Designation: F 887 – 97

Standard Specifications for Personal Climbing Equipment [1]

This standard is issued under the fixed designation F 887; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 These specifications cover acceptance testing of climbers and climber straps, body belts and positioning straps, and harnesses used by workers in the climbing of poles, trees, towers, and other structures.

1.2 Three types of climbers, Types A, B, and C, and two types of climber straps, Types A and B, are covered.

1.3 Two types of body belts, Types A and B, are covered.

1.4 Three types of positioning straps, Types A, B, and C, in two Styles I and II, are covered.

1.5 Two types of harnesses, Types A and B, are covered.

1.6 The values stated in inch-pound units are to be regarded as the standard.

1.7 The following safety hazards caveat pertains only to the test method portions, 9.2, 13.3, 14.3, 17.3 and Sections 18, 19, and 20, of these specifications: *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

B 117 Practice for Operating Salt Spray (Fog) Apparatus[2]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *billet*—the free (buckle hole) end of a belt or strap as opposed to the buckle end, which is designed to pass through the buckle for closing.

3.1.2 *body belt attachment*—a system of straps and buckles which allow the harness wearer to use a body belt in conjunction with the harness.

3.1.3 *compatible hardware*—dee-ring and snaphook which are shaped and dimensioned in relation to each other such that the connected dee-ring cannot depress the snaphook keeper a sufficient amount to release itself (see Fig. 1).

3.1.4 *dee-ring, D-ring*—a steel straight-sided (no protrusions along edge of dee-ring; see Fig. 1) forging in a circle configuration with an integral stirrup to accept the belt, assembled into a body belt for the purpose of accepting the snaphooks of a positioning strap.

3.1.5 *fall arrest attachment*—a connector element (usually a dee-ring or nylon loop) affixed to the body support, which is specifically designated for attaching the rest of the fall arrest system.

3.1.6 *full body harness*—a component with a design of straps which is fastened about the person in a manner so as to contain the torso and distribute the fall arrest forces over at least the upper thighs, pelvis, chest, and shoulders with means for attaching it to other components or sub-systems.

3.1.7 *gaff*—a component of a pole or tree climber attached to the climber shank, similar to a spur, which is shaped to permit the secure penetration of the pole or tree trunk.

3.1.8 *keeper*—a component of the snaphook, used as a latching device and held in a closed position by a spring (see Fig. 2).

3.1.9 *locking mechanism*—a component of the snaphook used in conjunction with the keeper to retain the keeper in a closed position until intentionally released and opened. A snaphook thus equipped, becomes a "locking snaphook."

3.1.10 *locking snaphook*—a snaphook with a locking mechanism (see 3.1.9).

3.1.11 *nose*—the curved end of the snaphook which the keeper rests on. It is rounded and overlaps the keeper latch in such a manner as to prevent the dee-ring from releasing the snaphook (see Fig. 2).

3.1.12 *part (body belt), load-bearing*—a part of the body belt or positioning strap that, when in use with both snaphooks of the positioning strap engaged in one dee-ring of the body belt, will be required to support all or part of the mass of the user. This includes all the material in the positioning strap, and, in the case of the body belt, the material to which the dee-rings are directly fastened, and the material of the buckle strap that passes across the wearer's abdomen.

3.1.12.1 *Discussion*—This definition and the strength requirements described in 14.3.2 are designed to ensure that the

[1] These specifications are under the jurisdiction of ASTM Committee F-18 on Electrical Protective Equipment for Workers and are the direct responsibility of Subcommittee F18.15 on Worker Personal Equipment.

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[2] *Annual Book of ASTM Standards*, Vol 03.02.

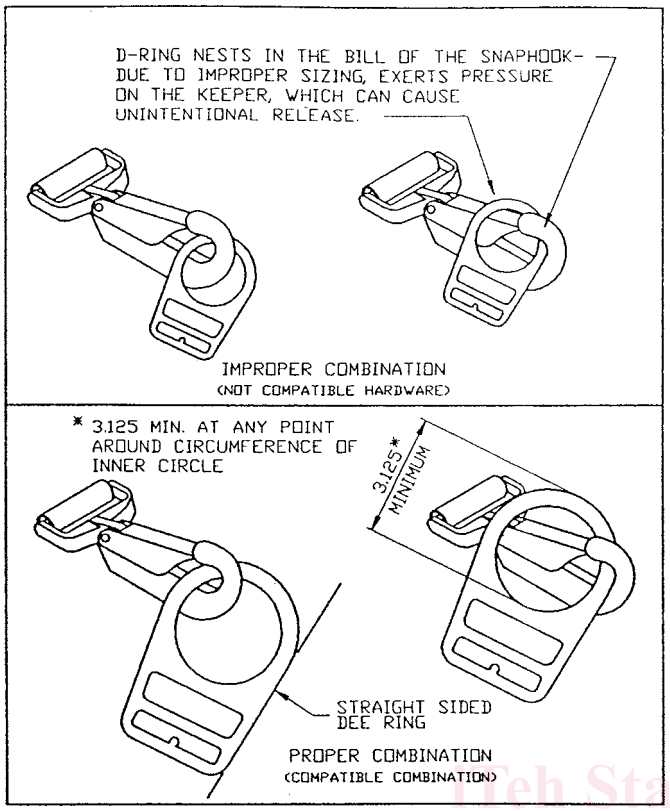


FIG. 1 Noncompatible and Compatible Hardware

buckle strap is strong enough to withstand certain emergency conditions, but are not to be construed as approval of attaching both snaphooks to the same dee-ring when working aloft. OSHA Subpart M (1926.502) prohibits working with two load-bearing snaphooks in the same dee-ring unless snaphooks are of the locking type and designed for such application.

3.1.13 *part (harness), load bearing*—a component of a harness to which arrest forces are directly transmitted in the event of a fall.

3.1.14 *protector, gaff*—a cap or guard designed to cover the points of pole or tree gaffs to protect the gaffs from damage or from injuring people or from damaging equipment.

3.1.15 *stirrup, climber*—the footrest of the pole or tree climber.

3.1.16 *stirrup, snaphook/dee-ring*—the closed rectangular portion of the positioning strap snaphook, or body belt dee-ring, that accepts the strap or belt material in a permanent manner.

4. Significance and Use

4.1 Pole and tree climber straps are personal tools or equipment utilized in climbing poles and trees. Body belts, positioning straps, and harnesses are personal tools or equipment utilized in climbing poles, trees, ladders, or structures. This personal climbing equipment aids in preventing and arresting falls.

4.2 Test methods included in these specifications are intended to provide uniform test procedures.

4.3 Snaphooks shall be engaged only to compatible hardware unless the snaphooks are of the locking type designed and used to prevent disengagement.

4.3.1 Locking snaphooks are highly recommended in lieu of regular snaphooks. Locking snaphooks that meet the requirements of these specifications, effectively prevent roll-out from occurring.

4.4 Illustrations are furnished only to amplify the text. They are not to be considered restrictive as to specific design details, except where so stated.

4.5 Except for the restrictions set forth in these specifications because of design limitations, the use and maintenance of this equipment is beyond the scope of the standard.

4.5.1 It is common practice and the responsibility of the user of this type of protective equipment to prepare complete instructions and regulations to govern in detail the correct and safe use of such equipment.

POLE AND TREE CLIMBERS

5. Classification

5.1 Climbers covered under these specifications shall be designated as Type A, B, or C, as follows:

5.1.1 *Type A*—Fixed length, non-adjustable, with permanently attached gaffs.

5.1.2 *Type B*—Adjustable length, with permanently attached gaffs.

5.1.3 *Type C*—Adjustable length, with replaceable and interchangeable gaffs (that is, pole to tree).

5.2 Climber straps covered under these specifications shall be designated as Type A or B, as follows:

5.2.1 *Type A*—One-piece straps that pass through the loops or rings on climbers and buckle one end to the other.

5.2.2 *Type B*—Two-piece ankle or bottom straps made so that each section can be attached to the climber ring, leaving the buckle end free to engage with the free billet end of the other piece.

6. Ordering Information

6.1 Orders for equipment under this specification shall include the following information:

6.1.1 Nomenclature,

6.1.2 Type,

6.1.3 Material, and

6.1.4 Size.

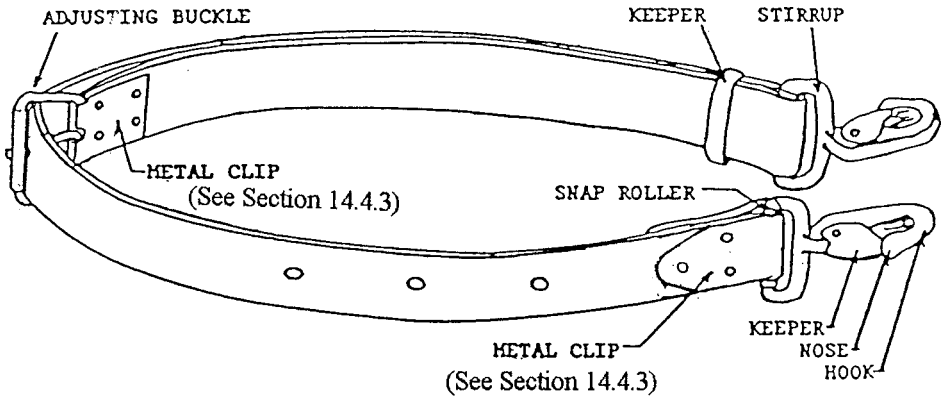
6.2 The listing of equipment, types, and sizes is not intended to mean that all shall necessarily be available from the manufacturer; this listing signifies only that, if made, the equipment, types, and sizes shall conform to the details of these specifications.

7. Pole and Tree Climbers

7.1 *Sizes*:

7.1.1 Type A shall be available in sizes from 14 to 22 in. (35 to 55 cm) in ½-in. (12.5-mm) graduations.

7.1.2 Types B and C shall be available with the size adjustment capability of 14¾ to 21 in. (37 to 53 cm) by increments of ¼ in. (6.5 mm).



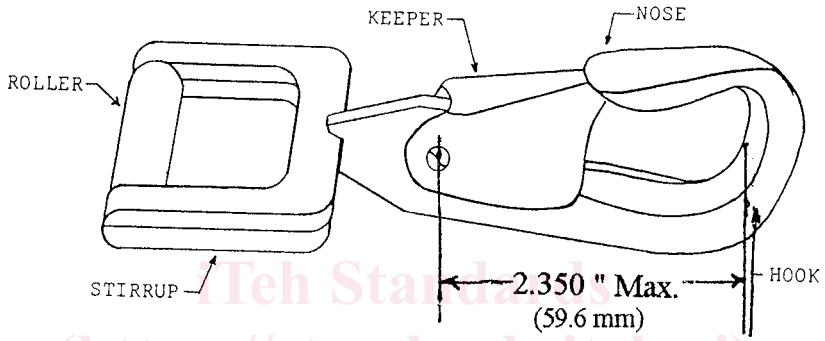


FIG. 2 Components of Positioning Strap

7.1.3 Adjustable climbers shall be equipped with positive locking, length-adjusting sections that can be double locked securely to the leg iron, permitting full compliance with standards established for fixed length climbers.

7.2 *Materials and Properties*—Leg irons shall be forged, utilizing forging-quality alloy steel or aluminum alloys. SAE 4140, SAE 8630 and SAE 8640 steel alloys with quenched and tempered structure, and 2014 T6 aluminum alloy are recommended. Other steel and aluminum alloys having properties listed in Table 1 are acceptable.

7.3 *Processing*—Manufacturers shall use a heat treatment to provide the required characteristics of the climber. The finished temperature of the forging shall be at the critical temperature of the material used. Cold working or overheating shall be avoided. Scaling, pitting, and surface decarbonization shall be removed on the inside critical section of the leg iron from 2 in. (5.1 cm) below the gaff to 6 in. (15.2 cm) above the gaff (see Fig. 3).

7.4 *Design*—The design of the leg iron shall be such that the maximum tensile stress at the point subjected to a fluctuating bending force of 300 lbf (1.3 kN) applied to the center of the stirrup section of the leg iron with sleeve in position shall be as indicated in the table below. The climber shall be held in the

TABLE 1 Properties of Steel and Aluminum Alloys Acceptable for Climbers

	For Fixed Gaff Climbers	For Replaceable Gaff Climbers [A]
Steel:		
Elongation in 2 in. (5 cm), min	14 %	14 %
Hardness	23 to 38 HRC 243 to 353 HB [B]	32 to 40 HRC 300 to 375 HB [B]
Yield strength, min, psi (MPa)	118 000 (815)	130 000 (895)
Aluminum:		
Elongation in 2 in. (5 cm), min	...	10 %
Hardness	...	125 to 140 HB [B]
Yield Strength, min, psi (MPa)	...	65 000 (450)

[A] Data from Federal Specification RR-C-430 C.
[B] Brinell hardness number with 3000-kg load, 10-mm ball.

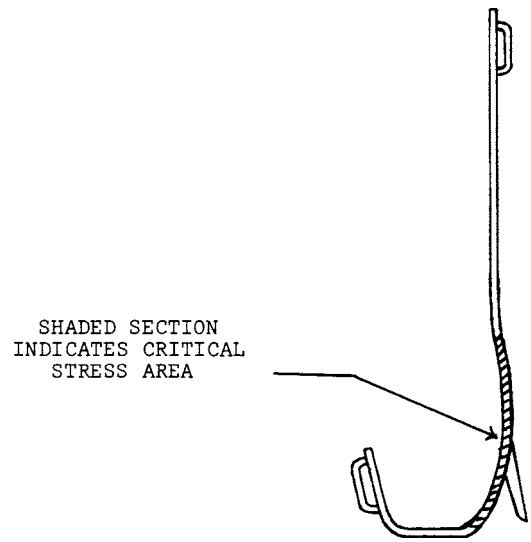


FIG. 3 Critical Stress Area of the Climber

climbing position by the gaff and at the top of the climber with the sleeve extended to provide a 16-in. (40.6 cm) length.

Leg Iron	Max Tensile Stress, psi (MPa)
Type A—Steel	27 000 (185)
Type B—Aluminum	9 000 (60)

7.5 *Finish*—Leg irons shall be free of surface cracks and seams. All steel leg irons shall be finished with a rust-resistant coating.

7.6 *Inspection, Marking, and Testing*:

7.6.1 All climbers shall be subjected to careful inspection by the manufacturer. When requested, the manufacturer shall provide certification that the climbers meet all requirements set forth in these specifications.

7.6.2 Completed leg irons shall be permanently marked by the manufacturer with the manufacturer's name, size (if fixed size), right or left, and the year of manufacture.

8. Climber Gaffs

8.1 *Sizes*—Pole gaffs shall measure at least 1 7/16 in. (37 mm) on the underside. Tree gaffs shall measure not more than 3½ in. (89 mm), nor less than 2¼ in. (57 mm) on the underside. Gaff design shall be as shown in Fig. 4.

8.2 *Material*—All gaffs shall be forged of forging-quality steel having the properties listed in Table 2.

8.3 *Finish*:

8.3.1 All fins or burrs shall be removed from the cutting edges of gaff.

8.3.2 All gaffs shall be finished with a rust-resistant coating.

8.4 *Inspection*:

8.4.1 All gaffs shall be subjected to careful inspection by the manufacturer. When requested, the manufacturer shall certify that the gaffs meet all requirements set forth in these specifications.

8.4.2 The size and shape of gaffs shall be checked with a gage available from the same manufacturer.

NOTE 1—Replaceable gaffs, whether pole or tree, fit only the climber iron of the particular manufacturer.

9. Climber Straps

9.1 *Sizes*—Climber straps shall be a minimum of 1 in. (2.5 cm) in width and ⅛ in. (3.18 mm) in thickness. The length shall be not less than 22 in. (55 cm) for the calf strap, or 24 in. (61 cm) for the one-piece ankle strap. Two-piece ankle straps shall be not less than 24 in. (61 cm) in length.

TABLE 2 Properties of Steel Alloy Acceptable for Gaffs

Elongation in 2 in. (5 cm), min	12 %
Hardness (tip)	45 to 55 HRC [A]
	421 to 546 HB [B]
Yield strength, psi (MPa)	212 000 (1460)

[A] There may be a variation of no more than three points in the Rockwell Hardness readings taken from the tip of the gaff to a point 1¼ in. (3.2 cm) back from the tip on the fixed gaff climber, 1 in. (2.5 cm) from the tip on replaceable gaff climbers.

[B] Brinell hardness number with 3000-kg load, 10-mm ball.

9.2 *Material and Properties*:

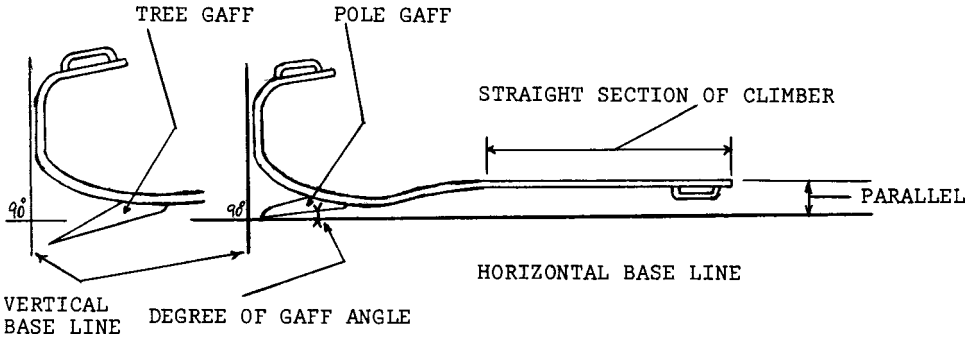
9.2.1 Leather used in the manufacture of climber straps shall be top grain cowhide and shall have a breaking strength of not less than 450 lbf/in. (79 kN/m) of width with buckle holes. The buckle holding strength of leather shall be not less than 200 lb (90 kg) static load when determined as follows:

9.2.1.1 Punch a hole 3/16 in. (4.76 mm) in diameter, centrally located in a 1-in. (25.4-mm) wide piece of strap, 1 in. from the end of the test piece. Into this hole, fit the tongue of a 1-in. assembled buckle of the design to be supplied with the climber strap. Apply the load to the buckle and to the free end of the strap. The buckle tongue shall not tear the leather under the specified static load of 200 lb (90 kg).

9.2.2 The leather shall show no cracking on the grain side when bent slowly over a ½-in. (12.7 mm) diameter mandrel, grain side out, through an angle of 180°. The leather shall not show piping or wrinkling of the grain side when bent over a mandrel 1-in. (25.4 mm) in diameter, with the grain side in, through an angle of 180°.

9.2.3 Fabric used in the manufacture of climber straps shall have a breaking strength of not less than 600 lbf/in. (105 kN/m) of width with buckle holes. Construction shall be a minimum of four plies of thickness of folded nylon, or of woven nylon, or equivalent material, constructed in such a way that no raw edges are exposed. The fabric shall be impregnated with neoprene or its equivalent, so that the plies or strands are not readily separable, except by chemical means.

9.2.4 The buckle holding strength of the finished fabric strap shall be not less than 300 lb (135 kg) static load without evidence of failure. Buckle tear shall be in the direction of load application when tested to failure.



NOTE 1—Degree of angle of the gaff, measured as shown, shall range from 11° to 17°, and the point of the gaff shall be a minimum of ⅜ in. (9.5 mm) above the lowest point of the leg iron stirrup. Tree gaffs are excluded from this requirement. The inside flat surface of the gaff at the tip shall be finished with a radius of approximately ¼ in. (6.4 mm) in accordance with the gage profile.

FIG. 4 Gaff Design

9.3 *Hardware*—Buckle frames shall be of welded wire or forged construction. Tongues shall be of an adequate gage wire to meet the strength criteria of 9.2.

9.4 *Design*—Buckle holes in the climber straps shall not exceed 3⁄16 in. (4.76 mm) in diameter. Straps shall be riveted to the buckles by at least two rivets, with the strap keeper centered between the rivets. The completed assembly shall meet the strength requirements of 9.2. Buckle pads or chafes may be added when desired.

10. Guarantee and Rejection

10.1 This specification covers the minimum electrical, mechanical, and physical properties to be guaranteed by the manufacturer and the detailed procedures by which such properties are to be determined. The purchaser may, at his option, perform or have performed any of these tests in order to verify the guarantee. Claims for failure to meet this specification are subject to verification by the manufacturer.

10.2 The manufacturer or supplier shall replace, without charge to the purchaser, unused equipment purchased under these specifications which upon examination or test within six months of initial delivery of the shipment fail to meet any of the criteria of these specifications.

10.3 If 5 % or more, but not less than two items in a lot or shipment, fail to meet the criteria of these specifications, the entire lot or shipment may be rejected.

10.4 If there is rejection of 5 % or more, but not less than two items in a lot or shipment, the testing shall be discontinued and the manufacturer notified. The manufacturer or supplier may request that his representative witness the testing of additional samples.

10.5 All rejected material shall be returned as directed by the manufacturer, at his or the supplier's request, without defacement beyond that already created by testing. Rejected material shall be tagged with an indication of the cause for rejection.

BODY BELTS AND POSITIONING STRAPS

11. Classification

11.1 Body belts covered under these specifications shall be designated as Type A or B, as follows:

11.1.1 *Type A*—Belt with dee-ring piece in fixed position.

11.1.2 *Type B*—Belt with dee-ring piece that has limited freedom of movement.

11.2 Positioning straps covered under this specification shall be designated as Type A, B, or C, with each type as either Style I or II as follows:

11.2.1 *Type A*—Adjustable length, with tongue buckle.

11.2.2 *Type B*—Adjustable length, with friction buckle.

11.2.3 *Type C*—Nonadjustable length strap.

11.2.4 *Style I*—Limited to straps to be used on pole or tree work, equipped with regular snaphooks.

11.2.5 *Style II*—Equipped with locking snaphooks and to be supplied on positioning straps for work on towers and similar structures.

12. Ordering Information

12.1 Orders for equipment under these specifications should include the following information:

12.1.1 Nomenclature,

12.1.2 Type,

12.1.3 Style,

12.1.4 Material, and

12.1.5 Size.

12.2 The listing of equipment, types, styles, and sizes is not intended to mean that all shall necessarily be available from the manufacturer. The listing signifies only that, if made, the equipment, types, styles, and sizes shall conform to the details of these specifications.

13. Body Belts

13.1 *Sizes*—The "dee" measurement will be the nominal distance from the heel or bar of one dee ring to the heel or bar of the other dee ring (see Fig. 5). Body belts shall be marked with the "dee" sizes since the dee size is the most critical. Body belts are normally furnished in the combination belt strap and dee sizes listed in Table 3 (see Fig. 6), however, belt strap measurements may vary on different style belts and with different manufacturers.

13.2 *Materials and Properties*:

13.2.1 *Leather*—Top grain leather or leather substitute may be used in the manufacture of body belts and accessories, but shall not be used alone as a load bearing component of the assembly.

13.2.2 *Fabric*—Plied fabric used in the manufacture of load bearing parts of body belts shall be constructed in such a way that no raw edges are exposed. Fabric shall be impregnated with neoprene, or its equivalent, so that the plies are not readily separable, except by chemical means. If webbing is used, it need not be impregnated.

13.3 *Test Method*:

13.3.1 *Tension Test*—A sample of new fabric used in a load bearing part shall be soaked in water for 24 h. It shall then be placed in a freezer at – 40°F (–40°C) for 4 h. At – 40°F (–40°C), it shall be bent over a 5⁄8-in. (15.9 mm) diameter

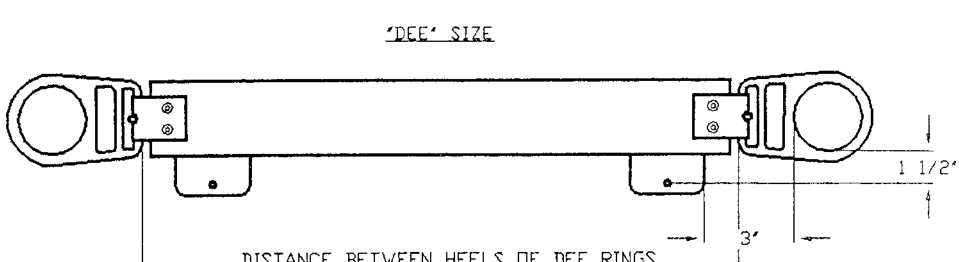
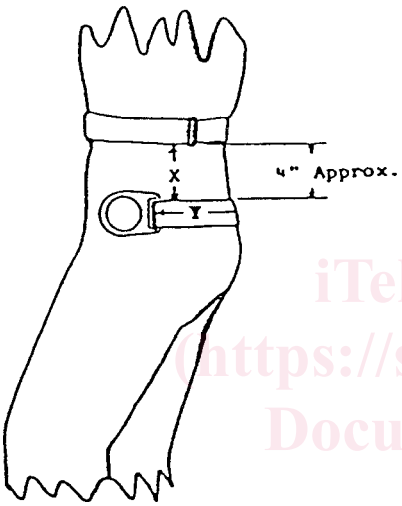


FIG. 5 "Dee" Measurement

TABLE 3 Available Body Belts Listed by Dee Size With Corresponding Belt Strap Size

Dee Size		Min		Center Hole		Max		No. of Tool Loops
in.	cm	in.	cm	in.	cm	in.	cm	
D18	46	32	81	36	91	40	102	3
D19	48	33	84	37	94	41	104	3
D20	51	34	86	38	97	42	107	3
D21	53	36	91	40	102	44	112	4
D22	56	37	94	41	104	45	114	4
D23	58	38	97	42	107	46	117	4
D24	61	40	102	44	112	48	122	4
D25	64	41	104	45	114	49	124	4
D26	66	42	107	46	117	50	127	4
D27	69	44	112	48	122	52	132	4
D28	71	45	114	49	124	53	135	4
D29	74	46	117	50	127	54	137	4
D30	76	47	119	51	130	55	140	4



X— Distance from waist or top of hip bone to where body belt is worn.
Y— Measurement is from front of hip bone around the back to the front of the other hip bone. This measurement is the Dee size.

FIG. 6 A Method Showing Where to Measure to Determine Correct "Dee" Size for a Body Belt

mandrel and reverse bent over the same mandrel through 180°. The sample shall then be stabilized at room temperature and the tensile strength determined. The breaking strength shall be at least 80 % of that of new material or not less than 3600 lbf (16 kN) for a section free from buckle holes, and not less than 2800 lbf (12.5 kN) for a section containing buckle holes. The tension test to determine the breaking strength shall be made in a straight pull with a dynamometer, or equivalent, with jaws separating at a maximum rate of 1-in. (2.5 cm)/min.

13.4 *Design*:

13.4.1 *Body Pad*—The cushion part of the body belt shall contain no exposed rivets on the inside and shall be at least 3 in. (7.6 cm) in width. The belt shall have pocket tabs extending at least 1½ in. (3.8 cm) down, and with the point of attachment at least 3 in. (7.6 cm) back of inside of the circle of dee-rings on each side for attachment of plier or tool pockets (see Fig. 7). On shifting dee belts, the measurement for pocket tabs shall be taken when the dee ring section is centered.

13.4.2 *Belt Straps*—Belt straps shall be made of fabric described in 13.2.2. Buckle holes shall be spaced on 1-in. (2.5-cm) centers, round or oval, to accommodate the tongue of the belt buckle. Buckle holes shall be spaced not in excess of ¼ in. (6.4 mm) in diameter if round, or ¼ by ⅜ in. (6.4 by 9.5 mm) if oval shaped, the greater dimension to be in the direction of the length of the strap. For grommet construction, holes shall be no larger than No. 2 grommet. No hole shall be permitted within 4 in. (10 cm) of the end of the strap. The nominal minimum body strap width shall be 1¾-in. (4.5 cm) (see Fig. 8).

13.4.3 *Tool Loops*—Tool loops shall be so situated on the body of the belt that 4 in. (10 cm) of the body belt in the center of the back, measuring from dee-ring to dee-ring, shall be free of tool loops and any other attachments (see Fig. 7). The material may be either leather or fabric ⅛-in. (3.175 mm) thick, 1-in. (2.5 cm) nominal width, with the loops having a maximum diameter of 1¾ in. (4.5 cm) and a minimum diameter of ¾ in. (1.9 cm). If a hammer loop is desired, it should be ordered in the position nearest the belt buckle.

13.4.4 *Circle Dee-Rings*—The design of the dee-ring shall be such that its minimum inside circle to outside circle opposite side dimension is 3.125 in. (7.94 cm), it is straight-sided and it shall not have any obstructions, protrusions, or a configuration that can allow pressure to be put on the snaphook keeper which can result in a disengagement. The dee-ring strap and the body strap shall not pass through or attach to that part of the dee-ring to which the positioning strap snaphooks are engaged. The dee-rings shall be installed in the body belt in such a manner that vertical travel in the assembly is prevented.

13.4.5 *Liners for Dee-Rings*—Suitable copper, steel, or equivalent liners shall be used around the bar of dee rings to prevent wear.

13.4.6 *Stitching and Thread*—All stitching shall be of nylon or equivalent thread and shall be lock stitched, not less than four nor more than seven stitches to the inch. The thread shall have a minimum breaking strength of 42 lbf (0.18 kN). Stitching parallel to an edge shall be approximately 3⁄16 in. (4.8 mm) from the edge of the narrowest member caught by the thread.

13.5 *Inspection, Marking, and Testing*:

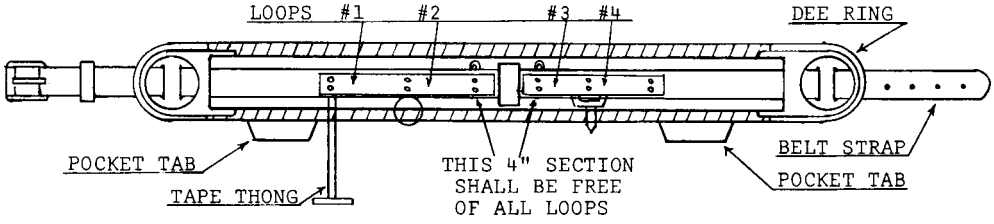


FIG. 7 Body Belt Nomenclature