INCH-POUND

MIL-R-5049D
26 December 1989
SUPERSEDING
MIL-R-5049C
16 AUGUST 1983

MILITARY SPECIFICATION

RING, WIPER, PISTON ROD

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

1. SCOPE

1.1 Scope. This specification covers piston rod wiper rings capable of removing dirt and ice (see 6.1).

1.2 Classification. Piston rod wiper rings covered by this specification shall be of the following types and class, and shall be coded as specified in MS28776 (see 6.2).

Type M - All metal.
Type R - Containing rubber or other elastomer which functions as a seal or a significant part of the contact force, or both.
Class 2 - Usable temperature -65° to +275°F.

1.3 Terms. The terms wiper ring and piston rod scraper are synonymous.

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).

Beneficial comments (recommendations, additions, deletions) and pertinent data which may be of use in improving this document should be addressed to: Oklahoma City Air Logistics Center/MMEOR, Tinker AFB OK 73145-5990 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 1650

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SPECIFICATIONS

Federal

QQ-B-626	Brass, Leaded And Nonleaded Rod, Shapes, Forgings And Flat Products With Finished Edges (Bar & Strip)
QQ-B-728	Bronze Manganese, Rod, Shapes, Forgings, And Flat Products (Flat Wire, Strip, Sheet, Bar And Plate)
QQ-B-750	Bronze, Phosphor, Bar, Plate Rod, Sheet, Strip, Flat Wire, And Structural And Special Shaped Sections
QQ-C-390	Copper Alloy Castings (Including Cast Bar)
QQ-C-450	Copper-Aluminum Alloy (Aluminum Bronze) Plate Sheet, Strip And Bar (Copper Alloy Numbers 606, 610, 613, 614 And 630)
QQ-C-465	Copper-Aluminum Alloys (Aluminum Bronze) (Copper Alloy Numbers 606, 614, 630 and 642), Rod, Flat Products With Finished Edges (Flat Wire, Strip And Bar), Shapes And Forgings
QQ-C-530	Copper-Beryllium Alloy Bar, Rod And Wire (Copper Alloy Numbers 172 And 173)
QQ-C-591	Copper Silicon, Copper Zinc Silicon, And Copper Nickel Silicon Alloys, Rod, Wire, Shapes, Forgings
PPP-B-601	Boxes, Wood, Cleated Plywood
PPP-B-636	Box, Shipping, Fiberboard

Military

MIL-P-116	Preservation, Methods Of
MIL-G-5514	Gland Design, Packings, Hydraulic, General Requirements For
MIL-H-5606	Hydraulic Fluid, Petroleum Base, Aircraft, Missile, And Ordnance
MIL-H-6083	Hydraulic Fluid, Petroleum Base, For Preservation & Operation
MIL-P-25732	Packing, Preformed, Petroleum Hydraulic Fluid Resistant, Limited Service At 275 Deg F (135 Deg C)
MIL-H-46170	Hydraulic Fluid, Rust Inhibited, Fire-Resistant, Synthetic Hydrocarbon Base
MIL-H-83282	Hydraulic Fluid, Fire Resistant, Synthetic Hydrocarbon Base, Aircraft, Metric, NATO Code Number H-537

STANDARDS

Military

MIL-STD-105	Sampling Procedures And Tables For Inspection By Attributes
MIL-STD-129	Marking For Shipment And Storage
MIL-STD-130	Identification Marking of U.S. Military Property
MIL-STD-831	Test Reports, Preparation Of
MIL-STD-889	Dissimilar Metals
MIL-STD-970	Standard & Specifications, Order Of Preference For The Selection Of
MIL-STD-2073/1A	DOD Material Procedures For Development And Application Of Packaging Requirements
MS28776	Scraper, Piston Rod
MS33675	Scraper, Installation, Packing Gland Ring

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Naval Publications and Forms Center, (ATTN: NPODS), 5801 Tabor Avenue, Philadelphia, PA 19120-5099.)

2.2 Non-Government publications. The following document(s) form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
ANSI B46-1-78 - Surface Texture (Surface Roughness, Waviness and Lay)

(Application for copies should be addressed to The American National Standards Institute, 1430 Broadway, New York, NY 10018-3308.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D3951 - Packaging, Commercial

(Application for copies should be addressed to: ASTM, 1916 Race St, Philadelphia, PA 19103.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related associated detail specifications, specification sheets, or MS standards), 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 Qualification. The wiper rings furnished under this specification shall be products which are authorized by the qualifying activity for listing on the applicable qualified products list at the time of award of contract (see 4.4 and 6.3).

3.2 Materials.

3.2.1 Rod bearing surfaces. The rod bearing surface of the wiper rings shall be fabricated of the metallic materials listed in table I or of any bronze, brass, or material suitable for the intended purpose.

3.2.2 Rubber used. Rubber used in type R, class 2 wiper rings shall be of a compound listed in QPL-83461, unless the contracting activity specifies a different compound more suitable for the intended purpose.

3.2.3 Dissimilar metals. Where dissimilar metals are used in the manufacture of wiper rings, such metals shall be suitably treated to prevent corrosion. Dissimilar metals are defined in MIL-STD-889.

3.2.4 Selection of materials. Specifications and standards for all materials, parts, and Government certification and approval of processes and equipment which are not specifically designated herein and which are necessary for the execution of this specification, shall be selected in accordance with MIL-STD-970.

TABLE I. Materials for Wiper rings.

Bronze	QQ-C-390 QQ-C-450 QQ-C-465 QQ-B-728 QQ-B-750	Comp. C3 Comp. 606 or 614, hard Comp. 642 Class A, half hard, or Class B, all Tempers Comp A, Hard
Brass	QQ-B-626	Hard
Copper-beryllium alloy	QQ-C-530	Condition A or H
Copper-silicon alloy	QQ-C-591	All classes half hard or hard
Rubber (type R, class 2)	MIL-P-83461	Procure approved items from any source shown in QPL-83461

3.3 Design and construction. The wiper rings shall conform to MS28776 and function as specified in a cavity conforming to MS33675.

3.4 Fluid compatibility. Wiper rings shall be satisfactory for use in, or exposed to the following actuating media:

Class 2: Fluid conforming to Specifications MIL-H-5606, MIL-H-6083, MIL-H-83282, MIL-H-46170 and air.

3.5 Performance.

3.5.1 Internal strain of copper-base alloys. Wiper rings made from copperbase alloys shall have no internal strain as revealed by the test specified in 4.6.1.

3.5.2 Rod Contact. The sliding surface of the wiper ring shall contact a minimum of 95 percent of the rod surface when tested as specified in 4.6.2.

3.5.3 De-icing. The wiper ring shall completely remove ice or frozen mixture from the surface of the piston rod when tested as specified in 4.6.3.

3.5.4 Breakout friction. The breakout friction of the wiper ring shall not exceed the values specified in MS28776.

3.5.5 Wear. The wiper ring shall show no evidence of malfunction after completion of the test specified in 4.6.5. After cycling, the wiper ring shall pass the test specified in 4.6.2.1.

3.5.6 Springiness. When tested as specified in 4.6.6, the wiper ring shall pass the test specified in 4.6.2.1.

3.6 Identification of product. Wiper rings shall be marked in accordance with Standard MIL-STD-130 and shall include the following information:

MS28776 (add type and class code)-(add Dash No.)

3.7 Workmanship. Wiper rings shall be free from defects and all details of workmanship shall be of a sufficiently high grade to insure proper operation and service life.

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 (examinations and tests) 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 this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

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

a. Qualification inspection (see 4.4)

b. Quality conformance inspection (see 4.5)

4.3 Qualification inspection.

4.3.1 Sampling instructions. Qualification test samples shall consist of the following on the basis of each type and class:

(a) If only one size is being made by a manufactured, six samples of the size shall be tested.

(b) If 25 or fewer sizes are made, 6 samples of the largest size and 6 samples of the smallest size being manufacturer, shall be tested.

(c) If more than 25 sizes are being manufactured, 6 each of the largest, intermediate, and smallest sizes shall be tested.

The manufacturer shall perform qualification tests on wiper rings in accordance with above sample sizes and submit three copies of a qualification test report in accordance with MIL-STD-831.

4.3.2 Tests. Qualification inspection shall consist of:

(a) Examinations (4.5.3)

(b) Tests (4.6)

4.4 Quality conformance inspection. The quality conformance inspection shall consist of the individual tests and sampling tests, 4.5.1 and 4.5.2, respectively.

4.4.1 Individual tests. All wiper rings submitted for acceptance under contract shall be subjected to the following tests:

(a) Examination of product (4.5.3.1)

(b) Rod contact (4.6.2)

4.4.2 Sampling tests. A sample shall be selected from each lot in accordance with MIL-STD-105, Inspection level S-2, acceptance number zero, and the following tests shall be conducted in the order listed.

(a) Internal strain of copper-base alloy (4.6.1)

(b) Breakout friction (4.6.4)

(c) Springiness (4.6.6)

4.4.3 Examinations.

4.4.3.1 Examination of product. All wiper rings shall be carefully examined to determine conformance to this specification with respect to materials, workmanship, dimensions, finish, and marking.

4.4.3.1.1 The dimensions coded (a) on MS28776 shall be gaged while the scraper ring is installed on a high tolerance rod as specified in 4.6.2.

4.4.3.2 Preservation, packaging, packing, and marking. Preparation for delivery shall be examined for conformance to section 5.

4.4.4 Rejection. When one or more wiper rings submitted for test for internal strain copper-base alloys fail in such a test, the entire lot shall be rejected. If one or more of the wiper rings fail to conform to the other requirements of the sampling tests, the whole lot shall be rejected.

4.5 Test methods.

4.5.1 Internal strain of copper-base alloys. Wiper rings made of copper-base alloys shall be immersed in an aqueous solution containing 100 grams of mercurous nitrate and 13 milliliters of nitric acid (specific gravity 1.42) per liter. After 15 minutes, the specimen shall be removed and examined for cracks. Any evidence of cracks shall be cause for rejection.

4.5.2 Rod contact. High and low tolerance plug gages or tubes shall be used for each size of scraper. The plug gages or tubing shall be of steel with a surface finish of 6 microinches or less, and shall be not less than 1 inch in length. The high and low tolerance dimensions shall be obtained in the table titled "O-ring gland dimensions" of Specification MIL-G-5514 (do not use the static application).

4.5.2.1 Qualification. Each wiper ring shall be placed at right angles to the longitudinal axis on both the high and low tolerance plug gages. The assembled wiper ring and plug gage shall be held before a strong light with the longitudinal axis of the gage toward the light. The wiper ring shall fit snugly and prevent the

passage of light for 95 percent of the circumference, and shall not exceed 0.001 clearance on a side for the other 5 percent of the circumference.

4.5.2.2 Production. Each wiper ring shall be placed on a low tolerance plug gage at right angles to the longitudinal axis and examined for surface contact as specified in 4.6.2.1.

4.5.3 De-icing. Performance shall be determined on one wiper ring of each size submitted as qualification samples. A clean, dry chrome-plated steel rod with a finish of 16 microinches or less, of suitable length, and the low tolerance diameter corresponding to the size of the wiper ring being tested shall be used for the following tests. The wiper ring shall be retained in a jig conforming to the high tolerance dimensions of MS33675.

4.5.3.1 Preaging. Wiper rings of type R, class 2, shall be preaged for a total of 72 hours (±1 hour) at high temperature, using the following cycle, while installed on the testing rod and jig:

(a) One-hour soak at room temperature in hydraulic fluid conforming to Specification MIL-H-5606

(b) One-minute drain.

(c) Twenty-four hours air bake at high temperature of 275°F, +0°, -10°F.

(d) Repeat for a total of three cycles.

(e) Thoroughly clean and dry rod.

(f) Test in accordance with 4.6.3.2.

(g) Test in accordance with 4.6.3.3.

Type M, class 2 wiper rings need not be preaged for this test.

4.5.3.2 The wiper ring and the chrome-plated steel rod shall be alternately cooled and sprayed or dipped in water until a coating of ice is formed on the rod, not les than 0.062 or more than 0.125 thick, over at least 12 continuous inches of the length of the rod. The wiper ring and the coated rod shall then be placed in a temperature of 0°F for a period of 6 hours. Within 2 minutes after removal from th cold box, the coated rod shall be forced through the wiper ring and the ice shall h removed as specified in 3.5.3.

*WARNING

Hydraulic fluid, MIL-H-5606 is highly toxic to eyes, skin and respiratory tract. Eye and skin protection is required. Good ventilation is normally adequate.

*WARNING

Extreme cold presents a serious freeze burn potential. Non-asbestos insulated gloves will be worn.

4.5.3.3 The wiper ring and the chrome-plated steel rod used in the above test shall be alternately cooled and dipped in a mixture composed of equal parts of No. 20 SAE oil, hydraulic fluid conforming to Specification MIL-H-5606, and fine sand or dust, until there is a coating of not less than 0.062 or more than 0.125 inch thick over at least 12 continuous inches of the length of the rod. The wiper ring and the coated rod shall then be placed in a temperature of -54°C (-65°F) for a period of 6 hours. Within 2 minutes after removal from the cold box, the coated rod shall be forced through a wiper ring installed in the jig specified in 4.6.3. The frozen mixture shall be removed as specified in 3.5.3.

4.5.4 Breakout friction. A jig shall be used which will retain the wiper ring in conformance with the low tolerance requirements of MS33675, and which will hold the rod in a vertical position. A clean, dry, chromeplated steel rod of suitable length, with a surface finish of 16 microinches or less and diametric dimensions in accordance with the high tolerance requirements of 4.6.2, shall be assembled in the jig with the wiper ring installed. A load, tending to force the rod through the wiper ring, shall then be applied to the rod, at a rate not to exceed 1 pound per second. The minimum load, including the weight of the rod, required to move the rod a minimum of 1 inch, shall be recorded and compared with the maximum breakout friction values specified in MS28776.

*WARNING

Handling hot items presents a serious burn potential. Heat resistant gloves will be worn.

4.5.5 Wear. A cycling setup similar to that shown in figure 1 shall be used for the wear test. One sample wiper ring shall be cycled under these conditions,unlubricated, for a minimum of 40,000 cycles, at a temperature of 70° (+30°F); plus a minimum of 10,000 cycles at the high temperature of +275° +0° -10°F. There shall be no appreciable wear on the rod as determined by circumferential and longitudinal readings of surface roughness values and changes in diameter. All readings of surface roughness, in accordance with ANSI B 46-1-78, and diameter before and after this test shall be recorded.

4.5.6 Springiness. A tapered mandrel shall be used to temporarily open the wiper ring to 0.010 inch over the maximum rod diameter, specified in the table titled "O-ring gland dimensions" of Specification MIL-G-5514, for which the wiper ring is intended. Without applying any force to restore the wiper ring to its original shape, the test specified in 4.6.2.1 shall be repeated.

4.6 Packaging inspection. Tests of methods of preservation and packaging shall be accomplished in accordance with Section 4 of MIL-P-116 to insure compliance with Section 5 of this specification.

5. PACKAGING

5.1 Preservation. Preservation shall be level A, C, or Industrial, IAW MIL-STD-2073/1A, as specified (see 6.2).

5.1.1 Level A.

5.1.1.1 Cleaning. Wiper-Rings shall be cleaned in accordance with process C-I of MIL-P-116.

5.1.1.2 Drying. Wiper-Rings shall be dried in accordance with process D-I of MIL-P-116.

5.1.1.3 Preservation application. Preservation shall not be used.

5.1.1.4 Unit packaging. Unless otherwise specified by the contracting activity, each Wiper-Ring shall be packaged in quantity unit packs of one each in accordance with Method of IC-I MIL-P-116. Each Wiper-Ring shall be placed in a PPP-B-636 fiberboard container weather resistant, with sufficient cushioning material between bag and unit container of a type, density, and thickness to ensure shock transmission does not exceed peak values in G's established for the Wiper-Ring when completed packs are subjected to the rough handling drop tests of MIL-P-116.

5.1.2 Level C. Each Wiper-Ring shall be clean, dry, and individually packaged in a manner that will afford adequate protection against corrosion, deterioration, and physical damage during shipment from supply source to the first receiving activity.

5.1.3 Industrial. The Industrial preservation of the Wiper-Ring shall be in accordance with ASTM D3951.

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

5.2.1 Level A. Wiper-Rings packaged as specified in 5.1.1 shall be packed in shipping containers conforming to PPP-B-601, Styles A or B, Class overseas, unless otherwise specified by the contracting activity. Insofar as practical, exterior shipping container shall be of uniform shape, size, minimum tare and cube consistent with the protection required.

5.2.2 Level B. Wiper Rings packaged as specified in 5.1.1 shall be packed in shipping containers conforming to PPP-B-636, class weather-resistant, unless otherwise specified by the contracting activity. Other requirements as specified in 5.2.1 apply.

5.2.3 Level C. Packing shall be applied which affords adequate protection during domestic shipment from the supply source to the first receiving activity for immediate use. This level shall conform to applicable carrier rules and regulations.

5.2.4 Industrial. The packaged Wiper-Ring shall be packed in accordance with ASTM D3951.

5.2.5 Packaging inspection. The inspection of these packaging requirements shall be in accordance with section 4.

5.3 Marking. In addition to any other markings required by the contract or order (see 6.2), interior and exterior containers shall be marked in accordance with MIL-STD-129.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The wiper rings are intended for use with hydraulic or pneumatic actuating cylinders, shock struts, and similar equipment items for the purpose of removing dirt, ice, or other foreign matter from the sliding rod (see 1.1).

6.2 Acquisition requirements. Acquisition documents must specify the following:

(a) Title, number and date of this specification.

(b) Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1).

(c) MS Part No (see 1.2).

(d) Number of wiper rings per intermediate container.

(e) Levels of packaging and packing (see 5.1 and 5.2).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time set for opening of bids, qualified for inclusion in Qualified Products List (QPL 5049) whether or not such products have actually been so listed by that date. The attention of the contractor is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or purchase orders for the products covered by this specification. The activity responsible for the Qualified Products List is Oklahoma City Air Logistics Center/MMEOR, Tinker AFB OK 73145-5990 and information pertaining to qualification of products may be obtained from that activity.

6.4 Retesting and resubmitting rejected lots. Lots found unacceptable shall not be resubmitted for reinspection unless all defective units are removed or all defects corrected by the supplier. The resubmitted lots shall be reinspected using either normal or tightened inspection for all types or classes of defects or merely reinspected for the particular types or classes of defects at the discretion of the Government.

6.5 Definition.

a. Lot. A lot shall consist of wiper rings of one type, class, and size.

6.6 Subject term (key word) listing.

Excluder
Seal, Dynamic
Scraper

6.7 Change from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

6.8 Concluding materials.

Custodians
AIR FORCE -99
Navy -AS
Army -AV

Preparing Activity
AIR FORCE -71

(Project: 1650-0443)

Reviewer:

Army -MI

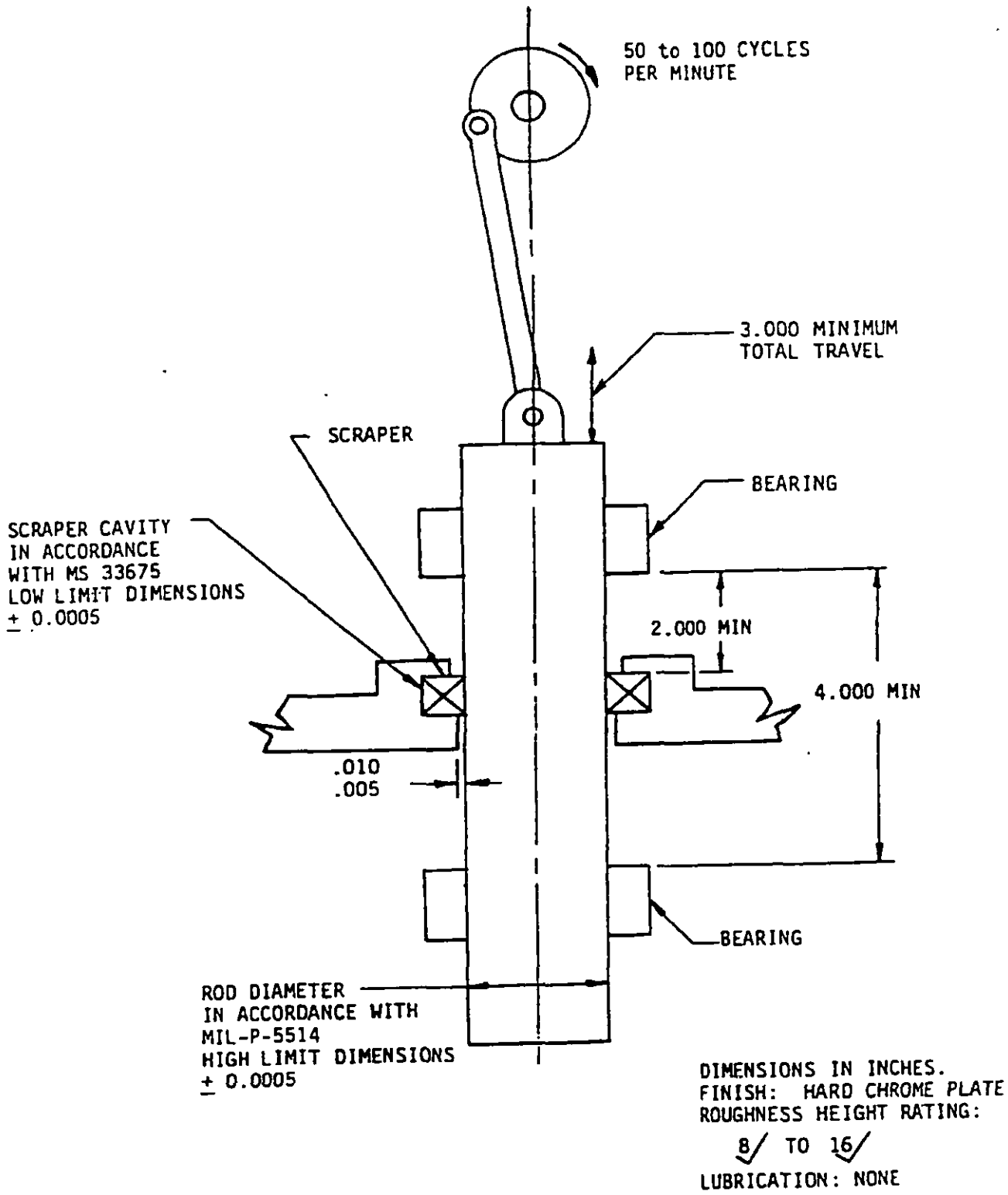

FIGURE 1. Wear test setup.

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER	2. DOCUMENT DATE (YYMMDD)
3. DOCUMENT TITLE		

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)	b. ORGANIZATION	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY

a. NAME	b. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON
c. ADDRESS (Include Zip Code)	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340

DD Form 1426, OCT 89 *Previous editions are obsolete.* 198/29