II pullers shall be in accordance with 3.8.1, 3.8.1.1, 3.8.1.3, and 3.8.1.5, except for the forcing screw design.

3.8.2.1 Forcing screw. The forcing screw shall be 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.

3.8.2.2 Live center. The live center shall be constructed of 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.

3.8.2.3 Shaft protector. At the option of the manufacturer, a shaft protector may be furnished in lieu of the live center (3.8.2.2). The shaft protector shall be made from high-grade steel, properly heat treated to resist breakage or deformation. It shall provide protection from the forcing screw to the shaft to which 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 losing and shall be provided with a small 60° angle centering point.

3.8.2.4 Type II pullers shall be similar to figure 8 and shall conform to table V for the size specified (see 6.1).

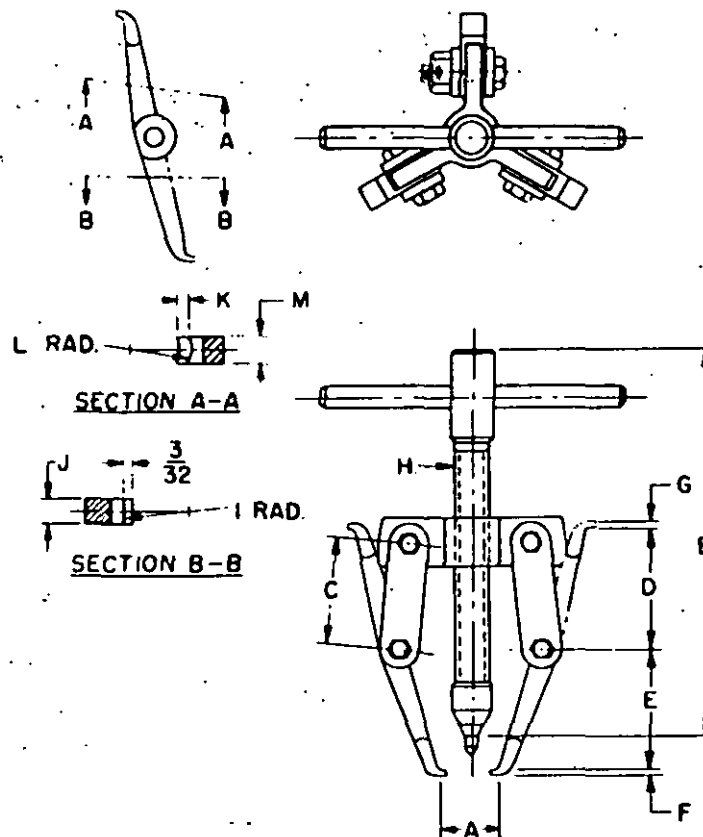


FIGURE 8. Type II, puller, mechanical, bearing, three-jaw, double end grip, aircraft electrical accessories.

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TABLE 7. Type II puller, mechanical, bearing, three-jaw, double end type, aircraft electrical connections

Size	Spaced range "P"				Dimensions												Tensile load (min.)	
	Small end		Large end		B	C	D	E	F	G	H	I	J	K	L	M	N	O
	Min.	Max.	Min.	Max.														
1	1/2	3/4	3/4	1-1/8	1-7/8	1.125	1.250	1.375	1.500	1.625	1.750	1.875	2.000	2.125	2.250	2.375	2.500	2.625
2	1-1/8	1-3/4	1-3/4	2-1/8	2	1.875	2.125	2.375	2.625	2.875	3.125	3.375	3.625	3.875	4.125	4.375	4.625	4.875

Tolerance on:
 Outside : 0.003.
 Front face : 1/64.

3.8.2.5 Finish. Type II puller jaws may be finished with aluminum paint at the option of the manufacturer.

3.8.3 Type III, slide hammer. Type III pullers shall consist essentially of a yoke, jaws conforming to 3.8.1.3, 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.

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

3.8.3.2 Slide hammer. The slide hammer shall be of high-grade steel, cylindrical in cross section, 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.

3.8.3.3 Slide rod. The slide rod shall be of high-grade steel, terminating at the end opposite to the jaws with a permanent means of keeping the slide hammer on the rod, such as a hexagon head, inset 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.

3.8.3.4 Class 1, bearing, two-jaw internal. Class 1 pullers shall have an adjusting bar with parallel alignment of the assembled jaws.

3.8.3.4.1 Adjusting bar. The adjusting bar shall be of 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 thumb-screw or nut and adjusting yoke.

3.8.3.4.2 Type III, class 1 pullers shall be similar to figure 1, and shall conform to table VI for the size specified (see 6.1).

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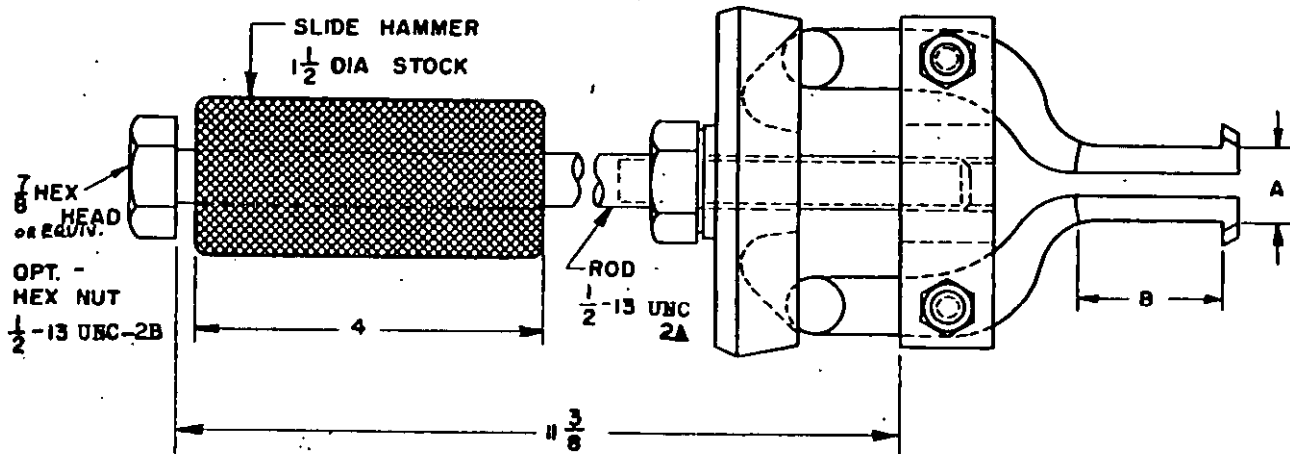


FIGURE 9. Type III, class 1, puller, mechanical, slide hammer, bearing, two-jaw, internal.

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

Size	Spread range A	Reach (Max.) B	Test load (min.)	Test ring I.D.
	<u>Inches</u>	<u>Inches</u>	<u>Pounds</u>	<u>Inches</u>
1	1/2 to 1-1/2	3/4	1,000	1
2	7/8 to 2	2	1,000	1
3	1/2 to 1-7/8	2	1,000	1

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

3.8.3.5.1 Style A, light-duty. Style A puller shall be furnished with individual two-and 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.

3.8.3.5.1.1 Adjusting cone. Adjusting cone shall be of 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.

3.8.3.5.1.2 Type III, class 2, style A pullers shall be similar to figure 10, and shall conform to table VII for the kind specified.

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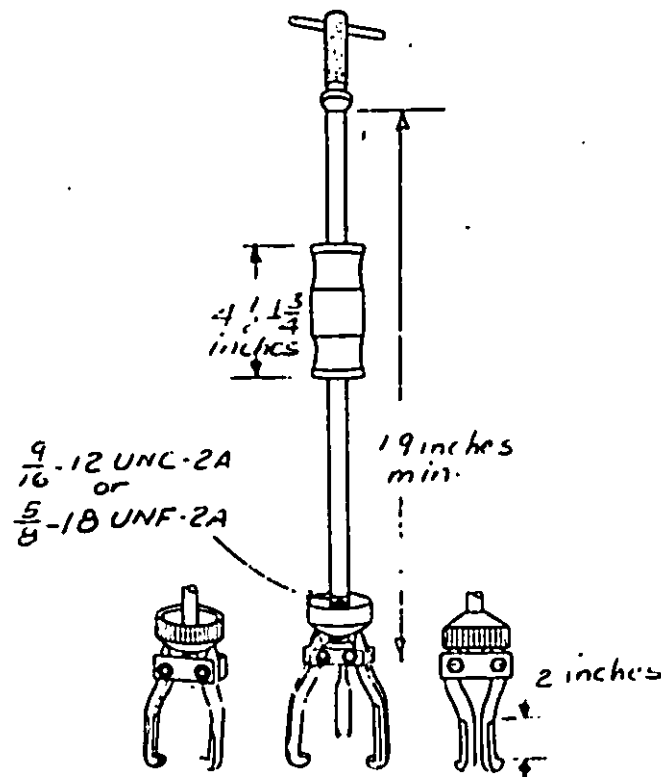


FIGURE 10. Type III, class 2, style A, puller, mechanical, slide hammer, gear and bearing, two- and three-jaw, external and internal, light duty.

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

	Spread range (outside willing)	Spread range (inside willing)	Test load (min.)
Two arm	<u>Inches</u> 1 to 4-1/2	<u>Inches</u> 1-1/4 to 3-3/4	<u>Pounds</u> 5,000
Three arm	1-1/2 to 4-1/2	1-5/16 to 4-3/4	5,000

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3.8.3.5.2 Style B, heavy duty. Style B pullers, in addition to the requirements specified in 3.8.3, shall consist of a suitable locking arrangement, spreader arrangement, and centering adapter. The parts shall be of high-grade steel properly heat treated to resist breakage or deformation. The pullers shall have an external spread range of from 0 up to and including 6-1/4 inches; an internal spread range of from 1/2 up to and including 3 inches, and withstand a min. test load of 10,000 pounds.

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

3.8.3.5.2.1.1 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.

3.8.3.5.2.2 Slide rod. Style B slide rod shall have an added threaded length and means provided on the pressure end for acceptance of a centering adapter.

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

3.8.3.5.2.4 Spreader arrangement. Suitable means shall be incorporated in the design of the puller for use in spreading the external and internal pulling assembly.

3.8.3.5.2.5 Centering adapter. The centering adapter shall be of a design capable of supporting the spreader disk and having a 60° center point with means for holding the adapter in place.

3.8.3.5.2.6 Type III, class 2, style B puller shall be similar to figure 11.

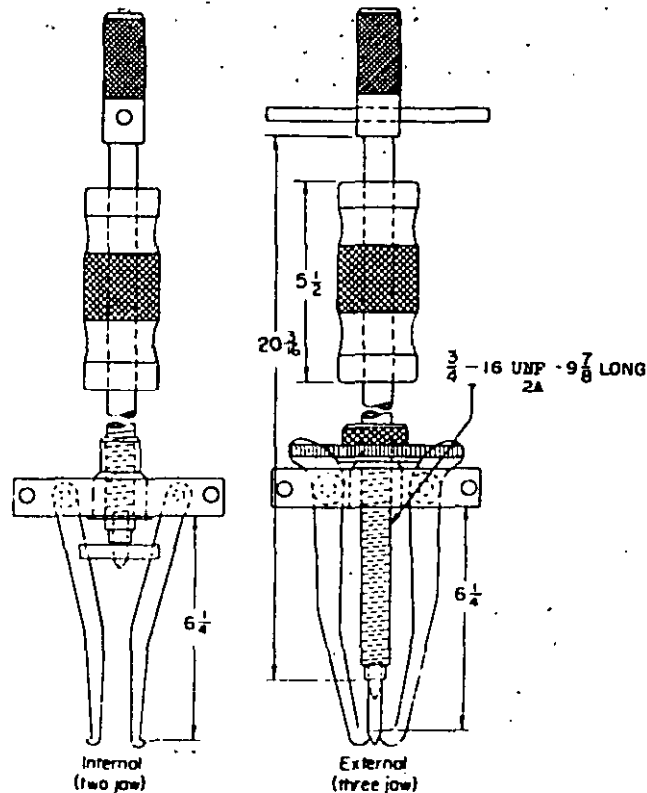


FIGURE 11. Type III, class 2, style B, puller, mechanical, slide hammer, gear and bearing, two- and three-jaw, external and internal, heavy duty.

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3.9.3.6 Class 3, bearing race, three-jaw, internal. Class 3 pullers shall be adjustable over an internal spread range of from 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.

3.9.3.6.1 Expansion plug. The expansion plug shall be of 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.

3.9.3.6.2 Type III, class 3 puller shall be similar to figure 12.

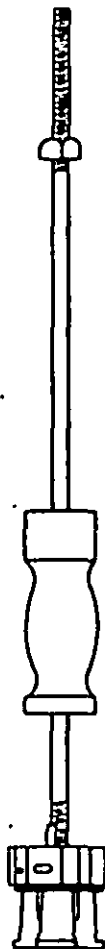


FIGURE 12. Type III, class 3, puller, mechanical, slide hammer, bearing race, three-jaw, internal.

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3.3.4 Type IV, bearing, clutch pilot. Type IV pullers shall consist essentially of a body, head, yoke, yoke screw, forcing nut, and jaws. The puller shall be furnished with two pairs of jaws and the combined spread range of the two pairs of jaws shall be from $25\frac{1}{4}$ of an inch up to and including 1-1/4 inches. The pullers shall be designed to allow free movement with a minimum of clearance between the working parts.

3.3.4.1 Body. The body shall be of a high-grade steel, of U-shape suitable for use 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.

3.3.4.2 Head yoke. The head yoke shall be of 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.

3.3.4.3 Yoke screw. The screw shall be of a high-grade steel. The head of the screw may be either a hexagon head suitable for accepting a standard size wrench or tee-handle drive with hexagon head. The thread of the screw shall be suitable to engage the thread of the head yoke and the screw point shall be so shaped as to center and expand the jaws.

3.3.4.4 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.

3.3.4.5 Jaws. The jaws shall be in accordance with the applicable requirements of 3.3.1.3.

3.3.4.6 Type IV pullers shall be similar to figure 13 and shall conform to table VIII for size specified (see 6.1).

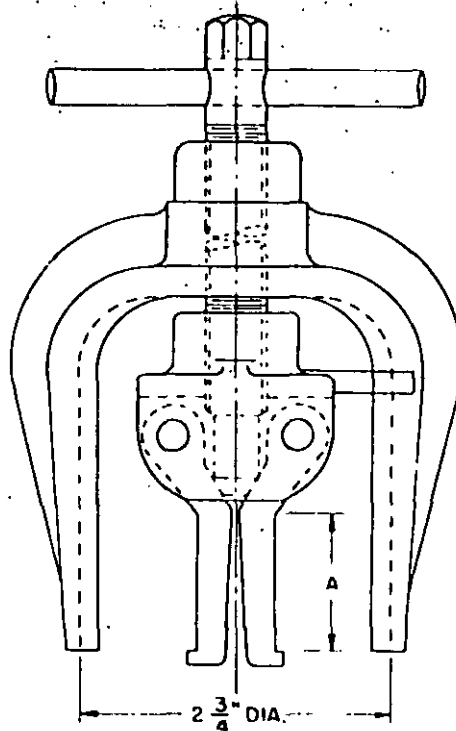


FIGURE 13. Type IV, puller, mechanical, bearing, clutch pilot.

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

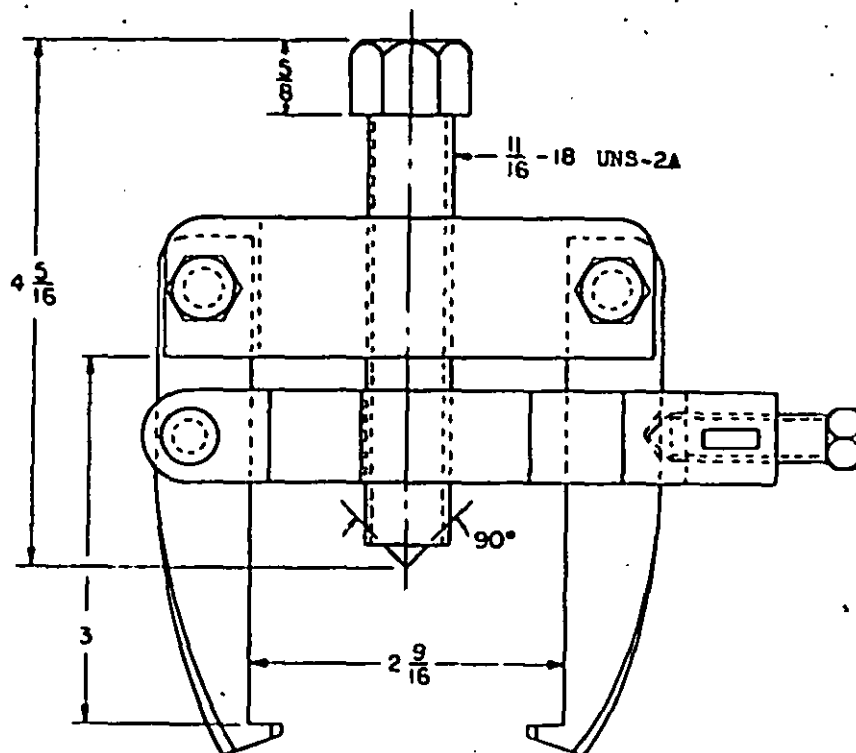
Size	Reach A (Min.)
	<u>Inches</u>
1	3/4
2	1-1/3

3.8.5 Type V, steering-gear arm. Type V pullers shall be in accordance with 3.8.1, 3.8.1.1, and 3.8.1.3 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.

3.8.5.1 Forcing screw. The screw shall be in accordance with 3.8.1.2 except for the center point, which shall be 90°.

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

3.8.5.3 Type V pullers shall conform to the dimensions shown on figure 14.

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

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3.8.6 Type VI, mechanical, ring type steering wheel, three-arm. 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.

3.8.6.1 Yoke. The yoke shall be in accordance with 3.8.1.1 and 3.8.1.5.

3.8.6.2 Forcing screw. The forcing screw shall be of high-grade alloy steel. The head of the screw shall be hexagonal in shape, 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 point.

3.8.6.3 Arms. The three-arms shall be of 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.

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

3.8.6.5 Pulling ring. The pulling ring shall be of 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.

3.8.6.6 Type VI pullers shall conform to the dimensions shown on figure 15, except the 5-1/4 inch dimension shall have a tolerance of $+3/8$, $-1/8$ inch.

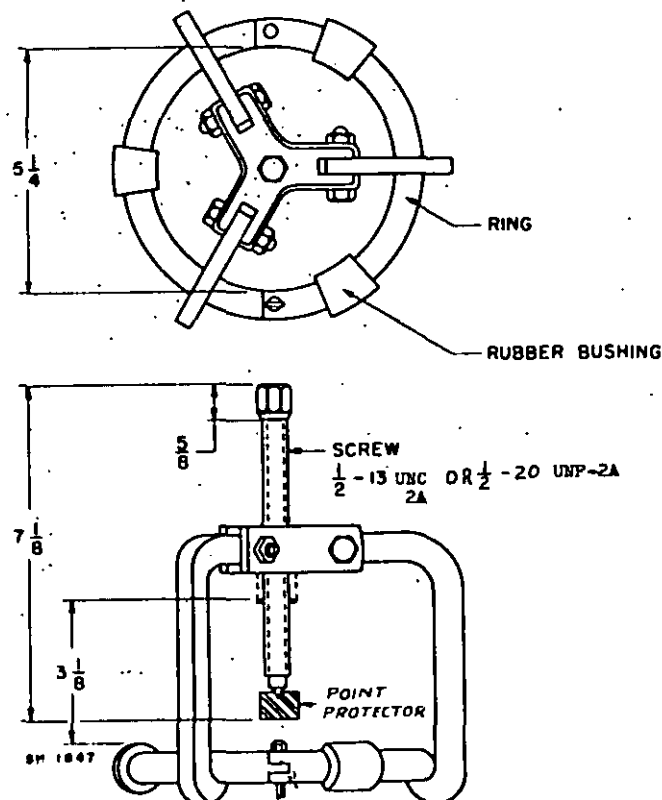


FIGURE 15. Type VI, puller, mechanical, ring type steering-wheel, three-arm.

3.8.7 Type VII, gear and bearing. 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.

3.8.7.1 Puller attachments and adapters when required (see 6.1), shall be in accordance with 3.9 and 3.10.

3.8.7.2 Cross block. The cross block shall be of either 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.

3.8.7.3 Slide plates and washers. The slide plates and washers shall be of 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.

3.8.7.4 Forcing screw. The forcing screw shall be of high-grade alloy steel, and have National Form threads. The head shall be either square or 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.

3.8.7.5 Forcing screw nut. The forcing screw nut shall be of high-grade steel, threaded to engage the thread of the forcing screw.

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

3.8.7.7 Legs. The legs shall be of high-grade alloy steel, 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.

3.8.7.8 Type VII pullers shall be similar to figure 16, and shall conform to table IX for the size specified (see 6.1).

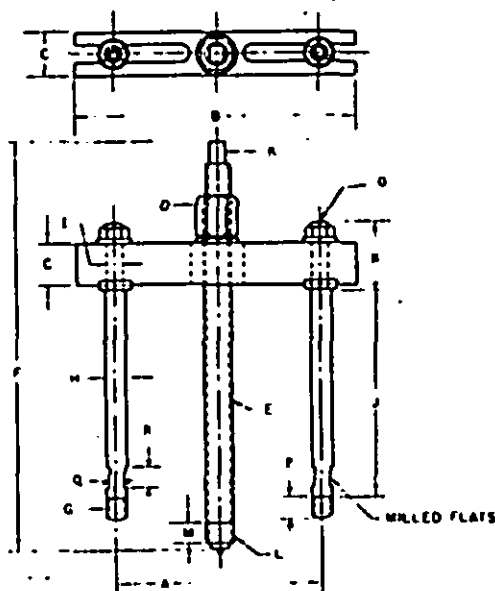


FIGURE 16. Type VII, puller, mechanical, gear and bearing.

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TABLE II. Type VII, weller, mechanical, gear and bearing

Size	Spread range A	Block length B	Block width C	Hex nut size D	Forcing screw E	Screw length F	Leg thread G	Leg diameter		Leg length J $\pm 1/16$
								H	I	
	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inch	Inches
1	2 by 7-3/4	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 by 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 by 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

TABLE IX. Type VII, weller, mechanical, gear and bearing (Con.)

Size	Forcing screw-head K	Thread UNF-2A L	Length of thread M	Test load (min.)	Length to shoulder N	Thread size O	Length to shoulder or length of threads P	Width across flats Q	Length of flats R
	Inch	Inches	Inch	Pounds	Inches	Inches	Inches	Inches	Inches
1 (Con.)	1/2	5/8-18	3/4	26,000	2-15/32 $\pm 1/8$	1/2 - 20 UNF-2A	23/32 $\pm 3/32$	0.500 +0.000 - .010	5/8 $\pm 1/16$
2 (Con.)	11/16	-----	-----	55,000	3-15/16 $\pm 7/32$	3/4 - 16 UNF-2A	1 $\pm 1/16$.750 + .000 - .010	11/16 $\pm 1/8$
3 (Con.)	1	-----	-----	70,000	5-1/8 $\pm 9/32$	1 - 14 UNS-2A	1-7/16 $\pm 7/32$	1.000 + .000 - .010 or 1.062 + .000 - .010	7/8 $\pm 3/16$

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.

3.8.8 Type VIII, gear and pulley. Type VIII pulley shall consist essentially of a cross block, forcing screw conforming to 3.8.7.4, and cap screws, and shall be properly heat treated to resist breakage or deformation. The pulley shall be capable of withstanding a minimum test load of 7,000 pounds.

3.8.8.1 Cross block. The cross block shall be of 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.

3.8.8.2 Cap screws. Cap screws shall be of high-grade quality steel.

3.8.8.3 Type VIII pulley shall conform to the dimensions shown on figure 17.

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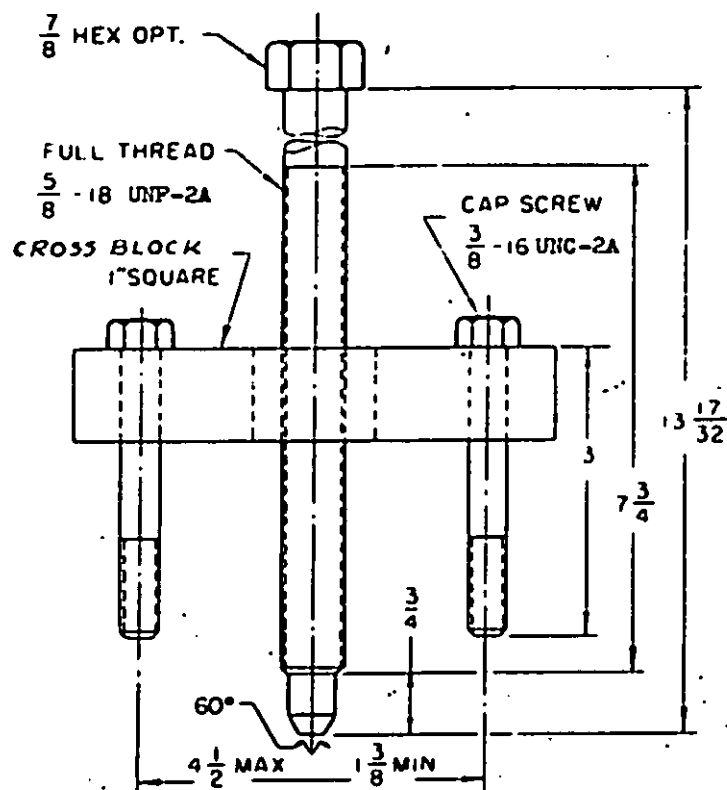


FIGURE 17. Type VIII, puller, mechanical, gear and pulley.

3.8.0 Type IX, impulse coupling, two-jaw. Type IX puller shall consist essentially of a cross block conforming to 3.8.8.1, forcing screw conforming to 3.8.7.4, securing nuts, washers 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.

3.8.0.1 Locking nuts. The locking nuts shall be of good-quality steel, hexagonal 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.

3.8.0.2 Jaws. The jaws shall be of 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 assure a firm grip in all pulling operations.

3.8.0.3 Type IX puller shall conform to the dimensions shown on figure 18.

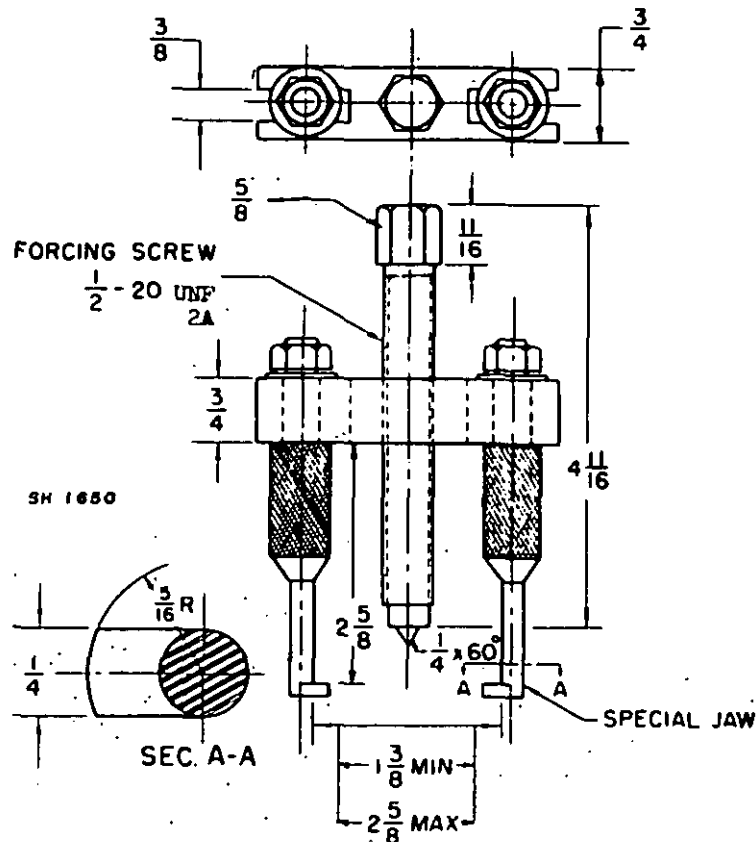


FIGURE 18. Type IX, puller, mechanical, impulse coupling, two-jaw.

3.9 Puller attachment, mechanical.

3.9.1 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 3.8.8.1, 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 3.8.3.2 and 3.8.3.3, 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.

3.9.1.1 Reducing adapter. The reducing adapter shall be of high-grade alloy steel. The head of the adapters 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.

3.9.1.2 Jaws. The jaws shall be of high-grade forged alloy steel. The jaws shall be so designed 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.

3.9.1.3 Type XI puller attachment shall be similar to figure 19 and shall conform to table X for the size specified (see 6.1).

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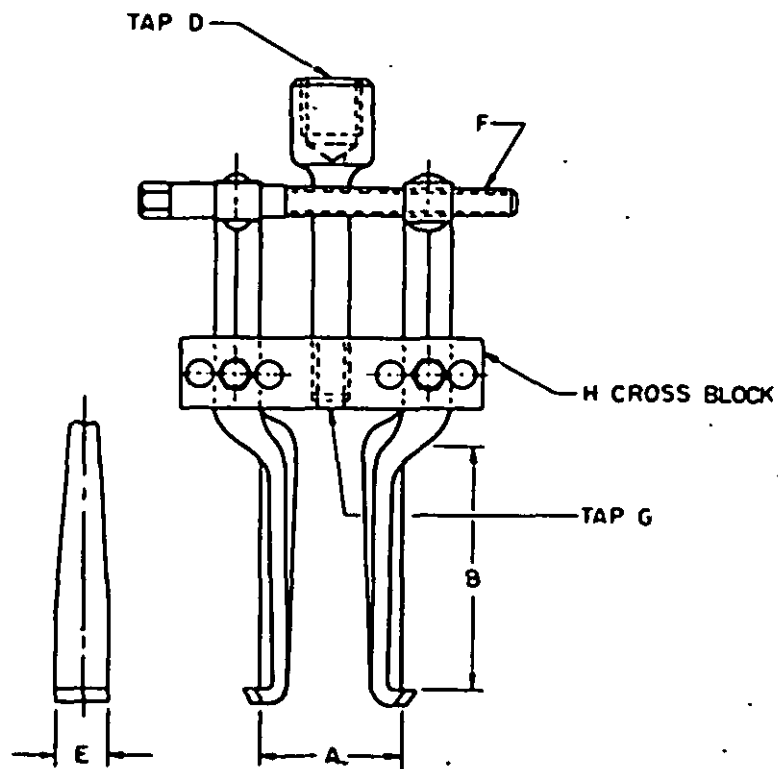


FIGURE 10. Type XI, miller attachment,
mechanical, bearing, internal.

TABLE I. Type XI, miller attachment, mechanical, bearing, internal

Size	Spread range	Width (Min.) B	Tap C	Jaw width E	Thread F	Pin G	Cross block H	Test ring I.D.	Test load Pounds
	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Pounds
1	1-1/2 to 5	2	1 -14TBS-28	13/16	7/16-14TBS-28	5/8-18TWF-28	1-1/4 32	2-3/4	7,000
2	1-1/2 to 6	4	1 -10TFL-28	1-1/8	7/16-14TBS-28	5/8-18TWF-28	1-1/4 30	2-3/4	7,000
3	1-1/2 to 6	5-1/2	1 -14TBS-28	1	7/16-14TBS-28	5/8-18TWF-28	1-1/4 32	2-3/4	7,000
5	3 to 9	5	1-1/2-12TWF-28	2	5/8-18TWF-28	1 -14TBS-28	1-3/4 32	4-1/4	12,000

3.9.2 Type XII, bearing, external. The type XII puller attachment shall be suitable for use with type I, class 1, and type VII pullers and shall consist essentially of a top and bottom block, can screws 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.

3.9.2.1 Blocks, top and bottom. The blocks shall be of high-grade forged alloy steel, and be so designed as to have the semi-circular knife edges and the lanced holes in proper alignment when the top and bottom blocks are assembled.

3.9.2.2 Can screws. The screws shall be of high-grade steel. The head of the screw shall be hexagonal in shape and the body threaded to engage the thread in the nut.

3.9.2.3 Nuts. The nuts shall be of high-grade steel, and threaded to engage the thread of the can screws.

3.9.2.4 Type XII puller attachment shall be similar to figure 20, and shall conform to the dimensions of table XI.

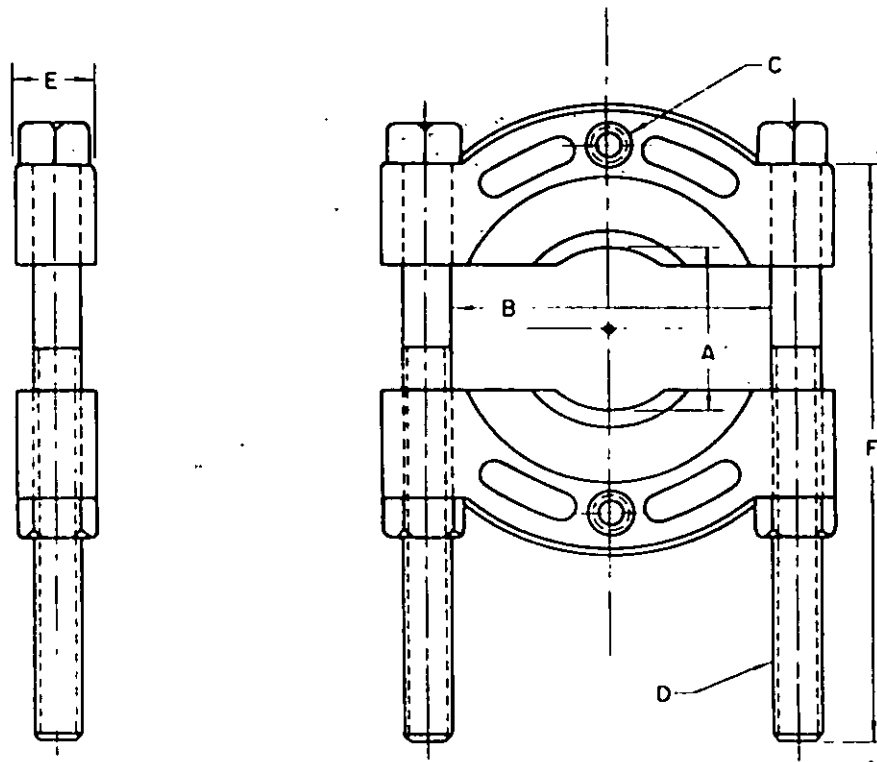


FIGURE 20. Type XII, puller attachment,
mechanical, bearing, external.

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TABLE XI. Type III, puller attachment, bearing external

Size	Spread range (Min.)	Inside width (Min.)	Top	Throat TV-2B	Thickness (Min.)	Length of screw (Min.)	Test ring	Test load	Test spread
	A	B	C	D	E	F	OD	Min.	At A
	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Pounds	Inches
2	3/8 to 4-3/4	4-1/4	5/8-18 UNF-2B	5/8-18	15/16	8	4-1/4	50,000	2
3	1 to 5-3/4	6	5/8-18 UNF-2B	3/4-15	1-1/4	9-3/4	5-3/4	70,000	3
4	1 to 9	6	5/8-18 UNF-2B	3/4-15	1-1/4	13	5-3/4	70,000	3
6	1 to 9	10	1-14 UNF-2B	1-1/8-12	1-7/8	19	8-3/4	90,000	6-1/2

3.10 Puller adapter mechanical.

3.10.1 Type XIII, gear and bearing. Type XIII adapter shall be designed for use with either type I, class 1, and type VII pullers where applicable, and shall be of steel conforming to the chemical requirements for B1111, B1112 and B1113 resulfurized steels of Q1-S-637. Classes 1 and 2 puller adapters shall be heat treated; classes 3, 4 and 5 shall be case-hardened.

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

3.10.2.1 Style A, with 5/8-18 UNF-2B tapped hole. Style A adapter shall be similar to figure 21 and shall conform to table XII for the size specified (see 5.1).

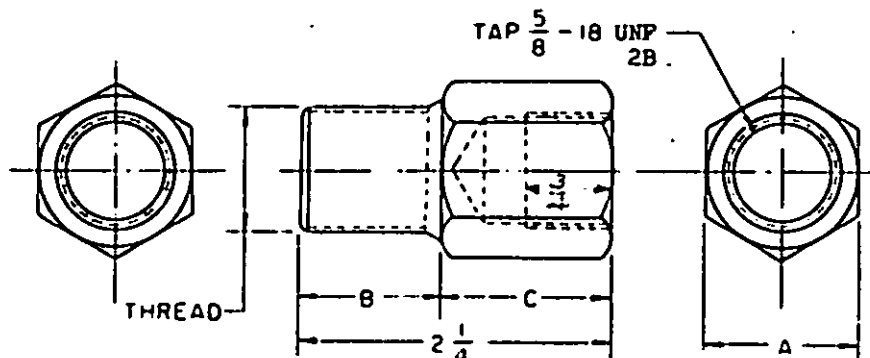


FIGURE 21. Type XIII class 1, style A puller adapter, forcing screw thread size adapting, mechanical, gear and bearing. male and female thread with 5/8-18 UNF-2B tapped hole.

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

Size	Dimensions, inches			
	Thread	A	B	C
1	1/4-20 UNC-2A	1	3/4	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

3.10.2.2 Style B, with 1 - 14 UNS-2B tapped hole. Style B adapter shall be similar to figure 22 and shall conform to table XIII for the size specified (see 6.1).

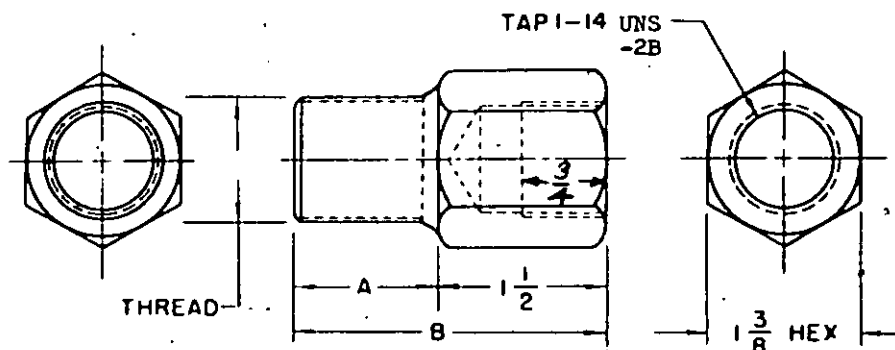


FIGURE 22. Type XIII, class 1, style B puller adapter, mechanical, gear and bearing, male and female thread with 1 - 14 UNS-2B tapped hole.

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TABLE VIII. Type VIII, class 1, style B, wailer adapter, mechanical, gear and bearing, male and female thread with 1-1/4 UNF-2B tapped hole

Size	Dimensions, inches		
	Thread	A	B
1	5/8-11 UNC-2A	1	2-1/2
2	3/4-15 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 -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	1-1/2-12 UNF-2A	1-1/2	3
12	1-1/2-6 UNC-2A	1-1/2	3

3.10.2.3 Style C, with 1-1/2-12 UNF-2B tapped hole. Style C adapter shall conform to the dimensions shown on figure 23.

3.10.3 Class 2, female thread. Class 2 adapter shall be hexagonal in shape, having 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.

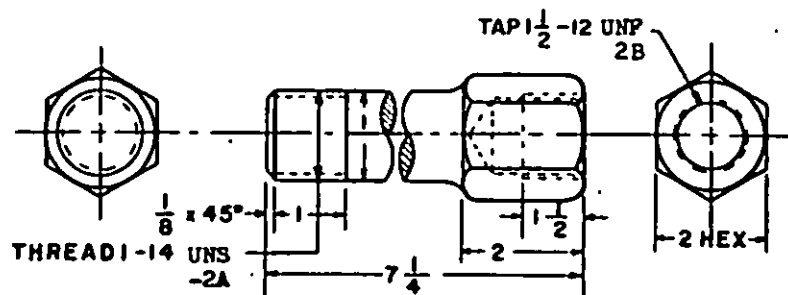


FIGURE 23. Type VIII, class 1, style C wailer adapter, mechanical, gear and bearing, male and female thread with 1-1/2-12 UNF-2B tapped hole.

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

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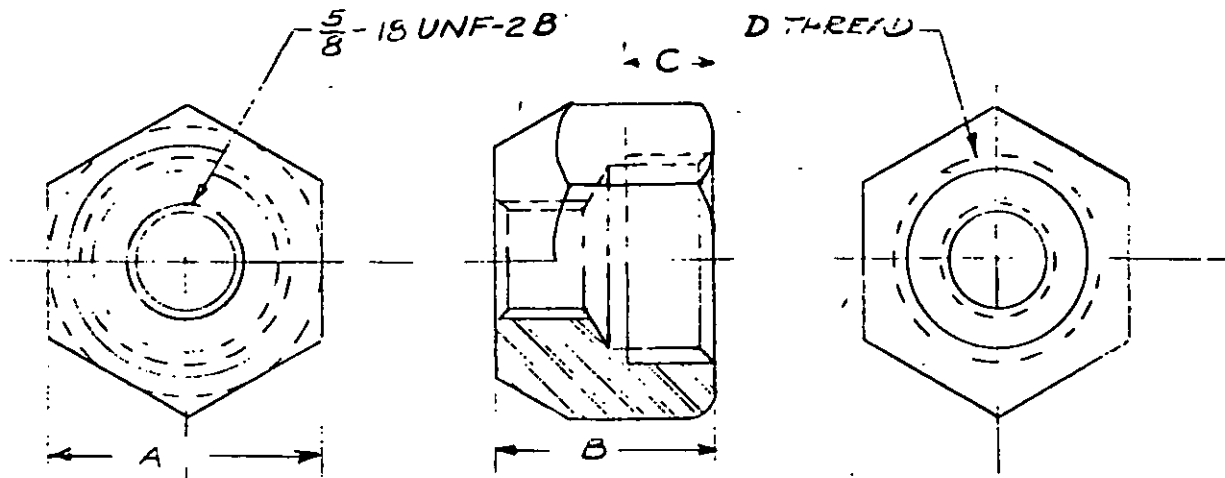


FIGURE 24. Type XIII, class 2, style A, puller adapter, mechanical, gear and bearing, female thread with 5/8-18 UNF-2B tapped hole.

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	Thread depth (min.)	Thread
	A	B	C	D
	<u>Inches</u>	<u>Inches</u>	<u>Inch</u>	
1	7/8	1-1/8	3/8	1/2-20 UNF-2B
2	1	1-1/8	thru	5/8-18 UNF-2B
3	1-1/8	1-9/16 - 1-5/8	9/16	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	7/16	7/8-14 UNF-2B
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	7/16	1 -14 UNS-2B
9	1-1/2	1-1/4 - 1-11/16	1/2	1-1/8-12 UNF-2B
10	1-5/8	1-1/2 - 1-13/16	5/8	1-1/4-12 UNF-2B
11	1-5/8	1-13/16 - 2-1/8	3/4	1-1/4-7UNC-2B
12	1-7/8	1-13/16 - 2-1/8	13/16	1-1/2-12 UNF-2B
13	2	1-13/16 - 2-1/8	7/8	1-1/2-6 UNC-2B

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

3.10.3.2 Style B, with 1-14 UNS-2B tapped hole. Style B adapter shall be similar to figure 25 and shall conform to table XV for the size specified (see 5.1).

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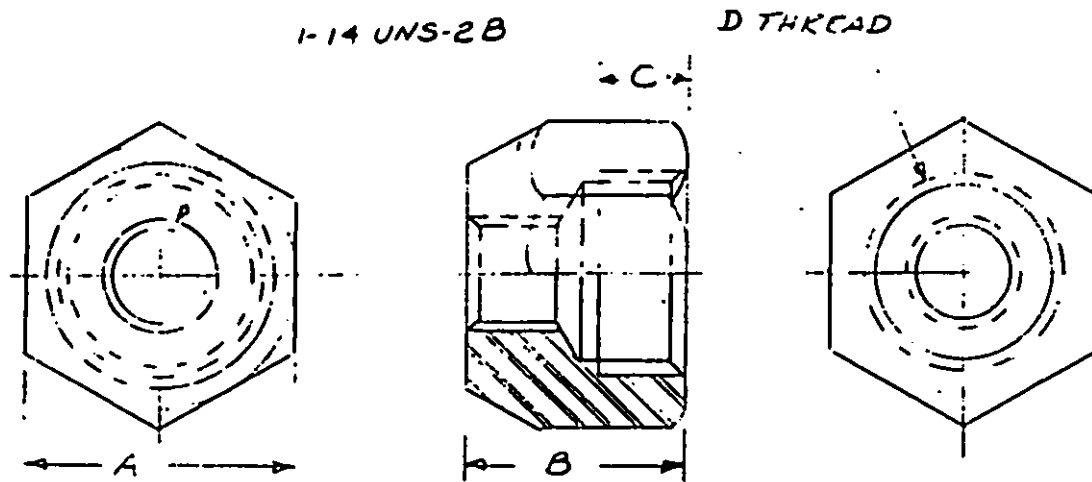


FIGURE 25. Type XIII, class 2, style B, puller adapter, mechanical, gear and bearing, female thread with 1-14 UNS-2B tapped hole.

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

	Hex size	Overall length $\frac{1}{2}$	Thread depth (min.)	Thread
Size	A	B	C	D
	<u>Inches</u>	<u>Inches</u>	<u>Inches</u>	
1	1-1/2	2	3/8	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	1-1/2-13 UNF-2B
5	1-3/4	2-1/2 - 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	1-1/2-5 UNC-2B

$\frac{1}{2}$ If two dimensions are given for the overall length, either one is acceptable.

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

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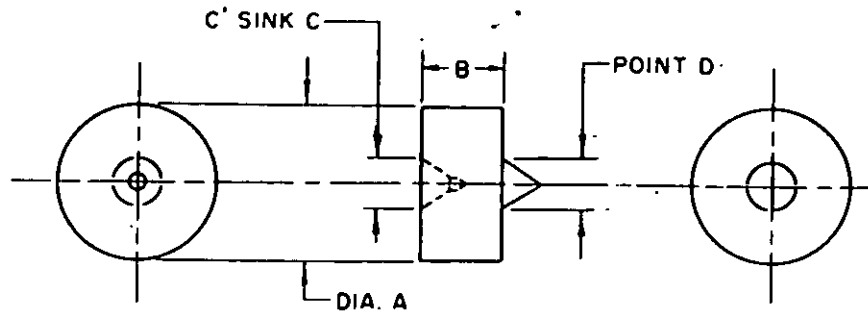


FIGURE 26. Type XIII, class 3, puller adapter, mechanical, gear and bearing, spacer.

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

Size	Dimensions			
	Diameter	Length	CTSK	Point
	A	B	C	D
	<u>Inches</u>	<u>Inch</u>	<u>Degrees</u>	<u>Degrees</u>
1	1-1/2	3/4	25/64 by 60	7/16 by 60
2	1-1/4	3/4	25/64 by 60	3/8 by 60
3	1	3/4	25/64 by 60	5/16 by 60
4	3/4	3/4	17/64 by 60	1/4 by 60
5	5/8	5/8	17/64 by 60	1/4 by 60
6	5/8	5/8	13/64 by 60	3/16 by 60

3.10.5 Class 4, step plate. 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, shall be similar to figure 27 and shall conform to table XVII for the size specified (see 6.1).

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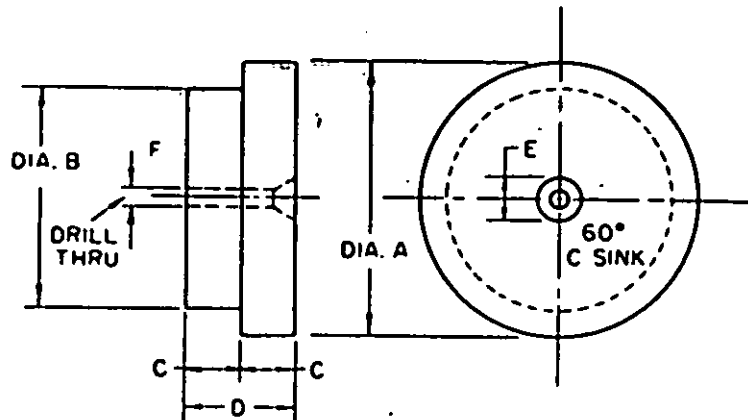


FIGURE 27. Type XIII, class 4, puller adapter, mechanical, gear and bearing, step plate.

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

Size	Dimensions					
	A	B	C	D	E	F
	<u>Inches</u>	<u>Inches</u>	<u>Inch</u>	<u>Inch</u>	<u>Inch</u>	<u>Inch</u>
1	1	3/4	1/4	1/2	1/4	9/54
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	11/64
6	1-3/4	1-3/8	3/8	3/4	3/8	11/54
7	1-7/8	1-1/2	3/8	3/4	3/8	11/54
8	2	1-5/8	3/8	3/4	3/8	11/54
9	2-1/8	1-3/4	3/8	3/4	3/8	11/64
10	2-3/8	1-7/8	3/8	3/4	3/8	11/54
11	2-1/2	2	1/2	1	3/8	11/54
12	2-5/8	2-1/8	1/2	1	3/8	11/64
13	2-3/4	2-1/4	1/2	1	3/8	11/54
14	2-7/8	2-3/8	1/2	1	3/8	11/64
15	3	2-1/2	1/2	1	3/8	11/64
16	3-1/4	2-3/4	1/2	1	3/8	11/54
17	3-1/2	3	1/2	1	3/8	11/64

3.10.5 Class 5, leg can. Class 5 adapter shall be hexagonal in shape, having an internal thread in one end to engage the thread of the leg and the opposite end faced right angle to the horizontal axis of the internal thread. The threaded hole shall be of sufficient depth to allow the face of the leg can to bear against the shoulder of the leg. Class 5 adapter shall be similar to figure 28 and shall conform to table XVIII for the size specified (see 6.1).

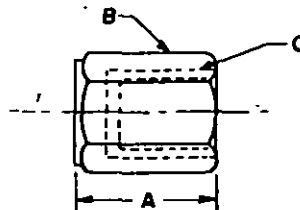


FIGURE 28. Type XIII, class 5, puller adapter, mechanical, gear and bearing, leg cap.

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

Size	Dimensions		
	Length	Hexagon	Thread
	A	B	C
	<u>Inches</u>	<u>Inches</u>	
1	1-1/2	1-1/8	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

3.11 Carrying case. When carrying cases are specified (see 5.1), 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 that will not sag or distort due to the weight of the components and provided with a sheet steel, hinged cover. The case shall be provided with one or more handles and adequate hardware for holding down the cover and shall have a durable coat of paint or enamel.

3.12 Finish.

3.12.1 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.

3.12.2 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 cadmium or zinc plate. All components, except cases and forcing screws, of pullers and puller attachments shall have one of the following coatings:

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3.12.2.1 Chromium plate. The finish shall be electrodeposited metal consisting of nickel followed by chromium, the minimum thickness being 0.0002-inch nickel and 0.0001-inch chromium.

3.12.2.2 Cadmium plate. The coating shall be electrodeposited cadmium not less than 0.0003 inch thick and shall be subjected to a chemical electrochemical chromating.

3.12.2.3 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.

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

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

3.13 Workmanship. Workmanship shall be of the highest grade throughout and equal in every respect to commercial practice. Pullers, puller attachments, and miller 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 or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to 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 Inspection of materials and components. In accordance with 4.1 above, the supplier is responsible for insuring that materials and components used were manufactured, tested, and inspected in accordance with the requirements of referenced subsidiary specifications and standards to the extent specified herein, or, if none, in accordance with this specification.

4.2 Sampling procedures. Sampling procedures shall be in accordance with MIL-STD-105. Data for sampling shall be as stated in table XIX.

4.3 Examination.

4.3.1 Visual examination. Each sample unit shall be examined for any nonconformance in design, material, finish, coating, construction, workmanship and marking. Defects are listed in table XX.

4.3.2 Dimensional examination. Each sample unit shall be examined for any nonconformance with capacity and dimensional requirements. Method of evaluating nominal dimensions specified in table I, shall be in accordance with 1.3.2.1.

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TABLE XIX. Sampling data

Category	Sample unit	Inspection level	AQL	AQL terms	Reference
Visual examination	1 ea.	II	<u>Major</u> 1.5 <u>Minor</u> 4.0	Defects per hundred units	4.3.1 table XIX
Dimensional examination	1 ea.	S-4	One class 1.0	Defects per hundred units	4.3.2
Testing	1 ea.	S-3	1.0	Percent defective	4.5

Note: Puller set. Each item in the set, including container, shall be formed into a separate lot, and inspected accordingly.

TABLE XX. Classification of defects

Categories	Defects
Critical:	None defined.
<u>Major:</u>	
101	Type, class, style, and size not as specified.
102	Materials defective or not as specified, evidence of cracks, or deep pits.
103	Screw-threads stripped, torn, cracked, drunken (not concentric), or not full threads.
104	Failure of components or assemblies to function properly.
105	Improper fit between mating components.
106	Component(s) bent or otherwise malformed.
107	Component(s) missing.
108	Manufacturing operation missing or incomplete.
109	When applicable, the carrying case fails to accommodate the miller(s) and components specified.
<u>Minor:</u>	
201	Tool not smoothly finished as specified; evidence of rust, fins, burrs, rough surfaces, or sharp edges.
202	Coating missing, incomplete, or not as specified; evidence of cracking, peeling, flaking, uncoated, or nonadherent areas.
203	Marking, manufacturer's name or trademark missing, illegible, incorrect, or not permanent.

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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 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 3.6.1.2), in the short reach position. The diameter of the forcing screw "F" 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 method approved by the inspector. The test load shall be applied through the forcing screw by supplying the torque load required 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 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. 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.C. 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 C.D. of table XI.

4.6 Inspection of preparation for delivery requirements. An inspection shall be made to determine that the preservation, packaging, marking, and marking comply with the requirements of MIL-H-15424 and section 5 of this specification.

5. PREPARATION FOR DELIVERY

5.1 Preservation and packaging. Preservation and packaging shall be level 1 or C, as specified (see 6.1).

5.1.1 Level A. The pullers shall be preserved and packaged in accordance with the level A requirements of MIL-H-15424 for puller, gear, and bushing.

5.1.2 Level C. The pullers shall be preserved and packaged to provide adequate protection against corrosion, deterioration, and physical damage during shipment from the supply source to the first receiving activity for immediate use.

5.2 Packing. Packing shall be levels A, B, or C, as specified (see 6.1).

5.2.1 Levels A and B. The pullers shall be packed in accordance with the level 1 or B requirements, as specified (see 6.1), of MIL-H-15424 for puller, gear, and bushing.

5.2.2 Level C. The pullers packed, as specified in 5.1, shall be overpacked in shipping containers

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that will provide adequate protection at the lowest rate against damage during direct domestic shipment from the supply source to the first receiving activity for immediate use. The shipping containers shall comply with the Uniform Classification Rules or National Motor Freight Classification Rules, as applicable.

5.3 Marking.

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

5.3.2 Military agencies. Marking shall be in accordance with MIL-H-15424.

6. NOTES

6.1 Ordering data. Purchasers should select the preferred options permitted herein, and include the following information in procurement documents:

- (a) Title, number, and date of this specification.
- (b) Selection of applicable levels of packaging and packing required (see 5.1 and 5.2).
- (c) Type, class, style, and size (see 1.2.1 and applicable table).
- (d) If carrying case is required, so state (see 3.5.3 and 3.11).
- (e) Whether "limited" or "complete" puller sets are required (see 3.6).
- (f) 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 3.8.1.4.1 and 3.8.7.1).
- (g) Whether pullers should be furnished with one pair of short jaws or one pair of long jaws or both (see 3.8.1.7).
- (h) Whether puller should be furnished with standard detachable center point or small detachable center point, or both (see 3.8.1.7).
- (i) When puller attachment should be used with type VII puller or used as a slide hammer (see 3.9.1).

6.1.1 When repair parts are required, specify the following:

- (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.

6.2 Superseding data. Type I, class 5, type VI, class 2, and type X of GGG-P-781A have been deleted from this specification. Puller kits, types XIV, XV, XVI, XVII, and XVIII are being transferred to specification GGG-P-643.

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MILITARY INTEREST:

Custodians:

Navy - SH
Air Force - 84

Review activities:

Navy - YD
Air Force - 85

User activities:

Navy - AS, OS, MC, CC
Air Force - 3G, SU, TG

Military coordinating activity:

Air Force - 84

Preparing activity:

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