

MIL-P-21143B
20 June 1984
SUPERSEDING
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MILITARY SPECIFICATION

PIN, STRAIGHT, HEADLESS (DOWEL), GENERAL SPECIFICATION FOR

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

1. SCOPE

1.1 Scope. This specification covers solid, cylindrical, steel, headless straight pins, which are commonly referred to as dowel or machine pins.

1.2 Classification. The headless straight pins shall be of the following classes as specified.

- Class 1 - .0002 inch over size
- Class 2 - .001 inch over size
- Class 3 - .0002 inch under size

2. APPLICABLE DOCUMENTS

2.1 Government documents

2.1.1 Specifications, standards, and handbooks. Unless otherwise specified, the following specifications, standards, and handbooks of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DODISS) specified in the solicitation form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

- QQ-P-416 - Plating, Cadmium (Electrodeposited)
- PPP-H-1581 - Hardware (Fasteners and Related Items), Packaging of

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Armament Research and Development Center, US Army Armament, Munitions and Chemical Compound, ATTN: DRSMC-TST-S (D), Dover, NJ 07801, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

MIL-P-21143B

MILITARY

- MIL-C-13924 - Coating, Oxide, Black, for Ferrous Metals
- DOD-P-16232 - Phosphate Coating, Heavy, Manganese or Zinc Base (For Ferrous Metals)
- MIL-P-21143/1 - Pin, Straight, Headless, (Dowel) (.0002 Over Size), Cres 303
- MIL-P-21143/2 - Pin, Straight, Headless, (Dowel) (.0002 Under Size), Cres 303

STANDARDS

MILITARY

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes
- MIL-STD-1312 - Fasteners, Test Methods
- MS16555 - Pin, Straight, Headless, (Dowel) (.0002 Over Size)
- MS16556 - Pin, Straight, Headless, (Dowel) (.001 Over Size)

(Copies of specifications, standards, handbooks, drawings, and publications required by manufacturers in connection with specific acquisition functions should be obtained from the contracting 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. The issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DODISS and the supplement thereto, if applicable.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- ANSI B46.1 - Surface Texture (Surface Roughness, Waviness and Lay)

(Applications for copies should be addressed to the American National Standards Institute, 1430 Broadway, New York, NY 10018.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM A29 - Steel Bars, Carbon and Alloy, Hot-Wrought and Cold-Finished, General Requirements for
- ANSI/ASTM A380 - Cleaning and Descaling Stainless Steel Parts, Equipment, and Systems, Standard Recommended Practice for
- ASTM A493 - Stainless and Heat Resisting Steel for Cold Heading and Cold Forging - Bar and Wire
- ASTM A582 - Free-Machining Stainless and Heat - Resisting Steel Bars, Hot-Rolled or Cold Finished

MIL-P-21143B

ASTM-E18 - Rockwell Hardness and Rockwell Superficial Hardness of
Metallic Materials, Standard Test Methods for

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

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

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references, other than specification sheets, cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

3.1 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet. In the event of any conflict between the requirements of this specification and the specification sheet, the latter shall govern.

3.2 Material. Recycled and reclaimed materials (see 3.1) shall be used to the maximum extent practicable.

3.2.1 Carbon and alloy steel. Carbon and alloy steel pins shall be made of any carbon or alloy steel grade in accordance with ASTM A29, except that the maximum sulphur and phosphorus of the chemical composition shall not exceed .05 and .04 percent respectively.

3.2.2 Corrosion resistant steel (austenitic). Austenitic corrosion resistant steel shall conform to Type 303 (UNS S30300) as specified in ASTM A582.

3.2.3 Corrosion resistant steel (martensitic). Martensitic corrosion resistant steel shall conform to steel Types 416 (UNS S41600) or 410 (UNS S41000) as specified in ASTM A582 and ASTM A493 respectively.

3.3 Dimensions. Dimensions and tolerances for all pins shall conform to the dimensional requirements of the applicable specification sheet or military standard. The dimensions of phosphate coated pins shall apply prior to phosphate coating. Cadmium plated pins shall be within the dimensional limits after plating (see 4.3.1).

3.4 Performance characteristics. Pins shall meet the following performance requirements when subjected to the applicable test as specified (see 4.3).

MIL-P-21143B

3.5 Double shear force. Pins shall be capable of withstanding the minimum double shear force as specified in Table I when tested in accordance with 4.3.2.

TABLE I. DOUBLE SHEAR FORCE.

PIN DIA (INCHES)	DOUBLE SHEAR FORCE (LBS) MIN	
	CARBON OR ALLOY STEEL	CRES
1/16 (.0625)	790	610
5/64 (.0781)	850	700
3/32 (.0938)	1,400	1,000
1/8 (.1250)	2,600	1,800
5/32 (.1562)	4,100	2,800
3/16 (.1875)	5,900	4,000
1/4 (.2500)	10,000	7,200
5/16 (.3125)	16,000	11,000
3/8 (.3750)	23,000	16,000
7/16 (.4375)	32,000	22,000
1/2 (.5000)	42,000	29,000
5/8 (.6250)	65,000	45,000
3/4 (.7500)	94,000	65,000
7/8 (.8750)	120,000	88,000
1 (1.0000)	160,000	110,000

3.6 Protective finish and surface treatment. The protective finish and surface treatment of the pins when specified in the applicable specification sheet or military standard shall be as follows (see 4.3.3).

3.6.1 Carbon or alloy steel pins. When phosphate coating or cadmium plating is specified for carbon or alloy steel pins (see 3.1), they shall conform to 3.6.1.1 or 3.6.1.2 as applicable. When uncoated pins are specified in the contract or order, black-oxide coated pins as specified in MIL-C-13924, Class 1 may be furnished at the option of the contractor.

3.6.1.1 Phosphate coating. Carbon or alloy steel pins shall be phosphate coated in accordance with DOD-P-16232, Type Z, Class 2.

3.6.1.2 Cadmium plate. Carbon or alloy steel pins shall be cadmium plated in accordance with QQ-P-416, Type II, Class 2.

3.6.1.3 Cleaning, descaling and passivation. Corrosion resistant steel pins shall be cleaned, descaled and passivated in accordance with ASTM A380.

MIL-P-21143B

3.7 Hardness.

3.7.1 Carbon or alloy steel pins. Carbon or alloy steel pins shall have a core hardness of 40-58HRC, and a case hardness of 58HRC minimum or equivalent. However, the core hardness of the pins shall not in any instance exceed the case hardness. Minimum penetration for the case hardness shall not be less than .020 inch. Pins 1/16 inch and less in diameter may have a hardness of 58-64HRC throughout. These requirements shall be met when tested in accordance with 4.3.4.

3.7.2 Corrosion resistant steel pins. Corrosion resistant steel pins shall have a hardness of 36-42 HRC or equivalent for Type 410 (UNS S41000) or Type 416 (UNS S41600) steel and a hardness of 75-83HRB or equivalent for Type 303 (UNS S30300) steel, when tested in accordance with 4.3.4.

3.8 Straightness. Each pin 4 inches in length or less shall be straight within an accumulative total of .0005 inch per inch of effective length. Pins greater than 4 inches in length shall be straight to within .002 inch maximum (see 4.3.5).

3.9 Surface roughness. Prior to coating, the surface roughness of the cylindrical surface (diameter) of the pins shall not exceed 16 microinches R.H.A (Roughness Height Average). The surface roughness of all other surfaces shall not exceed 125 microinches R.H.A. when defined in accordance with ANSI B46.1 (see 4.3.6).

3.10 Roundness. Each pin shall be round (cylindrical) about its longitudinal axis within the diameter limits specified on specification sheets and military standards, when measured with equipment that will detect a lobular condition.

3.11 Edges and Corners. All sharp edges shall be rounded or chamfered in accordance with the following:

PIN DIAMETER (INCH)	MAXIMUM RADIUS OR 45° CHAMFER (INCH)
.0625 to .1875	.0313
.2500 to .5000	.0469
over .5000	.0625

3.12 Workmanship. The workmanship shall be uniform in quality and free of irregularities or detrimental defects. The surfaces shall not contain any foreign matter. Edges and corners, as applicable shall be broken or rounded.

MIL-P-21143B

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, 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 Quality conformance inspection. Quality conformance inspections shall be as specified in Table II. Each pin that does not pass any of the tests specified shall be defective.

TABLE II. QUALITY CONFORMANCE INSPECTION.

EXAMINATION OR TEST	REQUIREMENT PARAGRAPH	EXAMINATION OR TEST PARAGRAPH
Group A		
Dimensions	3.3	4.3.1
Protective finish and surface treatment	3.6	4.3.3
Straightness	3.8	4.3.5
Surface roughness	3.9	4.3.6
Group C		
Double shear force	3.5	4.3.2
Hardness	3.7	4.3.4

4.2.1 Inspection lot. An inspection lot shall consist of all pins covered by a single specification sheet or military standard, produced under essentially the same conditions, and offered for inspection at one time.

4.2.2 Sampling for Group A inspection. Sampling for Group A inspection shall be as specified in 4.2.2.1 and 4.2.2.2.

4.2.2.1 Sampling for dimensions. Sampling shall be in accordance with MIL-STD-105 Inspection level I. The Acceptable Quality Level (AQL) shall be as indicated in Table III. The AQL shall apply to each individual defect, not to a group of defects.

4.2.2.2 Sampling for protective finish and surface treatment. Sampling for protective finish and surface treatment test of pins shall be in accordance with the applicable specifications referenced in 3.6.1.1 thru 3.6.1.3.

MIL-P-21143B

TABLE III. CLASSIFICATION OF DEFECTS.

CATEGORY	DEFECT	INSPECTION METHOD
Critical	None defined	
Major	AQL=1.0 percent defective	
101	Diameter (see 3.3)	SIE 1/
102	Straightness (see 3.8)	SIE 1/
103	Roundness (see 3.10)	SIE 1/
Minor	AQL=2.5 percent defective	
201	Edges and corners broken (see 3.11)	SIE 1/
202	Length (see 3.3)	SIE 1/
203	Protective finish and surface treatment missing (see 3.6 thru 3.6.1.3)	Visual
204	Workmanship (see 3.12)	Visual

1/ Standard inspection equipment

4.2.3 Sampling for Group C inspection. Sampling shall be in accordance with Level S-1 of MIL-STD-105. The AQL shall be 1.5 percent defective. Group C inspection shall be performed on sample units which have passed Group A inspection.

4.2.4 Noncompliance. If a sample fails to pass Group C inspection, the manufacturer shall notify the qualifying activity and the cognizant inspection activity of such failure and take corrective action on the materials or processes, or both, as warranted, and on all units of product which can be corrected and which are manufactured under essentially the same materials and processes, and which are considered subject to the same failure. Acceptance and shipment of the product shall be discontinued until corrective action, acceptable to the qualifying activity has been taken. After the corrective action has been taken Group C inspection shall be repeated on additional sample units (all tests and examinations, or the test which the original sample failed, at the option of the qualifying activity). Group A inspections may be reinstated; however, final acceptance and shipment shall be withheld until the Group C inspection has shown that the corrective action was successful. In the event of failure after reinspection, information concerning the failure shall be furnished to the cognizant inspection activity and the qualifying activity.

4.3 Methods of inspection.

4.3.1 Visual and dimensional examination. Each pin taken as specified in 4.2.2.1 shall be examined to verify conformance with this specification. Examination shall be conducted in accordance with Table III.

MIL-P-21143B

4.3.2 Double shear force test. Pins taken in accordance with 4.2.3 shall meet the requirements of 3.5 when tested in accordance with 4.3.2.2.

4.3.2.1 Shear test fixture. The shear test shall be made by means of a suitable fixture which meets the following requirements. The pins shall be placed in a hole that passes through a shear block and a plunger within the block. The maximum clearance between the shearing planes of the block and the plunger shall be .005 inch. The block and plunger shall be constructed so that the shear planes are normal to the longitudinal axis of the pin being tested. The block and plunger shall be made of hardened steel or shall have steel inserts with a minimum shearing-surface hardness of 65HRC. The clearance or interference between the pin and pinhole of the block and plunger shall be within the following limits.

PIN DIA (INCH)	MAX CLEARANCE (INCH)	MAX INTERFERENCE (INCH)
.0625 to .1875	.0003	.0002
.2500 to .4375	.0004	.0003
.5000 to .6250	.0005	.0003
.7500 to 1.0000	.0006	.0004

The pins to be tested shall be assembled with the block and plunger with the two ends of the pin at least one pin diameter away from the shear planes. A load equal to the minimum double shear value specified in Table I, for the pin size being tested, shall be applied to the plunger. If fracture occurs in the pin under the applied shear load, the pin shall be considered defective. Pins too short to be tested in double shear shall be tested by applying the test to two pins simultaneously in single shear.

4.3.2.2 Double shear test method. The pins shall be tested by the double shear method and shall have the minimum double shear force as shown in Table I.

4.3.3 Protective finish and surface treatment test. The carbon or alloy steel pins shall conform to the applicable protective finish and surface treatment test of QQ-P-416, MIL-C-13924 and DOD-P-16232 as specified in 3.6.1. Corrosion resistant steel pins shall meet the requirements of 3.6.1.3.

4.3.4 Hardness test. The test procedure shall be in accordance with ASTM E18, except that the core hardness of each specimen shall be measured on a transverse section of a point one-eighth of the diameter from the axis of the pin. The case hardness shall be determined with a Rockwell Superficial hardness tester in accordance with ASTM E18 using a 15 Kilogram load.

4.3.5 Straightness test. Straightness test of the pins shall be determined by supporting the pin ends in V-Blocks, and rotating the pins beneath a dial indicator. The tolerance shall be as specified in 3.8.

4.3.6 Surface roughness test. Surface roughness shall be checked by using surface texture equipment capable of measuring the requirement specified in 3.9.

MIL-P-21143B

4.3.7 Materials inspection. Materials inspection shall consist of certification supported by verifying data that the materials used in fabricating the pins are in accordance with the requirements of 3.2 prior to such fabrication.

4.3.8 Inspection of packaging. The sampling and inspection of the preservation-packaging, packing, and container marking shall be in accordance with the requirements of PPP-H-1581.

5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with PPP-H-1581 (see 6.2).

6. NOTES

6.1 Intended use. Pins covered by this specification are intended for use in machine applications employing light drives for torque transmission, positioning parts with respect to one another, and for fastening together two or more parts of an assembly.

6.2 Ordering data. Acquisition documents should specify the following:

- a. Title, number, and date of this specification and applicable specification sheet or applicable Military Standard
- b. Applicable military specification number(s) or standard(s)
(see 3.1)
- c. Level (degree) of protection in accordance with PPP-H-1581
(see 5.1)

6.3 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.

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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL*(See Instructions - Reverse Side)*

1. DOCUMENT NUMBER MIL-P-21143B		2. DOCUMENT TITLE Pin, Straight, Headless (Dowel), General Specification For	
3a. NAME OF SUBMITTING ORGANIZATION		4. TYPE OF ORGANIZATION (Mark one) <input type="checkbox"/> VENDOR <input type="checkbox"/> USER <input type="checkbox"/> MANUFACTURER <input type="checkbox"/> OTHER (Specify): _____	
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