DMS - 8300
SIGN FACE MATERIALS

EFFECTIVE DATES: MAY 2009–OCTOBER 2013.

8300.1. Description. This Specification establishes pre-qualification, warranty, material, and testing requirements, and approval procedures for the following sign face materials:

- reflective sheeting,
- conformable reflective sheeting,
- screen inks,
- colored transparent films and non-reflective black films, and
- anti-graffiti films and coatings.

8300.2. Units of Measurements. The values given in parentheses (if provided) are not standard and may not be exact mathematical conversions. Use each system of units separately. Combining values from the two systems may result in nonconformance with the standard.

8300.3. Material Producer List. The Materials and Pavements Section of the Construction Division (CST/M&P) maintains the Material Producer List (MPL) of all materials that have demonstrated the ability to conform to the requirements of this Specification. Materials appearing on the MPL, entitled "Sign Face Materials," do not require sampling and testing before use, but the Department may periodically sample materials to ensure conformance to this specification and may also sample if material quality is suspect.

8300.4. Bidders' and Suppliers' Requirements. The Department will only purchase or allow on projects those products listed by manufacturer and product code or designation shown on the MPL.

Use of pre-qualified materials does not relieve the contractor of the responsibility to provide materials that meet the specifications.

8300.5. Pre-Qualification Procedure.

A. Pre-Qualification Request. Submit a written request for evaluation to the Texas Department of Transportation, Construction Division, Materials and Pavements Section (CP-51), 125 East 11th Street, Austin, Texas 78701-2483.

Include the following information in the request:

- company name,
- physical and mailing addresses,
- type of material,
- company material designation (product name, style number, etc.), and
- contact person and telephone number.

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For sign sheeting submissions, include:

- Proposed TxDOT sheeting type,
- ASTM sheeting type,
- a test report with actual test data showing the material complies with the requirements of ASTM D 4956 for the sheeting type proposed, and
- the warranty statement required in Article 8300.6, 'Comprehensive Manufacturer's Warranty Requirements.'

B. Pre-Qualification Sample. For all proposed products, provide pre-qualification sample quantities at no cost to the Department in accordance with Tex-720-I.

The Department reserves the right to perform any or all tests in this Specification as a check on the tests reported by the manufacturer. In the case of any variance, the Department's tests will govern.

The Department will charge suppliers for the cost of sampling and testing of materials that do not meet the requirements of this specification in accordance with Section 8300.7.

C. Evaluation.

1. **Qualification.** The Department will list materials meeting the requirements of this Specification on the MPL.

   The Department may grant provisional pre-qualification after successful completion of the accelerated weathering requirements; or for materials that have undergone a full evaluation by the National Transportation Product Evaluation Program, and whose test results meet the minimum durability values required by this Specification.

   The Department will grant full pre-qualification after successful completion of the exterior exposure requirements. Failure to complete all exterior exposure requirements successfully is grounds for cancellation of provisional pre-qualification.

   Report changes in the composition or in the manufacturing process of any material to CST/M&P at the address shown in Article 8300.4.

   The Department will review significant changes reported and the material may require a re-evaluation. The Department reserves the right to conduct whatever tests deemed necessary to identify a pre-qualified material and determine if there is a change in the composition, manufacturing process, or quality, which may affect its durability or performance.

2. **Failure.** Producers not qualified under this Specification may not furnish materials for Department projects and must show evidence of correction of all deficiencies before reconsideration for qualification.

   Costs of sampling and testing are normally borne by the Department; however, the costs to sample and test materials failing to conform to the requirements of this Specification are borne by the supplier. The Director of CST/M&P will assess this cost at the time of testing.

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Amounts due the Department will be deducted from monthly or final estimates on Contracts or from partial or final payments on direct purchases by the State.

D. Periodic Evaluation. The Department reserves the right to randomly sample and evaluate pre-qualified materials for conformance to this Specification and to perform random audits of documentation. Department representatives may sample material from the manufacturing plant, the project site, and the warehouse.

Failure of materials to comply with the requirements of this Specification as a result of periodic evaluation may be cause for removal of those materials from the MPL.

E. Disqualification. Disqualification and removal from the MPL may occur if one of the following infractions occurs:

- material fails to meet the requirements stated in this Specification,
- the producer fails to report changes in the formulation or production process of the material to CST/M&P,
- the producer has unpaid charges for failing samples, or
- the producer has unresolved warranty issues.

F. Re-Qualification. A manufacturer or supplier may submit material for re-evaluation after documenting the problem and its resolution. Submit documentation identifying the cause and corrective action taken.

8300.6. Comprehensive Manufacturer's Warranty Requirements. Sign face material manufacturers must comply with all requirements of the following warranty. Failure to comply with the requirements of this warranty is cause for removal from the MPL.

Submit a statement indicating understanding and compliance with the provisions of the warranty and willingness to abide by the provisions to the address shown in Article 8300.4.A. Include the name, address, and telephone number of the person to contact regarding potential claims under the warranty provisions.

The warranty must include the use of one manufacturer's sign face material directly applied to a different manufacturer's sign face material. If a failure occurs, assignment of warranty responsibility is to the manufacturer of the sign face material that fails. (Example: If the sheeting separates from the sign substrate, the manufacturer of the sheeting attached to the substrate will be responsible. If the sheeting or film used for legend detaches from the sheeting attached to the substrate, the manufacturer of the legend material will be responsible for the failure.)

A. Certification. Submit a certification with each lot or shipment, which states that the material supplied meets the requirements listed. Show individual lot numbers on the certification.

B. Field Performance. Sign face materials processed, applied, stored, and handled according to the manufacturer's recommendations (or as required in this Specification when there is an exception to the manufacturer's recommendations), must perform satisfactorily for the number of years stated in Section 8300.6.C for that sign face material. The performance period begins at the time of application of the sign face material to the sign. The warranty requirements go into effect upon final acceptance by

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the Department. The Department will adjust the performance period to deduct the time between application of the sign face material to the sign and Department acceptance.

The sign face material is unsatisfactory if:

- it deteriorates due to natural causes to the extent that the sign is ineffective for its intended purpose (Example: When the sign is viewed from a moving vehicle under normal day and night driving conditions) or
- shows any of the following defects:
  - cracks discernible with the unaided eye from the driver's position while in an outside lane at a distance of 50 ft. (15 m) or greater from the sign
  - peeling in excess of 1/4 in. (6.4 mm)
  - shrinkage in excess of 1/8 in. (3.2 mm) total per 48 in. (1.2 m) of sheeting width
  - fading or loss of color to the extent that color fails to meet the requirements in ASTM D 4956 or
  - loss of reflectivity to a level below 80% for Types C, D, and E sheeting of the minimum values specified in ASTM D 4956 or in this Specification for new sheeting when measured at the angles specified for each type.

Provide the applicators with manuals, training videos, or both describing the proper application method. Submit, to the address shown in Article 8300.4.A, a copy of the current training materials provided with any updates as they occur. Include recommended procedures for the storage and handling of materials after application to the sign face up to final installation.

The sign face material manufacturer's warranty does not relieve the Contractor for unacceptable work or improper handling, storage, or installation. The Contractor is fully responsible for all materials and work until final acceptance by the Department.

C. Minimum Performance Period. All signs made with the type of sheeting indicated below and any other sign face materials used on each type of sheeting, except construction and maintenance work signs and barricades, must meet the minimum performance periods and replacement actions in Table 1.

Table 1

Warranty Period (yr.)

Sheeting Type	Period for Complete Sign Replacement and Installation	Additional Period for Sheeting Material Replacement Only
C, D	7	3
E	5	2

D. Manufacturer's Replacement Obligation. Where and when shown that retroreflective traffic signs processed in conformance with the sign face material manufacturer's recommendations (or as required in this Specification when there is an exception to the manufacturer's recommendations) have not met the field performance requirements above, a manufacturer's replacement obligation exists. The manufacturer must cover the costs of replacement of the sign on the roadway or of restoring the sign surface to its

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original effectiveness as determined by and at no cost to the Department for materials or labor.

Replacement sign face materials must:

- be the same type originally specified unless otherwise approved or directed,
- meet all the requirements of this Specification, and
- appear on the MPL.

Schedule with designated Department personnel, within 30 days of notification of potential replacement obligation, an on-site investigation to determine if the sign face material manufacturer's obligation exists.

Fulfill all obligations within 120 days after determination of obligations are made. The Department may replace signs where uncompleted obligations occur and may bill the manufacturer for all Department costs in performing the manufacturer's replacement obligation.

When in the judgment of the Department deteriorated signs present a traffic hazard, the Department reserves the right to remove the signs from the roadway and place them in storage for the manufacturer's inspection. Reimburse the Department for all costs, including labor for removal and replacement, when inspection reveals that a material manufacturer's obligation exists.

The materials manufacturer may use an independent Contractor to fulfill obligations to replace or refurbish signs on the roadway.

Terms of the Contract must be in conformance with the provisions of Contracts used by the Department for this type work, be approved by the Department, and save harmless the Department from any liability that may arise out of the Contractor's operations.

The Department can provide a sample Contract to the manufacturer upon the manufacturer's request.

The Department reserves the right to place a representative on the job to ensure that the signs are replaced or refurbished in conformance with Department standards. The Department will test all sign face materials used to fulfill the manufacturer's obligations to ensure compliance with this Specification.

Replacement material assumes the remaining warranty period of the material it replaces.

E. Sign Processors' Obligations. Submit the following with each shipment of signs or sign faces:

- Department Contract or purchase order number and
- a copy of the certification, as required in Section 8300.6.A, 'Certification,' showing the lot number of all sign face materials from which the completed signs or sign faces were processed.

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8300.7. Material Requirements for Reflective Sheeting. This Specification covers the general and specific requirements for the three types of reflective sheeting materials listed in Table 2—Types C, D, and E.

Meet all the requirements of ASTM D 4956, except when otherwise specified. For Type C and D white sheeting intended for use on permanently installed highway signs, the average coefficient of retroreflection for a roll of sheeting must not vary more than 15 % when comparing Ra at 0 degrees and rotated 90 degrees for the angle epsilon (or rotational angle) while tested at each observation angle (alpha) and the -4 entrance angle (Beta 1). Calculate the 15% variation by dividing the difference between Ra (0) and Ra (90) by Ra (90).

For white sheeting not meeting the 15% maximum orientation requirement, provide identification marks or other orientation features in or on the sheeting face denoting the optimum orientation of the sheeting. The markings must be visible from a minimum distance of 5 ft. and must be arrayed in such a manner that they will be readily distinguishable on cut-out legend, symbols, or borders. Provide guidelines illustrating the optimum sheeting orientation for sign fabrication.

The Department conducts outdoor weathering at the Department's test site in Austin, Texas or at other locations as deemed necessary by the Director of CST/M&P.

Meet the supplementary requirements specified in ASTM D 4956, Supplementary Requirement S3, 'Artificial Accelerated Weathering' when tested in accordance with ASTM G 155 using Exposure Cycle 1 with a quartz inner filter glass and Type "S" Borosilicate outer filter glass. The Department will test the following application types, not listed in Table S3.1, for the hours indicated and with the specified results as shown:

- nonconstruction work zone
  - 2,200 hr. and
  - meeting a minimum of 80% of the minimum specified initial retroreflectivity values for that type after accelerated weathering.
- construction work zone
  - 500 hr. and
  - meeting a minimum of 60% of the minimum specified initial retroreflectivity values for that type after accelerated weathering.

The manufacturer may fabricate identification marks to denote type of sheeting in or on the face of sheeting. When used, place the markings inconspicuously on 4 to 12 in. (100 to 300 mm) centers visible from a distance of not more than 30 ft. (9 m) or in a manner pre-approved by the Director of CST/M&P.

The sheeting manufacturer must furnish identification codes to the Department.

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Table 2
Sheeting Requirements

Type	ASTM D 4956 Type	Comments
C	III or IV	Must meet all requirements for non-fluorescent sheeting for ASTM Type III or IV. The MPL lists Type C sheeting made with encapsulated glass beads and microprismatic elements separately, and the Department may specify one or the other for specific applications. White sheeting for permanent signs not meeting the 15% maximum orientation requirement will be listed separately on the MPL and must be applied in the direction stated in Section 8300.7.F.
D	VII, VIII, IX, X	Must meet all requirements for non-fluorescent sheeting for ASTM Types VII, VIII, IX, X. White sheeting for permanent signs not meeting the 15% maximum orientation requirement will be listed separately on the MPL and must be applied in the direction stated in Section 8300.7.F.
E	VII, VIII, IX, X	Must meet all requirements for fluorescent sheeting for ASTM Types VII, VIII, IX, X.

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A. Film Characteristics. Meet the requirements of Table 3.

Table 3
Film Requirements

Characteristic	Requirement
Workability	The integrity of the film must be such that when the sheeting or a completed sign face is trimmed (in the normal manner) to match the sign substrate, the film must not crack, flake, nor chip on the sign panel or sign face side of the trim line.
Temperature Stability	▪ At any combination of temperatures from 50 to 100°F (10 to 38°C) and relative humidity from 20% to 90%, the sheeting must be able to be cut, applied, and color processed. ▪ Unapplied sheeting must withstand heat curing of process inks at temperatures up to 200°F (93°C), unless otherwise limited by the sheeting manufacturer and so stated in their technical literature.
Chemical Resistance	The surface of the sheeting or the face of a completed sign must be chemically resistant to the extent that there will be no surface change when wiped with a soft, clean cloth dampened with mild detergents or cleaners supplied by or recommended by the sheeting manufacturer.

B. Adhesive. Precoat the backside of the reflective sheeting with either a heat-activated or a pressure-sensitive adhesive. No additional coats of adhesive must be required to affix the reflective sheeting to the sign blank. The adhesive and liner, when used, must meet the requirements of ASTM D 4956.

Suppliers of reflective sheeting using a porous, textured-backing paper to protect the adhesive layer that is not suitable for use as a slip-sheet for packaging of completed signs, sign panels, or both, must supply rolls of slip-sheet paper in the various widths of reflective sheeting supplied. The area of slip-sheet paper, supplied in the various widths, must be the same as the area of reflective sheeting supplied in the various widths. Supplied slip-sheet paper is subsidiary to the reflective sheeting and any costs, direct or indirect, must be included in the bid price for reflective sheeting on State purchases.

The adhesive must have no staining effect on the reflective sheeting.

C. Reflected Night Color. The reflected night color must be:

- identifiable as the same color as the day color when observed at 50 ft. (15 m) and
- uniform and free of streaks, mars, and other imperfections.

D. Screened Sheeting Optical Performance. Before exterior exposure or Weather-Ometer (WOM) exposure, sheeting reverse screened with transparent ink must have the minimum coefficient of retroreflectivity values specified in ASTM D 4956.

(*NOTE:* Retroreflectivity will be determined in accordance with Tex-842-B.)

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E. Material Identification. Mark each container, carton, or box containing reflective sheeting with the information listed in ASTM D 4956.The identification numbers must also appear on the inside of the sheeting roll core. The identification number on the outside of the box and on the inside of the core must match. The mismatch of these numbers may be cause for rejection.

F. Sign Fabrication. When utilizing white sheeting for permanent signs that does not meet the 15% maximum orientation requirement, fabricate signs by applying the sheeting for cut-out legend, symbols, borders, and route marker attachments within the parent sign face with the identification marks or other orientation features in the optimum direction.

8300.8. Material Requirements for Conformable Reflective Sheeting.

A. General Requirements. Conformable reflective sheeting is intended for use on both flat surface and round plastic or metal posts. Meet all the requirements of ASTM D 4956, except when otherwise specified. In addition to the ASTM requirements, meet the requirements of Tex-843-B.

8300.9. Material Requirements for Screen Inks.

A. General Requirements. Specifically formulate screen inks for screening sign faces or legends on the type of reflective sheeting required.

B. Color. Screen inks, when screened onto any pre-qualified white reflective sheeting, must produce a color within the color requirements specified for the various colors of reflective sheeting in ASTM D 4956.

Use the type of screen recommended by the manufacturer.

Use screen inks as supplied or thinned according to the manufacturer's recommendations. Color will be determined by using ink from sealed, unopened containers as received from the manufacturer and according to manufacturer's recommendations for thinning.

C. Transparency. Black screen ink, when applied to white sheeting, must be completely opaque.

D. Durability. Screen inks, recommended by the ink manufacturer for use on any of the types of reflective sheeting, must exhibit the same durability as specified for that type of reflective sheeting.

When tested according to Federal Test Method 6301, "Adhesion (Wet) Tape Test," the results must show no process inks removed after processing a minimum of 96 hr. or after exposure of the sheeting types to durability and weathering tests specified.

8300.10. Material Requirements for Colored Transparent Films and Non-Reflective Black Films.

A. General. Colored, transparent films must consist of durable, electronically cuttable films coated with a transparent, pressure-sensitive adhesive protected by a removable liner. Non-reflective black films must be acrylic and consist of durable, electronically cuttable films coated with a pressure-sensitive adhesive protected by a removable liner.

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The films must be:

- designed to be cut on knife-over-roll (sprocket-fed or friction-fed) and flat bed electronic cutting machines;
- available in standard traffic colors;
- dimensionally stable; and
- designed to cut, weed, lift, and transfer.

The films must not release any volatile, organic compounds.

B. Color. When applied to retroreflective sheeting, the resulting color must fall within the color requirements specified for each color of reflective sheeting in ASTM D 4956. Black film must have a reflectance (Y) no greater than 4.0 as determined by Tex-839-B.

C. Coefficient of Retroreflection. When applied to retroreflective sheeting, the resulting coefficient of retroreflection must meet the minimum values specified in ASTM D 4956.

Retroreflectivity will be determined in accordance with Tex-842-B.

D. Adhesion. Adhesion must meet the requirements of ASTM D 4956.

E. Durability. All films, when applied to the various types of reflective sheeting, must meet the same durability requirements as specified for that type of reflective sheeting.

8300.11. Anti-Graffiti Films and Coatings.

A. Color. When applied to retroreflective sheeting, the resulting color must fall within the color requirements specified for the various colors of reflective sheeting in ASTM D 4956.

B. Coefficient of Retroreflection. When applied to retroreflective sheeting, the resulting coefficient of retroreflection reading must have the minimum values as shown in ASTM D 4956.

Coefficient of retroreflection will be determined in accordance with Tex-842-B.

C. Durability.

- Resistance and Exposure
  - The sheeting must show no cracking, crazing, blistering, chalking, or dimensional change after WOM exposure for 2,200 hr. and exterior exposure at 45° for 36 mo. or at 90° for 5 yr.
  - WOM exposure will be in accordance with ASTM G 155, using Exposure Cycle 1 with a quartz inner filter glass and Type "S" Borosilicate outer filter glass.
  - Exterior exposure will be facing south at the Department's exterior exposure test site in Austin, Texas or other locations as deemed necessary by the Director of CST/M&P.

8300.12. Contrast Ratio of Sign Faces and Completed Signs. For all sign faces and completed signs using transparent screen inks or transparent films, the "Contrast Ratio" is the

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quotient obtained when the coefficient of retroreflection of the white is divided by the coefficient of retroreflection of the other color.

The contrast ratio will be determined at an observation angle of 0.2° and an entrance angle of -4°.

For all signs, which use white and red reflective sheeting, the contrast ratio must not be less than 4.0 or greater than 15.0. For all other signs, sign panels, sign faces, and traffic control devices, the contrast ratio must not be less than 4.0.

8300.13. Packaging. Package the materials in containers that will permit normal shipping and storage without the material sustaining damage or becoming difficult to apply.

Roll material must contain no more than three splices per 50 yd. (46 m). The length of the roll core must not be less than the width of the material.

A. Pressure-Sensitive Material. The ends of the material must be cut square with an overlap splice of 3/8 ± 1/8 in. in width (9.5 ± 3.2 mm). Edges of the overlap splice are to be straight and square.

B. Heat-Activated Material. Cut the ends of the material square, but jointed closely together and held securely in place with a removable tape.

8300.14. Archived Versions. Archived versions are available.

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