

DD-G-451D
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SUPERSEDING
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FEDERAL SPECIFICATION

GLASS, FLOAT OR PLATE, SHEET, FIGURED
(PLAT, FOR GLAZING, MIRRORS AND OTHER USES)

This specification was approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal agencies.

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers the requirements for cut sizes of flat glass for glazing, mirrors and other uses.

1.2 Classification. Glass shall be of the following types, classes, qualities, styles, and forms, as specified (see 6.2):

Type I - Primary glass (float or plate or sheet).

Class 1 - Transparent.

Quality q1 - Mirror select.
q2 - Mirror.
q3 - Glazing select.
q4 - Glazing A.
q5 - Glazing B.
q6 - Greenhouse.

Class 2 - Heat absorbing and light reducing.

Quality q3 - Glazing select.
q4 - Glazing A.
q5 - Glazing B.

Style A - Higher light transmission.
B - Lower light transmission.

Class 3 - Light reducing, tinted.

Quality q3 - Glazing select.
q4 - Glazing A.
q5 - Glazing B.

Type II - Rolled, flat.

Class 1 - Translucent.
2 - Heat absorbing.

Style A - Higher light transmission.
B - Lower light transmission.

Class 3 - Light reducing, tinted.

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Forms (classes 1, 2, and 3).

Form 1 - Wired, polished both sides.
 2 - Wired and figured.
 3 - Figured.

Quality q7 - Decorative.
 q8 - Glazing.

Finish f1 - Figured one side.
 f2 - Figured both sides.

Mesh (forms 1 and 2):

m1 - Diamond.
 m2 - Square.
 m3 - Parallel strand.
 m4 - Special.

Pattern (forms 2 and 3):

p1 - Linear.
 p2 - Geometric.
 p3 - Random.
 p4 - Special.

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issues in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

Federal Specifications:

PP-S-781 - Steel, Strapping, Flat.
 PPP-B-601 - Boxes, Wood, Cleated-Flywood.
 PPP-B-621 - Boxes, Wood, Nailed and Lock-Corner.
 PPP-F-320 - Fiberboard; Corrugated and Solid, Sheet Stock (Container Grade), and Cut Shapes.

Federal Standard:

Fed. Std. No. 123 - Marking for Shipment (Civil Agencies).

(Activities outside the Federal Government may obtain copies of Federal Specifications, Standards, and Handbooks as outlined under General Information in the Index of Federal Specifications and Standards and at the prices indicated in the Index. The Index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

(Single copies of this specification and other Federal Specifications required by activities outside the Federal Government for bidding purposes are available without charge from Business Service Centers at the General Services Administration Regional Offices in Boston, New York, Washington, DC, Atlanta, Chicago, Kansas City, MO, Fort Worth, Denver, San Francisco, Los Angeles, and Seattle, WA.

(Federal Government activities may obtain copies of Federal Specifications, Standards, and Handbooks and the Index of Federal Specifications and Standards from established distribution points in their agencies.)

Military Standards:

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
 MIL-STD-129 - Marking for Shipment and Storage.

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(Copies of Military Specifications and Standards required by contractors 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 a specific issue is identified, the issue in effect on date of invitation for bids or request for proposal shall apply.

National Motor Freight Traffic Association, Inc., Agent:

National Motor Freight Classification.

(Application for copies should be addressed to the American Trucking Associations, Inc., Traffic Department, 1616 P Street, N.W., Washington, DC 20036.)

Uniform Classification Committee, Agent:

Uniform Freight Classification.

(Application for copies should be addressed to the Uniform Classification Committee, Room 1106, 222 South Riverside Plaza, Chicago, IL 60606.)

3. REQUIREMENTS

3.1 Material. Glass shall be a fused inorganic substance made from a mixture of natural silica sand and two or more alkaline salts such as soda, lime, or potash.

3.2 Types I and II.

3.2.1 Edges. Edges shall be cut, ground, swiped, seamed, ground and polished, beveled, or mitred, as specified (see 6.2).

3.2.2 Marking. Unless otherwise specified (see 6.2), each light of glass, except when recut, shall be labeled with the manufacturer's name or brand, the quality of the glass, and the nominal thickness designation.

3.3 Type I, primary glass (float, plate or sheet).

3.3.1 Dimensional tolerances, classes 1, 2, and 3. Tolerances for length, width, and thickness shall be in accordance with table I (see 6.2).

3.3.2 Defects in primary glass. Defects shall be not greater than those listed in tables II, III, and IV.

3.3.2.1 Reference notes for tables II, III, and IV. Reference notes are as follows:

- (a) Separated by at least 12" (30.5cm).
- (b) Separated by at least 24" (61.0mm).
- (c) The central area is considered to form an oval or circle centered on the light whose axes or diameters do not exceed 80 percent of the overall dimension. The remaining area is considered the outer area.
- (d) The central area is considered to form an oval or circle centered on the light whose axes or diameters do not exceed 50 percent of the overall dimension. The remaining area is considered the outer area.

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- (e) Intensity - scratches, rubs, and crush. When looking through the glass and perpendicular to it using daylight without direct sunlight or with background light suitable for observing each type of defect, the defects shall not be detectable at distances greater than the following, except for heavy intensity (see 4.3.3):

<u>Intensity</u>	<u>Distance</u>
Paint	8 inches (20.3cm)
Light	3 feet (91.4cm)
Medium	11 feet (3.35m)
Heavy	> 11 feet (3.35m)

- (f) Intensity - process surface defects. When viewed in normal reflected light, the defects are classified as follows:

Paint - visible only to the trained eye.
 Light - just noticeable.
 Medium - visible as a slight grayish haze.
 Heavy - readily visible as a cloudy surface.

- (g) Vision interference angle (see 4.3.2).

- (h) Intensity - ream, strings, lines and other linear distortion. When evaluated using the shadowgraph, the intensities of these defects are defined as having a shadowgraph readout at distances greater than or equal to the following (see 4.4.4):

<u>Intensity</u>	<u>Minimum distance</u>
Light	3 inches (7.6cm)
Medium	2 inches (5.1cm)
Heavy	1 inch (2.5cm)

- (i) Intensity - wave. When evaluated using the shadowgraph, the intensities of wave are defined as having shadowgraph readouts at distances greater than or equal to the following (see 4.4.4):

<u>Intensity</u>	<u>Minimum distance</u>
Medium	10 inches (25.4cm)
Heavy	6 inches (15.2cm)

- (j) Gaseous inclusions, knots, dirt, and stones may be round or elongated. For elongated defects of this type(s) the maximum size specified shall be determined by adding the length and width of the defect and dividing by two
- $$\frac{(L + W)}{2}$$

- (k) For defects of a smaller size or of less intensity, the minimum separation shall be proportionately less. The larger of the two defects shall govern the separation. Defects not specifically mentioned shall be compared to the defect they closely resemble.

- (l) Glass greater than 6.0mm (1/4") in thickness may contain proportionally more and larger defects.

3.3.3 Quality q6, greenhouse. Glass may contain defects of any size or intensity but shall contain no stones which may cause spontaneous breakage.

TABLE I. Dimensional tolerance for rectangular shapes of transparent Primary Glass (Float, Plate or Sheet).

Thickness			Tolerance						Generally Available in the Following Qualities
Nominal Decimal Inch	Traditional Designation	Metric Designation	Thickness Range		Length and Width Cut Sizes				
			Inch	mm	Inch	mm			
							Min.	Max.	
0.04 "	Micro/Slide	1.0mm	0.031	0.049	0.79	1.24	1/16"	1.6	q4,q5
0.06	Photo	1.5mm	0.050	0.070	1.27	1.78	1/16	1.6	q4,q5
0.08	Picture	2.0mm	0.071	0.084	1.80	2.13	1/16	1.6	q4,q5
0.09	Single	2.5mm	0.085	0.101	2.16	2.57	1/16	1.6	q1,q2,q4,q5
0.11	Lami	2.7mm	0.102	0.114	2.59	2.90	1/16	1.6	q4,q5
0.12	Double-1/8"	3.0mm	0.115	0.134	2.92	3.40	1/16	1.6	q1,q2,q3,q4,q5,q6
0.16	5/32"	4.0mm	0.149	0.165	3.78	4.19	1/16	1.6	q3,q4,q5
0.19	3/16"	5.0mm	0.180	0.199	4.57	5.05	1/16	1.6	q1,q2,q3,q4,q5
0.21	7/32"	5.5mm	0.200	0.218	5.08	5.54	1/16	1.6	q3,q4,q5
0.23	1/4"	6.0mm	0.219	0.244	5.56	6.20	1/16	1.6	q1,q2,q3
0.32	5/16"	8.0mm	0.252	0.332	7.42	8.43	5/64	3.0	q3
0.39	3/8"	10.0mm	0.355	0.406	9.02	10.31	3/32	2.4	q3
0.49	1/2"	12.0mm	0.469	0.531	11.91	13.49	1/8	3.2	q3
0.63	5/8"	16.0mm	0.594	0.656	15.09	16.66	5/32	4.0	q3
0.75	3/4"	19.0mm	0.719	0.781	18.26	19.84	3/16	4.8	q3
0.87	7/8"	22.0mm	0.844	0.906	21.44	23.01	7/32	5.6	q3
1.00	1"	25.0mm	0.969	1.031	24.61	26.19	1/4	6.4	q3
1.23	1-1/4"	32.0mm	1.125	1.375	28.58	34.93	5/16	7.9	q3

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Table 1L Primary glass (float or plate or sheet), type I, class I, qualities q1 and q2, maximum allowable defects for thicknesses 6.0mm (1/4") or less (1).

Defects	q1 Mirror Select Quality				q2 Mirror Quality	
	Up To 25 Square Feet		Over 25 Square Feet		Centrald	Outerd
	Centralc	Outerc	Centralc	Outerc		
Gaseous Inclusionsj	1/32 inch ^{a,k} (0.8mm)	3/64 inch ^{a,k} (1.2mm)	3/64 inch ^{a,k} (1.2mm)	1/16 inch ^{a,k} (1.6mm)	1/4 inch ^{b,k} (6.4 mm)	1/4 inch ^{b,k} (6.4 mm)
Open or Translucentj Gaseous Inclusions	None	1/64 inch ^{a,k} (0.4mm)	1/64 inch ^{a,k} (0.4mm)	1/32 inch ^{a,k} (0.8mm)	1/4 inch ^{b,k} (6.4mm)	1/4 inch ^{b,k} (6.4mm)
Knots, Dirt & Stonesj	None	1/64 inch ^{a,k} (0.4mm)	1/64 inch ^{a,k} (0.4mm)	1/32 inch ^{a,k} (0.8mm)	1/32 inch ^{b,k} (0.8mm)	1/32 inch ^{b,k} (0.8mm)
Scratches and Rubs	Faint ^e < 6" (15.2cm)	Light ^e < 6" (15.2cm)	Faint ^e	Light ^e	Light ^e < 6" (15.2cm)	Light ^e < 6" (15.2cm)
Crush	None	None	Faint ^{b,k} < 1/2 inch (12.7 mm)	Faint ^{b,k} < 3/4 inch (19.0 mm)	Light ^{b,k} < 1/4 inch (6.4 mm)	Light ^{b,k} < 1/4 inch (6.4 mm)
Digs	None	None	1/64 inch ^b (0.4mm)	1/32 inch ^b (0.8mm)	1/4 inch ^b (6.4 mm)	1/4 inch ^b (6.4 mm)
Ream, Strings, Lines & Other Linear Distortion	30°g or Light ^h	30°g or Light ^h	30°g or Light ^h	30°g or Light ^h	45°g or Medium ^h	45°g or Medium ^h
Wave	Medium ⁱ	Medium ⁱ	Medium ⁱ	Medium ⁱ	Medium ⁱ	Medium ⁱ
Process Surface Defects	Faint ^f	Light ^f	Faint ^f	Light ^f	Light ^f	Light ^f

Reference Notes (see 3.3.2.1)

Table III. Primary glass (float or plate or sheet), type I, classes 1, 2, and 3, quality q3, maximum allowable defects for thickness 5.0mm (1/4") or less (1).

Defects	q3 Glazing Select Quality					
	Up to 25 Square Feet		25 to 75 Square Feet		Over 75 Square Feet	
	Central ^c	Outer ^c	Central ^c	Outer ^c	Central ^c	Outer ^c
Gaseous Inclusions ⁱ	1/16 inch ^{a,k} (1.6mm)	3/32 inch ^{a,k} (2.4mm)	1/8 inch ^{a,k} (3.2mm)	3/16 inch ^{a,k} (4.8mm)	1/4 inch ^{a,k} (6.4mm)	1/4 inch ^{a,k} (6.4mm)
Open or Trans- lucent Gaseous Inclusions ^j	3/64 inch ^{a,k} (1.2mm)	1/16 inch ^{a,k} (1.6mm)	3/64 inch ^{a,k} (1.2mm)	1/16 inch ^{a,k} (1.6mm)	1/4 inch ^{a,k} (6.4mm)	1/4 inch ^{a,k} (6.4mm)
Knots, Dirt & Stones ^j	1/64 inch ^a (0.4mm)	1/32 inch ^a (0.8mm)	1/16 inch ^a (1.6mm)	1/16 inch ^a (1.6mm)	1/8 inch ^a (3.2mm)	1/8 inch ^a (3.2mm)
Scratches & Rubs	Medium ^e	Medium ^e	Medium ^e	Heavy ^e	Heavy ^e	Heavy ^e
Crush	Medium ^e < 1/16 inch ^b (1.6mm)	Medium ^e < 3/32 inch ^b (2.4mm)	Medium ^e < 1/8 inch ^b (3.2mm)	Heavy ^e < 3/16 inch ^b (4.8mm)	Heavy ^e < 1/4 inch ^b (6.4mm)	Heavy ^e < 1/4 inch ^b (6.4mm)
Digs	1/16 inch ^b (1.6mm)	3/32 inch ^b (2.4mm)	1/8 inch ^a (3.2mm)	3/16 inch ^a (4.8mm)	1/4 inch ^a (6.4mm)	1/4 inch ^a (6.4mm)
Ream, Strings, Lines & Other Linear Distortion	45°g or Medium ^h		90°g or Heavy ^h		90°g or Heavy ^h	
Wave	Medium ⁱ	Medium ⁱ	Medium ⁱ	Heavy ⁱ	Heavy ⁱ	Heavy ⁱ
Process Surface Defects	Medium ^f	Medium ^f	Medium ^f	Heavy ^f	Heavy ^f	Heavy ^f

Reference Notes: (see 3.3.2.1)

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Table IV. Primary glass (float, plate or sheet), type I, classes 1, 2, and 3, qualities q4 and q5, maximum allowable defects for thickness 6.0mm (1/4") or less (1).

Defects	q ⁴ Glazing A		q ⁵ Glazing B	
	Central ^d	Outer ^d	Central ^d	Outer ^d
Gaseous inclusions ^j	1/4 inch ^{a,k} (6.4mm)	1/2 inch ^{a,k} (12.7mm)	1/2 inch ^{a,k} (12.7mm)	3/4 inch ^{a,k} (19.0mm)
Open or translucent ^j Gaseous inclusions	1/4 inch ^{b,k} (6.4mm)	1/4 inch ^{b,k} (6.4mm)	1/4 inch ^{b,k} (6.4mm)	1/4 inch ^{b,k} (6.4mm)
Knots, dirt & ^j Stones	1/32 inch ^{b,k} (0.8mm)	1/16 inch ^{b,k} (1.6mm)	1/16 inch ^{b,k} (1.6mm)	1/8 inch ^{b,k} (3.2mm)
Scratches and rubs	Light ^e	Light ^e	Medium ^e	Medium ^e
Crush	Light ^e < 1/4 inch ^b (6.4mm)	Light ^e < 1/2 inch ^b (12.7mm)	Medium ^e < 1/2 inch ^b (12.7mm)	Medium ^e < 3/4 inch ^b (19.0mm)
Digs	1/4 inch ^b (6.4mm)	1/2 inch ^b (12.7mm)	1/2 inch ^b (12.7mm)	3/4 inch ^b (19.0mm)
Ream, strings, lines and other linear distortion	30°g or Light ^h		90°g or Heavy ^h	
Wave	Medium ⁱ	Medium ⁱ	Heavy ⁱ	Heavy ⁱ
Process surface Defects	Medium ^f	Medium ^f	Heavy ^f	Heavy ^f

Reference Notes: (see 3.3.2.1)

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3.4 Type II, rolled.3.4.1 Forms, classes 1, 2, and 3.3.4.1.1 Forms 1 and 2 wired.

3.4.1.1.1 Thickness and dimensional tolerances. The allowable tolerances for rectangular shapes shall be plus or minus 1/16 inch (1.6mm) for each 1/8 inch (3.2mm) of nominal thickness. Thickness, and tolerance on thickness shall be in accordance with table V (see 6.2).

TABLE V. Thickness and tolerance for wired glass

Thickness		Tolerance Thickness			
		Plus		Minus	
Inch	mm	Inch	mm	Inch	mm
7/32a	5.6	1/32	0.8	1/64	0.4
1/4	6.4	3/64	1.2	0	0
3/8	9.5	1/64	.4	3/64	1.2

a - Never approved by Underwriters' Laboratories for fire resistance.

3.4.1.1.2 Wire and mesh. Diameter of wires shall be $0.020 + .005 - .003$ inch ($0.51 + 0.13 - 0.08$ mm). Discoloration and slight distortion of wire is permissible.

- (a) Mesh m1, Diamond, shall be welded. Openings in the mesh shall not exceed 1-1/4" (31.8mm) between wire intersection measured across diagonal corners of the Diamond.
- (b) Mesh m2, Square, shall be welded. Openings in the mesh shall not exceed 5/8" (15.9mm) between wire intersections measured along a side of the Square.
- (c) Mesh m3, Parallel Strand, spacing shall be $1/2 \pm 3/32$ " (12.7 ± 2.4 mm).

3.4.1.1.3 Glass, polished or figured.

- (a) Form 1, polished both sides. Glass may contain waviness which does not interfere with vision normal to the surface.
- (b) Form 2, figure both sides. Glass shall not contain fire cracks, exposed wire or stones which can cause spontaneous breakage.

3.4.1.2 Form 3, figured glass.3.4.1.2.1 Thickness and dimensional tolerances.

(a) Finishes f1 and f2, patterns p1, p2, and p3. The allowable tolerances for cut rectangular shapes shall be plus or minus 1/16 inch (1.6mm) for each 1/8 inch (3.2mm) of thickness. Thickness, and tolerances on thickness shall be in accordance with table VI (see 6.2).

Table VI. Thickness and tolerances for figured glass, patterns p1 to p3

Thickness		Tolerance, thickness			
		Plus		Minus	
Inch	mm	Inch	mm	Inch	mm
1/8	3.2	3/64	1.2	1/64	0.4
3/16	4.8	1/32	1.2	1/64	.4
7/32	5.6	3/64	1.2	1/64	.4
1/4	6.4	3/64	1.2	1/64	.4
5/16	7.9	3/64	1.2	1/32	.8
3/8	9.5	3/64	1.2	1/32	.8

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3.4.1.2.2 Glass. Figured glass shall be free from fire cracks and stones which can cause spontaneous breakage.

3.4.1.2.3 Surface pattern.

- (a) Quality q7, decorative. Surface pattern shall be clear, sharp, and defined, and free from disfiguration which affects the appearance of the pattern. The smooth sides shall be free from open gaseous inclusions greater than 3/32 inch (2.4mm) or equivalent elliptical open inclusions up to 5/8 inch (15.9mm) long with no more than 3 of the maximum size in each 50 square feet (4.64m²) of each cut sheet.
- (b) Quality q8, glazing. Surface pattern shall be free from large areas of blemishes. Scattered areas of non-uniform surface and scattered surface blemishes are permissible. The smooth side shall be free from imbedded foreign materials, and shall be free from open gaseous inclusions greater than 1/8 inch (3.2mm) or equivalent elliptical open inclusions up to 3/4 inch (19mm) long with no more than 3 of the maximum size in each 50 square feet (4.64m²) of each cut sheet.

3.5 Class 2, types I and II, heat absorbing.

3.5.1 Transmittance, styles A and B. The illuminant C (daylight) and solar transmittance shall be in accordance with table VII (see 4.4.2, 4.4.3, and 6.2).

TABLE VII. Transmittance for heat absorbing glass

Thickness Styles A and I		ICI illuminant C	Transmittance a/	Solar transmittance a/
		Style A	Style B	Styles A and B
		Percent, Min.	Percent, Max.	Total Percent, Max.
.110"	3.0mm	80	80	67
.197"	5.0mm	75	75	56
.236"	6.0mm	70	70	52
.315"	8.0mm	65	65	45
.394"	10.0mm	60	60	39
.472"	12.0mm	50	50	36

a/ Straight line interpolation may be used for intermediate thicknesses, as an approximation.

3.5.2 Thickness and dimensional tolerances. Thickness and tolerances shall be according to the requirement already specified for the applicable glass.

3.5.3 Defects. The type and number of defects shall be not greater than that already specified for the applicable glass with the addition that light smoke is acceptable.

3.5.4 Tint. The tint of each type, style, and form shall be as specified (see 6.2 and 6.5).

3.6 Class 3, types I and II, light reducing, tinted.

3.6.1 Tint. The tint of each type, style, and form shall be as specified (see 6.2 and 6.5).

3.6.2 Luminous Transmittance. Light reducing glass is produced in a wide range of luminous transmittance values. The transmittance of each type and form of glass shall be as specified (see 6.2).

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 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 that supplies and services conform to prescribed requirements.

4.2 Sampling. Each unit of product in the sample as selected in 4.2.1 shall be 12 in (304mm) in width by 16 in (405mm) in length, in the specified thickness.

4.2.1 Visual examination of end item. Sampling for visual examination shall be in accordance with inspection level S-3 in MIL-STD-105.

4.3 Examination.

4.3.1 End item. Glass selected in accordance with 4.2.1 shall be examined for defects listed in table VIII. The acceptable quality levels (AQL's) in MIL-STD-105 shall be 2.5 percent defective for major defects and 4.0 percent defective for minor defects.

TABLE VIII. Classification of defects, end item

Defects	Major	Minor
Type, class, style, and form not as specified.	X	
Edges not as specified.	X	
Dimensions not within tolerance.	X	
Tint of heat absorbing or light reducing glass not as specified.	X	
Defects greater than those permitted for the specified glass.	X	
Labels on glass missing when required.		X
Damage or defects affecting function or serviceability.	X	
Damage or defects not affecting function or serviceability.		X

4.3.2 Ream, strains and distortion, type I. Place sample in a vertical position at a distance of 36 inches (91.5cm) from a brick wall or similar background showing straight lines. The viewer shall look through the sample at a distance of 36 inches (91.5cm) from the sample using daylight without direct sunlight or with background light suitable for observing each type of defect. View the sample at an angle to the surface of not less than vision interference angle in tables II, III, and IV, for the applicable glass. Line of vision shall be perpendicular to wall.

4.3.3 Scratches, rubs, stones, and gaseous inclusions, type I. Place samples in a vertical position 36 inches (91.5cm) from the viewers position. The viewer shall look through the sample using daylight without direct sunlight or with background light suitable for observing each type of defect.

4.3.4 Cut sizes. Measure length and width from edge to edge including flares.

4.3.5 Inspection of preparation for delivery. An inspection shall be made to determine that the packing and marking comply with the requirements with table IX. The sample unit shall be one shipping container fully prepared for delivery. Sampling shall be in accordance with MIL-STD-105. The inspection level shall be S-2 and the AQL shall be 6.5 defects per hundred units.

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TABLE IX. Classification of preparation for delivery defects

Examine	Defects
Marking (exterior and interior)	Omitted when required; incorrect; illegible, improper size, location, sequence, or method of application.
Materials	Any component missing or damaged.
Workmanship	Inadequate application of components such as incomplete closure of container flaps, loose strapping, inadequate stapling. Distortion of container.

4.4 Tests.

4.4.1 Specimens. Select two specimens from the sample selected in 4.2.1. For specimens with figured surfaces, grind and polish surfaces to a smooth surface.

4.4.2 Luminous transmittance. Measure transmittance for conformance to 3.5.1 and 3.6.4 by illuminating each specimen with light having the spectral composition of ICI illuminant "C" (see 3.5.1 and 6.3). Measure the ratio of transmittance to incident luminous flux by one of the following methods:

- (a) Visual photometer.
- (b) Corrected barrier-layer cell such as a Weston Photronic cell equipped with a Viscon filter.
- (c) Calculation from the spectral distribution of illuminant "C" (see 6.3).

4.4.3 Total solar transmittance. Calculate transmittance for solar energy from the measured spectral transmittance of the glass, using the values for spectral distribution of solar energy received at sea level by a surface perpendicular to the sun's rays through an air mass of 2 (see 3.5.1 and 6.4).

4.4.4 Ream, strings, lines, and wave, type II, shadowgraph. Focus a light projector with a 500 watt lamp and an objective lens with an approximate 2 inch (5.1cm) aperture and an approximate 12 inch (30.5cm) focal length on a flat white projection screen positioned 25 feet (7.6m) from the light source in a dark room. Place the glass in a vertical position parallel to the screen between the light and the screen. Move the glass slowly toward the screen with a vertical oscillating motion. The shadowgraph readout is the distance at which the distortion just blends with the general shadow of the glass on the screen (see tables II, III, and IV).

4.4.5 Rejection. Failure of any specimen to pass any of the tests in 4.4 shall be cause for rejection of the lot represented by the specimens. A lot shall be rejected for failure to meet the test requirements of this specification when tested in accordance with 4.4.

5. PREPARATION FOR DELIVERY

5.1 Packing. Packing shall be level A or Commercial as specified (see 6.2).

5.1.1 Level A. Class of like description in quantities as specified (see 6.2), shall be packed in a close-fitting box conforming to PPP-B-601, overseas type, style B, or PPP-B-621, class 2. Each pane of glass shall be separated with a sheet of neutral or slightly acid newsprint or kraft paper of equal width and length to the glass, plus or minus 1/4 inch, or powdered interleaving material. The boxes shall be lined on all interior surfaces with not less than three layers of fiberboard conforming to PPP-F-320, type CF, class domestic, variety SW. The box shall be closed and strapped in accordance with the appendix to the applicable box specification, except that banding shall conform to type I, class B of QQ-S-781. When the gross weight of the box exceeds 200 pounds, skids shall be provided as specified in the applicable box specification.

5.1.2 Commercial. The glass shall be packed to insure arrival at destination in satisfactory condition and be acceptable to the carrier at lowest rates. Containers and packing shall comply with Uniform Freight Classification Rules or National Motor Freight Classification Rules.

5.2 Marking.

5.2.1 Civil agencies. In addition to markings required by the contract or order, the shipping containers shall be marked in accordance with Fed. Std. No. 123. Each container shall be marked on both sides with the words GLASS - DO NOT DROP OR THROW: GLASS-HANDLE WITH CARE; or a similar precautionary marking with letters a minimum of 1-inch high.

5.2.2 Military agencies. In addition to markings required by the contract or order, the shipping containers shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use.

6.1.1 Primary glass (float, plate, or sheet):

- (a) Mirror select quality. Intended for silvering for mirror applications and is seldom used for glazing.
- (b) Mirror quality. Intended for mirror applications.
- (c) Glazing select quality. Intended for uses where superior glazing quality is required for windows, doors and other uses such as furniture.
- (d) Glazing A quality. Intended for selected glazing.
- (e) Glazing B quality. Intended for general glazing and other uses.
- (f) Greenhouse quality. Intended for greenhouse glazing or similar applications where quality is unimportant.

6.1.2 Rolled:

- (a) Decorative quality. Intended for use where design and esthetic characteristics are major considerations.
- (b) Glazing quality. Intended for general glazing where fire retardation, security and safety are a consideration.
- (c) Wired glass. Intended for skylights and general glazing where fire retardation, security and safety are a consideration.

6.1.3 Heat absorbing. Intended for glazing where reduction of solarheat is required.

6.1.4 Light reducing. Intended for reducing the amount of visible light transmission for use in applications where glare is a problem.

6.2 Ordering data. Purchasers should select the preferred options permitted herein, and include the following information in procurement documents:

- (a) Title, number, and date of this specification.
- (b) Type, class, quality, style, and form (see 1.2, 6.5, and 6.6).
- (c) Edges (see 3.2.1).
- (d) Marking (labels will be furnished only when specified) (see 3.2.2).
- (e) Primary glass (float, plate or sheet) thickness (see 3.3.1).
- (f) Wired glass, thickness (see 3.4.1.1 and 6.8).
- (g) Figured, whether pattern should be on one side or both sides (see 1.2 and thickness (see 3.4.1.2.1).
- (h) Heat absorbing glass, thickness (see 3.5.1, 3.5.2, and table VII) and tint (see 3.5.4 and 6.5).
- (i) Light reducing glass, thickness, form and transmittance (see 3.6.1 and 3.6.4), and tint (see 3.6.3 and 6.5).
- (j) Selection of applicable level of packing required (see 5.1).
- (k) Quantities of glass required in shipping container (see 5.1.1).

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6.3 Luminous transmittance. Detailed information on the ICI illuminant "C" is contained in the following reference:

Journal of the Optical Society of America, Volume 34, page 635, 1944.

Spectral curve based on standard ICI luminosity function is contained in each of the following references:

Proceedings, Sixth Session International Commission on Illumination, Geneva, page 67, 1924.

Journal of the Optical Society of America, Volume 34, page 641, 1944.

National Bureau of Standards, Journal of Research, Volume 6, RP289, page 465, 1931.

6.4 Radiant transmittance. Detailed information on the measurement of radiant transmittance is given by Parry Moon in "Proposed Standard Solar - Radiation Curves for Engineering Use" of Journal Franklin Institute, Volume 230, page 604, table III, 1940.

6.5 Tint. Heat absorbing glasses and light reducing glasses are available in a variety of tints. These types of glass vary in tint between different manufacturers and from melt-to-melt so some variation in tint may occur.

6.6 Rolled, patterned or wired glass. When ordering rolled glass special consideration should be given to wire configuration and to pattern, surface finish or design.

6.7 Scratches and surface defects. In normal handling of glass slight scratches and other surface defects may occur. These may ordinarily be removed by buffing to allow the glass to comply with the specification.

6.8 Samples. If for any particular purpose samples with bids are necessary, such as wired glass which may contain numerous gaseous inclusions along the wire, they should be specifically asked for in the invitation for bids and the particular purpose to be served by the bid sample should be definitely stated.

6.9 Glossary of terms.

6.9.1 Glass and types of glass.

- (a) Glass is an inorganic product of fusion which has cooled to a rigid condition without crystallizing. Glass is typically hard and brittle, and fractures in a conchoidal manner. It may be colorless or tinted, and transparent to opaque. Masses or bodies of glass may be tinted, translucent, or opaque by the presence of dissolved, amorphous, or crystalline material. Clear glass that does not contain such added materials is designated in this specification as "Class 1 - Transparent" for primary glass or "Class 1 - Translucent" for Rolled Glass. Glass that contains such added materials is designated "Class 2 - Heat Absorbing or Class 3 - Light Reducing, Tinted".
- (b) Plate glass. Glass from which surface irregularities have been removed by grinding and polishing, so that the surfaces are virtually plane (flat) and parallel.
- (c) Float glass. Glass which has virtually plane and parallel surfaces formed by floating in a continuous ribbon of glass on the surface of a bath of molten metal in a controlled atmosphere.
- (d) Sheet glass. Transparent, flat glass having glossy, fire-finished, apparently plane and smooth surfaces, but having a characteristic waviness of surface.

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- (e) **Wired glass.** Rolled glass having a layer of meshed or standard wire completely imbedded in the sheet.
- (f) **Figured glass.** Flat glass having a pattern on one or both surfaces.
- (g) **Heat-absorbing glass.** Glass for intercepting appreciable portions of radiant energy-especially solar energy.
- (h) **Light-reducing glass.** Glass which is formulated to reduce the transmission of light.

6.9.2 Defects in glass.

- (a) **Crush.** A lightly pitted area resulting in a dull gray or white appearance over the region.
- (b) **Digs.** Deep, short scratches.
- (c) **Dirt.** A small particle of foreign matter imbedded in the glass surface.
- (d) **Gaseous inclusions.** Round or elongated bubbles in the glass.
- (e) **Knot.** A transparent area of incompletely assimilated glass having an irregular knotty or tangled appearance.
- (f) **Lines.** Fine cords or strings, usually on the surface of sheet glass.
- (g) **Open gaseous inclusions.** Bubbles at the surface of glass which are open leaving a cavity in the finish surface.
- (h) **Process surface defects.** The surfaces of plate glass having very fine surface defects remaining from the grinding and polishing process consisting of fine pits and cracks which are denoted as "finish". When this condition is visible it is called "short finish". Float glass can also have some slight surface defects which originated in the process. These can be small particles of foreign materials on either surface or slight defects in the bottom (float) surface.
- (i) **Ream.** Inclusions within the glass or layers or strings of glass which are not homogeneous with the main body of the glass.
- (j) **Rubs.** Abrasion of the glass surfaces producing a frosted appearance. A rub differs from a scratch in having appreciable width.
- (k) **Scratches.** Any marking or tearing of the surface produced in manufacturing or handling, appearing as though it were done by a sharp or rough instrument.
- (l) **Smoke.** Streaked areas appearing as slight discoloration.
- (m) **Stones.** Any crystalline inclusion imbedded in the glass.
- (n) **Strings.** Transparent lines appearing as though a thread of glass had been incorporated into the sheets.
- (o) **Wave.** Defects resulting from irregularities of the surfaces of glass making objects viewed at varying angles appear wavy or bent.

6.10 Cross reference table.

<u>DD-G-451D</u>		<u>DD-G-451C</u>	
<u>Type I</u> - Primary glass (float or plate or sheet)	replaces	<u>Type I</u> - Plate or float and	
		<u>Type II</u> - Sheet, flat.	
<u>Class 1</u> - Transparent			
quality q1 - Mirror select	replaces	q1 - Silvering float/plate	
	replaces	q2 - Mirror glazing float/plate	
	replaces	q4 - AA sheet	
	replaces	q7 - A silvering sheet	

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quality q2 - Mirror
 quality q3 - Glazing select
 quality q4 - Glazing A
 quality q5 - Glazing B
 quality q6 - Greenhouse

Class 2 - Heat absorbing and
 light reducing

qualities q3, q4, and q5

Style A - Higher light
 transmission
 Style B - Lower light
 transmission

Class 3 - Light reducing, tinted

qualities q3, q4, and q5

Type II - Rolled, flat

Class 1 - Translucent
 Class 2 - Heat absorbing

Style A - Higher light
 transmission
 Style B - Lower light
 transmission

Class 3 - Light reducing, tinted

Forms, (classes 1, 2, and 3):

Form 1 - Wired, polished
 both sides
 Form 2 - Wired and figured
 Form 3 - Figured

quality q7 - Decorative
 quality q8 - Glazing

Finish f1 - Figured one side
 Finish f2 - Figured both sides

Mesh (forms 1 and 2):

m1 - Diamond
 m2 - Square
 m3 - Parallel strand
 m4 - Special

Pattern (forms 2 and 3):

p1 - Linear
 p2 - Geometric
 p3 - Random
 p4 - Special
 p4 - Special
 p4 - Special

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q8 - B silvering sheet
 q3 - Float/glazing plate
 q5 - A sheet
 q6 - B sheet
 q9 - Greenhouse sheet

q3 - Glazing, float/plate

q3 - Glazing, float/plate

Type III - Rolled, flat,
 and corrugated

Kind A - Flat (deleted)

q10 - Decorative
 q11 - Glazing

m2 - Hexagonal (deleted)

m4 - Rectangular (deleted)

p1 and p2
 p3 and p4
 p5 and p6
 p11
 p7, p8, p9, and p10 (deleted)
 Kind B - Corrugated (deleted)
 Form 5, 6, and 7 (deleted)

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MILITARY INTEREST:

Custodians:

Army - ME
Navy - YD
Air Force - 84

Review activities:

Army - ME, CE
Navy - YD
Air Force - 84

User activity:

Navy - MC

CIVIL AGENCY COORDINATING ACTIVITIES:

Commerce - WBS
DOT - FIS
GSA-FSS, PCD
HUD
FAA

PREPARING ACTIVITY: GSA-FSS

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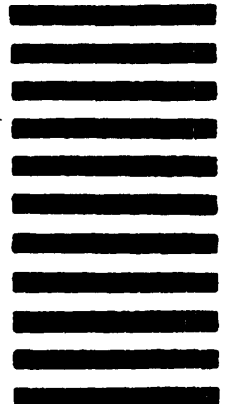
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