INCH-POUND

MIL-Q-47057A(MI)
16 July 1990
SUPERSEDING
MIL-Q-47057(MI)
10 May 1974

MILITARY SPECIFICATION

QUARTZ, FUSED, OPTICAL GRADE

This specification is approved for use by the U.S. Army Missile Command, Department of the Army, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification establishes the requirements for two types of clear optical grade fused quartz to be used in the fabrication of optical elements where a low coefficient of thermal expansion is desired.

1.2 Classification. The fused quartz shall be of the following types as specified (see 6.2).

Type I - Standard

Type II - Special

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks 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 any pertinent data which may be of use in improving this document should be addressed to: Commander, U.S. Army Missile Command, ATTN: AMSMI-RD-SE-TD-ST, Redstone Arsenal, AL 35898-5270, 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 6650

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

SPECIFICATION

MILITARY

MIL-G-174	Glass, Optical
MIL-O-16898	Optical Elements, Packaging of

STANDARD

FEDERAL

FED-STD-406	Plastics, Methods of Testing

MILITARY

MIL-STD-129	Marking for Shipment and Storage

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

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 SOCIETY FOR TESTING MATERIALS

ASTM C 336	Annealing Point and Strain Point of Glass, Test Method of
ASTM E 111	Young's Modulus at Room Temperature, Method for Determination of
ASTM E 228	Test Method for Linear Thermal Expansion of Solid Materials with a Vitreous Silica Dilatometer

(Application for copies should be addressed to the American Society for Testing Materials, 1916 Race Street, 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 First article. When specified (see 6.2), a sample of material shall meet the requirements of first article inspection (see 4.3).

3.2 Material. The material shall be fine annealed, clear, fused quartz having an approximate refractive index of 12.4585, and a minimal purity of 99.97 percent silicon dioxide (SiO_2).

3.2.1 Form. The fused quartz optical glass shall be supplied to the form specified in the contract (see 6.2).

3.3 Mechanical properties.

3.3.1 Coefficient of expansion. The maximum coefficient of expansion shall be 5.5 times 10-7 centimeters (cm) per cm per degree Celsius (c) (1.8 degree Fahrenheit (F)) in the range of zero to 300 degrees C (32 to 572 degrees

3.3.2 Modulus of elasticity. The Modulus of elasticity shall be 10.4 times 10 pounds per square inch minimum.

3.4 Physical properties.

3.4.1 Specific gravity. The specific gravity shall be 2.200 plus or minus 0.004 grams per cubic centimeter.

3.4.2 Strain point. The strain point shall be 1070 degrees C (1958 degrees F), maximum.

3.4.3 Annealing point. The annealing point shall be 1140 degrees C (2084 degrees F), maximum.

3.4.4 Inclusions. The allowable maximum and minimum size inclusions shall be as specified in Table I. The permissible number of maximum size inclusions shall be one per each cubic centimeter (cc) of glass. The sum of the diameter of all inclusions larger than the minimum size per cc of glass shall not exceed the diameter of the allowable maximum size. Inclusions smaller than the minimum size shall be disregarded.

Table I. Inclusion criteria

Type	Maximum size (millimeters)	Minimum size (millimeters)
I Standard	0.50	0.10
II Special	2.5	0.25

3.4.5 Striae grade. The striae grade of Type I and Type II material shall conform to the following grades specified in Specification MIL-G-174.

a. Type I, Grade B.

b. Type II, Grade C.

3.4.6 Color. The material shall meet the color requirement specified in Specification MIL-G-174.

3.4.7 Finish. Laps, folds, stones, fire cracks, or formed pressings shall not be deeper than one half the grinding stock specified in the applicable drawing or as detailed in Table II of Specification MIL-G-174.

3.5 Workmanship. The workmanship shall be such as to insure a high quality product which is uniform, and in conformance with this specification. The fused quartz shall be free of dirt, foreign materials, cracks, or contaminants.

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 assure 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 examination and testing of material shall be classified as follows:

a. First article inspection (4.3).

b. Quality conformance inspection (4.4).

4.3 First article inspection. First article inspection shall be conducted only on the first article sample and shall consist of all the examinations and tests specified herein.

4.3.1 First article sample. The first article sample shall be prepared using the same methods proposed for the preparation of subsequent production lots of material. The first article sample shall be subjected to all examinations and tests specified herein. Unless otherwise specified (see 6.2), the Government will perform the examinations and tests for first article sample acceptance at the contractor's plant. First article samples which do not meet all the requirements of this specification shall be rejected and returned to the contractor. Subsequent quantities will not be considered for acceptance until approval of the first article sample has been obtained.

4.4 Quality conformance inspection. Quality conformance inspection for acceptance of quartz shall consist of the following examinations and tests:

a. Coefficient of expansion (see 4.5.1.1).

b. Specific gravity (see 4.5.2.1).

c. Inclusions (see 4.5.2.4).

4.4.1 Lot size and sampling.

4.4.1.1 Lot size. Lot size shall consist of all the quartz submitted for acceptance at the same time, which has been prepared by the same company without change in materials or processes in one continuous period of operation.

4.4.1.2 Sampling. Unless otherwise specified (see 6.2), sampling shall be in accordance with MIL-G-174. Failure of sample to meet the quality conformance inspection requirements shall be cause for lot rejection.

4.5 Methods of inspection.

4.5.1 Mechanical property tests.

4.5.1.1 Coefficient of expansion. The coefficient of expansion specified in 3.3.1 shall be determined in accordance with ASTM E 228.

4.5.1.2 Modulus of elasticity. The modulus of elasticity specified in 3.3.2 shall be determined in accordance with ASTM E 111.

4.5.2 Physical property tests.

4.5.2.1 Specific gravity. The specific gravity specified in 3.4.1 shall be determined in accordance with FED-STD-406, Method 5011.

4.5.2.2 Strain point. The strain point specified in 3.4.2 shall be determined in accordance with ASTM C 336.

4.5.2.3 Annealing point. The annealing point specified in 3.4.3 shall be determined in accordance with ASTM C 336.

4.5.2.4 Inclusions. The examination for inclusions shall be in accordance with Specification MIL-G-174 for compliance with 3.4.4 for Type I material. Compliance with 3.4.4 for Type II material shall be as follows:

a. Blanks shall contain not more than one bubble ranging from one millimeter (mm) to 2.5 mm in diameter and no more than three bubbles ranging from 0.25 mm to one mm in diameter. Bubbles under 0.25 mm not to be considered.

4.5.2.5 Striae grade. The striae grade specified in 3.4.5 shall be determined in accordance with Specification MIL-G-174.

4.5.2.6 Color. The color specified in 3.4.6 shall be determined in accordance with Specification MIL-G-174.

4.5.2.7 Finish. The finish specified in 3.4.7 shall be determined in accordance with Specification MIL-G-174.

5. PACKAGING

5.1 Preservation, packaging, and packing. Preservation, packaging, and packing shall be Level A, B, or C as specified (see 6.2) in accordance with MIL-O-16898.

5.2 Marking. In addition to any special marking required by the contract or order, unit packages, intermediate packages, and shipping containers shall be marked in accordance with the requirements of Standard MIL-STD-129.

5.2.1 Special marking. Shipping containers shall be marked with words "GLASS - HANDLE WITH CARE." The appropriate side of the container shall be clearly marked to indicate "TOP" or "OPEN THIS SIDE."

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 clear optical grade fused quartz covered by this specification is intended for use in the fabrication of optical mirrors and lenses in optical systems where a low coefficient of expansion is desired.

6.2 Acquisition requirements. Acquisition documents must specify the following:

a. Title, number, and date of the specification.

b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1 and 2.2).

c. Whether a first article sample is required (see 3.1).

d. Where first article sample inspection shall be performed (see 4.2).

e. Sampling plan if other than specified (see 4.4.1.2).

f. Any special marking requirements.

g. Packaging limitations (see 5.1).

h. Form (see 3.2.1) and type (see 1.2).

6.3 Subject term (key word) listing.

Dioxide
Elasticity
Striae
Thermal

6.4 Changes 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.

Custodian:
Army - MI

Preparing activity:
Army - MI

Project No. 6650-A178

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.
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I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER	2. DOCUMENT DATE (YYMMDD)
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4. NATURE OF CHANGE (*Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.*)

5. REASON FOR RECOMMENDATION

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a. NAME (Last, First, Middle Initial)	b. ORGANIZATION	
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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