DMS-8390, Materials for Motor Vehicle License Plates

Overview

Effective Date: May 2003 – July 2004 (refer to 'Archived Versions' for previous versions).

This Specification governs for the materials, composition, quality, sampling, and testing of materials necessary for production of license plates.

Bidders’ and Suppliers’ Requirements

Before any bid is considered, the materials proposed for submission must be of manufacture and product code or designation shown on the list of approved manufacturers.

Payment

Payment for all materials under this Specification will be in conformance with the condition prescribed in the Contract awarded by the State.

Prequalification

Prequalification of materials for motor vehicle license plates consists of submission of request and technical data, evaluation of materials, and demonstration of production capabilities.

Request for Prequalification

Contact the Texas Department of Transportation, Director of Vehicle Titles and Registration Division, 125 East 11th Street, Austin, TX 78701-2483, to prequalify your materials.

Submit technical data exhibiting characteristics of all proposed materials at the time of contact. Information submitted must include time and temperature required for curing of any inks, clear coats, and other materials proposed for use in the production of completed license plates.

The Materials & Pavements Section of the Construction Division (CST/M&P) will notify you if a review of the technical data indicates that the proposed materials comply with the specified requirements.

Evaluation of Materials

Provide the following materials and services for the evaluation:
♦ sufficient reflective material to produce 300 license plates;
♦ 1.9 L (1/2 gal.) of message coating ink;
♦ 7.5 L (2 gal.) of varnish and/or clear coat, if required;
♦ sufficient solvents for the ink, varnish and/or clear coat; and
♦ the name, telephone number, and address of the manufacturer’s technical representative who will be present at the Texas Department of Criminal Justice (TDCJ) license plate plant during the prequalification production run.

Upon receipt of the above materials and information, CST/M&P will notify the technical representative and, at a mutually agreed time, will schedule the prequalification production run. The technical representative must be present at the prequalification production run.

During the prequalification run, sample plates will be taken after each production step. These plates, along with completed license plates, will be used for testing.

**General**

All materials specified must meet all specified requirements before and after exposure in an Atlas Type E Weather-Ometer. Weather-ometer exposure will be in accordance with ASTM "G 153, Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials," using Exposure Cycle 1 (18 min. for water spray in every 120 min. of light exposure).

The exposure period will be 1,200 hr. for multi-year license plate material and 280 hr. for 1-yr. license plate material. CST/M&P will notify you after evaluation of material.

If materials fail to comply with the specified requirements and prequalification testing is requested at less than 1 yr. from the date of notification of failure for the same or new materials, submit a request for prequalification testing and a cashier's check for $1,000.00 payable to the "TxDOT Fund" to cover costs of testing and evaluation.

**Demonstration of Production Capabilities**

To ensure access to stretch and registry equipment, and the technical capabilities to install and maintain the equipment, meet 1 of the following conditions:

♦ Install stretch and registry equipment at the license plant through which the prequalification plates, as shown in 'Evaluation of Materials,' will be run, or
Supply the name of an independent company or an agency of another state using
the sheeting and the stretch and registry equipment to produce license plates.
(Also supply the name and phone number of an individual knowledgeable in
these operations with the company or State agency. The Department reserves the
right to visit these locations to verify production characteristics.)

Stretch and registry equipment must be of such quality that production losses due to
slight variations will not exceed 2%.

Prequalified Sources

Prequalified sources will remain on or be removed from the list of prequalified
sources in accordance with the following:

Re-evaluation

Report changes in the composition or in the manufacturing process of any material to
CST/M&P. Significant changes reported by the manufacturer, as determined by the
Director of CST/M&P, may require a re-evaluation of performance.

The Department reserves the right to conduct whatever tests are deemed necessary to
identify a prequalified material and to determine if a change has been made in
composition, manufacturing process, or quality, which may affect its durability or
performance.

Changes detected in the composition or in the manufacturing process, not reported
by the manufacturer, may be cause for removal of that material from the list of
prequalified materials.

Periodic Evaluation

The Department reserves the right to periodically evaluate the performance of
materials.

Samples for periodic evaluation of performance will be selected at random from
materials submitted on State purchase orders. Failure of materials to comply with the
specified requirements will be cause for removal of those materials from the list of
prequalified materials.

Technical Services

Provide the license plate manufacturing plant with all technical services that TDCJ
deems necessary and specifically requests during the procurement and installation of
equipment, the training of personnel, and the production of license plates.

Technical service provided at locations other than the license plate manufacturing
plant is not considered a part of this Specification.
Provide 15 man-days of technical service and 5 man-trips to the plant at no extra cost.

Each additional man-day of technical service specifically requested by TDCJ and each trip necessitated by such request will be compensated at the same rate and subject to the same regulations (where applicable) as provided for State employees in the General Appropriations Bill for the State of Texas.

Provide this technical service when requested by TDCJ and make it available within 48 hr. after the request. Provide technical service to TDCJ when material fails at not cost regardless of time involved.

**Warranty**

**Guarantee**

Submit, in writing, a guarantee to reimburse the State for all expenses incurred due to materials failure if more than 5% of the license plates issued become unserviceable due to appearance, change of the message coating or graphic coating, or reflectivity failure before the full issue has expired.

**Reimbursement**

Reimbursement must be in the form of cash or materials as determined by the State.

**Sheeting**

The sheeting must be marked and traceable to the specific manufacturer's production run numbers from which the material originated.

The warranty marks must be approximately 28.5 mm (1-1/2 in. in diameter on standard 150 mm by 300 mm (6 by 12 in.) plates and be a design mutually agreed upon by the Department and the sheeting manufacturer.

The manufacturer may vary the number, design, and placement of the marks for plates with nonstandard sizes.

♦ **Warranty Marks must meet the following criteria:**

  - be verifiable on a license plate once properly affixed to the vehicle's designated mounting area, from an approximate head-on distance of 1.8 m (6 ft.);
  - not be observable at 0.6 to 6 m (2 ft. to 20 ft.) or when the viewer steps to one side from the head-on viewing position;
  - be verifiable under ambient light and retroreflected light and should not interfere or conflict with the plate design or aesthetics; and
• not alter the sheeting colors or reduce the sheeting brightness below the specified levels.

Sampling and Testing

The Department will sample and test in accordance with the CST/M&P Manual of Testing Procedures.

The Department will sample reflective materials in accordance with "Tex-720-I, Sampling Reflective Sheeting," and will sample all liquid materials at the rate of a 0.9 L (1 qt.) sample per batch.

The Department will test in accordance with 'Material Requirements' for acceptance of materials submitted on a purchase order and will only consider materials prequalified in accordance with this Specification and on the list of prequalified materials maintained by VTR.

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 must be borne by the Contractor or supplier. This cost will be assessed at the rate established by the Director of CST/M&P and in effect at the time of testing.

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.

Material Requirements

General Requirements

This Specification covers the general and specific requirements for all materials necessary for the production of motor vehicle license plates. All materials must:

♦ meet all requirements of this Specification, except when specific requirements are shown for a particular material;

♦ be supplied by the same supplier; and

♦ which require a curing cycle in the production of completed license plates, exhibit curing characteristics compatible with the existing production facilities.

Retroreflective Materials

♦ Sheetings

• The material used to produce retroreflection must consist of flexible sheeting containing embedded spherical lens elements plus any other coatings required to produce a license plate.
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- The reflective sheeting must be similar in day color and reflected night color.
- The finished or unfinished sheeting surface must be similar in day color and reflected night color.
- The finished or unfinished sheeting surface must be readily roll coated and compatible with transparent and opaque colors recommended by the sheeting manufacturer.
- When required, a preprinted design must be included on the reflective sheeting. The colors, whether transparent or opaque, and the design must be approved by the Department.

♦ Application
- Characteristics of the sheeting materials must be such that they can be applied with equipment used to produce reflectorized license plates.
- This includes applicators, and stretch and registry control equipment which are necessary for processing preprinted reflective sheeting.
- All splices in graphic reflective sheeting must be registered to not interrupt processing through stretch and registry control equipment.
- All splices in the reflective sheeting or protective liner must be of sufficient strength to prevent tearing during application.
- Any roll of reflective sheeting in which the sheeting or protective liner tears 4 or more times during application will be rejected and replaced by the supplier at no cost.

♦ Adhesion
- The adhesion of the reflective sheeting to aluminum, cold rolled steel or galvanized steel must be such that it is impossible to pull or peel the sheeting from the substrate in pieces greater than 2 in.² in size.
- Samples will be conditioned at 60°C (140°F) for 48 hr. and then allowed to cool at room temperature 20 to 27°C (68 to 80°F) for 12 hr. before testing for adhesion. Adhesives other than that on the back of the sheeting will not be allowed.
- The adhesive must have a protective liner that will protect the precoated adhesive and the sheeting face from being contaminated by the adhesive. This liner must be of a type that will permit easy and automatic removal during sheeting application.
- The protective liner attached to the adhesive must be easily removed by peeling without soaking in water or other solvents and must be easily removed after accelerated storage for 4 hr. at 66°C (150°F) under weight of 1750 kg sq. m (2-1/2 lb. per sq. in.).

♦ Packaging and Storage
• Reflective sheeting materials must be packaged 1 roll per box in 0.25 kg per sq. mm (350 lb. per sq. in.) tensile strength cardboard boxes.
• The lot or batch number must be stamped or affixed with a permanent label to the inside of each roll core and on the exterior of the box.
• Mismatch of lot or batch numbers on the box and inside the roll core may be cause for rejection.
• No lot must exceed 3000 m² (32,500 ft.²).
• If a larger lot size is desired a request must be submitted.
• Ship no more than 36 boxes per pallet and no more than 2 lots or batches per pallet.
• Place boxes on pallets so that lot or batch numbers are readily visible.
• Attach shipping or packaging list to 1 box on a pallet showing all lot or batch numbers and number of boxes of each lot or batch number on the pallet.
• Any material found to be in unusable condition due to deterioration any time during a 12-mo. period after receipt at the license plate manufacturing plant must be replaced without cost by the material supplier.

**Message Coatings**

Message coatings must be completely cured for further processing and handling when subjected to 1.5 to 2.0 min. baking time in a continuous 2 stage oven capable of maintaining a maximum temperature of 200°C (390°F) at the first stage and a maximum temperature of 170°C (340°F) at the second stage.

The message coating must be a type that can be applied by equipment used by TDCJ to coat messages on license plates. This coating must be compatible with all other finishes on the license plate and so that when applied as directed by the manufacturer, it will not chip, peel, or excessively fade during exposure in an Atlas Type E Weather-Ometer.

The length of exposure will be 280 hr. for 1-yr. license plates and 1,200 hr. for multi-year license plates.

**Graphics**

Any graphics or preprinted design required must be compatible with all other finishes on the license plate and of such quality that it will not chip, peel, excessively fade, or change color when subjected to the durability requirements specified for a completed license plate.

**Varnishes and Clear Coats**

Varnishes and clear coats used to produce a finished license plate must be completely cured as follows:
Maximum drip time after application of 15 min. and 25 min. of baking time in an equally spaced (4 stage) continuous oven, which is capable of maintaining a maximum temperature of 140°C (290°F) at the first and fourth stages, and 200°C (390°F) at the second and third stages.

The varnish and clear coat must be compatible with all other finishes on the license plate. It must be of such quality that when applied by the dipping process as directed by the manufacturer, and cured as directed by the manufacturer, a completed license plate will be produced that is uniform in reflectivity and will meet the durability requirements for a completed license plate specified.

**Completed License Plate**

**Design**

The completed license plate must conform to all details and dimensions required by the plans and specifications submitted by the Department to TDCJ.

**Appearance**

Re reflectorized license plates (new and after exposure) must demonstrate a smooth surface uniform in color and retroreflectivity. In any license plate, variations in color or retroreflectivity noticeable at a distance of 15 m (50 ft.) or more, under normal day and night conditions, will be cause for rejection of the license plate.

Completed license plates must be free from ragged edges, cracks, scales, blisters, extraneous materials, and similar undesirable defects.

**Color**

The diffuse background color, before and after 1,200 hr. exposure in an Atlas Weather-Ometer, must comply with the following specified color requirements.

Color requirements are defined by an enclosed area formed by using the following CIE Chromaticity coordinates as corner points and the listed Y reflectance limits.

<table>
<thead>
<tr>
<th>Color</th>
<th>CIE Chromaticity Coordinate Corner Points</th>
<th>Y Reflectance Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>0.300 - 0.290 0.360 - 0.360 0.340 - 0.380</td>
<td>Y = 40 Min.</td>
</tr>
<tr>
<td>Red</td>
<td>0.600 - 0.290 0.650 - 0.350 0.550 - 0.340</td>
<td>Y = 5 - 12</td>
</tr>
<tr>
<td>Orange</td>
<td>0.520 - 0.360 0.600 - 0.400 0.640 - 0.360</td>
<td>Y = 12 - 30</td>
</tr>
<tr>
<td>Yellow</td>
<td>0.440 - 0.460 0.490 - 0.460 0.490 - 0.410</td>
<td>Y = 30 - 40</td>
</tr>
<tr>
<td>Green</td>
<td>0.250 - 0.330 0.020 - 0.370 0.030 - 0.370</td>
<td>Y = 10 - 30</td>
</tr>
<tr>
<td>Blue</td>
<td>0.130 - 0.050 0.200 - 0.240 0.090 - 0.150</td>
<td>Y = 9 - 20</td>
</tr>
</tbody>
</table>

Color will be determined in accordance with "Tex-839-B, Determining Color in Reflective Materials."
Reflectivity

Each license plate must meet all the following retroreflective requirements.

- The background of the license plates must average the following minimum specific intensities with no single plate having less than 87.5% of these minimum values when tested according to "Tex-842-B, Measuring Retroreflectivity."
  - Values will be expressed in units of lumens per lux per square meter (candlepower per foot-candle per square foot).
  - To facilitate photometric testing, test panels will provide an area with a minimum of 23,225 mm² (36 in.²) of reflective surface. Dependent upon the preprinted design (where present), some careful piecing may be necessary.

<table>
<thead>
<tr>
<th>New, Unexposed Brightness Values 0.2 Divergence Angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angle of Incidence</td>
</tr>
<tr>
<td>---------------------</td>
</tr>
<tr>
<td>-4°</td>
</tr>
<tr>
<td>30°</td>
</tr>
<tr>
<td>50°</td>
</tr>
<tr>
<td>White</td>
</tr>
<tr>
<td>Yellow</td>
</tr>
<tr>
<td>Orange</td>
</tr>
<tr>
<td>Red</td>
</tr>
<tr>
<td>Green</td>
</tr>
<tr>
<td>Blue</td>
</tr>
</tbody>
</table>

- After exposure for 1,200 hr. for multi-year license plates or 280 hr. for 1-yr. license plates in an Atlas Weather-Ometer, completed license plates must exhibit a minimum of 50% of the reflectance for new unexposed license plates for each color, as shown in the above table.
- In addition, the face of the license plate must not exhibit crazing, cracking, peeling, loss of message coating, or significant change in color of the message coating and graphics.

Resistance to Thermal Change

Completed license plates will be subjected to the following 3 cycles. The sample will be:

- brought to room temperature and then placed in an oven at the specified maximum temperature for approximately 1 hr.;
- removed from the oven and immediately (within 2 min.) subjected to the specified minimum air temperature for approximately 1 hr.;
- removed from the oven.

Upon completion of the 3 cycles, the sample will be returned to room temperature. The materials performance will be evaluated as provided for in "Sampling and Testing." The temperature range will be -1.1° ± 2.8°C and 65.5° ± 2.8°C (30° ± 5°F and 150° ± 5°F).
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Chemical Resistance

Completed license plates tested must show no apparent change in color or retroreflectivity after testing for chemical resistance. Test panels will be:

♦ exposed for 15 min. Test chemicals will be sodium chloride solution (5.0% in water) and mineral spirits in accordance with ASTM "D 235, Standard Specification for Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry CleaningSolvent)";

♦ rinsed for 3 to 5 min.;

♦ allowed 1 hr. to dry; then

♦ examined for changes caused by the specific chemical. Changes within 1/4 in. of any edge of the panel will be ignored.

Effective Performance Life

Reflective sheeting applied and processed into license plates according to the sheeting manufacturer’s instructions, will be considered to perform effectively for the service life expected if the plates show no fading, cracking, blistering, or peeling, which will significantly impair the intended visibility or legibility of the plate.

Physically undamaged clean rear plates on vehicles in normal use must retain at least 5 candlepower per meter candle, per plate for the length of time specified for each color below.

Measurements will be made at 0.2-degree observation angle and minus 4-degree entrance angle.

<table>
<thead>
<tr>
<th>Performance Life</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Color</strong></td>
</tr>
<tr>
<td>White</td>
</tr>
<tr>
<td>Yellow</td>
</tr>
<tr>
<td>Orange</td>
</tr>
<tr>
<td>Lemon-Yellow</td>
</tr>
<tr>
<td>Blue</td>
</tr>
<tr>
<td>Gold</td>
</tr>
<tr>
<td>Green</td>
</tr>
</tbody>
</table>

Abrasion Resistance

Satisfactory performance is demonstrated when a finished plate is subjected to 10 L (2.6 gal.) of falling sand directly applied to the legend portion of the plate and no appearance of the background color can be detected through the abraded portion of the roll coated legend at the end of the test.

TDCJ must replace plates that fail no additional cost to the Department.

Archived Versions

Archived versions of "DMS-8390, Materials for Motor Vehicle License Plates" are available through the following links:

♦ Click on 8390-0898 for the specification effective August 1998 through April 2003.