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10 May 1974
SUPERSEDING
MIS 14284
1 March 1965

MILITARY SPECIFICATION

QUARTZ, FUSED, OPTICAL GRADE

This specification is approved 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. The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of the specification to the extent specified herein.

SPECIFICATION

Military

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

STANDARDS

Federal

FED-STD-406	Plastics, Methods of Testing

Military

MIL-STD-129	Marking for Shipment and Storage

(Copies of specifications, standards, drawings and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposals shall apply.

American Society for Testing Materials

ASTM C 336	Annealing Point and Strain Point of Glass, Test Method for
ASTM C 337	Average Linear Expansion of Glass, Method of Test for
ASTM E 111	Young's Modulus at Room Temperature, Method for Determination of

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

Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.

3. REQUIREMENTS

3.1 Preproduction sample. Unless otherwise specified (see 6.2), a preproduction sample (4.2) of material shall meet the requirements of this specification.

3.2 Material. The material shall be fine annealed, clear, fused quartz having an approximate refractive index of 1.4585, 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 F).

3.3.2 Modulus of elasticity. The modulus of elasticity shall be 10.4 times 10^6 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 supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier 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 Preproduction sample. The preproduction sample shall be prepared using the same methods proposed for the preparation of subsequent production lots of material. The preproduction 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 preproduction sample acceptance at the contractor's plant. Preproduction 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 preproduction sample has been obtained.

4.3 Classification of examinations and tests. The examination and testing of material shall be classified as follows:

a. Preproduction tests (4.4).

b. Quality conformance tests (4.5).

4.4 Preproduction tests. Preproduction tests shall be conducted only on the preproduction sample and shall consist of all the examinations and tests specified herein.

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

a. Coefficient of expansion (see 4.6.1.1).

b. Specific gravity (see 4.6.2.1).

c. Inclusions (see 4.6.2.4).

4.5.1 Lot size and sampling.

4.5.1.1 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.

4.5.1.2 Sampling. Unless otherwise specified (see 6.2), sampling shall be in accordance with MIL-G-174. Failure of sample to meet the quality conformance test requirements shall be cause for lot rejection (see 4.7).

4.6 Test methods.

4.6.1 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 C 337.

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

4.6.2 Physical property tests.

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

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

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

4.6.2.4 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.

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

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

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

5. PREPARATION FOR DELIVERY

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

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 Ordering data. Procurement documents should specify the following:

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

b. Whether a preproduction sample is required (see 3.1).

c. Where proproduction sample test shall be performed (see 4.2).

d. Sampling plan if other than specified (see 4.5.1.2).

e. Any special marking requirements.

f. Packaging limitations (see 5.1).

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

6.3 Supersession data. This specification includes the requirements of Missile Interim Specification MIS-14284, dated 1 March 1965.

Custodian:
Army-MI

Preparing Activity:
Army-MI
Project No. 6650-A073

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

OMB Approval
No. 22 R255

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