Preclear Reflective License Plate Sheeting
With Ensure™ Image and Optional Ensure™ Virtual Security Thread
For Use on Multi-Year License Plates
Series 4750E/4750T

Product Bulletin 4750E/4750T - OUS

October 2005

Replaces PB 4750/4750E dated January 1997

Description

3M™ Preclear Reflective License Plate Sheeting Series 4750E/4750T is a durable, all-weather, retroreflective sheeting consisting of lens elements enclosed within a transparent resin, designed for use in the fabrication of multi-year reflective license plates. Plates can be embossed and roll coated with either transparent or opaque roll coating inks to produce attractive license plates which function 24 hours a day to enhance night time safety and the legibility of the vehicle identification system. The sheeting appears similar during the day and at night (when viewed by reflected light) and is highly reflective when viewed at both head-on and wide entrance angles.

The backside of the reflective sheeting is pre-coated with a pressure sensitive adhesive, protected by a removable liner, for application to license plate substrates.

The versatility of 3M sheetings, processing materials and equipment allow the design of a license plate system specific to the desires and requirements of plate issue relative to color, reflectivity, durability, design and plate manufacture.

3M™ Ensure™ Image

Series 4750E/4750T sheeting with 3M Ensure™ Image contains directional positive identification images or marks that are an integral part of the sheeting and are visible only within a specific viewing angle range. The marks are extremely difficult to counterfeit and facilitate visual examination of the finished license plates for specified purposes of:

A. Inventory control.
B. Production traceability.
C. Identification of year of manufacture.
D. Identification of sheeting manufacturer.
E. Positive field verification of license plate authenticity.

The Ensure image may be a custom design mutually agreed upon by the purchaser and 3M. The Ensure image size and spacing depends on the width of the sheeting purchased. Each license plate will have a minimum of three images visible on the finished plate.

Orientation

The directional identification marks allow for easy visual verification of the license plate authenticity as follows:

A. The center most mark on the plate will be visible to a viewer standing directly in front of the plate at a distance of 4-8 feet (1.2 - 2.5 m). This represents an angle of 30° above the perpendicular to the plate.

B. The center most mark on the plate shall not be visible to a viewer:
   1. Standing at a distance of either 2 feet (.6 m) or 20 feet (6.1 m) directly in front of the plate.
   2. When the viewer has stepped from the head-on viewing position to either side thus forming an angle greater than 45° to the plate.

The directional identification marks will be visible in either diffuse daylight or by retroreflected light at night. The marks will not alter the color of the sheeting, reduce the sheeting brightness below the minimum specified levels, or interfere with appearance and legibility of finished license
plates. In diffuse daylight, the directional identification marks are equally visible in all standard colors. The marks cannot be removed by chemical or physical means from the sheeting or the finished license plate without visibly damaging the reflective sheeting.

Optional 3M™ Ensure™ Virtual Security Thread

Series 4750T sheeting also contains an Ensure™ virtual security thread that runs vertically or horizontally through standard vehicle registration plates for purposes of security and anti-counterfeiting. The virtual security thread shall be buried beneath the surface of the sheeting and shall consist of two sinusoidal waves where one wave appears to float above and one wave appears to float below the Ensure Image in the retroreflective sheeting. The virtual security thread shall be durable for the service life of the license plate. The virtual security thread shall be visible in the unprinted areas of the plate from within a standard police vehicle under high beam headlight illumination, as well as outside of the vehicle, on a license plate properly affixed to the vehicle’s designated mounting area, from an approximate distance of 0 to 50 feet (0 to 15 meters) at a head-on viewing angle. The two sinusoidal wave images shall be visibly distinct from an approximate distance of 0 to 20 feet (0 to 6 meters). The virtual security thread shall not be visible when viewed from an angle greater than 45 degrees from the head-on viewing position.

The virtual security thread shall be verifiable under both diffuse daylight and retroreflected light at night. The virtual security thread shall not alter the color of the sheeting, reduce sheeting brightness below the minimum specified brightness levels, or interfere with appearance and legibility of finished license plates. In diffuse daylight the virtual security thread is visible in all standard sheeting colors.

Performance Considerations

Series 4750E/4750T license plate sheetings are designed for multi-year applications. Experience indicates that finished plates, processed and applied as recommended, will perform without appreciable fading, cracking, blistering or peeling for a period up to five years.

Performance Characteristics

A. Reflectivity

The minimum reflectivity values of 3M sheeting series 4750E/4750T are shown in Table A.

Table A

<table>
<thead>
<tr>
<th>Sheet Color</th>
<th>Entrance Angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>4750E/4750T</td>
</tr>
<tr>
<td>Yellow</td>
<td>4751E/4751T</td>
</tr>
<tr>
<td>Red</td>
<td>4752E/4752T</td>
</tr>
<tr>
<td>Gold</td>
<td>4753E/4753T</td>
</tr>
<tr>
<td>Orange</td>
<td>4754E/4754T</td>
</tr>
<tr>
<td>Lt. Blue</td>
<td>4756E/4756T</td>
</tr>
<tr>
<td>Lt. Green</td>
<td>4757E/4757T</td>
</tr>
<tr>
<td>Lemon Yellow</td>
<td>4761E/4761T</td>
</tr>
</tbody>
</table>

1Observation (Divergence) Angle - The angle between the illumination axis and the observation axis
2Entrance (Incidence) Angle - The angle from the illumination axis to the retroreflector axis. The retroreflector axis is an axis perpendicular to the retroreflective surface.

All measurements shall be conducted in accordance with ASTM E-810, “Standard Test Method for Coefficient of Retroreflection of Retroreflective Sheeting.”

The reflectivity of the flat area of the same test plate, totally wet by rain, will not be less than 90% of the values specified in Table A. Wet performance measurements shall be conducted in accordance with ASTM E-810. Contact your 3M Technical Representative for wet performance measurement test set-up.

To measure the reflectivity values of applied 3M sheeting, prepare test plates as follows:

- Test plates of the same size and format as the actual issue must be produced of the same materials, on the same equipment, and by the same general processes of metal cleaning, laminating, embossing or debossing and roll coating as the production plates.
- The plates must be designed to have a minimum of 36 square inches (230 sq cm) of flat area in one section of the plate to facilitate photometric testing.
• All test plates should be conditioned for 24 hours at 72°F ± 5°F (22°C ± 1°C) and 50 ± 5% R.H. prior to testing.
• Each plate must be thoroughly hand washed (see Cleaning), prior to testing.

B. Adhesive
Test plates as prepared above will resist peeling, scuffing and marring from recommended application surfaces, during normal use handling and resist shocking off when jabbed with a spatula at -10°F (-23°C).
Prior to application, the protective paper liner can be removed from the adhesive by peeling without soaking in water or other solvents. The liner can be removed after accelerated storage for 4 hours at 150°F (65°C) under a weight of 2.5 pounds per square inch (0.18kg/cm²).

Fabrication of Reflective License Plates
A. Substrates
The pre-coated adhesive will form a permanent bond to the surface of clean, chemically treated or conversion coated aluminum substrates normally used in the manufacture of license plates and as recommended by 3M. Contact your 3M Technical Representative for specific substrate recommendations.

B. Application
3M sheeting is designed for application to clean flat coil or sheet stock by continuous squeeze roll application.
A minimum of 48 hours storage after application of sheeting is required before embossing or debossing. Laminated blanks must be stored on edge and used within one year after date of receipt of the 3M sheeting for best embossing results.

C. Embossing and Debossing
The reflective sheeting as applied to flat metal is sufficiently flexible to permit the embossing or debossing requirements of most conventional license plate designs.
3M sheeting may be embossed or debossed up to 2mm or 0.080 inches with standard embossing equipment and dies used for license plate production. Minimum embossing temperature is 70°F (21°C).

D. Color Processing
The legend is applied to embossed or debossed plates by roller coating with the following recommended high quality transparent or opaque inks.

Note: Care should be taken in choosing color combinations to ensure attractiveness and maximum legibility. To assure suitable contrast for maximum legibility and safety, 3M recommends use of dark color roll coated characters on a white or yellow reflective sheeting background.

E. Oven Dried Inks
3M series 4850 Opaque
3M series 4950 Transparent

Note: Cool the license plates to room temperature before packing.

F. Air Drying
Contact your 3M Technical Representative for appropriate air dry inks.

Cleaning
For maximum service, do not use abrasive, or chemically harsh cleaners. Use the same care as is used in cleaning the paint surface on the vehicle. The license plate surface should be cleaned of normal use dirt accumulation by washing with a mild detergent and water using a soft bristle brush or cloth. Following cleaning, the plate should be thoroughly rinsed with water.
To remove tar, oil, or road film, cautious use of mild solvents such as mineral spirits, turpentine, kerosene, or other solvents, commonly used on vehicle finishes may be employed. Use of aromatic solvents or ketones or solvents containing them should be avoided.

Storage
Sheeting and roll coat inks must be stored in their original package in a cool, dry area and should be used within one year after date of receipt.

General Characteristics and Packaging
The reflective sheeting as supplied will be of good appearance, free from ragged edges and cracks and packaged according to commercial standards. The sheeting must be spliced for continuous roll application. Additional sheeting is supplied to compensate for splices.

Specifications
The information contained herein on 3M reflective sheeting Series 4750E/4750T is considered to describe typical minimum requirements for an effective reflective license plate material. As such, the information could be incorporated into a product purchase specification to be used in conjunction with a specification for finished retroreflective license plates.
Health and Safety Information

Read all health hazard, precautionary, and first aid statements found in the Material Safety Data Sheet, and/or product label of chemicals prior to handling or use.

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