GLASS, PERFORMANCE, SAFETY, FLOAT LAMINATED FOR WINDSHIELDS	**∇ WSS-M28P1-B1**
LAMINATED FOR SIDE GLASS AND BACKLITES	**∇WSS-M28P1-B2**
LAMINATED FOR ALL OTHER GLASS APPLICATIONS	**∇WSS-M28P1-B3**
TEMPERED FOR SIDE GLASS AND BACKLITES	**∇ WSS-M28P1-B4**
TEMPERED FOR ALL OTHER GLASS APPLICATIONS	**∇WSS-M28P1-B5**
POLYCARBONATE (PC) COATED, FOR SIDE GLAZING AND BACKLITES	**∇WSS-M28P1-B6**
POLYCARBONATE (PC) COATED, FOR ALL OTHER GLAZING APPLICATIONS	**∇WSS-M28P1-B7**

1. SCOPE

The following specifications define performance requirements for:

B1 - Laminated products for windshields.
B2 - Laminated products used in areas such as side glass and backlites.
B3 - Laminated products used anywhere driver visibility is not a concern such as roof glazing or behind the 'B' pillar on trucks.
B4 - Tempered products used in areas such as side glass and backlites.
B5 - Tempered products used anywhere driver visibility is not a concern such as roof glazing or behind the 'B' pillar on trucks.
B6 - Polycarbonate (PC) coated products used in areas such as fixed side glazing and fixed backlites.
B7 - Polycarbonate (PC) coated products used anywhere driver visibility is not a concern such as fixed roof glazing or behind the 'B' pillar on trucks.

2. APPLICATION

These specifications were released originally for processed safety glazing that meet all Governmental and other standards (reference para 3.8) used for glazing motor vehicles.

3. REQUIREMENTS

3.1 APPROVED SOURCES

This specification is performance based and does not have approved sources.

All test plaques must go through process conditions identical to that of final production parts.

3.4 APPEARANCE

Automotive windows are defined as "appearance items" according to AIAG (Automotive Institute Action Group) Production Part Approval Process (PPAP). This requires that adequate approval of appearance criteria must be defined and adhered to. Since this specification is the sole definition of such criteria, adherence to it satisfies the intent of PPAP Appearance Item Requirements, therefore, no additional appearance approval reporting is required.

Date	Action	Revisions	Rev. 08
2018 03 12	Revised	See Summary of Revisions for Details	P. Konopka NA
2018 02 09	Revised	See Summary of Revisions for Details	P. Konopka NA
2015 06 29	Revised	See Summary of Revisions for Details	J. Crist, NA

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∇ 3.5 TRADEMARK

The trademark shall meet all criteria of the local or intended market requirements and shall include any additional information required by the country of intended use. The trademark shall be legible from inside or outside the vehicle and the location of the trademark shall be designated and/or approved by all responsible activities of the Ford Motor Company. The trademark location shall be shown on the engineering drawing.

The trademark may be applied using ceramic coatings in glass or via a printing, laser part marking, tool marking, film lamination, or film insert molding (FIM) procedure in polycarbonate. In the case of polycarbonate glazing, the method or methods allowable shall be specified on the engineering document.

Reference: RQT-011101-12080, RQT-001800-004030 & Design Rule: FX-011101-0008

3.6 GLAZING CONSTRUCTION

The following items and tolerances to these items shall be specified on the engineering drawing and SCCAF (Special and Critical Characteristics Acceptance Form) (reference glossary):

- glazing material construction, including color,
- individual ply construction thickness
- gradient band, coating(s), including which surface (1-4) the coating is applied to
- identification of which surface (1-4) is air or tin
- grid lines
- obscuration pattern (such as on moon roofs)

3.7 VISIBILITY DISTORTION

The finished parts must be visually inspected per the RQT-011101-012053 Optical Distortion Test. This inspection is to be included in the manufacturer's control plan as agreed upon by both Materials Engineering and Design Engineering. Boundary samples encompassing both reflectance and transmission are to be signed off by the Ford Assembly Plant Incoming Quality, STA and PD Engineering groups and will be used to establish the threshold of an acceptable part and will be retained by the glass suppliers for the duration of the program.
All boundary samples must include images of the readings taken using a distortion analyzer as referenced in RQT-011101-012053 and also include images of the part at vehicle installation angle using a point source light projected on a white background.

Reference: Design Rule: FX-011100-0006 for Boundary Sample Information

∇ 3.8 GOVERNMENTAL REQUIREMENTS

The finished parts must meet all Ford Motor Company Corporate, Homologation, World Regulatory, Materials and Transportation requirements for all markets within program definition (e.g. EEC/ECE, FMVSS, etc.)

Reference: RQT-011101-12080 & Design Rule: FX-011101-0008

3.9 EDGE FINISH

(SAE J673)
The edge requirements of finished parts shall be as specified on the engineering drawing. Typically edge finish numbers 1, 2, 3, 4 or 5 are used for automotive glazing applications.

Reference: RQT-011104-013722 & RQT-011104-013723

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3.10 TOTAL GLAZING THICKNESS

Nominal glazing thickness of finished parts, including the tolerance, must be as shown on the engineering drawing and SCCAF.

3.11 GRADING AREAS FOR DEFECT DETERMINATION

These areas shall be specified on the engineering drawing. Refer to Figures 1, 2, 3, 4 and 5.

The following grading areas have been identified to allow variation in appearance defect requirements:

	ALL GLAZING
AREA 'A'	Central area of the glazing out to area 'B'.
AREA 'B'	Painted areas, including dot patterns, mirror button footprint and gradient band.
AREA 'C'	Nonvisible area of the glazing covered or concealed by a module, molding or weatherstrip or by adjacent components. Area designation may be surface dependent.

3.12 INSPECTION METHOD FOR DETERMINING APPEARANCE FLAWS

The glazing shall be examined under diffuse lighting conditions with illumination as shown in Figure 5. The test part shall be examined by looking through the part as shown in Figure 5. The observer's eye shall be level with the center of the test part. The grid board must be large enough to allow the inspector to observe the entire glazing against the grid pattern (i.e. the grid board must be at least 1.6 times the width and height of the test part). The inspector moves as necessary to see each area of the glass against white and black at least once.

An appearance item will be considered a flaw if it is detectable within 15 seconds without being highlighted. If an appearance flaw is observed, the applicable specification requirements must be referenced to determine if the flaw is acceptable. Edge quality of the test part may be evaluated by viewing the perimeter of the part under the same inspection conditions.

This inspection method applies to all defects listed in section 3.12, although optical distortion must also pass the test described in Paragraph 3.12.6.

3.12.1 Manufacturing Defects and Glazing Quality

Any variations due to specific part requirements must be specified on the engineering drawing. Flaws in Area 'C' are permitted, as long as they do not affect glass structural integrity or function. If flaws are detected during inspection per 3.12 above, the following criteria will be used to determine acceptance or rejection and the Tier 1 supplier is responsible for all glass flaws that fall outside the criteria.

	Area 'A'	Area 'B'
Basic defects, including bubbles, seeds, stones, top tin, paint spots, and adhesion chips	1.0 mm maximum, including distortion for windshields. 0.5 x 1.0 mm (3 allowed); 1.0 mm dia. (6 allowed), no more than 6 total for backlites and quarter windows, 150 mm separation. Adhesion chips are not allowed.	
Bloom	Not allowed	
Bulls eyes	Permitted if not visible at in vehicle position	
Dig/rub	Not allowed	
Etch mark, crush	Not allowed	
Optical distortion	Distortion permitted within 10 mm of paint edge, otherwise must be approved by boundary sample review and signoff.	

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	Area 'A'	Area 'B'
Lint (laminated & PC only)	One 1.0 mm length per part.	One 1.5 mm length per part.
Scratches (definitions can be found in the "Glossary of Terms" para 4.4)	Heavy 5.1-10.0 mm none allowed; Heavy 0.5-5.0 mm and Medium 10.1-20.0 mm no more than 2 in a 305 mm dia.; Medium 3.0-10.0 mm and Light 20.1-40.0 mm no more than 3 in a 305 mm dia.; Light 6.0-20.0 no more than 4 in a 305 mm dia.	
Edge Treatment (Shiners, etc.)	Refer to SAE J673 for glass edge definition. Specific edge requirements identified on part drawing.	
Tool marks, including mold marks, cloth marks, screen marks, and tong marks.	Not allowed	Not allowed unless agreed upon in approved boundary sample
Water stain	Not allowed	

3.12.2 Vinyl Defects for Laminated Glass Products (B1, B2, & B3)

	Area 'A'	Area 'B'	Area 'C'
Air Penetration	None allowed	None allowed	5.0 mm sides & top, 10.0 mm bottom
Dirt/foreign Material	1.0 mm, 305 mm separation	1.5 mm, 305 mm separation	Not specified
Vinyl trim	None allowed	None allowed	1.0 mm measured from painted short
Short vinyl	None allowed	None allowed	2 mm x 50 mm total, combined totals not to exceed 50 mm per edge

3.12.3 Glass Cutting and Handling Defects

	Laminated (B1,B2,& B3)	Tempered (B4 & B5)
Drilled holes All must be chamfered	Not applicable	Not Allowed
Flake chip	Not permitted on #1 edge 3.0 x 3.0 x 0.3 mm permitted if not visible in car position Area C only.	Not allowed
Leads	None permitted	
Vee chip	None permitted	

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3.12.4 Glass Ceramic Coating and Heating Element Defects

Ceramic Coating defects, as described below are permitted in Area 'B' as long as they do not affect part function or glass structural integrity and function. Ceramic Coating defects in Area 'C' are permissible.

Ceramic Coating void	Repairs not allowed. Up to 8 voids per part <= 1.5 mm dia. permitted if separated by 300 mm and within urethane path
Ceramic Coating scratch or mar	Repairs not allowed. Scratches / mars within urethane path up to 2.0 x 25.4 mm acceptable, 1 max per part.
Dots missing or run together	Not allowed. Reference Design Rule FX-011100-0012
Ceramic Coating edge consistency, smoothness and straightness of paint edgework	Sawtooth <0.5 mm peak height permitted, 0.5 to 1.0 permitted over 150 mm length per edge.
Heater grid color appearance to be dark red	Variations in color due to silver on different surfaces must be within approved boundary sample
Bus bar visibility through black paint	Not allowed
Discoloration from heater tab	Not allowed
Silver void on Ceramic Coating bus bar	1 mm max. allowable only if not visible from outside of vehicle and part performance is not affected

3.12.5 Polycarbonate Potential Defect List (By Process)

3.12.5.1 Polycarbonate Defects

Defect	Definition of Defect	Acceptance Criteria
Black Specks	Point defects caused by foreign matter encapsulated within the part. The foreign matter could be degraded polycarbonate, metal, dust, debris, etc.	Area "A": not allowed Area 'B': 1.5 mm, 305 mm separation Area 'C': 1.5 mm, 305 mm separation
Contamination or Smudges	Visible inclusion of a substance other than that in the original material (e.g. dirt)	Area "A": not allowed Area 'B': 1.5 mm, 305 mm separation Area 'C': 1.5 mm, 305 mm separation
Optical Distortion	See Glossary	See section 3.7
Debris	Matter trapped in the coating layer of a part (overspray / crosslinked coating)	Area "A": not allowed Area 'B': 1.5 mm, 305 mm separation Area 'C': 1.5 mm, 305 mm separation
Discoloration	Material that has undergone decomposition resulting in a yellow, brown, or black streak in the molded part.	Area "A": not allowed Area 'B': 1.5 mm, 305 mm separation Area 'C': 1.5 mm, 305 mm separation
Fingerprints	A deposit left on the coated or uncoated surface by touching it with either a gloved or ungloved hand.	No fingerprints permissible in finished part.
Flow Interruption	Visible mark near the gate of a part where the smooth flow of polycarbonate has been interrupted	None allowed in Area A or B.
Dot Runs (Coating drip marks)	Coating runs caused by the dotted fade out pattern leaving a visible blemish on the part's surface	Allowed as long as it does not cause any major distortion reference Design Rule FX-011100-0012
Picture Framing	Coating defect of a buildup of material at the juncture between the 2 shots of a multi-shot injection molded piece	Allowed if picture frame is < 2.0mm into transparent area

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Coating Runs	Visible streaks in the coating layer	None allowed in the “A” and “B” area
Defect	Definition of Defect	Acceptance Criteria
White Specks	Point defect having a white appearance	Area "A": not allowed Area 'B': 1.5 mm, 305 mm separation. Area 'C': 1.5 mm, 305 mm separation
Haze	Reduced transparency of the part, frequently seen as a whitening of the surface with no distinct edges to the whitened area. Affected area larger than 4 square mm.	None allowed in viewing area of finished part.
Surface roughness	Roughness caused by the coating process	None allowed in the visible surface area. Only allowed in the “C” area

3.12.5.2 Polycarbonate Cutting and Handling Defects

Defect	Definition of Defect	Acceptance Criteria
Flake Chip	Shell-like chips which may flake off an edge, either on the periphery or at a drilled hole.	On edge #1&2 1.5 mm dia. Maximum, 1 per 150 mm length allowed in area “A” & “B”. 6.0 x 0.7 x 5.0 mm permitted in Area C only.
Leads	Small cracks or vents perpetrating from the edge of the glazing, sometimes caused by a V-chip	None permitted
Scratches	Continuous line defect observed by the penetration into either the polycarbonate's surface or the coating.	None allowed in area “A” 2 Allowed in a 305mm area in Area “B” if not detectable by tracing your fingernail across the scratch. Allowed in Area ”C”
Scuff	Abrasion of the surface caused by something rubbing on it and removing part of the coated surface or the uncoated surface	None allowed in area “A”&”B” Allowed in Area ”C”
Gouge / Cut	Inadvertent removal of surface or edge material causing a linear defect or an incorrect edge form	None allowed in area “A”&”B” Allowed on area “C” surface. For edges, radius change of not more than 1.5 mm in a 76 mm length is allowed

3.12.5.3 Polycarbonate Printing Defects (Blackout, Heat Grid, Antenna)

Procedures for prints must be approved by the Ford Motor Company (Materials). Printing defects, as described below are permitted in area “C” as long as they do not affect part function or glazing structural integrity.

Defect	Definition of Defect	Acceptance Criteria
Pinhole- coating void No repairs required (if in urethane path only)	Transparent region of printed area allowing light to be transmitted through it.	Up to 8 voids per part <= 1.5 mm dia. permitted if separated by 300 mm.
Registration Error	Correctly printed part but in the wrong location	Only within +/- 1 mm of the desired location is allowed, location to be specified on the Engineering Drawing.
Incorrect Print – Logo	The incomplete printing of the desired logo image on the surface of a part	Missing any part of the logo is not allowed.
Ink Smear	Correctly printed part with the ink smeared before it was properly dried producing a defect	From the edge closest to the "B" region none is allowed; along the edge closest to the "C" region, a smear protruding 2 mm is allowed.
Incorrect Print – Dots	The incomplete printing of the	1.0 x 6.0 mm allowed, 305 mm separation.

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missing or run together	desired image on the surface of a part	reference Design Rule FX-011100-0012
Defect	Definition of Defect	Acceptance Criteria
Edge of print not consistent	Printing edge has inconsistent smoothness and straightness	Saw tooth <0.5 mm peak height permitted, 0.5 to 1.0 permitted over 150 mm length per edge
Grid Color		Variations in color due to silver on different surfaces are acceptable.
Defect	Definition of Defect	Acceptance Criteria
Bus bar visibility through decoration layer		Not allowed
Discoloration from heater grid, antenna, bus bar	Discoloration of bus typically due to oxidation.	Not allowed on blackout area Allowed on bus bar due to oxidation
Silver void on heater grid, antenna, or bus bar		Allowable only if not visible from outside of vehicle and part performance is not affected. May be repaired (touch ups) if void is less than 3 mm in diameter and part performance is not affected post touch up.

3.12.5.4 Polycarbonate Decoration Defects
(Laser, Tool obscuration, Film Insert Molding or Lamination)

Defect	Definition of Defect	Acceptance Criteria
Coating defect over laser decoration	Delamination or cracking of coating with genesis from the edge of the laser part mark. This may occur when laser part marking occurs after coating procedure and the laser power is too high.	No damage to coating system that exceeds 0.1mm from edge of laser mark.
Coating defect over tool marking	Coating drips, runs, and or build up due coating over laser part marking. This may occur when laser part marking occurs before coating procedure	No drips, build up, or run visible in area “A” or “B”. Defects in the “C” area are allowed, so long as they do not result in cracking or delamination of coating.
Wrinkling of Film	Film folds or wrinkles during the manufacturing process, resulting in wrinkled lines in the in the glazing piece.	Not allowed in “A” and “B” areas
Film Delamination	Film delaminates from PC substrate or coating delaminates from film	Not allowed in any area.
Air, oil, or moisture Penetration (bubbles)	Air, oil, or water pockets trapped underneath film.	None allowed in areas “A” and “B”. For area “C” <1.5mm diameter allowed.
Dirt/foreign Material	Dirt or foreign material stuck between the film and the PC.	Area "A": not allowed Area 'B': 1.5 mm, 305 mm separation Area 'C': 1.5 mm, 305 mm separation

3.12.6 Optical Defects

All types of optical defects (e.g. bulls eyes, cloth marks, and ripple) shall be inspected using a point source light (see Glossary) as shown in Figure D1. The test part is mounted at vehicle installation angle and is located between the point source light and a white projection board so that the projected light passes through the glazing before reaching the projection board. The total distance between the point source light and projection board is 8m, with the test part is halfway between. The test part (excluding backlites) is rotated around its vertical axis as needed to simulate views from the side. The inspector observes the

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