Quality control

Material / Specification: MIL-G-174B optical glass
Range / Description: QC-MIL-G-174B

MIL-G-174B
5 December 1986
SUPERSEDING
MIL-G-174A
5 November 1963

MILITARY SPECIFICATION

GLASS, OPTICAL

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 optical glass to be used in the fabrication of optical elements. Requirements for special, class 2 (nonstandard), glass will be in accordance with the contract or purchase order.

1.2 Classification. Optical glass shall be of the following classes, grades, and forms (see 6.2):

Class 1 - Standard
Class 2 - Special
Grades - A, B, C, D (striae content)
Forms - Plates, slabs, formed pressings.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards and handbooks. Unless otherwise specified, the following specifications, standards, and handbooks 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

PPP-B-601	-	Boxes, Wood, Cleated Plywood.
PPP-B-621	-	Box, Wood, Nailed and Lock-Corner.
PPP-B-636	-	Box, Shipping, Fiberboard.
PPP-C-1752	-	Cushioning Material, Packaging, Unicellular Polyethylene Foam, Flexible.
PPP-C-1797	-	Cushioning Material, Resilient, Low Density, Unicellular, Polypropylene Foam.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document, should be addressed to: Commander, US Army Armament, Research and Development Center, ATTN: SMCAR-ESC-AS, Dover, New Jersey 07801-5001 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

MILITARY

MIL-P-116	-	Preservation, Methods of.
MIL-O-13830	-	Optical Components for Fire Control Instruments; General Specification Governing the Manufacture, Assembly and Inspection of.
MIL-P-17667	-	Paper, Wrapping, Chemically Neutral (Noncorrosive).
MIL-I-45208	-	Inspection Systems Requirements.

STANDARDS

MILITARY

MIL-STD-105	-	Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-129	-	Marking for Shipment and Storage.
MIL-STD-2073	-	DoD Material Procedures for Development and Application of Packaging Requirements.

2.1.2 Other Government documents. The following other Government documents form a part of this standard to the extent specified herein:

CODE OF FEDERAL REGULATIONS
Nuclear Regulatory Commission, Rules and Regulations Title 10 - Chapter I, Part 40.

(Application for copies should be addressed to Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.) Copies of specifications, standards, drawings, publications and other Government documents required by contractors 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 documents form a part of this standard to the extent specified herein. Unless otherwise specified, issues of documents which are DOD adopted shall be those listed in the issue of the DODISS specified in the solicitation. Issues of documents which have not been adopted shall be those in effect on the date of the cited DODISS.

ASTM

ASTM D 3951 - Standard Practice for Commercial Packaging.

(Application for copies of ASTM publications should be addressed to ASTM, 1916 Race Street, Philadelphia, PA 19103).

(Industry association specifications and standards are generally available for reference from libraries, technical groups and using Federal agencies).

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, 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 Materials. Materials used shall be capable of producing optical glass which conforms to the requirements for type, grade, and form as detailed in this specification and as specified by the applicable contract or purchase order (see 6.2).

3.1.1 Color. Optical glass shall be free of color to the extent that a standard white target shall appear unchanged in color when viewed through a thickness of 2 centimeters of all glasses having an index of refraction to 1.60 or less in the 589.3 nanometer (nm) sodium D line. The glass may appear slightly yellow or slightly green when viewed through a thickness of two centimeters of all glasses having an index of refraction greater than 1.60 in the 589.3 (nm) sodium D line.

3.1.2 Absorption. Optical glass with a refractive index of 1.60 or higher shall not absorb more than 2 percent of monochromatic radiation in a path length of one centimeter. Optical glass with a refractive index below 1.60 shall not absorb more than one percent of monochromatic radiation in a path length of one centimeter.

3.1.3 Radioactive material. Optical glass specified herein shall contain no thorium or other source material as defined in Title 10, Code of Federal Regulations, paragraph 40, in excess of 0.05 percent by weight or any other added radioactive material.

3.2 Class requirements. Optical glass shall conform to either standard or special class requirements. Glass shall be classified as standard class when it is production-type glass available from domestic sources, and it shall be so indicated by type name and number. Glass classified as special class shall be so indicated by type name and number followed by (S). When radiation protected glass is required, type designation shall be followed by (P).

3.3 Class 1 - standard.

3.3.1 Detail requirements. Detail requirements for standard glass shall be as specified herein.

3.3.2 Type name. Type name shall be specified by indicating the nonproprietary trade designation, or in the absence of such designation, the characteristic constituent of the glass.

3.3.3 Type number. Type number shall be specified by two sets of numbers separated by a dash. The first set shall consist of three numbers corresponding to the first three round digits after the decimal point of the refractive index of the glass for the sodium D line (589.3 nm). The second set after the dash shall consist of three numbers corresponding to the first three digits of the Abbe constant (see 3.3.5) (e.g., 1.511-63.5=511-635).

3.3.4 Index of refraction. Standard glass shall have an index of refraction correctly identified to the fourth decimal place, and shall conform to the nominal value specified in the contract within the following tolerances; below 1.600, ± 0.0010; from 1.600 to 1.730, ± 0.0015; and above 1.730, ± 0.0020.

3.3.5 Abbe constant. Standard glass shall have the Abbe constant correctly identified to the first decimal place, and shall conform to the nominal value specified in the contract within the following tolerances: below 30, ± 0.2; from 30 to 45, ± 0.3, between 45 and 55, ± 0.4; over 55, ± 0.5.

3.3.6 Partial dispersions. Standard glass shall conform to the partial dispersion values specified in the contract.

3.3.7 Strain. Distribution of permanent strain in standard glass shall be symmetrical, and the birefringence resulting from permanent strain shall not produce more than 10 millimicrons relative retardation or path difference per centimeter of transmitted sodium D light.

3.3.8 Striae grade requirements. Standard glass shall conform to Grade A, B, C or D as specified herein and in the contract.

3.3.8.1 Grade A. Grade A glass shall contain no visible striae, streaks, or cords when tested in accordance with methods specified herein.

3.3.8.2 Grade B. Grade B glass shall contain only striae which are light and scattered when viewed in the direction of maximum visibility and which are just above the limit of visibility when tested in accordance with methods specified herein.

3.3.8.3 Grade C. Grade C glass shall contain only striae which are light when viewed in the direction of maximum visibility, and are parallel to the face of the plate when tested in accordance with methods specified herein.

3.3.8.4 Grade D. Grade D glass shall contain more or heavier striae than contained in grade C. Striae shall be parallel to the face of the plate when tested in accordance with methods specified herein.

3.3.9 Required certified samples. The contractor shall prepare two sets of samples representing strain and grades of striae. These samples shall be submitted by the contractor to the activity specified herein for approval as certified calibrated samples (see 6.2). Approved samples will be returned to the contractor for use as inspection standards on present and future contracts.

3.3.10 Inclusions. Inclusions may be numerically classified from 0 to 50 as indicated in table I. The permissible total cross-section in (mm^2) per 100 (cm^3) volume resulting from the sum of all cross-sections in that volume shall be as specified in table I. The permissible number of maximum size inclusions shall be one per each cubic centimeter (cc) of glass provided the resulting cross-section, as specified in table I, is not exceeded. Inclusions smaller than the minimum size shall be disregarded.

3.3.10.1 Maximum size inclusion. Maximum permissible size of inclusions shall be as specified in table I.

3.3.10.2 Minimum size inclusion. Minimum size inclusions to be considered in evaluating the quantity of inclusions shall be as specified in table I.

TABLE I. Inclusions vs. cross-section area.

Inclusion no.	Maximum total cross-sec. area $mm^2/100cm^3$	Maximum size diameter millimeter (mm)	Minimum size diameter millimeter (mm)
0	0.03	0.20	0.06
1	0.12	0.39	0.06
2	0.25	0.57	0.06
3	0.50	0.80	0.06
5	0.20	0.05	0.02
10	0.80	0.10	0.03
15	1.80	0.15	0.05
20	3.15	0.20	0.05
30	7.10	0.30	0.10
40	12.60	0.40	0.10
50	19.70	0.50	0.10

3.3.11 Finish. Laps, folds, stones and fire cracks on formed pressings shall not be deeper than one-half the grinding stock specified in the applicable drawing or as detailed in table II, and shall not be so discolored as to interfere with the index of refraction measurement.

TABLE II. Finish.

Reticles, window	Edging stock on diameters	Grinding stock each surface
d < 76.2 mm	2.5, +0.5 mm	1.5, +0.5 mm
76.2 <= d <= 127.0 mm	3.8, +1.0 mm	1.5, +0.8 mm
d > 127.0 mm	As specified in drawing and contract.	
Lenses:		
When either r < 101.6 mm:		
d < 50.8 mm	2.5, +0.5 mm	1.5, +0.5 mm
50.8 <= d <= 76.2 mm	3.0, +0.8 mm	1.5, +0.8 mm
76.2 <= d <= 127.0 mm inclusive	5.1, +1.0 mm	1.5, +1.0 mm
When 101.6<= rs <=254.0 mm	6.1, +1.0 mm	1.5, +1.0 mm
When rs > 254.0 mm	7.9, +1.0 mm	1.5, +1.0 mm
d > 127.0 mm	As specified in drawing and contract.	
Prisms:		
Having all dimensions of 101.6 mm or less. Surface other than hypotenuse or clay.	2.5, +0.8 mm	
Hypotenuse or clay surface	4.6, +1.0 mm	
Any dimensions over 106.6 mm	As specified in drawing or contract.	

r= radius, rs= shorter radius, d= diameter
<= less than or equal to >= greater than or equal to

3.3.12 Form. Class 1 optical glass shall be supplied to the form specified in the contract.

3.3.12.1 Plates or slabs. Optical glass of this form shall be flat and reasonably square or rectangular, with sides not less than 50 mm or greater than 304 mm thick. If the width is no greater than 160 mm, then length up to 575 mm shall be permitted.

3.3.12.1.1 Dimensions. Optical glass in the form of plates or slabs shall have the thickness specified in the contract within the following tolerances: up to and including 20 mm thick, minus 0 to 2 mm; over 20 mm thick, minus 0 to plus 4.

3.3.12.1.2 Length. Length of usable glass shall not be less than 95 percent of the total length of the plate or slab.

3.3.12.1.3 Fractures. Vented fractures exceeding one centimeter in length and aiming toward the center of the plate shall be cause for rejection. Pressure or fire cracks deeper than 0.5 millimeter shall be cause for rejection.

3.3.12.2 Formed pressings. Optical glass of this form shall have the dimensions as specified in the drawing or contract.

3.3.12.2.1 Additional material. When drawings or finished optical elements are furnished, additional material for grinding stock shall be added to the dimensions of the finished elements. Surface stock for lens of prism blanks shall be measured from the lowest point of the "sink," i.e., the depression on the upper molded surface created by the cooling of the blank. Unless otherwise specified on the drawings, additional material for grinding stock shall be added as shown in table II.

3.4 Class 2 - special. Detail requirements for special glass shall be as specified (see 6.2).

3.5 Workmanship. All glass shall be fabricated and finished in a thorough, workmanlike manner and all manufacturing and processing operations shall be correctly performed. Glass shall be clean and free of burrs, cracks, chips, grease, or oil (except where specifically required). All required markings shall be neat, legible, and sharply defined.

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 purchase order, suppliers may use their 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.

4.1.1 General provisions. Quality assurance provisions of this specification and of other documents referenced herein form the basis for inspection to be performed by the supplier. Inspection shall be in

accordance with the requirements of MIL-I-45208 and MIL-O-13830.

4.2 Inspection provisions.

4.2.1 Inspection lot. Unless otherwise specified by the contracting officer, inspection lot size, formation, and presentation of lots shall be in accordance with "Submission of Product" as defined in MIL-STD-105. Optical glass produced by the pot method shall be considered a lot resulting from each melt and annealing. When a lot is not identifiable from a melt, or the optical glass is produced by the continuous process, the lot shall not consist of more than 500 pounds of material offered for delivery at one time.

4.2.2 Conformance inspection. Conformance inspection shall be performed for all requirements specified in sections 3 and 5.

4.2.2.1 Plates, slabs or formed pressings. Unless otherwise specified, 100 percent inspection shall be performed for all requirements herein. Rejection of more than 10 percent by weight of a specific lot shall be cause for rejection of the entire lot.

4.2.2.2 Sampling.

4.2.2.2.1 Melts. When glass is produced by the melts method, one sample representing the lot (melt) shall be used for acceptance inspection.

4.2.2.2.2 Continuous process. When glass is produced by the continuous process, five samples shall be drawn for acceptance inspection from each lot produced (see 4.2.1) unless otherwise specified (see "Note" under 4.4.4).

4.2.2.3 Requirements and test procedures. Table III lists characteristics, requirements, and tests constituting conformance inspection of optical glass covered by this specification.

TABLE III. Requirements and tests

Characteristics	Requirement	Test procedure
Materials	3.1	Visual
Color	3.1.1	4.4.1
Absorption	3.1.2	4.4.2
Radioactive material	3.1.3	4.4.10
Class requirements	3.2	Visual
Type name and number	3.3.2 and 3.3.3	Visual
Index of refraction	3.3.4	4.4.3
Abbe constant	3.3.5	4.4.4
Partial dispersions	3.3.6	4.4.4.1
Strain	3.3.7	4.4.5
Striae (Grades A, B, C, and D)	3.3.8.1 to 3.3.8.4	4.4.6
Required samples (standards)	3.3.9 and 6.2	4.4.7
Inclusions	3.3.10, 3.3.10.1, and 3.3.10.2 w/table I	4.4.8
Finish	3.3.11 (w/table II)	4.4.9
Form	3.3.12	Per contract
Plates or slabs	3.3.12.1	Std. meas. Equip. (SME)
Dimensions	3.3.12.1.1	SME
Length	3.3.12.1.2	SME
Fractures	3.3.12.1.3	Visual-SME
Formed pressings	3.3.12.2	Visual-SME
Additional material	3.3.12.2.1	Visual-SME
Class 2 - special	3.4 and 6.2	Visual-contract
Workmanship	3.5	Visual

4.2.2.4 Disposition of nonconforming product. Rejected lots shall be screened for all defective characteristics. Removal or correction of defective units and resubmittance of rejected lots shall be in accordance with "Acceptance and Rejection" as specified in MIL-STD-105.

4.3 Inspection equipment. Except as otherwise provided in the contract, the contractor shall furnish and maintain all required measuring and testing equipment in accordance with the "Inspection Equipment" requirement of MIL-I-45208. The Government reserves the right to use the test equipment for its own independent inspections to the extent that such use will not unduly interfere with the contractor's delivery schedule.

4.3.1 Government furnished inspection equipment. Where the contract provides for Government furnished test equipment, care and maintenance of that equipment shall be in accordance with "Inspection Equipment" and "Government Furnished Material" requirements of MIL-I-45208.

4.3.2 Contractor furnished inspection equipment.

4.3.2.1 Government design. All inspection equipment required by the drawings and forming a part of the contract but not provided by the Government, shall be supplied by the contractor. Alternate designs may be substituted only as specified in "Inspection Provisions" of MIL-I-45208.

4.3.2.2 Contractor design. The contractor shall design and supply inspection equipment compatible with the test methods and procedures specified in 4.4. Concept, construction, materials, dimensions, and tolerances used in design of test equipment shall be selected and controlled to ensure that test equipment will provide positive rejection of a product which exceeds the prescribed tolerance limit, and will reliably indicate acceptability of a product which does not exceed 90 percent of the prescribed tolerance limit. Construction shall be designed to facilitate routine calibration of the equipment.

4.4 Test methods and procedures.

4.4.1 Color. To determine conformance with 3.3.1, glass shall be inspected with a photometer to determine transmissivity of white light. A white target and illuminant shall be utilized for this test. To inspect the glass for compliance within the limits of slightly yellow or slightly green, the contractor shall request a comparison standard of these colors from the Government. Comparison can be determined by a colorometer to determine conformance with 3.1.1.

4.4.2 Absorption. Light absorption shall be determined by measurement in white light. A spectro-photometer shall be used to determine transmittance for the 589.3 nm sodium D line. Absorption shall be determined as follows:

$$OC = -\ln \frac{T}{\frac{(1-R)^2}{t}}$$

Where: OC = absorption per centimeter
T = transmittance for the 589.3 nm sodium D line
R = calculated Fresnel reflectance at a boundary between air and glass as defined by:

$$R = \left[\frac{N_D - 1}{N_D + 1}\right]^2$$

t = measured thickness of the sample

4.4.3 Index of refraction. Index of refraction can be obtained by immersion of a sample of glass in a transparent glass receptacle containing a mixture of bromonapthalene and mineral oil. When the sample is first observed to disappear, a sample of the solution shall read on a refractometer, and the readings shall be within the limits of 3.3.4. The sample for this test shall be obtained by cutting a corner of convenient size from the material to be tested. One end of the cut corner shall be sharp at approximately 90 degrees, and one side adjacent to this end shall be polished.

4.4.4 Abbe constant. Abbe constant as required by 3.3.5 shall be inspected by means of an Abbe refractometer, using a daylight source but calibrated to read directly in "nd" (refractive index) when determining the refractive index for sodium light. A set of standard tables are used to check the "v" (Abbe) values. An accurate check of the v— value can be made with a monochromatic light source and can be measured for the C (red) and F (blue) lines of hydrogen. One sample per batch, melt, or lot is sufficient for the refractive index and dispersive power which can be checked to 0.00002.

Note. When material is supplied in formed pressings or continuous production and the blanks can not be identified by the melt of glass from which they are made, the refractive index (4.4.3) and Abbe constant (4.4.4) tests shall be conducted on representative samples as follows:

No. in lot size	Sample size	No. defects to reject lot
0 - 25	100%	-
26 - 180	25	1
181 - 500	40	2
500 - over	110	3

4.4.4.1 Partial dispersions. Test for partial dispersions shall be performed with the test for Abbe constant (see 4.4.4) to determine conformance with 3.3.6. Values shall be as specified in 6.2.

4.4.5 Strain.

4.4.5.1 Plates and slabs. Each plate or slab of optical glass which is not to be subjected to a further annealing process shall be inspected for

amount and symmetry of strain. A standard polariscope with a sensitive tint plate and calibrated strain disks shall be used. Standard glass shall be accompanied by an annealing record which certifies that it has been sufficiently annealed to comply with the requirements of 3.3.7. The contractor shall furnish samples having known amounts of strain to aid the judgment of the inspector. These samples shall be subject to approval by the Government prior to processing. Size of each sample shall be sufficient to perform strain tests and analysis without limitations.

4.4.5.2 Formed pressings. Formed blanks shall be inspected for amount and symmetry of strain. A standard polariscope with a sensitive tint plate and calibrated strain disks shall be used. Blanks weighing more than one-half pound (226.8 grams) or larger than 102 mm in any dimension shall receive 100 percent inspection for strain. Unless otherwise specified, all other blanks shall be sampled as specified under "Note" in 4.4.4.

4.4.6 Striae

4.4.6.1 Plates, slabs or formed pressings. Each plate, slab or formed pressing shall be inspected for striae by method 2 as detailed below whenever possible. Method 1, as detailed below, will only be used when the refractive index of the glass cannot be matched by an immersion liquid or when the size of the sample makes immersion unfeasible. In all cases, evaluation of striae content shall be made in the direction perpendicular to the direction of intended use, if known, or in the direction of maximum light path.

4.4.6.2 Striae test method 1. A striaescope shall be utilized for this test as illustrated in figure 1. S is a light source, D is a diffusion screen of finely ground glass, A is a pinhole aperture at the rear focus of the L1 collimating achromatic lens, and B is a moveable cross slit in the rear focal plane of the L2 objective lens. The sample to be inspected is placed at P with its polished surfaces normal to the line of sight. Deflection and shift of light which may result from the slight out-of-parallel condition of the polished surfaces can be compensated for by the movable cross slit, which must be adjusted until the sample appears in half shadow. In this position, striae can be detected by tilting or moving the sample across the field.

4.4.6.3 Striae test method 2. As illustrated in figure 2, S is a monochromatic light source, D is a diffusion screen of finely ground glass, A is a pinhole aperture at the rear focus of the L1 collimating lens, and B is a movable cross slit in the focal plane of the L2 lens. An optical cell, filled with a suitable immersion liquid having the same refractive index as the sample to be tested for the particular wavelength used, is placed between the lenses. The sample to be inspected is immersed in the liquid, and striae can be detected by moving or tilting the sample.

4.4.7 Required samples (standards). The contractor shall provide samples for inspection of strain and striae content in conformance with 3.3.9. The samples, after approval as required by 3.3.9 and 6.2.(g), shall be used as inspection standards for final acceptance inspection of samples submitted for strain and striae quality.

4.4.8 Inclusions. Examination for optical quality shall be made to determine the number of inclusions permissible per each 100 cc of glass as specified in 3.3.10. Minimum size necessary to be considered for acceptance

or rejection, and the maximum size permissible, shall be as specified in table I. A comparison standard representing inclusion numbers should be utilized to determine sizes and quantity in compliance with 3.3.10. Inspection equipment fixture capable of best determining size of inclusions is shown in figure 3, and is suitable for both methods of inspection defined below.

4.4.8.1 Method 1. As illustrated in figure 3, the sample to be inspected is illuminated by a beam of light from the side, and viewed normally against a dark background. Inclusions will appear as bright specks on a dark field. This test method is preferred when the sample has two polished surfaces.

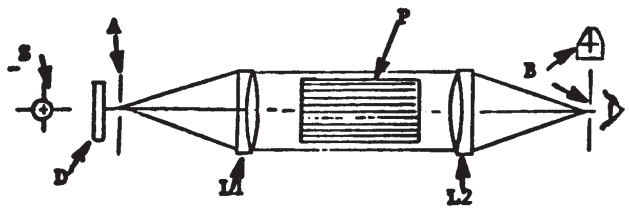
4.4.8.2 Method 2. Sample to be inspected shall be immersed in an optical cell containing a liquid having the same refractive index as the sample. The sample is illuminated by a beam of light from the side, and viewed normally against a dark background in the same manner as shown in figure 3. This test method is preferred when the sample does not have two adequately polished surfaces.

4.4.9 Finish. Examination of optical glass for quality of finish shall be performed to determine compliance with 3.3.11. A visual examination for laps, folds, stones, cracks, and other types of surface marks shall be made. When detected, they shall be measured with standard measuring equipment to determine acceptance or rejection in conformance with the intended use as specified in Table II, or as otherwise specified on drawings. Obvious discoloration shall be considered unacceptable.

4.4.10 Radioactive material. Finished glass shall be tested by X-ray spectrometer fluorescence techniques, or an approved alternate, for compliance with 3.1.3. Equipment and method used in performing X-ray fluorescence must have a minimum detectable level for thorium and other source material of less than 100 parts per million (ppm) with an accuracy of ± 25 ppm. Certified glass standards of the same composition with added source material will be used to calibrate the spectrometer. Should analysis show a source material concentration greater than 0.05% by weight (500 ppm) for any sample, all glass in the lot from which the sample was obtained shall be rejected.

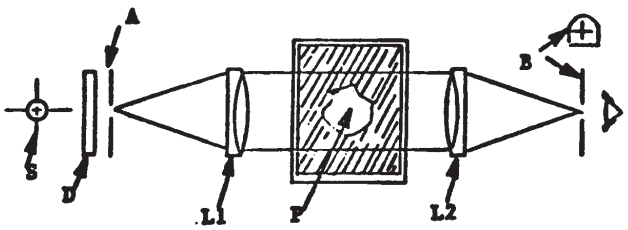
4.4.11 Packaging, packing and marking. Examination for packaging, packing and marking to determine compliance with section 5 shall be as follows:

Characteristic	Requirement	Test procedure
Plates or slabs	5.1.1	Visual-spring scale
Formed blanks	5.1.1	Visual-spring scale
Packing	5.2	Visual
Level A	5.2.1	Federal Specifications PPP-B-601 and PPP-B-621
Level B	5.2.2	Visual-spring scale
Commercial	5.2.3	ASTM D3951
Marking	5.3, 5.3.1	Visual



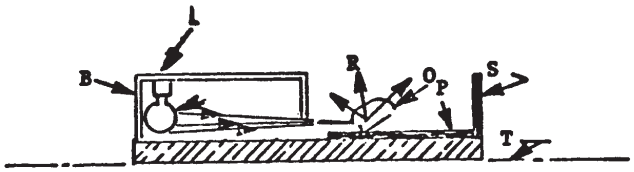
A - Pin hole aperture
B - Movable cross slit
D - Diffusion screen
L1 - Collimating achromatic lens
L2 - Objective lens
P - Sample of optical class
S - Light source

Figure 1. Striae inspection system - Method 1 (side view).



A - Pin hole aperture
B - Movable cross slit
D - Diffusion screen
L1 - Collimating lens
L2 - Objective lens
P - Sample in liquid filled cell
S - Monochromatic light source

Figure 2. Striae inspection system - Method 2.



B. Box
L. Lamp (100 watts)
O. Optical blank
P. Black paper
R. Rays scattered by bubbles and defects
S. Shield
T. Table

Figure 3. Quality inspection device.

5. PACKAGING

5.1 Preservation. Preservation shall be levels A, C, or commercial (see 6.2).

5.1.1 Level A.

5.1.1.1 Cleaning. Cleaning shall be in accordance with appendix F of MIL-STD-2073.

5.1.1.2 Drying. Drying shall be in accordance with appendix F of MIL-STD-2073.

5.1.1.3 Preservation application. Unless otherwise specified, optical glass shall be preserved in accordance with MIL-P-116. Glass shall be wrapped in nonabrasive, chemically inert tissue conforming to MIL-P-17667, over wrapped with cushioning material conforming to PPP-C-1797, and secured with tape. If the glass weighs more than 20 pounds, wrap shall be as required above and cushioned with material conforming to PPP-C-1752. Packaging shall be one each in unit containers consisting of fiber board boxes built in accordance with PPP-B-636.

5.1.2 Level C. Unless otherwise specified, level C requirements are as shown for level A except that the barrier bag is omitted.

5.1.3 Commercial. Unless otherwise specified, requirements shall be in accordance with ASTM D3951.

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

5.2.1 Level A. When required, shipment of not more than 10 pounds, consisting of only one type and size of preserved optical glass plates, slabs, or formed blanks packed as specified in 5.1.1, shall be packed in overseas cleated plywood or mailed wood boxes conforming to PPP-B-601 or PPP-B-621.

5.2.2 Level B. Preserved glass shall be packed in a weather resistant fiber board box conforming to PPP-B-636 (special requirements) when weight and cube permit, otherwise a domestic type and class of cleated plywood or nailed wood box conforming to PPP-B-601 or PPP-B-621 shall be used.

5.2.3 Level C. Preserved glass shall be packed in a domestic fiber board box conforming to PPP-B-636, style optional, special requirements.

5.2.4 Commercial. Preserved glass shall be packed in accordance with ASTM D3951.

5.3 Marking. Each packaged item and shipping container shall be marked in accordance with MIL-STD-129.

5.3.1 Shipping containers. Shipping containers shall be marked with the 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. Optical glass covered by this specification is intended for the manufacture of optical elements, assemblies, and systems used in optical instruments, optical sighting and ranging equipment, and similar military equipment utilizing visual optics.

6.2 Ordering data. Procurement documents should specify the following:

(a) Title number, and date of this specification
(b) Class (see 3.2)
(c) Grade (see 3.3.8)
(d) Form, size, and quantity (see 3.3.12 and 3.3.9)
(e) Partial dispersion values (see 3.3.7)
(f) Detail requirements for class 2 special glass
(g) Where to submit standard samples (see 3.3.9)
(h) Selection of applicable levels of packaging and packing (see 5.1 and 5.2)

6.3 Suggested features to be included in the contract.

6.3.1 Other characteristics. Physical properties of the required optical glass should be specified in the applicable contract or purchase order. These physical properties may consist of, but are not limited to, the following: coefficient of expansion, softening point, annealing point, density, specific gravity, strain point, and requirements for resistance to weather and acid conditions.

6.3.2 Radiation resistant optical glass. Optical glass resistant to gamma radiation should be designated in the applicable contract or purchase order by adding the suffix (P) meaning protected, to the type name.

6.3.3 Material for selected spectrum use. Optical glass intended for use in the visible spectrum where selective absorption is a critical factor should have that pertinent characteristic specified by C.I.E. tristimulus values in the contract, detailed specification, or purchase order. Optical glass intended for use outside the visible spectrum should have transmittance or absorptance values specified in the applicable contract or purchase order.

6.4 Definitions. Words, terms, and expressions used in this specification which are peculiar to the general field of optics are defined in MIL-STD-1241, "Optical Terms and Definitions." Terms peculiar to this specification are defined below:

6.4.1 Production-type glass. Production-type glass is defined as glass for which mix and quality control data are sufficiently established to repeatedly obtain characteristics as specified in the contract or purchase order without additional charges for its manufacture.

6.4.2 Limits of visibility. Defects smaller than 0.03mm average diameter, when viewed with the unaided eye, are considered to be beyond the limits of visibility.

6.5 Subject term (key word) listing.

Abbe constant

Absorption
Cleaning
Color
Commercial
Conformance inspection
Dimensions
Drying
Finish
Fire cracks
Folds
Formed pressings
Government furnished equipment
Inclusions
Index of refraction
Laps
Limits of visibility
Marking
Materials
Meets
Optical glass
Packaging
Packing
Partial dispersions
Plates
Preservation
Radioactive
Required certified samples
Sampling
Slabs
Special
Standard
Stones
Strain
Striae content
Striaescope
Transmissivity
Type
Workmanship

6.6 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 - AR
Navy - OS
Air Force - 99

Review Activities:
Army - AV, EA, MI

Preparing activity:
Army - AR

Project 6650-0141