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3 June 1980
SUPERSEDING
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MILITARY SPECIFICATION

PITONS, MOUNTAIN

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers five types of steel mountain pitons.

1.2 Classification. The mountain pitons shall be of the following types as specified (see 6.2).

Type I - Horizontal Rock
Type II - Vertical Rock
Type III - Wafer Rock
Type IV - Ice
Type V - Angle Rock

2. APPLICABLE DOCUMENTS

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

SPECIFICATIONS

FEDERAL

QQ-S-698 - Steel, Sheet and Strip, Low-Carbon
QQ-W-461 - Wire, Steel, Carbon (Round, Bare, and Coated)
PPP-B-621 - Boxes, Wood, Nailed and Lock-Corner
PPP-B-636 - Boxes, Shipping, Fiberboard

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: US Army Natick Research and Development Command, Natick, MA 01760 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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- MIL-P-116 - Preservation-Packaging, Methods Of
- MIL-I-6868 - Inspection Process, Magnetic Particle
- MIL-L-10547 - Liners, Case, and Sheet, Overwrap; Water-Vaporproof or Waterproof, Flexible

STANDARDS

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- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes
- MIL-STD-129 - Marking for Shipment and Storage
- MIL-STD-1188 - Commercial Packaging of Supplies and Equipment

DRAWING

US ARMY NATICK RESEARCH AND DEVELOPMENT COMMAND

2-10-3 - Pitons, Mountain

(Copies of specifications, standards, drawings, and publications 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 otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply:

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- A 108 - Steel Bars, Carbon, Cold Finished, Standard Quality
- A 519 - Seamless Carbon and Alloy Steel Mechanical Tubing
- A 576 - Steel Bars, Carbon, Hot Rolled, Special Quality

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

(Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

3. REQUIREMENTS

3.1 First article. When specified (see 6.2), the contractor shall furnish samples of finished pitons for first article inspection (see 4.3 and 6.4).

3.2 Materials. The materials for the components shall conform to the requirements specified in table I (see 6.5).

TABLE I. Materials and components

	Type I	Type II	Type III	Type IV	Type V
Pitton body	Killed steel con- forming to hot rolled or cold rolled, commer- cial quality, chemical compo- sition 1009 of QQ-S-698 or G10100 of ASTM A 576 or ASTM A 108	Killed steel con- forming to hot rolled or cold rolled, commer- cial quality, chemical compo- sition 1009 of QQ-S-698 or G10100 of ASTM A 576 or ASTM A 108	Killed steel con- forming to hot rolled or cold rolled, commer- cial quality, chemical compo- sition 1009 of QQ-S-698 or G10100 of ASTM A 576 or ASTM A 108	Seamless conforming to steel alloy grade 4130 of ASTM A 519	Killed steel con- forming to hot rolled or cold rolled, commer- cial quality, chemical compo- sition 1020 of QQ-S-698 or G10200 of ASTM A 576 or ASTM A 108
Collar and shackle	----	----	----	Killed steel con- forming to hot rolled or cold rolled, commer- cial quality, chemical compo- sition 1015 of QQ-S-698, G10150 of ASTM A 576 or ASTM A 108 or steel tube alloy grade 4130 of ASTM A 519	----
Ring	----	----	Killed steel con- forming to compo- sition 1010 of QQ-W-461	-----	Killed steel con- forming to compo- sition 1010 of QQ-W-461

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3.3 Construction. The construction of the pitons shall conform to the design, details, and dimensions shown on Drawing 2-10-3 and as specified herein.

3.3.1 Piton blanks. All piton blanks shall be fabricated so that the taper of the blade is uniform throughout the blade length and the grain flow lines of the steel are parallel to the longitudinal axis of the blank.

3.3.2 Types I, II and III pitons. The types I and II pitons and the body of the type III piton shall be fabricated of the material specified in table I and shall be forged. The grain flow lines, when tested as specified in 4.4.3.2, shall be parallel to the longitudinal axis of the blades. The pitons shall withstand a force of 2200 pounds (9.8 kN) minimum for types I and II and 2000 pounds (8.9 kN) minimum for type III without breaking when tested as specified in 4.4.3.2. The pitons shall not break during the bending cycle portion of the test.

3.3.3 Type IV piton. The type IV piton shall be constructed of the steel specified in table I and fabricated to provide the strength to meet the performance requirements specified herein. The shackle shall be forged with the flow lines of the steel parallel to the long axis of the blank and around the contour of the holes. The shackle, when forged shall be tested for direction of the flow lines as specified in 4.4.3.2. As an option the shackle may be formed by stamping. The shackle shall be assembled to the body as shown on Drawing 2-10-3 and shall rotate freely around the body. When the welded collar construction is used the welds shall provide sufficient strength so that the collar can withstand an axial static load of 2500 pounds (11.1 kN) minimum when tested as specified in 4.4.3.2. When tested for strength as specified in 4.4.3.2 the piton shall withstand a force of 565 pounds (2.51 kN) minimum without breaking or noticeable bending (permanent distortion). The piton shall show no evidence of transverse cracks or rupture when tested for bending as specified in 4.4.3.2. Minor cracking or ruptures in the longitudinal direction are acceptable.

3.3.4 Type V piton. The body of the type V piton shall be fabricated of the material specified in table I and shall be formed from flat stock or forged. When the body is forged the grain flow lines of the steel when tested as specified in 4.4.3.2, shall be parallel to the long axis of the blade. When tested as specified in 4.4.3.2, the piton shall withstand a force of 2700 pounds (12.0 kN) minimum without breaking. The piton shall show no evidence of rupture when tested for bending as specified in 4.4.3.2.

3.3.5 Rings. Rings for types III and V pitons shall be fabricated of the material specified in table I and shall be gas welded or electric welded as specified on Drawing 2-10-3. The welded joint shall be smooth, free of cracks and rough or projecting edges and of sufficient strength to withstand a proof load of 2700 pounds (12.0 kN) minimum when tested as specified in 4.4.3.2.

3.3.6 Stress relieving. The pitons shall be stress relieved as necessary to meet the performance requirements specified in 3.3.2, 3.3.3 and 3.3.4 (see 6.3).

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3.4 Marking for identification. The letters "U.S." in letters 1/4 inch (6 mm) high minimum; and the manufacturer's name, trade name, or trademark and the year of manufacture (last two digits) in characters 3/16 inch (5 mm) high minimum shall be etched (not indented) into the metal on the blade of the piton in any convenient location.

3.5 Workmanship.

3.5.1 Welds. Workmanship for the welded rings for the types III and V pitons shall be as specified in 3.3.5.

3.5.2 Forging and stamping. When magnetic particle tested, as specified in 4.4.3.2, the pitons shall show no evidence of a crack, tear, split, lamination, inclusion 1/4-inch (6 mm) or more in length or concentration of two or more inclusions each less than 1/4-inch (6 mm) in length and in an area one square inch (645 mm²) or less. The pitons shall be free of laps when visually examined as specified in 4.4.3.1.1. All intersecting planes of forgings shall have smoothly rounded fillets.

4. QUALITY ASSURANCE PROVISIONS

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

4.2 Classification of inspection. The inspection requirements specified herein are classified as follows:

- a. First article inspection (see 4.3).
- b. Quality conformance inspection (see 4.4).

4.3 First article inspection. When required (see 6.2), the first article submitted in accordance with 3.1 shall be inspected as specified in 4.4.3.1 and 4.4.3.2. The presence of any defect or failure to pass any test shall be cause for rejection of the first article.

4.4 Quality conformance inspection. Sampling for inspection shall be performed in accordance with MIL-STD-105, except where otherwise indicated hereinafter.

4.4.1 Component and material inspection. In accordance with 4.1, components and materials shall be inspected in accordance with all the requirements of referenced specifications, drawings, and standards unless otherwise excluded, amended, modified, or qualified in this specification or applicable purchase document.

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4.4.2 In-process inspection. Inspection shall be conducted to assure that the piton bodies are stress relieved as specified in 3.3.6. Whenever non-conformance is noted, correction shall be made to the affected items and lot in process.

4.4.3 End item inspection.

4.4.3.1 End item examination.

4.4.3.1.1 Visual examination. The pitons shall be examined for visual defects. The defects shall be classified in accordance with the list below. The lot shall consist of one type of piton. The sample unit shall be one piton. The inspection level shall be II and the acceptable quality levels (AQLs) expressed in defects per hundred units shall be 1.5 for major defects and 4.0 for total defects (major and minor defects combined). One hundred percent inspection shall be performed for critical defects on each lot. Any piton found to contain a critical defect during the 100 percent inspection shall be rejected. At its discretion the Government may verify the results of the contractors inspection for critical defects by 100 percent examination or by sampling inspection. The Government may at its discretion reject the lot immediately when one critical defect is found. As an option, the contractor may perform the examination for critical defects in conjunction with the 100 percent magnetic particle test required in 4.4.3.2.

Examine	Defect	Classification		
		Critical	Major	Minor
Construction and workmanship	Any sharp edge (except inside at bottom of type IV piton)			X
	Edge at bottom of type IV piton not sharp		X	
	Fillets not rounded smoothly			X
	Ring of types III and V pitons omitted or deformed		X	
	Taper of blade (where required) not uniform throughout length of blade		X	
	Shackle of type IV piton not securely retained or will not rotate freely		X	
	Collar on type IV piton omitted		X	
	Any lap on types I, II or III pitons	X		
Welds	Not type specified		X	
	Omitted (type IV piton)		X	
	Not smooth, rough or projecting edge			X
Marking	Omitted, incomplete, incorrect, illegible, not correct size or not applied in the specified manner			X

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4.4.3.1.2 Dimensional examination. The pitons shall be examined for compliance with all dimensions specified on Drawing 2-10-3. Any dimension not within the specified tolerance shall be classified as a defect. The inspection level shall be S-3 and the AQL expressed in terms of defects per hundred units shall be 2.5.

4.4.3.2 End item testing. Testing of the completely fabricated pitons shall be performed in accordance with table II for the characteristics specified. Pitons used in all strength bend, and direction of flow lines tests, with the exception of the strength test of the welds on the rings shall not be included in the quantity required to fulfill the contract.

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TABLE II. Testing of end item

Characteristic	Requirement reference	Test method	Number determinations per sample unit	Results reported as			Inspection level	AQL
				Pass or fail	Numerically to nearest	Pass or fail		
Strength of welds on rings, types III and V pitons	3.3.5	4.5.1	1	X	--	100%	0	
Strength test:								
- Type IV piton	3.3.3	4.5.2	1	--	To nearest 5 pounds (0.01 kN)	S-4	0.25	
- Type V piton	3.3.4	4.5.3	1	--	To nearest 10 pounds (0.1 kN)	S-4	0.25	
Collar shear test (type IV piton) (not applicable to alternate upset construction when furnished)	3.3.3	4.5.4	1	X	--	S-3	0.65	
Bending and strength test, types I, II and III pitons	3.3.2	4.5.5	2	X	--	S-4	0.65	
Bending test:								
- Type IV piton	3.3.3	4.5.6	1	X	--	S-4	0.65	
- Type V piton	3.3.4	4.5.7	1	X	--	S-4	0.65	
Direction of flow line test	3.3.2, 3.3.3 and 3.3.4	4.5.9	1	X	--	S-4	0.65	
Magnetic particle	3.5.2	4.5.8	1	X	--	100%	0	

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4.4.4 Packaging inspection. An examination shall be made to determine that the preservation, packing and marking comply with the section 5 requirements. Defects shall be scored in accordance with the list below. The sample unit shall be one shipping container fully packaged except that it need not be closed. Examination of closure defects shall be made on shipping containers fully packaged. The lot size shall be the number of shipping containers in the end item inspection lot. The inspection level shall be S-2 and the AQL shall be 2.5 defects per hundred units.

<u>Examine</u>	<u>Defect</u>
Marking (exterior interior)	Omitted; incorrect; illegible; of improper size, location, sequence or method of application.
Materials	Any component missing, damaged, or not as specified.
Content	Number of interior containers per shipping container is more or less than required. Number of pitons per interior container not as specified. <u>1/</u>
Preservation	Not as specified.

1/ For this defect one interior container shall be examined from each shipping container in the sample.

4.5 Methods of inspection.

4.5.1 Proof loading of rings, types III and V pitons. All rings for type III and type V pitons shall be proof loaded to determine soundness of welds as specified herein and as shown on Drawing 2-10-3. The proof load shall be applied to the inner perimeter of the ring by insertion of two hooks or links. A hardened steel split thimble or collar conforming to the inner perimeter of the ring shall be used to minimize elongation or distortion. The ring shall be placed so that the direction of pull is parallel to a line tangent to the ring at point of weld. A proof load of 2700 -0, + 100 pounds (12.0 -0, + .4 kN) shall be applied. Any breakage, visible rupture, crack or split shall constitute failure of the test and the piton shall be rejected. Any piton that has been loaded in excess of the maximum specified shall be rejected. Each acceptable piton shall be stamped with the letters "PL" using indelible ink. Size of letters shall be 1/4 inch (6 mm) high minimum.

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4.5.2 Type IV piton strength test. The type IV piton shall be tested using a clamping block. The clamping block shall have a cylindrical hole having a $21/32 + 1/32, - 0$ inch ($16.7 + 0.8, - 0$ mm) diameter. The clamping block shall have a saw cut connecting the top surface of the block with the top of the cylindrical hole as shown on Drawing 2-10-3. The circumference of the cylindrical hole at the front face of the clamping block shall have a rounded edge to a radius of $1/8 \pm 1/64$ inch (3.2 ± 0.4 mm). The corners formed by the intersection of the sides of the saw cut and the cylindrical hole shall be rounded to a radius of $1/8 \pm 1/64$ inch (3.2 ± 0.4 mm). The saw cut opening shall allow the clamping block to close when clamped in a vise, chuck or other suitable means and shall completely encircle the piton tube except for the saw cut which shall not be greater than $1/16$ inch (1.6 mm) when fully clamped. With the piton clamped in the block with a distance of $2 \pm 1/16$ inches (50.8 ± 1.6 mm) between the top face of the clamping block and the shackle's center plane, a pull force shall be applied parallel to the shackle by means of a hook or link of $1/4$ inch (6 mm) round steel bar, in a direction at right angles to the tubing. The pull force shall be increased until the piton tube breaks or shows noticeable bending (permanent distortion). Breaking or noticeable bending of the piton below the minimum force specified in 3.3.3 shall constitute failure of the test.

4.5.3 Type V piton strength test. The piton shall be clamped in a vise opening consisting of standard flat knurled parallel jaws that are sufficiently wide so that the tapered thickness to be gripped is that shown vertically at section E-E on the Drawing 2-10-3. A pull force shall be applied to the ring toward the apex of the "V" of the piton by insertion of a steel hook or link, diameter $1/2 \pm 1/32$ inch (12.7 ± 0.8 mm), bent to an inside radius at point of contact of $7/32 + 1/32, - 0$ inch ($5.6 + 0.8, - 0$ mm). The pull force shall be increased until the piton ring or blade breaks. Breaking of the piton ring or blade below the minimum force specified in 3.3.4 shall constitute failure of the test.

4.5.4 Collar shear test. The type IV piton collar shall be held against a suitable stop and an axial load shall be applied to the piton body in such a manner as to equally distribute the applied load between the four spot welds. Any evidence of weld failure below the minimum force specified in 3.3.3 shall constitute failure of the test. All pitons subjected to this test shall be discarded.

4.5.5 Types I, II and III pitons bending and strength test. The types I, II, and III pitons shall be held firmly in a vise between two $1/4$ inch (6 mm) thick metal plates at a point not more than $1/4$ inch (6 mm) from the mid-point of the overall piton body length including head but not including the ring as shown on Drawing 2-10-3. The piton shall then be bent at room temperature with a hammer, over a mandrel having a $1/8$ inch (3 mm) radius (formed by rounding the edges of the metal plates) through successive angles of 90 degrees in one direction, 180 degrees in the opposite direction and another 90 degrees in reverse direction, bringing the piton back to its initial position. Breaking of the piton shall constitute failure of the test. Pitons that pass the bend test shall remain in the original bend test position and a pull force shall be applied to the eye or ring at right angles to the gripping surfaces of the vise jaws by insertion of

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a steel hook or links, diameter $1/2 \pm 1/32$ inch (12.7 ± 0.8 mm). Failure of any piton to withstand the minimum force specified in 3.3.2 without breaking shall constitute failure of the test.

4.5.6 Type IV piton bend test. The type IV piton shall be held firmly in a vise at any point and bent at room temperature with a hammer, over a mandrel of $1/8$ inch (3 mm) radius, through an angle of 90 degrees. Any evidence of transverse crack or rupture, of the piton shall constitute failure of the test. Minor cracking or rupture in the longitudinal direction are acceptable.

4.5.7 Type V piton bend test. The type V piton shall be clamped firmly in a vise with the pointed end inserted into the vise jaws not less than 1 inch (25 mm) and not more than 2 inches (51 mm). The piton shall then be bent with a hammer, over a mandrel of $1/8$ inch (3 mm) radius, through 90 degrees in the direction indicated on Drawing 2-10-3, without rupture. Any rupture shall constitute failure of the test.

4.5.8 Magnetic particle test. All pitons not subjected to strength, bend and direction of flow lines tests shall be magnetic particle tested. The rings on the types III and V pitons are not required to be tested. The test shall be performed in accordance with MIL-I-6868. The wet process continuous method using fluorescent particles shall be used. Any piton showing evidence of a crack, tear, split, lamination, inclusion $1/4$ inch (6 mm) or more in length or concentration of two or more inclusions each less than $1/4$ inch (6 mm) in length and in an area one square inch (645 mm^2) or less shall be rejected. Minor crazing in the upset bead on the type IV piton shall not be scored as a defect. Each acceptable piton shall be stamped with the letter "M" using indelible ink. Size of letter shall be $1/4$ inch (6 mm) high minimum.

4.5.9 Direction of flow lines. Forged pitons shall be etched in such a manner as to determine the direction of flow lines for compliance with 3.3.1 and 3.3.3. Any forged shackle with flow lines not parallel to long axis and around the hole of the blank shall be classified as a defect. All pitons and shackles subjected to this test shall be discarded.

5. PACKAGING

5.1 Preservation. Preservation shall be level A or Commercial as specified (see 6.2).

5.1.1 Level A.

5.1.1.1 Preservative application. Each piton shall be cleaned by process C-1, thoroughly dried, and then coated with preservative conforming to type P-1 of MIL-P-116. The preservation coating shall be dry prior to packing.

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5.1.1.2 Unit packing. Pitons of one type only, with preservative applied as specified in 5.1.1.1, shall be unit packed in the quantities as specified in table III in a snug-fitting fiberboard box conforming to FTC, type CF, variety optional or type SF, class domestic of PPP-B-636. The pitons shall be nested, agitated, and alternated, as applicable, to assure a compact well-filled box. Care shall be exercised when packaging the type V piton to assure that the sharp ends bear against opposite walls of the box in equal number. Closure shall be in accordance with the appendix of PPP-B-636.

TABLE III. Unit packing and packing of pitons

<u>Piton</u>	<u>Quantity per unit pack</u>	<u>Quantity per shipping container</u>
Type I	100	600
Type II	150	900
Type III	150	900
Type IV	50	300
Type V	75	450

5.1.2 Commercial. The pitons shall be preserved in accordance with MIL-STD-1188.

5.2 Packing. Packing shall be level A, B, or Commercial as specified (see 6.2).

5.2.1 Level A packing. Pitons of one type only, preserved as specified in 5.1, shall be packed in the quantities as specified in table III, in a snug-fitting fiberboard shipping container conforming to style FTC, V2s of PPP-B-636, except that the weight limitations shall be waived; or in a nailed wood shipping container conforming to class 2, style 2 or 4 of PPP-B-621. Nailed wood containers shall be provided with a type I or II, grade C case liner conforming to MIL-L-10547. Closure and reinforcing with flat strapping or tape banding shall be in accordance with the appendix of the applicable container specification.

5.2.2 Level B packing. Pitons of one type only preserved as specified in 5.1, shall be packed in the quantities as specified in table III, in a snug-fitting fiberboard shipping container conforming to style FTC, type CF, variety DW of PPP-B-636 or in a nailed wood shipping container conforming to class 1, style 2 or 4 of PPP-B-621. Each fiberboard shipping container shall be closed and reinforced as specified in 5.2.1.

5.2.3 Commercial packing. Pitons, preserved as specified in 5.1, shall be packed in accordance with MIL-STD-1188.

5.3 Marking. In addition to any special marking required by the contract, unit packs and shipping containers shall be marked in accordance with MIL-STD-129 or MIL-STD-1188, as applicable.

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6. NOTES

6.1 Intended use. The pitons are intended to be used to provide security for men or equipment in operations involving steep ascents by driving the pitons into cracks in rock or ice. The type I, II, III and V pitons are for use in rock ascents, and the type IV piton is for use in conjunction with ice operations.

6.2 Ordering data. Procurement documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Type of piton required (see 1.2).
- (c) When a first article is required (see 3.1, 4.3, and 6.4).
- (d) Selection of applicable levels of preservation and packing (see 5.1 and 5.2).

6.3 Stress relieving process. A suggested stress relieving process is to heat the piton to 1200°F (650°C) and then cool in air.

6.4 First article. When a first article is required, it shall be inspected and approved under the appropriate provisions of ASPR 7-104.55. The first article should be a preproduction sample consisting of six pitons. The contracting officer should include specific instructions in all procurement instruments regarding arrangements for inspection and approval of the first article.

6.5 Recycled material. It is encouraged that recycled material be used when practical as long as it meets the requirements of the specification (see 3.2).

6.6 Metric equivalents. Metric equivalents, indicated in parentheses throughout this document, are based on practices, conversion factors, and symbols specified in ASTM E 380 Standard for Metric Practice, and are for information only. In each instance, the value stated in US customary units shall be controlling.

6.7 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

Custodians:

Army - GL
Navy - NU
Air Force - 99

Preparing activity:

Army - GL
Project No. 8465-0809

Review activities:

Navy - MC
DLA - CT

User activity:

Air Force - 45

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MIL-P-1474J PITONS, MOUNTAIN	
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