MIL-J-6193C

13 January 1984

SUPERSEDING
MIL-J-6193B
21 June 1966

MILITARY SPECIFICATION

JOINTS, UNIVERSAL PLAIN, LIGHT AND HEAVY DUTY

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

1. SCOPE

1.1 Scope. This specification covers light and heavy duty, plain universal joints for use in intermittent operations suitable for Military applications.

12 Classification. The universal joints shall be of the following classes.

Class 1 - Light Duty
Type A - Square End
Type B - Round End
Class 2 - Heavy Duty

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

QQ-P-416	Plating, Cadmium (Electrodeposited)
PPP-B-601	Boxes, Wood, Cleated-Plywood
PPP-B-636	Box, Fiberboard

MILITARY

MIL-P-116	Preservation, Methods Of
MIL-B-121	Barrier Material, Greaseproofed, Waterproofed, Flexible
MIL-M-7866	Molybdenum Disulfide, Technical Lubrication Grade

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 Air Logistics Center/MMEDO, Kelly AFB, TX 78241 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter

MILITARY

MIL-L-7870	Lubricating Oil, General Purpose, Low Temperature
MIL-G-81322	Grease, Aircraft, General Purpose, Wide Temperature Range

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-794	Part And Equipment, Procedures For packaging And Packing
MT L-STD- 1186	Cushioning, Anchoring, Bracing, Blocking, And Waterproofing; With Appropriate Test Methods
MS20270	Joint - Universal, Plain, Light Duty
MS20271	Joint - Universal, Plain, Heavy Duty

* (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 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-B-633-78	Zinc On Iron And Steel Electrodeposited Coatings Of
ASTM-D-3951-82	Packaging, Commercial

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

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

3. REQUIREMENTS

3.1 Qualification. The universal joints furnished under this specification shall be a product which has been tested, and passed the qualification test specified herein, and has been listed on or approved for listing on the applicable qualified products list.

3.2 Material. The material used in the manufacture of Plain bearing universal joints shall be of the highest quality and entirely suitable for the purpose.

3.3 Design and Construction.

3.3.1 Dimensions. Dimensions shall be as specified on MS20270 and MS20271 Drawings.

TABLE I. Axial tensile and compressive loads.

Class of joint	Nominal Size of Joint	Torsionsal Play		± 2% Tension & Compression (lb)	± 2% Static Torque (lb in.)	± 2% Torque Load (lb in.)	Length of Run (hrs)
		Torque ± 2% (lb in.)	± 2% Limit Degrees				
1	3/8	4	1.00	200	175	26	2
1	1/2	4	0.80	200	250	38	2
1	5/8	4	0.64	300	500	75	2
1	3/4	4	0.53	400	1,000	150	2
1	7/8	8	0.46	500	1,750	262	2
1	1	8	0.40	600	2,500	375	2
1	1 1/4	8	0.32	800	5,000	750	2
1	1 1/2	8	0.27	1,100	7,500	1,125	2
2	3/8	4	0.83	500	200	30	5
2	1/2	4	0.62	1,000	600	90	5
2	5/8	4	0.50	1,500	1,080	162	5
2	3/4	4	0.42	2,000	1,900	285	5
2	7/8	8	0.36	3,500	3,000	450	5
2	1	8	0.32	5,000	4,700	705	5
2	1 1/4	8	0.24	7,000	9,500	1,425	5
2	1 1/2	8	0.20	9,000	14.500	2,175	5

3.3.2 Assembly. The joints shall be assembled with pins and bearings pinned or locked into place to prevent disassembly of the finished joint.

3.3.3 Hardness. The hub sections of joints (Dimension H on MS20270 and MS20271) shall not exceed Rockwell hardness C-40.

3.3.4 Plating. All external steel parts of joints shall be cadmium plated in accordance with Type II, Class 2 of QQ-P-416; or zinc plated in accordance with ASTM B 633.

3.3.5 Lubrication. Class 1 joints shall be lubricated with oil conforming to MIL-L-7870 Class 2 joints shall be lubricated with a lubricant consisting of a uniform mixture of MIL-G-81322 grease with a 6 ± 1/2 percent by weight additive of MIL-L-7866 lubricant, molybdenum disulfide.

3.3.6 Closures. Class 2 joints shall have flexible covers that are resistant to ozone cracking and will exclude dirt and dust from. the bearing surfaces and retain the lubricant on these surfaces at all temperatures between 71° centigrade (C) and -55°C during operation.

3.4 Performance.

3.4.1 Angularity. The joints shall be of such a design and construction as to be operable to an angle of not less than 30 degrees measured between the axes of the hubs.

3.4.2 Torsional play. The torsional play shall not exceed the limit when the joint is subjected to the torque shown in Table I and tested as specified in 4.5.2.

3.4.1 End and side play. The play in the joint shall not exceed the pertinent limits when tested as specified in 4.5.3.

3.4.4 Tightness. The moment of force required to move the joint through the minimum angle of 30 degrees shall not exceed the limits specified in 4.5.4.

3.4.5 Axial load. The joints shall support the axial tensile and compressive loads as shown in Table I, with angle A as shown on Figure 1 equal to zero for 30 seconds without any permanent deformation or excessive tightness after the load is removed.

3.4.6 Static torque. At least three specimens shall be subjected to torque load conditions specified in 4.5.6.

3.4.7 Endurance. At least four specimens shall be subjected to the endurance test specified in 4.5.7.

3.4.8 Lubricant retention. The lubricant retention cover shall retain the lubricant and not crack or show signs of failure when tested as specified in 4.5.8. Slight bleeding of lubricant on surface Of cover is permissible.

3.5 Identification of product. Each joint shall be permanently and legibly marked in accordance with provisions of MIL-STD-130 with the manufacturer's name or trademark and the dash numbers as shown on the applicable MS20270 or MS20271.

3 .5.1 Use of AN or MIL designations. AN or MIL designations shall not be applied to a product, except for qualification test samples, nor referred to in correspondence or sales matter, until notification has been received from the qualifying service that the product has been approved for Military use.

3.6 Workmanship. All details of manufacture shall be in accordance with the best practices for high quality Military parts.

3.7 Reclaimed materiels. The use of reclaimed materiels shall be encouraged to maximum extent possible.

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 tests. The inspection and testing of universal joints shall be classified as follows:

a. Qualification tests Qualification test are those tests accomplished on samples submitted for qualification as satisfactory products.

b. Acceptance tests: Acceptance tests are those tests accomplished on products submitted for acceptance under contract.

4.3 Qualification tests.

4.3.1 Sampling instructions. Qualification test samples shall consist of four test specimens, fabricated as shown in Figure 2, and at least seven additional test specimens, two of which shall be fabricated as shown in Figure 1, for each type and size universal joint upon which qualification is desired. Samples shall be identified as required and forwarded to San Antonio Air Logistic Center/MMIRCC Kelly AFB, Texas 78241.

4.3.1.1 Complete data shall be furnished on universal joints submitted for qualification tests, including part numbers of joint assemblies, detailed data on materials, heat treatment. finish, lubrication, and a complete set of details and assembly prints.

4.3.2 Tests. The qualification tests of joints shall consist of a complete examination of the joint and performance of all of the tests specified herein.

4.4 Acceptance tests. The contractor shall furnish all samples and shall be responsible for accomplishing the required tests. When inspection is conducted at the contractor's plant, all inspection and testing shall be under the supervision of the Government inspector. Contractors not having laboratory testing facilities satisfactory to the Government shall engage the services of a commercial testing laboratory acceptable to the procuring activity. The contractor shall furnish test reports, in duplicate, showing quantitative results for all test required herein, and signed by an authorized representative of the contractor or laboratory, as applicable.

Acceptance or approval of material during course of manufacture shall in no case be construed as a guaranty of the acceptance of the finished product.

4.4.1 Sampling. A random sample for torsional play, end and side play, and tightness tests shall be selected in accordance with Table II.

TABLE II. Torsional Play.

Lot size	Sample size	Acceptance No.	Rejection No.
Under 200	3	0	1
200-2000	4	0	1
over 2000	8	1	2

4.4.1.1 Lot. A lot shall consist of all joints of the same type and size submitted for inspection at the same time and place.

4.4.1.2 Samples shall be in addition to the quantity specified by contract or purchase order and shall be furnished without additional cost to the Government. Samples not damaged by inspection may, at the discretion of the inspector, be returned to the contractor to be applied to the order.

4.4.2 Tests. The inspection test of the joints shall consist of the following tests. Examination of product, torsional play, end and side play and tightness.

4.5 Test methods.

4.5.1 Examination of product. A random sample shall be selected in accordance with MIL-STD-105, using inspection level II and AQL 1.5 and the rejection provisions contained therein. Each joint in the sample lot shall be carefully examined and checked to determine conformance with this specification. If the sample fails this test, the entire lot shall be examined in detail, defective discarded and the lot resubmitted for sampling according to the above procedure, by using inspection level III and AQL 1.0. If the second sample fails to pass, the lot shall be rejected.

4.5.2 Torsional play. With the retaining cover and lubricant removed, apply the pertinent torque specified in Table I, to the joint, to obtain an initial reading, then reverse the torque load and take a second reading. The torsional play at the circumference of the joint is the difference between the two readings and shrill not exceed the pertinent limit shown in Table I. The torsional play shall be measured before and after the endurance test.

4.5.3 End and side play. With the lubricant retaining cover, and the lubricant removed, apply a 5-pound load alternately in either the endwise or sidewise direction to obtain an initial reading, then reverse the load and take a second reading. The total play is the play recorded between the two readings. Measure the side play in the same plane as an inspection hole, then rotate the joint through an angle of 90 degrees and measure it again. The maximum allowable end and side play is as follows:

	End play inches	Side play inches
Class 1 joints	0.0035	0.0080
Class 2 joints	0,0027	0.0055

4.5.4 Tightness. The moment of force required to move the upper end of the joint through the minimum angle of 30 degrees shall be measured with the lower end of the joint clamped in a vertical position. The moment of force shall not exceed 0.20 pound-inch + 2%. Class 2 joints shall be tested for tightness with the lubricant retaining covers removed and may be lubricated during the test.

4.5.5 Axial load. Two samples shall be subjected to the axial tension and compression test. The axial load specified in Table I, for the particular joint, shall be applied with angle "A", as shown in figure 1, equal to zero for 30 seconds. After application of the axial load, the joint shall be inspected again for tightness according to paragraph 4.5.4.

4.5.6 Static torque. Joints shall withstand 90 percent of the static torque load shown in Table I without exceeding 12 degrees deflection and shall not completely fail under less than the full static torque load shown in Table 1.

4.5.7 Endurance. Joints shall withstand continuous operation under the torque loads specified and for lengths of run shown in Table I, at 120 revolutions per minute (rpm) with the angle shown on Figure 1 equal to 15 degrees. The joint shall be considered to have failed if worn enough to produce 5 degrees or more torsional play in each joint. The lubricant shall be retained by the means provided on the joint under test throughout the endurance run.

4.5.7.1 Before starting the endurance test, Class 1 joints shall be submerged in a lubricating oil conforming to MIL-L-7870.

4.5.7.2 Class 2 joints shall be subjected to the endurance test with lubricant retainers in place. Failure of lubricant retainer cover or device during the test shall be considered sufficient reason for rejection of the joint under test.

4.5.7.3 Endurance test equipment shall be of such design and construction that the test specimen will be free from inadvertent end loads during the entire test, Means shall be provided to avoid high starting torque loads. The applied torque during the test shall be substantially constant. A smooth running mechanism free from vibration and shock loads shall be used.

4.5.7.4 Forced cooling shall be used during the endurance test.

4.5.8 Lubricant retention. Class 2 endurance test specimens shall be held for 24 hours at -55°C and then operated at an angle of 20 degrees for 1 hour at 3 rpm. The temperature shall then be raised to 71°C for 160 hours and the joint operated at an angle of 20 degrees for 1 hour at 3 rpm. Fai lure of the lubricant retention cover to retain lubricant shall be cause for rejection.

4.6 Inspection of the preservation, packaging, packing and marking for shipment and storage. Sample items or packs and the Inspection of the preservation, packaging, packing and marking for shipment and storage shall be in accordance with the requirements of section 5, or the documents specified therein.

5. PACKAGING

5.1 Preservation and Packaging. Preservation and packaging shall be Level A or C or Standard Practice for Commercial Packaging (see 6.2).

5.1.1 Level A.

5.1.1.1 Level A. Cleaning and Drying shall be in accordance with the applicable procedures of MIL-P-116.

5.1.1.2 Unit Packaging. Joints lubricated as specified in Section 3 shall be wrapped with barrier material conforming to MIL-B-121, Grade A and packaged in accordance with method IA of MIL-P-116.

5.1.2 Level C. The Level C preservative for joints shall conform to MIL-STD-794 requirements of this level. OR

5.1.2 Commercial Packaging. Commercial packaging shall be in accordance with ASTM D 3951-82.

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

5.2.1 Level A. The Joints preserved and packaged as specified in 5.1.1.2 shall be packed in a container conforming to PPP-B-601, overseas type. The closure of shipping container shall be in accordance with the appendix of the shipping container specification.

5.2.2 Level B. The Joints shall be preserved and packaged as specified in 5.1.1.2 and shall be packed in a container conforming to PPP-B-636, weather resistant. The closure of shipping container shall be in accordance with the appendix of the specification.

5.2.3 Level C. Joints preserved and packaged as specified in 5.1.1.2 shall be packed in manner to insure carrier acceptance and safe delivery at destination. Container shall be in accordance with either the uniform freight classification rules or regulations of other carriers as applicable to the mode of transportation. OR

5.2.3 Commercial Packing. Packing shall be accomplished in accordance with ASTM D 3951-82.

5.3 Physical Protection. The joints shall be cushioned, anchored, blocked and braced in accordance with MIL-STD-1186. The Freefall Drop Test, Edgewise Drop Test and Cornerwise Test shall be in accordance with the Appendix of MIL-STD-1186. The tests are not required when level C or Commercial packing is specified.

5.4 Marking. in addition Lo any special marking by the contact or order (6.2) interior packages and exterior containers shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use, The universal joints covered by this specification are for intermittent operation of control systems for use in Military applications.

*6.2 Ordering data.

*6 .2.1 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number and date of this specification.
b. Quantities and class required (see 1.2).
c. Place samples are to be forwarded (see 4.3.1).
d. Selection of applicable level of preservation, 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 whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer Lo 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 San Antonio ALC/MMIRCC Kelly AFB, Texas 78241 and information pertaining to qualification of products may be obtained from that activity.

*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 inaccuracies in the 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.

Custodians:

Navy - AS
Air Force - 99

Reviewers:

Army – ME

User.

Navy - MC, CG

Preparing activity

Air Force - 82

Project Nr. 301O-OO43

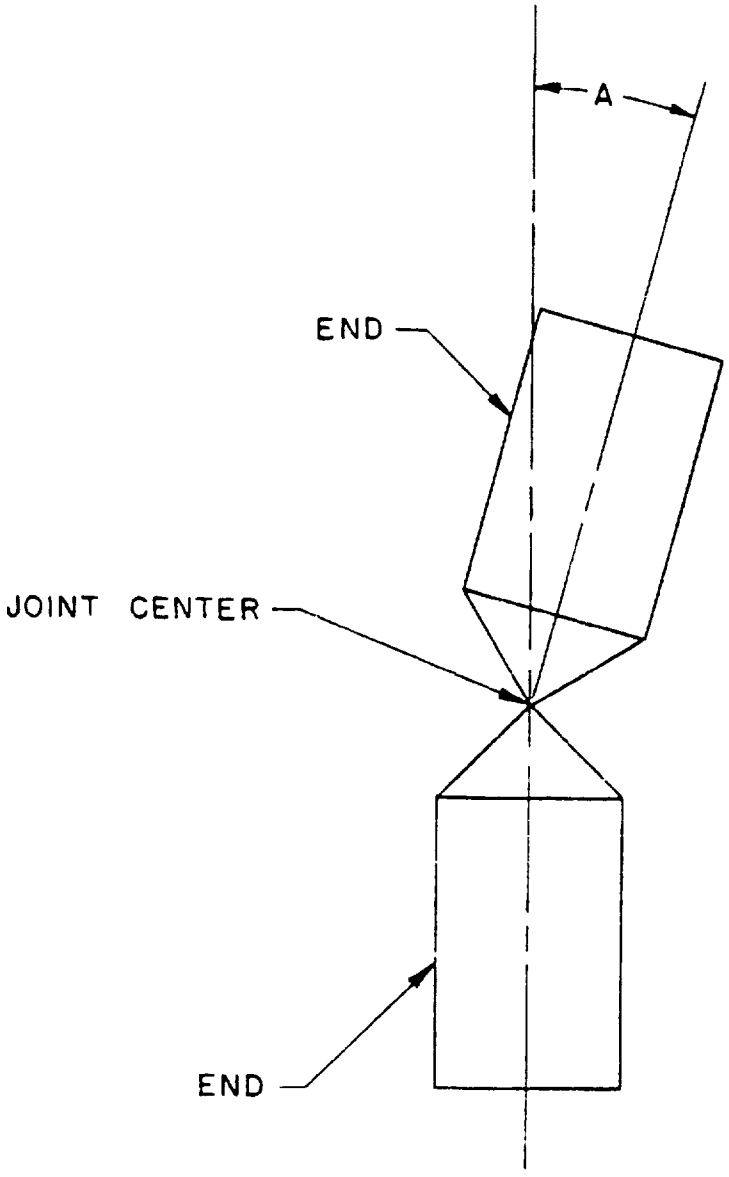

FIGURE 1. JOINT

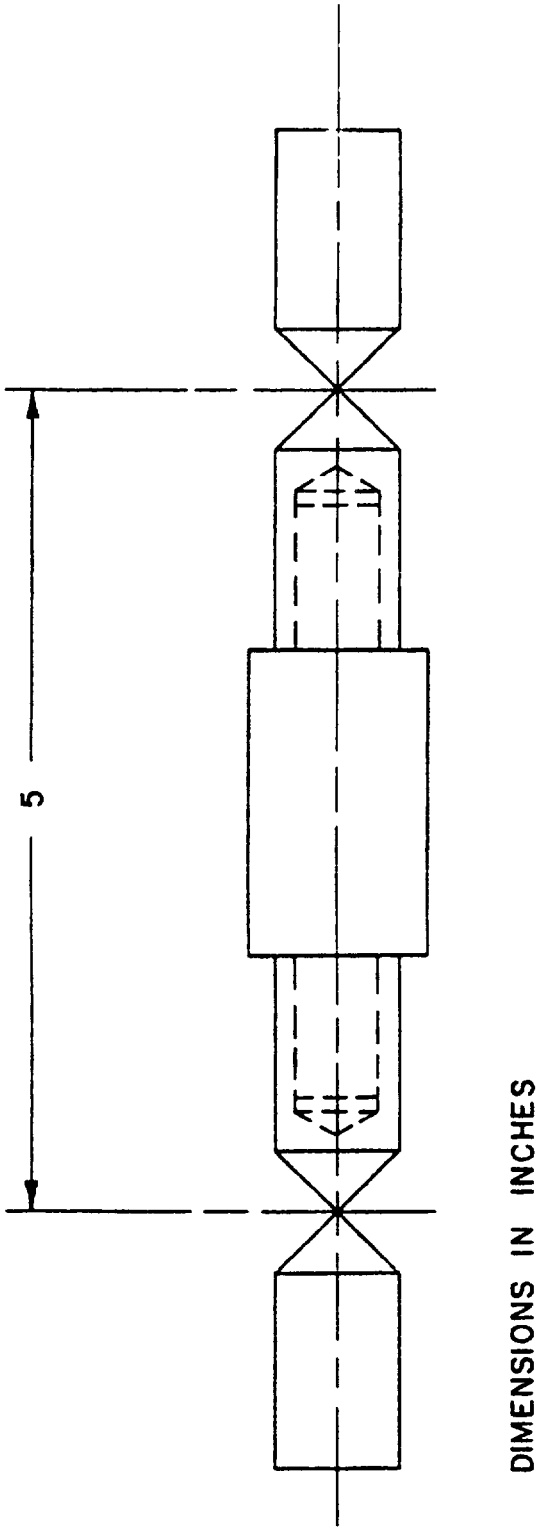

FIGURE 2. FRICTION TORQUE TEST SPECIMEN

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions Reverse Side)

1 DOCUMENT NUMBER	2 DOCUMENT TITLE
MIL-J-6193C	JOINTS, UNIVERSAL, PLAIN, LIGHT AND HEAVY DUTY

3a. NAME OF SUBMITTING ORGANIZATION	4 TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR
	☐ USER
b ADDRESS *(Street, City, State, ZIP Code)*	☐ MANUFACTURER
	☐ OTHER *(Specify)* _____

5 PROBLEM AREAS

a. Paragraph Number and Wording

b. Recommended Wording

c. Reason/Rationale for Recommendation

6 REMARKS

7a NAME OF SUBMITTER *(Last, First, MI)* – Optional	b WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
c MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8 DATE OF SUBMISSION *(YYMMDD)*

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