MIL-G-47034A
22 April 1987
SUPERSEDING
MIL-G-47034(MI)
19 April 1974

MILITARY SPECIFICATION

GLASS, FILTER, COLORED

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

1. SCOPE

1.1 Scope. This specification covers the material, physical and mechanical properties and inspection requirements for four related grades of colored filter glass for use in optical systems.

1.2 Classification. The glass shall be of the following grades with color specification (CS) numbers (see 6.2):

Grade A, CS No. 2-58 (Red)
Grade B, CS No. 2-59 (Red)
Grade C, CS No. 5-56 (Blue)
Grade D, CS No. 5-57 (Blue)

2. APPLICABLE DOCUMENTS

2.1 Government documents.

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

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: US Army Tank-Automotive Command, ATTN: AMSTA-GDS, Warren, MI 48397-5000, 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 9340

SPECIFICATION
MILITARY

MIL-G-174	- Glass, Optical.

STANDARDS
MILITARY

MIL-STD-105	- Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-45662	- Calibration System Requirements.

(Copies of specification and standards required by the contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

2.2 Other publications. The following document(s) form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted shall be those listed in the issue of the DODISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS shall be the issue of the nongovernment documents which is current on the date of the solicitation.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 336	- Method for Annealing Point and Strain Point of Glass by Fiber Elongation, Test for.
ASTM C 338	- Softening Point of Glass, Test Method for.
ASTM D 792	- Specific Gravity and Density of Plastic by Displacement, Test Methods for.
ASTM E 228	- Linear Thermal Expansion of Rigid Solids with Vitreous Silica Dilatometer, Test Method for.

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

(Nongovernment standards and other publications are normally available from the organizations which prepare or which 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 specification and the references cited herein (except for associated detail specifications, specification sheets or MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 First article. Unless otherwise specified (see 6.2), the contractor shall furnish sample colored filter glass which shall be subjected to first article inspection (see 4.4). First article inspection samples, properly marked with identifying information, shall be representative of the unit to be furnished to the Government. All subsequent colored filter glass delivered to the Government shall conform to these samples in all of their pertinent physical and performance attributes.

3.2 Material. The materials shall be of high quality silica, boric oxide, soda, aluminum oxide, colorants, and other ingredients necessary to produce fine annealed high-quality colored filter glass. The materials used shall also be such as to produce colored filter glass which conform to the requirements for type and grade as detailed in this specification. Grades A and B shall have a refractive index of 1.507 ± 0.001 and grades C and D shall have a refractive index of 1.472 ± 0.001 (see 4.8.1).

3.2.1 Recycled materials. The use of recycled materials which meet the requirements of the applicable material specifications without jeopardizing the intended use of the item shall be encouraged.

3.3 Design and construction.

3.3.1 Thickness. The material shall meet the control thickness requirements specified in table I (see 4.8.2).

TABLE I. Thickness.

Grade (CS No.)	Thickness, mm	
	Filter	Molder/Blank
A (2-58)	1.4 - 4.6	5.5 - 6.5
B (2-59)	1.4 - 4.6	5.5 - 6.5
C (5-56)	3.9 - 5.1	7.5 - 8.5
D (5-57)	4.4 - 5.6	7.5 - 8.5

3.4 Physical properties. The material shall meet the physical property requirements specified in table II (see 4.8.3).

TABLE II. Physical properties.

Property	Grade (CS No.)				ASTM test methods
	A (2-58)	B (2-59)	C (5-56)	D (5-57)	
Specific gravity, g/ccm, ± 0.004	2.500	2.500	2.290	2.300	D 792
Strain point, °C, max.	499	499	365	372	C 336
Annealing point, °C, max.	533	533	412	411	C 336
Softening point, °C, min.	770	770	665	660	C 338

3.5 Inclusions. The allowable maximum and minimum size inclusions shall be 0.50 millimeter (mm) and 0.10 mm respectively. The permissible number of maximum size inclusions shall be one per 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 (see 4.8.4).

3.6 Mechanical properties.

3.6.1 Coefficient of expansion. The material shall meet the coefficient of expansion requirements specified in table III throughout the range of zero to 300 degrees Celsius (°C) (see 4.8.5.1).

TABLE III. Coefficient of expansion.

Grade (CS No.)	Expansion, cm/cm/°C, max.
A (2-58)	0.000043
B (2-59)	0.000043
C (5-56)	0.000094
D (5-57)	0.000092

3.7 Optical properties.

3.7.1 Transmittance wave length. The material grades A and B (sharp cut red filters) and grades C and D (blue filters) shall meet the transmittance wave length requirements specified in tables IV and V respectively (see 4.8.6.1).

TABLE IV. Transmittance wave length (grades A and B).

Grade (CS No.)	Nanometers			
	1/	2/	3/	4/
A (2-58)	637 - 648	678	617	15
B (2-59)	628 - 637	66	608	15

1/ The wave length limits within which shall lie the wave length where the transmittance is 37 percent (%) (this wave length is known as the "cut").
2/ The transmittance shall be 80% or greater from this wave length to 750 millimicrons.
3/ The transmittance shall be less than 0.5% at all shorter wave lengths.
4/ The difference between the wave lengths where transmittance is 15% and 60% is not greater than this value.

TABLE V. Transmittance wave length (grades C and D).

Grade (CS No.)	Nanometers			
	1/	2/	3/	4/
C (5-56)	555	49	no value	T 740 = T 530 ± 15
D (5-57)	514	40	no value	T 740 = T 519 ± 3

1/ Wave length at which transmission is 15.0 ± 0.7%
2/ The difference between the wave lengths at which the transmission is 15% and 60% shall be equal to the specified value within a tolerance of ± 5 millimicrons. This requirement is applicable in the blue portion of the spectrum.
3/ % transmission at wave length of 750 millimicrons.
4/ Transmittance (T) in % not corrected for surface reflection.

3.8 Workmanship. The workmanship shall be such as to insure a high quality product which is uniform and in conformance with this specification. The colored filter glass shall be free of dirt, foreign materials, cracks, or contaminants (see 4.8.2).

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order (see 6.2), 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 or witness 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 Responsibility for compliance. All items must 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 assuring that all products or supplies submitted to the Government for acceptance comply wih all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.1.2 Inspection equipment. Unless otherwise specified in the contract (see 6.2), the contractor is responsible for the provision and maintenance of all inspection equipment necessary to assure that supplies and services conform to contract requirements. Inspection equipment must be capable of repetitive measurements to an accuracy of 10% of the measurement tolerance. Calibration of inspection equipment shall be in accordance with MIL-STD-45662.

4.2 Classification of inspections:

a. First article inspection (see 4.4).
b. Quality conformance inspections (see 4.5).
   1. Examination (see 4.5.2).
   2. Tests (see 4.5.3).
c. Control tests (see 4.6).

4.3 Inspection conditions. Unless otherwise specified (see 6.2), all inspections shall be conducted under the following conditions:

a. Air temperature 23 ± 10°C
b. Barometric pressure 28.5 + 2.0 inches mercury (Hg)
   - 3.0
c. Relative humidity 50 ± 30 percent

4.4 First article inspection. Unless otherwise specified (see 6.2), the Government shall select samples produced under the production contract (see 6.2) for first article inspection. First article samples shall be inspected as specified in table VI. Approval of the first article sample by the Government shall not relieve the contractor of his obligation to supply samples that are fully representative of those inspected as a first article sample. Any changes or deviation of the production units from the first article sample shall be subject to the approval of the contracting officer.

TABLE VI. Classification of inspections.

Title	Requirement	Inspection	First article	Quality conformance		Control
				Examination	Tests	
Materials and construction	3.2	4.8.1	X		X	X
Defects (see table VII)	3.3 and 3.8	4.8.2	X	X		
Physical properties	3.4	4.8.3	X		X	X
Inclusions	3.5	4.8.4	X		X	
Coefficient of expansion	3.6.1	4.8.5.1	X		X	X
Transmittance wave length	3.7.1	4.8.6.1	X		X	X

4.4.1 First article inspection failure. Any deficiency found during, or as a result of the first article test shall be evidence that all items already produced prior to completion of the first article test are similarly deficient unless contrary evidence satisfactory to the contracting officer is furnished by the contractor. Such deficiencies on all items shall be corrected by the contractor. The Government shall not accept products until first article testing is completed to the satisfaction of the Government.

4.5 Quality conformance inspection.

4.5.1 Sampling.

4.5.1.1 Lot formation. An inspection lot shall consist of all the material manufactured during an identifiable production period, from one manufacturer, submitted at one time for acceptance.

4.5.1.2 Sampling for examination. Samples for quality conformance examination shall be selected in accordance with general inspection level II of MIL-STD-105.

4.5.2 Examination.

4.5.2.1 Acceptable quality level. Each sample selected in accordance with 4.5.1.2 shall be examined to determine conformance to the following acceptable quality levels (AQL).

Classification	AQL
Major	1.0
Minor	2.5

4.5.2.2 Classification of defects. For examination purposes, defects shall be classified as listed in table VII.

TABLE VII. Classification of defects.

Category	Defect	Method of examination
Critical	None	
Major	AQL 1.0% Defective	
101	Control thickness, out of tolerance (see 3.3 and table I).	SIE 1/
102	Faulty workmanship affecting performance (see 3.8).	Visual
Minor	AQL 2.5% Defective	
201	Faulty workmanship affecting appearance (see 3.8).	Visual

1/ SIE = Standard Inspection Equipment.

4.5.3 Test. Samples from each lot shall be subjected to the quality conformance tests specified in table VI.

4.6 Control tests. Unless otherwise specified (see 6.2), control tests shall be conducted on one unit from each lot of 200 units consecutively produced, except that not more than one test shall be performed in a 3-month period, nor less than one test in a 6-month period. The units shall be subjected to the tests specified in table VI.

4.7 Failure. Failure of any unit to pass any of the specified quality conformance or control tests shall be cause for the Government to refuse acceptance of the production quantity represented, until action taken by the contractor to correct defects and prevent recurrence has been approved by the Government.

4.8 Methods of inspection.

4.8.1 Materials and construction. Conformance to 3.2 shall be determined by inspection of contractor records providing proof or certification that design, construction, processing, and materials conform to requirements. Applicable records shall include drawings, specifications, design data, receiving inspection records, processing and quality control standards, vendor catalogs and certifications, industry standards, test reports, and rating data.

4.8.2 Defects. Conformance to 3.3 and 3.8 shall be determined by examination for the defects listed in table VII. Examination shall be visual, tactile, or by measurement with standard inspection equipment.

4.8.3 Physical properties. To determine conformance to 3.4, property values shall be determined as specified in table II.

4.8.4 Inclusions. To determine conformance to 3.5, the samples shall be tested in accordance with MIL-G-174.

4.8.5 Mechanical properties.

4.8.5.1 Coefficient of expansion. To determine conformance to 3.6.1, the coefficient of expansion values specified in table III shall be determined in accordance with ASTM E 228.

4.8.6 Optical properties.

4.8.6.1 Transmittance wave length. To determine conformance to 3.7, the transmittance wave length values specified in tables IV and V shall be determined by measurement with a spectrophotometer or equivalent for the visible region of the spectrum and with a spectrometer or equivalent for the ultraviolet and infrared regions of the spectrum.

5. PACKAGING

5.1 Preservation, packaging, packing, and marking. Preservation, packaging, packing, and marking for the desired level shall be in accordance with the applicable packaging standard or packaging data sheet specified by the contracting authority (see 6.2).

6. NOTES

6.1 Intended use. The colored filter glass furnished under this specification is intended for use in optical systems.

6.2 Ordering data. Acquisition documents should specify the following:

a. Title, number, and date of this specification.
b. Filter grade and color required (see 1.2).
c. If first article is not required (see 3.1).
d. If responsibility for inspection shall be other than as specified (see 4.1).
e. If responsibility for inspection equipment shall be other than as specified (see 4.1.2).
f. If inspection conditions shall be other than as specified (see 4.3).
g. If first article inspection is not required (see 4.4).
h. If control testing shall be other than as specified (see 4.6).
i. Selection of applicable level and packaging standard or packaging data sheet (see 5.1).

6.3 Definitions.

6.3.1 Control thickness. The control thickness is the allowable thickness within the specified range necessary to meet the filter requirements of a given color specification number.

6.3.2 Color specification number. The color specification number (C.S. No.) specifies the spectral transmittance of the polished filter within its control thickness range (see 3.3.1).

6.4 Subject term (key word) listing.

Colored Filter Glass
Filter Glass, Colored
Glass Filter

6.5 Changes from previous issue. Asterisks (or vertical lines) are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Custodians:
Army - AT
Air Force - 99
Navy - AS

Preparing activity:
Army - AT

(Project 9340-0068)

Review activities:
Air Force - 84
DLA - GS

User activity:
Army - MI

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
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b. ADDRESS *(Street, City, State, ZIP Code)*	☐ USER
	☐ 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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PREVIOUS EDITION IS OBSOLETE.

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NOTE: This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification 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.

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