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GGG-C-2773

12 March 1992

SUPERSEDING

MIL-C-82069C

15 April 1985

# FEDERAL SPECIFICATION

## CYLINDER RECONDITIONING AND CORRECTION EQUIPMENT: PORTABLE

This specification is approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal agencies.

### 1. SCOPE

1.1 Scope. This specification covers cylinder reconditioning and correction equipment. The correction units are specifically for the cylinder walls of internal combustion engines.

1.2 Classification. Cylinder reconditioning and correction equipment shall be of the following classes, types, and sizes as specified (see 6.2).

Class 1 - Reamer, ridge, with cutting range to be no less than 1-1/2 inches and no greater than 5 inches

Type I - With supporting bracket

Type II - With interior cylinder wall-clamping mechanism

Class 2 - Hone, spring-loaded, cylinder glaze breaking

Size A - 3/4- to 2-inch cylinder diameter capacity range

Size B - 2- to 7-inch cylinder diameter capacity range

Class 3 - Hone, flexible brush type, cylinder glaze breaking/reconditioning

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\*Beneficial comments (recommendations, additions, deletions) and any pertinent\*

\*data which may be of use in improving this document should be addressed to: \*

\*Commanding Officer (Code 156), Naval Construction Battalion Center, Port \*

\*Hueneme, CA 93043-5000, by using the Standardization Document Improvement \*

\*Proposal (DD Form 1426) appearing at the end of this document or by letter. \*

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FSC 5110

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

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Class 4 - Hone, adjustable, cylinder correction

Size C - 2- to 2-3/8-inch cylinder diameter capacity range

Size D - 2-11/16- to 5-3/4-inch cylinder diameter capacity range

Size E - 2-11/16- to 14-1/2-inch cylinder diameter capacity range

## 2. APPLICABLE DOCUMENTS

### 2.1 Government documents.

2.1.1 Specifications and standards. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

#### Federal Standards

FED-STD-123 - Marking for Shipment (Civil Agencies)

#### Military Specifications

MIL-M-18058 - Machinery, Metal and Woodworking, Packaging of

#### Military Standards

MIL-STD-105 - Sampling Procedures and Tables for Inspection by  
Attributes

MIL-STD-129 - Marking for Shipment and Storage

(Unless otherwise indicated, copies of federal and military specifications and standards are available from the Standardization Documents Order Desk, Bldg. 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

(Copies of specifications and standards 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 Non-Government publications. The following document forms a part of this document to the extent specified herein. Unless otherwise specified, the issue of the document which is DoD adopted is that listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issue of the document not listed in the DODISS is the issue of the document which is current on the date of the solicitation (see 6.2).

AMERICAN NATIONAL STANDARDS INSTITUTE, INC. (ANSI):

ANSI B46.1 - Surface Texture

(Application for copies should be addressed to the American National Standards Institute, Inc., 11 W. 42nd Street, New York, NY 10036)

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2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

### 3. REQUIREMENTS

3.1 Description. The cylinder reconditioning equipment shall consist of ridge reamers and abrasive type cylinder hones, both rigid and flexible. The cylinder correction equipment shall consist of rigid abrasive type cylinder hones and honing stand when required.

3.1.1 Class 1, ridge reamers. The ridge reamer shall be a hand-operated, cylinder ridge-cutting assembly, incorporating an internal aligning mechanism and a bracket or other type elevation control.

3.1.2 Class 2, spring-loaded hones. The honing unit shall be a spring-loaded, portable drill-operated cylindrical bore hone. The drive shank shall fit 1/4- and 1/2-inch drill chucks. The abrasive devices shall be suitable for the intended operation.

3.1.3 Class 3, flexible brush-type hones. The flexible brush-type hones shall be composed of globules of silicone carbide or other selected abrasives and grits, laminated to the ends of high-density filaments secured in a twisted wire or central core for chucking to and driven by an electric drill motor or other rotary power.

3.1.4 Class 4, adjustable correction cylinder hones. The correction hone unit shall be operable with either an electric or air-operated portable drill with a drive shaft suitable for use in a 1/2-inch or larger drill chuck. The abrasive devices shall be capable of correcting out-of-round or tapered cylinders in internal combustion engines.

3.2 First article. When specified (see 6.2), the contractor shall furnish one unit of the equipment classification specified for first article inspection and approval (see 4.2.1 and 6.4).

3.3 Standard commercial product. The reamers and hones of each classification shall, as a minimum, be in accordance with the requirements of this specification and shall be the manufacturer's standard commercial product to the extent possible. Additional or better features which are not specifically prohibited by this specification but which are a part of the manufacturer's standard commercial product, shall be included in the reamers and hones being furnished. A standard commercial product is a product which has been sold or is being currently offered for sale on the commercial market through advertisements or manufacturer's catalogs, or brochures, and represents the latest production model.

3.4 Interchangeability. All units of the same classification furnished with similar options under a specific contract shall be identical to the extent necessary to insure interchangeability of component parts, assemblies, accessories, and spare parts.

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3.5 Materials. Materials used shall be free from defects which would adversely affect the performance or maintainability of individual components or of the overall assembly. Materials not specified herein shall be of the same quality used for the intended purpose in commercial practice. Unless otherwise specified herein, all equipment, material, and articles incorporated in the work covered by this specification are to be new and fabricated using materials produced from recovered materials to the maximum extent possible without jeopardizing the intended use. The term "recovered materials" means materials which have been collected or recovered from solid waste and reprocessed to become a source of raw materials, as opposed to virgin raw materials. None of the above shall be interpreted to mean that the use of used or rebuilt products is allowed under this specification unless otherwise specified.

3.6 Performance. Roughness average (R/a) as used herein shall be in accordance with ANSI B46.1.

3.6.1 Class 1, ridge reamers. Ridge reamers, when aligned and positioned within the bore of an engine cylinder block, with the cutter adjusted for the desired depth of cut as the drive nut is rotated, shall follow the worn cylinder wall and produce a smooth, uninterrupted transition with a maximum taper of 0.004 inch per foot and with a maximum roughness average of 20 microinches (20 microinches R/a) from the worn wall to the unworn section above the ring travel. The reamer shall completely remove all buildup or metal ridges from the cylinder wall, without leaving rough areas, gouges, overcuts, undercuts, or grooves.

3.6.2 Class 2, honing units. The honing units, when positioned within the bore of a cylinder, shall be capable of breaking surface glaze and honing out minor corrosion spots, pits, and scratches from the interior surfaces of cylinders, provided such surface defects are not deeper than the range from usable to unusable internal diameters as specified by the manufacturer's limits. The honing units shall be capable of resurfacing the cylinders to a maximum roughness value of 20 microinches R/a using a 180 grit hone. Operating alignment shall not require special guides or braces. Immersion in brake fluid, kerosene, or denatured alcohol, for a period of 8 hours, shall not cause softening of the stone bonding material or separation of the abrasive stone from the backing plates. The hone shall be suitable for closed or open cylinder work as specified (see 6.2).

3.6.3 Class 3, flexible hones. The flexible hone, when positioned within the bore of a cylinder, shall be capable of breaking surface glaze and minor corrosion spots, pits, and scratches from the cylinder. Operating alignment shall not require special guides or braces. Bottoming against a closed or stepped cylinder shall not cause damage to the hone. The hone shall be resistant to brake fluid, kerosene, or denatured alcohol and the globules shall not separate from the bristles. The honing units shall be capable of resurfacing the cylinders to a maximum roughness value of 20 microinches R/a using a 180 grit size hone.

3.6.4 Class 4, cylinder correction units. The cylinder correction units, when aligned and positioned within the bore of an engine cylinder block shall be capable of removing minor irregularities on cylinder walls, correcting cylinder out-of-roundness to within 0.0004 inch total indicator reading, and correcting cylinder taper to within 0.0004 inch per foot. The units shall be capable of producing a surface finish having a maximum roughness of 20 microinches R/a

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using a 180 grit size hone. Immersion in brake fluid, kerosene, or denatured alcohol, for a period of 8 hours, shall not cause softening of the abrasive bonding material or separation of the abrasive material from the backing plates.

3.7 Design and construction. The cylinder reconditioning and correction equipment and all component parts shall conform to accepted engineering and manufacturing practices relative to design, strength, and quality of materials. When specified (see 6.2), replacement abrasive stones and cutters shall be furnished.

3.7.1 Class 1. The class 1 ridge reamer shall incorporate a rotating cutting assembly, and an aligning means capable of maintaining the centerline of cutter rotation parallel to the cylinder wall. The cutter blade or scraper insert shall be of tungsten carbide or alloy tool steel, ground and hardened to provide life without resharpening. Cutting nose blades shall progress up the contour of the cylinder wall, as the cutter head revolves on or about a threaded shaft or sleeve, shall have a 3/4-inch throw and shall cut a band not less than 5/8-inch wide. Pivoted scraper type cutters shall make a 3/4-inch cut and shall rotate in a single plane, perpendicular to the cylinder wall. Cutter assemblies shall be so constructed that rotation of the drive nut by means of a wrench or crank will not result in forces which might affect accuracy of adjustment or cut. Alignment, depth of cut adjustment, and locking devices shall be convenient and accessible.

3.7.1.1 Type I. Type I ridge reamer shall be provided with a support bracket, a centrally located boss, and two or three legs that have flat machined shoes over the cylinder opening. The boss shall be internally threaded for use with cutting nose blades or provided with bushings and an elevation locking device, if used, with a scraper type cutter. When the shoes are in contact with the surface of a cylinder block, the bracket shall accurately position the centerline of the revolving cutter assembly perpendicular to the surface of the lock.

3.7.1.2 Type II. Type II ridge reamer shall incorporate a mechanism consisting of three equally spaced shoes with the outer edges parallel to the cylinder wall and a linkage to cause simultaneous advancement of the shoes against the cylinder wall while accurately centering the revolving cutter assembly. When locked at the desired elevation within the cylinder, the mechanism shall maintain the rotating cutter assembly deep enough to secure the reamer and allow for cutting action.

3.7.2 Class 2. Class 2 cylinder hones shall consist of a rotating assembly of not less than two spring-loaded arms with self-adjusting shoes. The drive shall be rotated by a shaft with drill shank designed to fit 1/4- and 1/2-inch drill chucks for sizes A and B respectively. Spring tension shall be preset for internal cylinder conditioning at normal drill speed within the range of sizes for which the honing unit is designed. A spread limiter shall be incorporated for size B to provide for easy removal from and insertion into cylinders. The hone shall be self-centering and self-bottoming and shall be adaptable for use on straight and stepped cylinders. When specified (see 6.2), honing units shall be furnished with two sets each of fine and medium grit stones. All replaceable parts shall be manufactured to such standards, clearances, and tolerances that any such parts of a particular type or model can be replaced or adjusted without requiring modification.

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3.7.3 Class 3. Class 3 flexible brush hones shall consist of an assembly of globules of silicone carbide or other selected abrasives and grits attached to spring action, high-density bristles or nylon filaments to force the globules into contact with the cylinder wall. The units shall be so spaced as to impart a consistent crosshatch honing pattern. The globules shall have grits of between 20 and 800 and lengths proportionate to the diameters selected. Diameter of the hone and grit size shall be as specified (see 6.2).

3.7.4 Class 4. Class 4 adjustable cylinder hones shall consist of an adjustable body incorporating a hand-operated mechanism for setting and maintaining the abrasive stones and adjustable guides. The drive shaft shall be suitable for use with a 1/2-inch or larger drill chuck. The drive shaft shall permit the honing of rear cylinders next to the firewall and extending under the vehicle cowl. The unit shall be self-centering and self-bottoming and shall be adaptable for use on straight and stepped cylinders.

3.7.4.1 Stones and holders. When specified (see 6.2), correction units shall be furnished with two sets each of the following honing stones: roughing stones, 80 to 100 grit; finishing stones, 220 to 240 grit; and polishing stones, 320 to 400 grit. Each honing unit shall utilize not less than two stones which shall be securely mounted in metal holders. The metal holders shall prevent chatter that produces a roughness of more than 25 microinches R/a for 100 grit stone, 10 microinches R/a for 240 grit stone, and 5 microinches R/a for 300 grit stone. If stone guides are required to meet the performance characteristics of this specification (see 3.7.4.1.1), stone guides shall be furnished for each unit. The honing stones shall be not less than 4 inches in length and capable of being installed without the use of special tools.

3.7.4.1.1 Stone guides. The honing unit shall always maintain a minimum of four equally spaced contact points with the cylinder being honed. If the honing unit contains less than four stones, stone guides shall be incorporated into the design to ensure that the total stones and guides always equal four. The stone guides shall be not less than 3-7/8 inches in length and they shall have the same adjustment as the stones.

3.7.4.2 Honing stand. When specified (see 6.2), a honing stand shall be furnished. The honing stand shall be made of steel and shall permit rigid and unobstructed stable suspension of the honing unit and power unit (drill) above the cylinder being corrected. This stand shall be provided with an adjustable stop to prevent the engine crankshaft and honing unit from being damaged as a result of overstroking the hone. A spring shall be provided to return the unit on the upstroke.

3.8 Fitted case. When specified (see 6.2), a case or box shall be provided for holding and transporting each complete set of cylinder reconditioning or correction equipment. The case shall be fabricated from sheet steel not less than 0.0325 inch (U.S. revised standard gauge No. 21) nominal thickness and shall be equipped with a hinged cover, locking device, and carrying handle.

3.9 Finish. Finish shall be in accordance with manufacturer's standard practice. Material not inherently corrosion resisting shall be properly coated or covered with a chemical or electrochemical finish to provide protection against atmospheric corrosion.

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3.10 Identification marking. Identification shall be permanently and legibly marked directly on the reconditioning and correction equipment or on a corrosion-resisting metal plate securely attached to the reconditioning and correction equipment at the source of manufacture. Identification shall include the manufacturer's model number, name and trademark to be readily identifiable to the manufacturer.

3.11 Equipment manual. When specified (see 6.2), the manufacturer shall furnish with each reconditioning or correction unit an equipment manual that is normally furnished the commercial market. The manual, for the honing unit furnished, shall contain necessary operating instructions, drawings, illustrations, parts list, manufacturer's part numbers, lubricating instructions, assembly and disassembly instructions, safety precautions to ensure proper operating, and maintenance instructions.

### 3.12 Workmanship.

3.12.1 Steel fabrication. The steel used in fabrication shall be free from kinks, sharp bends, and other conditions which would be deleterious to the finished product. Manufacturing processes shall not reduce the strength of the steel to a value less than intended by the design. Manufacturing processes shall be done neatly and accurately. All bends shall be made by controlled means to insure uniformity of size and shape.

3.12.2 Bolted connections. Bolt holes shall be accurately punched or drilled and shall have the burrs removed. Washers or lockwashers shall be provided in accordance with good commercial practice, and all bolts, nuts, and screws shall be tight.

3.12.3 Riveted connections. Rivet holes shall be accurately punched or drilled and shall have the burrs removed. Rivets shall be driven with pressure tools and shall completely fill the holes. Rivet heads, when not countersunk or flattened, shall be of approved shape and of uniform size for the same diameter of rivet. Rivet heads shall be full, neatly made, concentric with the rivet holes, and in full contact with the surface of the member.

3.12.4 Welding. Welding procedures shall be in accordance with a nationally recognized welding code. The surface of parts to be welded shall be free from rust, scale, paint, grease, or other foreign matter. Welds shall be of sufficient size and shape to develop the full strength of the parts connected by the welds. Welds shall transmit stress without permanent deformation or failure when the parts connected by the weld are subjected to proof and service loadings.

3.12.5 Castings. All castings shall be sound and free from patching, misplaced coring, warping, or any other defect which reduces the casting's ability to perform its intended function.

## 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

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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.

4.1.1 Component and material inspection. Components and materials shall be inspected in accordance with all the requirements specified herein and in applicable referenced documents.

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

- a. First article inspection (see 4.2.1).
- b. Quality conformance inspection (see 4.2.2).

4.2.1 First article inspection. The first article inspection shall be performed on one unit when a first article is required (see 3.2 and 6.2). This inspection shall include the examination of 4.4, the tests of 4.5, and, when specified, the first article pack inspection of 4.6 (see 4.6 and 6.2). The first article may be either a first production item or a standard production item from the supplier's current inventory provided the item meets the requirements of the specification and is representative of the design, construction, and manufacturing technique applicable to the remaining items to be furnished under the contract.

4.2.2 Quality conformance inspection. The quality conformance inspection shall include the examination of 4.4, the tests of 4.5, and the packaging inspection of 4.6. This inspection shall be performed on the samples selected in accordance with 4.3.

4.3 Sampling. Sampling and inspection procedures shall be in accordance with MIL-STD-105. The unit of product shall be one complete reamer or hone. All reamers or hones of the same classification offered for delivery at one time shall be considered a lot for the purpose of inspection. If an inspection lot is rejected, the contractor may rework it to correct the defects, or screen out the defective units, and resubmit for a complete reinspection. Resubmitted lots shall be reinspected using tightened inspection. If the rejected lot was screened, reinspection shall be limited to the defect causing rejection. If the lot was reprocessed, reinspection shall be performed for all defects. Rejected lots shall be separate from new lots, and shall be clearly identified as reinspected lots.

4.3.1 Sampling for examination. Examination shall be based on inspection level II and an Acceptable Quality Level (AQL) of 2.5 percent defective.

4.3.2 Sampling for tests. Tests shall be based on inspection level S-2 and an AQL of 4.0 percent defective.

4.4 Examination. Each unit selected shall be examined for compliance with the requirements specified in section 3 of this specification. Any redesign or modification of the contractor's standard product to comply with specified requirements, or any necessary redesign or modification following failure to meet specified requirements shall receive particular attention for adequacy and



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suitability. This element of inspection shall encompass all visual examinations and dimensional measurements. Noncompliance with any specified requirement shall constitute one defect.

4.5 Performance tests. The reamer, honing unit, and cylinder correction unit selected for testing shall be performance tested by reconditioning not less than two cylinders of appropriate size. The test cylinders shall have been selected from equipment in need of repair. The honing unit shall be driven by an electric or air hand portable drill. Stone sets shall be immersed in hydraulic brake fluid, kerosene, or denatured alcohol for a period of 8 hours, then removed and placed in an ambient room temperature of 80 degrees Fahrenheit (oF) plus or minus 5oF, for a period of 8 hours prior to testing. Failure to perform within the tolerances specified in 3.6, misalignment, loss of parts on removing the unit from the cylinder, or grooving of the cylinder wall, shall constitute one defect. To determine conformance to 3.6.2, 3.6.3, and 3.6.4, the stone sets shall be examined for bonding separation from the backing plate or loss of filaments or globules from the flexible hones. Any evidence of separation or softening of the bonding material shall constitute one defect of the stone sets. In addition to the above tests, the cylinder bores for the class 4 unit test shall be out-of-round and tapered to at least 0.0005 inch and 0.0005 inch per foot, respectively. Ridges shall be removed from each cylinder prior to the honing operations. The class 4 unit shall hone the cylinders in accordance with the manufacturer's instructions to determine compliance with 3.6.4 and 3.7.4.1. Failure to meet these requirements shall constitute one defect.

4.6 Preparation for delivery inspection. The inspection of the preservation, packaging, packing, and marking shall be in accordance with the requirements of section 4 of MIL-M-18058. The inspection shall consist of the quality conformance inspection; and, when specified (see 6.2), a preproduction pack shall be furnished for examination and test within the time frame required (see 6.2).

## 5. PREPARATION FOR DELIVERY

5.1 Preservation, packaging, and packing. Preservation, packaging, and packing shall be in accordance with the requirements of MIL-M-18058 with the level of preservation, packaging and the level of packing as specified (see 6.2).

5.1.1 Equipment with carrying case. When a carrying case is provided, individual components shall be packaged and placed within the carrying case. The carrying case shall be utilized as the consolidation container in accordance with MIL-M-18058; however, the carrying case shall also be placed in a container specified for consolidated packaging. When specified (see 6.2), the consolidation container will be omitted for the carrying case.

### 5.2 Marking.

5.2.1 Military agencies. Shipments to military agencies shall be marked in accordance with MIL-STD-129.

5.2.2 Civil agencies. Shipments to civil agencies shall be marked in accordance with FED-STD-123.

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## 6. NOTES

6.1 Intended use. Reamers and hones are intended for use in automotive repair shops for reconditioning and correcting cylinder walls when wear or damage is not sufficiently extensive to require reboring. Class 1 reamers are used to remove cylinder ridge. Type I reamers are used on engines with the face of the block perpendicular to the cylinders and on short stroke engines with insufficient cylinder depth to accommodate an expanding clamping mechanism. Type II reamers are used on both perpendicular and slant-face block engines, except for a few with very short stroke pistons. Class 2 and 3 cylinder honing units are used for breaking surface glaze and minor damages, such as spots, pits, scratches, and corrosion. Class 4 honing units are used for removing minor irregularities and correcting tapered or out-of-round cylinder bores.

6.2 Ordering data. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Class, type, and size of cylinder reconditioning or correction equipment required (see 1.2).
- c. Issue of document required if other than as specified (see 2.1.1).
- d. When first article is required for inspection and approval (see 3.2, 4.2.1, and 6.4).
- e. Specify if the hone or unit is for use in open ended or closed cylinders (see 3.6.2).
- f. When replacement abrasive stones and cutters are required (see 3.7).
- g. When honing unit shall be furnished with two sets of fine and medium grit stones (see 3.7.2).
- h. Diameter and grit size of flexible hone required (3.7.3).
- i. When honing unit shall be furnished with two sets of roughing, finishing, and polishing stones (see 3.7.4.1).
- j. When honing stand is required (see 3.7.4.2).
- k. When carrying case or box is required (see 3.8).
- l. When equipment manual is required (see 3.11).
- m. When a first article pack is required and time frame required for submission (see 4.2.1 and 4.6).
- n. Level of preservation and level of packing required (see 5.1).
- o. When consolidation container can be omitted for carrying case (see 5.1.1).

6.3 Data requirements. When this specification is used in an acquisition and data are required to be delivered, the data requirements shall be developed as specified by an approved Data Item Description (DD Form 1664) and delivered in accordance with the approved Contract Data Requirements List (CDRL), incorporated into the contract. When the provisions of DoD Federal Acquisition Regulations (FAR) Supplement, Part 27, Sub-Part 27.475-1 (DD Form 1423) are invoked and the DD Form 1423 is not used, the data should be delivered by the contractor in accordance with the contract or purchase order requirements.

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6.4 First article. When a first article inspection is required, the item will be tested and should be a first production item or it may be a standard production item from the contractor's current inventory as specified in 4.2.1. The first article should consist of a reconditioning or correction honing unit as specified in the acquisition documents. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examination, test, and approval of the first article.

#### 6.5 Key words.

Brush  
Hone  
Reamer

#### MILITARY INTERESTS:

##### Custodians

Army - GL  
Navy - YD  
Air Force - 99

##### Review Activity

Air Force - 84

##### User Activity

Army - ME

#### CIVIL AGENCY COORDINATING ACTIVITIES:

GSS/FSS - 6FET-CO

DOT/FAA - ACO

NASA/NA - Code 720

NASA/NA - Code DE-PMO-21

#### PREPARING ACTIVITY:

Navy - YD

(Project 5110-0318)

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Orders for this publication are to be placed with General Services Administration, acting as an agent for the Superintendent of Documents. See section 2 of this specification to obtain extra copies and other documents referenced herein.