

MIL-T-4638B(USAF)

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SUPERSEDING

MIL-T-4638A(USAF)

26 June 1969

## MILITARY SPECIFICATION

## TESTERS, MATERIAL HARDNESS (ROCKWELL TYPE)

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

## 1. SCOPE

1.1 Scope. This specification covers requirements for hardness testers for testing the hardness of ferrous and nonferrous metals.

1.2 Classification. Hardness testers covered by this specification shall be of the following types and sizes:

## Type I Standard Rockwell

Size 3 - 3-inch capacity  
 Size 8 - 8-inch capacity  
 Size 12 - 12-inch capacity  
 Size 16 - 16-inch capacity

## Type II Superficial Rockwell

Size 3 - 3-inch capacity  
 Size 8 - 8-inch capacity  
 Size 12 - 12-inch capacity  
 Size 16 - 16-inch capacity

## 2. APPLICABLE DOCUMENTS

\* 2.1 Government documents.

\* 2.1.1 Specifications and standards. Unless otherwise specified (see 6.2), the following specifications and standards 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

PPP-B-601

Box, Wood, Cleated-Plywood

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: the Engineering Division, San Antonio ALC/MMEDO, Kelly AFB, Texas 78241 by using the self addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

FSC 6635

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Military

MIL-P-116

Preservation, Methods Of

STANDARDS

Federal

FED-STD-H28

Screw Thread Standard For Federal Services

MILITARY

MIL-STD-129

Marking For Shipment And Storage

MIL-STD-130

Identification Marking Of US Military Property  
Parts And Equipment, Procedures For Packaging  
Of

MIL-STD-794

MIL-STD-1186

Cushioning, Anchoring, Bracing, Blocking, And  
Waterproofing; With Appropriate Test Methods

\* (Copies of specifications, standards, 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 document(s) 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 SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 3951

Standard Practice for Commercial Packaging.

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

UNIFORM CLASSIFICATION COMMITTEE

Uniform Freight Classification Ratings, Rules And Regulations

(Application for copies should be addressed to the Uniform Classification Committee, 202 Union Station, 516 West Jackson Boulevard, Chicago IL 60606.)

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

3. REQUIREMENTS

3.1 First article. When specified (see 6.2), the supplier shall furnish one complete hardness tester for first article inspection. The first article may be either a preproduction model or an initial production item which conforms to the requirements of this specification. In either case, the approved first article and the production items shall be identical and in accordance with the terms of the contract. Approval of the first article

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shall not relieve the supplier of the responsibility to furnish equipment in accordance with the requirements of this specification.

3.2 Design. The hardness tester shall be of the latest design, convenient to operate and entirely adequate for the purpose intended. All parts subject to wear shall be readily accessible for adjustment or repair. The hardness tester shall also be free from any characteristics or defects that may render the tester unsuitable or inefficient for the purpose intended. The tester and its equipment shall be complete so that, when installed in its intended application, it can be used for any operation for which it was designed.

3.2.1 Material. All metal stock used in the fabrication of hardness testers covered by this specification shall have a properly refined structure with uniform elemental distribution, be sound and free from nonmetallic inclusions, injurious porosity, excess segregation, soft spots, hard spots and other injurious defects.

3.2.2 Tool steel. The tool steel used in the construction of testers of this type shall be made by the crucible or electric furnace process. Ingots from which bar stock is made shall be sufficiently reduced in cross-section and in such manner as to assure proper refinement of structure and uniform carbide distribution.

3.2.3 Castings. Castings shall be of uniform quality, free from blow holes, porosity, hard spots, shrinkage defects, cracks and other injurious defects. Strength and other essential physical properties of castings shall be adequate throughout for the purpose intended. Materials not specifically designated shall be entirely suitable for the purpose intended.

3.2.4 Welding, brazing and soldering. These processes shall be performed in accordance with the best commercial practice. In no event shall such processes, including peening and plugging, be used on castings or forgings for reclaiming any parts of the tester without authorization of the procuring agency.

3.2.5 Fastening devices. All screws, pins, bolts, and similar parts shall be installed with an adequate means for preventing loss of proper tightness and adjustment. All such parts when subject to removal or adjustment shall not be swaged, peened, staked, or otherwise deformed.

3.2.6 Threads. All threaded parts shall be in accordance with the applicable requirements of FED-STD-H28.

3.2.7 Lubrication. All parts requiring lubrication shall be readily accessible without requiring disassembly.

3.2.8 Surface finish. All castings, forgings, molded or welded parts, shall be thoroughly cleaned and free from sand, dirt, fins, sprues, scale, flux, or other harmful or extraneous materials. External surfaces shall be smoothed and all edges shall be rounded or beveled. All bearing surfaces between matching parts shall be finished by machining, grinding, or scraping to the necessary tolerances to provide the required accuracy. Surface roughness of bearing surfaces shall be such as to not reduce bearing areas to any appreciable extent nor to detract from the appearance of the tester. Other outside surfaces of unpainted parts shall be suitably finished.

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\* 3.2.9 Reclaimed Materials. Reclaimed materials shall be used to the maximum extent possible without jeopardizing the intended use of item.

3.3 Component parts. The hardness tester shall consist of the following parts and assemblies:

- Cast frame
- Elevating screw and nut
- Spindle unit
- Indicator head
- Loading beam
- Dash pot and linkage
- Accessories

3.3.1 Frame. The frame shall be of cast iron or cast aluminum. It shall be designed to be sufficiently rigid to prevent the possibility of strains in its members from affecting the magnitude or direction of the loads. Where the depth measuring device operates through the framework, its rigidity shall be sufficient to prevent strains from causing errors in the depth measurement. The base shall be machined square with the spindle unit and elevating screw assembly. Provisions shall be made to assure ready access to the dash pot linkage assembly, loading beam, spindle unit and weights.

3.3.2 Elevating screw. The elevating screw shall be made of good quality steel. The screw shall have an accurately machined thread to insure smooth action and long life. The screw shall slide freely in a close fitting lapped bushing inserted in the base of the frame. The screw shall be keyed to the bushing to prevent turning. The upper end of the screw shall be bored to fit standard anvils and shall be faced square with the axis (see 3.4).

3.3.2.1 Elevating screw bushing. The elevating screw bushing shall be adjustable to insure alignment of the penetrator axis with the elevating screw axis.

3.3.2.2 Telescoping cover. The screw shall be protected by a telescoping cover of metal tubing to exclude dust and dirt from the screw and to protect the threads from accidental damage.

3.3.2.3 Capstan nut. The nut shall be cast iron, of the capstan type with three or four equally spaced bars, securely attached to the periphery with which the nut is turned to raise or lower the elevating screw. The nut shall be smoothly threaded and shall fit the screw without binding or excessive looseness.

3.3.3 Spindle unit. The spindle unit shall be as near frictionless as practicable. The spindle shall be accurately bored to receive standard penetrator shanks (see 3.8.4 and 3.9.4). The spindle shall be drilled and tapped for a knurled screw or similar device, to hold the penetrator shank. The lower end of the spindle shall be faced square with the axis. The axis of the spindle shall be perpendicular and in line with the axis of the elevating screw.

3.3.4 Indicator head. The indicator head shall be in accordance with applicable requirements specified in 3.8.2 and 3.9.2.

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3.3.5 Minor load spring. The minor load spring shall apply a load of 10 kilograms to the spindle for Type I standard tester and a load of 3 kilograms for the Type II superficial tester.

3.3.6 Loading beam. The loading beam shall be constructed of fixed length levers. Levers shall be of the proper length to insure accurate loading of the spindle. It shall be as near frictionless as practicable to insure application of the entire load to the spindle.

3.3.7 Dash pot and linkage. The dash pot shall regulate the rate of application of the major load to the spindle. The linkage shall not bind at any point nor tend to throw the loading beam out of alignment. The dash pot shall be provided with an adjusting valve to regulate the time required to apply the full load. The valve shall be so designed that it may be adjusted without the use of tools and with sufficient friction to hold it in adjustment. Sufficient oil for filling the dash pot shall be furnished with each tester.

3.3.8 Trip lever. The trip lever shall be located on the upper right hand side of the tester. It shall lift the major load off the spindle and hold it in suspension when in the forward position. A slight clockwise movement of the trip lever shall cause the major load to be applied to the spindle. No part of the weight of the trip lever mechanism shall be applied to the spindle. The trip lever shall be cushioned so that no shock, caused by returning the lever to the forward position, will be transferred to the indicating mechanism.

3.3.9 Level cover. The tester shall be provided with a removable cover, over the lever mechanism, to exclude dust.

3.3.10 Pivot design. The sides forming the knife-edge of a pivot shall make an angle which does not exceed 90°. The offset of a knife-edge, measured from the base center line of the pivot, shall be less than 10 percent of the pivot width.

3.3.10.1 Physical characteristics. In the region of the knife-edge, a pivot shall have a Rockwell hardness on the C scale of not less than 56, when made of special alloy steel, and of not less than 60 when made of high carbon steel, or of other material. Pivots shall not be brittle or liable to breakage or fracture as a result of normal use.

3.3.10.2 Positioning. Pivots shall be firmly secured in position without swaging or staking.

3.3.10.3 Knife-edges. Knife-edges shall bear throughout the entire length of the parts designed to be in contact.

3.3.10.4 Bearings. The entire surface of a bearing, which is designed to be in contact with a knife-edge, shall be smooth and at least as hard as the opposing knife-edge (see 3.3.10.1).

3.3.10.5 Alternate design. Bearing designs other than knife edge types are permissible at the option of the manufacturer, provided there is no loss of service life or accuracy when compared with a tester with knife edge bearings.

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3.3.11 Ball chuck penetrators. The ball seat of the ball chuck penetrator shall be concentric with the axis of the shank. A flat shall be provided on the penetrator shank for the penetrator retaining screw. The chuck shoulder shall be true and square with the shank. The chuck collect shall hold the ball firmly in the seat.

3.3.11.1 Balls. The balls shall be of the best grade steel, round and free from blemishes. The balls, regardless of size, shall be within plus or minus 0.0001-inch of the nominal size and shall be round within plus or minus 0.00002-inch. No scratches or other surface imperfections shall be visible when viewed with the aid of a 10 power magnifying glass. The balls shall be hard enough to give accurate hardness readings over the entire range of the scales for which they are intended.

3.3.11.2 Special chucks and balls. When specified in the invitation for bids, chucks shall be furnished for 1/8-inch, 1/4-inch, or 1/2-inch balls. Quantity and size of chucks and balls shall be stated in the invitation for bids (see 6.2).

3.3.11.3 Quality. Special chucks and balls shall be of good commercial quality, accurately ground and finished to give accurate readings.

3.3.12 Diamond penetrator. The diamond shall be set in a powdered metal matrix which is hard enough to eliminate sinking, and which can be sintered at a temperature that is not detrimental to the diamond. A flat shall be provided on the penetrator shank, for the penetrator retaining screw. The shoulder shall be true and square with the shank. The apex of the sphero-conical point shall be concentric with the axis of the shank.

3.3.12.1 Penetrator form. The sphero-conical diamond point indenter shall be ground and polished to a cone of approximately 120° angle, with a mechanically lapped spherical apex. The round and conical surfaces shall meet in a truly tangential manner. The penetrator form shall be checked by making a series of five indentations each on test blocks of approximately C25 and C65 Rockwell for the standard penetrator and approximately Rockwell 30-N-75 and 30-N-45 for the superficial penetrator. All readings shall be within the tolerance marked on the test block.

3.3.12.2 Diamond penetrator finish. The diamond penetrators shall have a gem polish. No flaws, scratches, or wheel marks shall be visible with a magnifying glass of 10 power in a subdued light of uniform color, such as natural daylight at a north window, or the light of a jeweler's Diamondlite.

3.3.13 Test blocks. The steel test blocks shall be approximately 2 inches in diameter or 1-3/4-inches square and 5/16-inch thick. The brass test blocks shall be approximately 1-1/2-inches wide, 2-1/2-inches long and 1/4-inch thick. The hardness of each block shall be marked on the edge of the block in a permanent and legible manner. The hardness of the test block shall be determined by making a minimum of five impressions, one in the center and four near the outer edges. The average of the five readings shall be taken as the true Rockwell hardness of the test block. The block shall be marked with values that include the range of all five readings. Brass blocks shall not vary more than two hardness numbers for blocks of Rockwell B30, or greater hardness, or more than three hardness numbers for blocks softer than Rockwell B30. Steel blocks shall not vary more than one hardness number for blocks of Rockwell C30 or greater hardness, or more than two hardness numbers for blocks softer than Rockwell C30.

3.3.14 Cover. One fabric or plastic cover shall be furnished with each hardness tester. The cover shall be large enough to cover the entire machine to protect it from dust, dirt and other extraneous matter.

3.3.15 Conversion chart. A chart shall be furnished with each tester to enable the operator to determine approximate relative value of one scale to another. The chart shall include approximate conversion scales for tensile strength for steel in the C-scale range.

3.4 Anvils. Unless otherwise specified, four anvils shall be furnished with each hardness tester (see 6.2). The anvil shank shall be 3/4-inch diameter and 3/4-inch long. All anvils shall have a minimum hardness of Rockwell C60.

3.4.1 Raised spot anvil. Unless otherwise specified, one raised spot anvil shall be furnished with each hardness tester. The shoulder shall be approximately 1-1/2 inches in diameter and the raised spot shall be a minimum of 5/16-inch diameter and 1/8-inch high. The spot shall be polished; it shall be smooth, flat, and free from scratches or pits.

3.4.2 Raised "V" spot anvil. Unless otherwise specified, one raised "V" anvil shall be furnished with each hardness tester. The shoulder shall be a minimum of 1-1/4 inch in diameter, the raised spot shall be a minimum of 1/2-inch diameter and 1/2-inch high with a minimum 90° "V" cut 3/8-inch wide, in the top surface. The apex of the "V" shall be at right angles to the axis of the anvil shank. The "V" shall be centrally located with respect to the axis of the anvil shank.

3.4.3 Flat anvil. Unless otherwise specified, one flat anvil shall be furnished with each hardness tester. The anvil face shall be a minimum of 2-1/2 inches in diameter and ground square with the axis of the anvil shank.

3.4.4 Standard "V" anvil. Unless otherwise specified, one standard "V" anvil shall be furnished with each hardness tester. The "V" portion shall be a minimum of 1-1/2 inches in diameter with a minimum 120° angle "V" cut 1-1/4-inches wide, in the top surface. The "V" shall be centrally located with respect to the axis of the anvil shank.

3.4.5 Diamond spot anvil. When specified in the invitation for bids, a diamond spot anvil shall be furnished. The diamond spot anvil shall be similar to the raised spot anvil, but shall have a diamond set in a hard matrix in the center of the spot. The diamond shall be polished flat and at right angles to the axis of the anvil shank.

3.4.6 Large "V" anvil. When specified in the invitation for bids one large "V" anvil shall be furnished. The anvil shall be a minimum of 3-inches in diameter with a minimum 120° "V" cut, 2-1/2-inches wide, in the top surface square with the axis of the shank. The apex of the "V" shall be centrally located with respect to the axis of the shank.

3.4.7 Large flat anvil. When specified in the invitation for bids, one large flat anvil shall be furnished. The large flat anvil shall be threaded to fit the elevating screw. The anvil shall be approximately 8 inches in diameter. The face shall be square with the axis of the thread and shall have concentric grooves out in the face approximately 1/2 inch apart. The grooves shall be a minimum of 0.090-inch wide and 0.040-inch deep.

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3.5 Work rest. When specified in the invitation for bids, one work rest shall be furnished (see 6.2). The work rest shall fit on the upper end of the elevating screw. It shall extend approximately 14 inches to one side of the elevating screw and shall have an adjustable work support. It shall extend approximately 10 inches on the opposite side and shall have an adjustable counter weight.

3.6 Jack rest. When specified in the invitation for bids, one jack rest shall be furnished (see 6.2). The jack rest shall have a substantial cast base. The elevating screw and the capstan nut shall be similar to like parts of the hardness tester. The elevating screw shall have a hole bored in the upper end to receive the standard anvils furnished with the hardness tester. The jack shall have an adjustable range equivalent to that of the hardness tester with which it is to be used.

3.7 Storage rack. A storage rack shall be furnished with each hardness tester for holding anvils and penetrators. The rack shall be made of wood or sheet metal. It shall be designed to hold at least three penetrators and the four anvils considered as standard equipment.

3.8 Type I standard tester. The Type I standard tester shall be adaptable for any standard or special Rockwell scale, other than Superficial scales (see Table I), by the insertion of the proper penetrator in the spindle and the application of the proper major load.

TABLE I - Standard Rockwell Hardness Scales.

Scale	Penetrator	Lead, Kilograms	Dial Figures
A	Diamond	60	Black
B	1/16 inch Ball	100	Red
C	Diamond	150	Black
D	Diamond	100	Black
E	1/8 inch Ball	100	Red
F	1/16 inch Ball	60	Red
G	1/16 inch Ball	150	Red
H	1/8 inch Ball	60	Red
K	1/8 inch Ball	150	Red
L	1/4 inch Ball	60	Red
M	1/4 inch Ball	100	Red
P	1/4 inch Ball	150	Red
R	1/2 inch Ball	60	Red
S	1/2 inch Ball	100	Red
V	1/2 inch Ball	150	Red

3.8.1 Capacity. Hardness testers shall be furnished in four sizes. All four sizes shall have a minimum throat depth of approximately 5 inches. Vertical capacity between anvil and penetrator shall be a minimum of 3 inches for Size 3, 8 inches for Size 8, 12 inches for Size 12, and 16 inches for Size 16.

3.8.2 Indicator and lever assembly. The indicator and lever assembly shall be designed to read correctly without the necessity of frequent adjustment. All levers shall be of a fix length to eliminate the possibility of maladjustment. The indicator shall be full jeweled, direct reading and shall be sufficiently accurate to indicate through the leverage system, variations



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in the depth of the penetration of 0.00008-inch, with an accuracy of plus or minus 0.00004-inch. The graduations shall be black. The outer circle of figures and letters shall be black in color and shall be used when tests are made with the diamond penetrator. The inner circle of figures and letters shall be red in color and shall be used when tests are made with a ball penetrator. The dial background shall be white. The dial shall be graduated in 100 equal divisions and shall be numbered clockwise every 10 divisions from "0" through "90." The "0" graduation on the outer circle shall coincide with the "30" graduation on the inner circle. The letter "C" shall be above or to the left of each number on the outer circle and the letter "B" shall be above or to the left of each 1/8 inch high. The graduations shall be not less than approximately 3/16 inch and every tenth graduation shall be further extended to approximately 1/4 inch. The graduated dial with the inner and outer circles of numbers and letters shall be rotatable with a knurled bezel, but with sufficient friction to hold the dial at any desired point. The dial shall have a tell-tale hand to indicate when the minor load is applied. The pointers shall be dull black in color and shall be approximately 0.010 inch wide at the pointer end. The graduations on the dial shall be approximately the same width as the pointer tip.

3.8.3 Weight. Each tester shall be equipped with a weight rod to carry the loose weights. The weight rod and loading beams shall be sufficiently heavy to apply an additional load of 50 kilograms to the spindle. One loose weight of sufficient mass to apply an additional load of 40 kilograms to the spindle shall be provided. One loose weight of sufficient mass to apply an additional load of 50 kilograms to the spindle, shall be provided. The loose weights and weight pan shall be interchangeable between testers of the same make and model.

3.8.4 Penetrators. Unless otherwise specified, one ball chuck penetrator and two standard diamond penetrators shall be furnished with each hardness tester (see 6.2). The shank of the penetrators shall be 1/4 inch diameter and 7/16 inch long.

3.8.5 Ball chuck penetrators. Unless otherwise specified, the ball chuck penetrator shall be for 1/16 inch balls (see 6.2).

3.8.6 Balls. Unless otherwise specified, 100 each 1/16-inch diameter balls shall be furnished with each hardness tester (see 6.2).

3.8.7 Test blocks. Unless otherwise specified, two steel blocks, one approximately Rockwell C25 and one approximately Rockwell C65, shall be furnished (see 6.2). One brass block approximately Rockwell B40 and one approximately Rockwell B80, shall be furnished (see 3.3.13).

3.9 Type II superficial tester. The Type II superficial tester, shall be adaptable for standard superficial N or T scales, or special superficial scales W, X, and Y (see Table II), by the insertion of the proper penetrator in the spindle and the application of the proper major load.

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TABLE II - Superficial Rockwell Hardness Scales

Scale	Penetrator	Load, Kilograms
15-N	Diamond	15
30-N	Diamond	30
45-N	Diamond	45
15-T	1/16 inch Ball	15
30-T	1/16 inch Ball	30
45-T	1/16 inch Ball	45
15-W	1/8 inch Ball	15
30-W	1/8 inch Ball	30
45-W	1/8 inch Ball	45
15-X	1/4 inch Ball	15
30-X	1/4 inch Ball	30
45-X	1/4 inch Ball	45
15-Y	1/2 inch Ball	15
30-Y	1/2 inch Ball	30
45-Y	1/2 inch Ball	45

3.9.1 Capacity. Superficial hardness testers shall be furnished in the same sizes as standard hardness testers (see 3.8.1).

3.9.2 Superficial indicator and lever assembly. The indicator and lever assembly shall be designed to read correctly without the necessity of frequent adjustment. All levers shall be of a fixed length to eliminate the possibility of maladjustment. The indicator shall be full jeweled, direct reading, and shall be sufficiently accurate to indicate, through the leverage system, variations in the depth of the penetration of 0.00004-inch, with an accuracy of plus or minus 0.00002-inch. The graduations and figures shall be black in color. The dial background shall be white. The dial shall be graduated in 100 equal divisions and shall be numbered clockwise every 10 divisions from "0" through "90". The numbers shall be approximately 1/8-inch high. The graduations shall be not less than 1/8-inch in length, except that every fifth graduation shall be extended to approximately 3/16-inch and every tenth graduation shall be further extended to approximately 1/4-inch. The graduations shall be approximately the same width of the pointer. The graduated dial shall be rotatable with a knurled bezel, but with sufficient friction to hold the dial at any desired point. The dial shall have a tell-tale hand to indicate when the minor load is applied. The pointers shall be dull black in color and shall be approximately 0.010-inch wide at the pointer end.

3.9.3 Weights. Each tester shall be equipped with a weight rod to carry the loose weights. The weight rod and loading beam shall be sufficiently heavy to apply an additional load of 12 kilograms to the spindle. Two loose weights, each with sufficient mass to apply a load of 15 kilograms to the spindle, shall be provided. The loose weights and weight pan shall be interchangeable between testers of the same make and model.

3.9.4 Superficial penetrators. Unless otherwise specified, one ball chuck penetrator conforming to the requirements of 3.8.5, 100 balls conforming to the requirements of 3.8.6, and two superficial diamond penetrators shall be furnished with each hardness tester. The shank of the penetrators shall be 1/4-inch diameter and 7/16-inch long. The diamond penetrators shall be plainly marked to denote that they are to be used for superficial testing.

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3.9.5 Test blocks. Unless otherwise specified, two steel blocks, one approximately Rockwell 30-N-75 and one approximately Rockwell 30-N-45, shall be furnished (see 6.2). Two brass test blocks, one approximately Rockwell 30-T-70 and one approximately Rockwell 30-T-45, shall be furnished (see 3.3.13).

3.10 Interchangeability. All replaceable parts shall be constructed to definite standards, tolerances, and clearances, in order that any such part of a particular type or model may be replaced or adjusted without requiring modification. All such parts, where practicable, shall be permanently and legibly marked with the manufacturer's part number.

3.11 Painting. Unless otherwise specified, the hardness testers shall be painted in accordance with the manufacturer's standard practice (see 6.2).

3.12 Identification. Equipment, assemblies, and parts shall be marked for identification in accordance with MIL-STD-130.

3.13 Handbook of instructions. Unless otherwise specified (see 6.2), the contractor shall furnish two copies of a handbook of instructions sealed in a waterproof envelope, securely attached to each hardness tester supplied under this specification. The handbook shall contain necessary operating instructions, illustrations, parts list, and safety precautions to insure proper operating and maintenance of the hardness tester. Additional copies of the instruction handbook and mailing address to whom additional copies shall be sent will be specified by the procuring activity (see 6.2).

3.14 Workmanship. The hardness tester and its equipment shall be new and of the quality workmanship necessary to produce a tester and equipment of good appearance, having stability, and efficient operating characteristics found in first class commercial quality items of a similar nature.

#### 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 Classification of inspection. Unless otherwise specified (see 6.2), the inspection requirements specified herein are classified as follows:

1. First article inspection (see 4.2.1).
2. Quality conformance inspection (see 4.2.2).

4.2.1 First article inspection. First article inspection shall be applied to the production model or initial production item noted in 3.1. Unless otherwise specified (see 6.2), first article inspection shall consist of the examination in 4.3 and all tests under 4.4. Failure of the first article to pass the examination or any of the tests shall be cause for rejection.

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4.2.2 Quality conformance inspection. Unless otherwise specified (see 6.2), quality conformance inspection shall be applied to production units offered for acceptance under the contract. Quality conformance inspection shall consist of 1 through 3 as follows, and failure of any unit to pass an examination or test shall be cause for rejection of the unit.

1. Product examination (see 4.3).
2. Test methods (see 4.4).
3. Inspection of preparation for delivery (see 4.8).

4.3 Product examination. Unless otherwise specified (see 6.2), each hardness tester shall be visually examined to determine compliance with requirements of Section 3.

4.4 Test methods.

4.4.1 Accuracy. The tester shall be tested for accuracy of head and correctness of indentations by checking against calibration blocks of accepted hardnesses. For Type I testers, test blocks of approximately Rockwell C25, C60, B40, and B80 shall be used. For Type II testers, test blocks of approximately 30-N-75, 30-N-45, 30-T-70, and 30-T-45 shall be used. Every test made on each block shall be within the range specified in 3.3.13 in order to be acceptable. The tester shall be capable of making repeat readings.

4.4.2 Test of diamond penetrator. Accuracy of the diamond penetrators shall be checked by taking readings on standard test blocks (C25 and C65 for standard Rockwell Type I and 30-N-75 and 30-N-45 for superficial Rockwell Type II), using a tester of accepted accuracy. No less than three readings shall be taken with each penetrator. All readings shall be within the tolerance marked on the test block. Each standard diamond penetrator shall be subjected to an overload test of not less than 200 kilograms. Each superficial diamond penetrator shall be subjected to an overload test of not less than 60 kilograms. Penetrators shall not chip or crack as a result of the overload test.

4.4.3 Penetrator balls. The penetrator balls shall meet the requirements specified in 3.3.11.1.

4.4.4 Test blocks. The test blocks shall be tested in accordance with the requirements of 3.3.13, using a Rockwell hardness tester of accepted accuracy.

4.5 Test equipment. Tests shall be conducted, using suitable equipment of known or accepted accuracy, acceptable to the Government inspector and the procuring agency.

4.6 Reports. When required by the procuring agency, the contractor shall furnish reports on tests in duplicate, showing the quantitative results for all tests and analysis of materials used and signed by the Director of the Laboratory in which the tests were conducted, or by his authorized assistant.

4.7 Retests. Rejected testers shall not be resubmitted for inspection without furnishing full particulars concerning previous rejections and measures taken to overcome the defects.

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4.8 Preparation for delivery examination. Inspection of preservation, packaging, packing and marking for shipment shall be examined to determine compliance with Section 5.

5. PACKAGING.

5.1 Preservation. Preservation shall be level A, C or commercial as specified (See 6.2).

5.1.1 Level A. Each tester shall be preserved and packaged Method IIa in accordance with MIL-P-116. The unit container shall conform to PPP-B-601, overseas type.

5.1.2 Level C. The level C preservation for testers shall conform to the MIL-STD-794 requirements for this level.

5.1.3 Commercial. The commercial/industrial preservation of testers shall be in accordance with the requirements of ASTM D 3951.

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

5.2.1 Level A. The packaged testers as specified in 5.1.1 need not be overboxed. The unit container shall be used as the shipping container.

5.2.2 Level B. Same as Level A.

5.2.3 Level C. The Level C packing for testers shall conform to the MIL-STD-794 requirements for this level.

5.2.4 Commercial. The packaged testers shall be packed in accordance with the requirements of ASTM D 3951.

5.3 Physical Protection. Cushioning, anchoring, bracing, blocking and waterproofing shall be in accordance with MIL-STD-1186. Waterproofing requirements for cushioning materials and containers shall be waived for domestic shipments. Drop tests of MIL-STD-1186 shall be waived when the item is preserved, packaged and packed for immediate use or when drop tests of MIL-P-116 are applicable.

5.4 Marking.

5.4.1 Levels A, B and C. In addition to any special or other identification marking required by the contract (see 6.2), each container shall be marked in accordance with MIL-STD-129.

5.4.2 Commercial. Commercial/industrial marking shall be in accordance with the requirements of ASTM D 3951.

6. NOTES

6.1 Intended use.

6.1.1 Type I. Type I hardness testers are intended for use in testing metals for hardness in any of the fifteen standard Rockwell scales (see Table I).

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6.1.2 Type II. Type II hardness testers are intended for use in testing metals for hardness in any of the fifteen superficial Rockwell scales (see Table II).

6.2 Ordering data.

6.2.1 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number and date of this specification.
- b. Type and size (see 1.2).
- c. First article when required (see 3.1).
- d. Painting requirements, if different (see 3.11).
- e. Special chucks and balls, if required (see 3.3.11.2).
- f. Anvils required, if different (see 3.4).
- g. Work rest, if required (see 3.5).
- h. Jack rest, if required (see 3.6).
- i. Number and kind of penetrators, if different (see 3.8.4 and 3.9.4).
- j. Size of ball chuck required, if different (see 3.8.5 and 3.9.4).
- k. Test blocks required, if different (see 3.8.7 and 3.9.5).
- l. Number and size of balls required, if different (see 3.8.6 and 3.9.4).
- m. Handbook requirements (see 3.13).
- n. Classification of inspection, if different (see 4.2).
- o. First article inspection, if different (see 4.2.1).
- p. Quality conformance inspection, if different (see 4.2.2).
- q. Product examination, if different (see 4.3).
- r. Level of packaging and packing required (see Section 5).

6.3 Noncompliance. Each bidder offering hardness testers that do not comply in every particular with this specification shall submit with his bid a detailed statement covering each and every point of noncompliance. Should no exception be submitted, the testers offered shall be capable of complying in every particular with this specification. Any variations found to exist at the time of inspection shall be corrected by the contractor, regardless of the cost incurred and free of additional expense to the Government.

6.4 Changes from previous issue. The margins of this specification are marked with asterisks to indicate where changes (additions, modifications, corrections, deletions) from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any

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inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

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Project No. 6635-F119





**STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL**

*(See Instructions – Reverse Side)*

<p>1. DOCUMENT NUMBER <b>MIL-T-4638B(USAF)</b></p>	<p>2. DOCUMENT TITLE <b>TESTERS, MATERIAL HARDNESS (Rockwell Type)</b></p>
<p>3a. NAME OF SUBMITTING ORGANIZATION   </p>	<p>4. TYPE OF ORGANIZATION <i>(Mark one)</i></p> <p><input type="checkbox"/> VENDOR</p> <p><input type="checkbox"/> USER</p> <p><input type="checkbox"/> MANUFACTURER</p> <p><input type="checkbox"/> OTHER <i>(Specify)</i>: _____</p>
<p>b. ADDRESS <i>(Street, City, State, ZIP Code)</i>   </p>	
<p>5. PROBLEM AREAS</p> <p>a. Paragraph Number and Wording:        </p> <p>b. Recommended Wording:        </p> <p>c. Reason/Rationale for Recommendation:        </p>	
<p>6. REMARKS              </p>	
<p>7a. NAME OF SUBMITTER <i>(Last, First, MI)</i> – Optional</p>	<p>b. WORK TELEPHONE NUMBER <i>(Include Area Code)</i> – Optional</p>
<p>c. MAILING ADDRESS <i>(Street, City, State, ZIP Code)</i> – Optional</p>	<p>8. DATE OF SUBMISSION (YYMMDD)</p>

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