



Preclear Reflective License Plate Sheeting

With Ensure™ Image and Optional Ensure™ Virtual Security Thread

For Use on Multi-Year License Plates

Series 4780E/4780T

Product Bulletin 4780E/4780T

April 2014

Replaces PB 4780E/4780T dated April 2007

Description

3M™ Preclear Reflective License Plate Sheeting 4780E/4780T 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 nighttime 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 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.

Series 4780E/4780T sheeting is available with personalized graphic designs which offer a unique opportunity to promote a country, state or national attraction, event or image while continuing to provide the motorist with the safety aspects of fully reflective license plates. Additional stretch and registry control equipment is required to process graphic printed sheetings.

3M sheetings, processing materials and equipment provide flexibility in 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 4780E/4780T 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 two images visible on the finished plate.

Orientation

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

- A. The centermost 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 perpendicular to the plate.
- B. The centermost 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 4780T sheeting with 3M™ Ensure™ Virtual Security Thread also contains a second mark that runs vertically or horizontally through standard vehicle registration plates for purposes of security and anti-counterfeiting. The virtual security thread is buried beneath the surface of the sheeting and consists 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 is durable for the service life of the license plate.

The virtual security thread is 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 are visibly distinct from an approximate distance of 0 to 20 feet (0 to 6 meters). The virtual security thread is not visible when viewed at an angle greater than 45 degrees from the head-on viewing position.

The virtual security thread is verifiable under both diffuse daylight and retroreflected light at night. The virtual security thread does not alter the color of the sheeting, reduce sheeting brightness below 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 4780E/4780T 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™ Preclear Reflective License Plate Sheeting 4780E/4780T are shown in Table A.

Table A

Minimum Coefficient of Retroreflection Candlepower per foot candle per Square Foot Candelas per Lux per Square Meter (0.2° Observation Angle¹)

Sheeting Color	Entrance Angle ²	
	-4°	40°
White 4780E/4780T	70	16
Yellow 4771HE/4771HT	50	10

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."

Measurement on reflective sheeting with a preprinted graphic design shall be taken in an unprinted sheeting area.

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 process of metal cleaning, laminating, embossing or debossing and roll coating as production plates.
- The plates must be designed to have a minimum of 36 square inches (230 cm²) 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°C (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 (0.18 kg/cm²).

Fabrication of Reflective License Plates

Note: For recommended manufacturing procedures used in the fabrication of license plates refer to Information Folder 9.8.

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 recommended 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).

To enhance the printability and quality of the embossed or debossed license plates, they must be roll coated within 24 hours.

D. Color Processing

The legend is provided on embossed or debossed plates by roller coating with the following recommended high quality transparent or opaque inks and foils.

Note: Care should be taken in choosing color combinations to ensure attractiveness and maximum legibility. This is especially true with graphic design sheetings. To assure suitable contrast for maximum legibility and safety, 3M recommends use of dark color roll coated characters on a white reflective sheeting background.

D1. Oven Dried Inks

3M Series 4800 Opaque
3M Series 4850 Opaque
3M Series 4900 Transparent
3M Series 4950 Transparent

Note: For recommended roll coat ink practices, refer to Product Bulletins 4800/4900 and 4850/4950.

Contact your 3M Technical Representative for assistance with oven drying conditions. Cool the license plates to room temperature before packaging.

D2. Dry Roller Coat Foils

Note: For recommended dry rollercoating practices refer to Product Bulletin HSF 100/200.

Use Series HSF100 or 200 dry rollercoat foils.

Contact your 3M Technical Service Representative for additional information on dry rollercoating foils.

Cleaning

For maximum service, do not use abrasive or chemically concentrated 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, or kerosene may be employed. Use of aromatic solvents and ketones or solvent mixtures 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 4780E/4780T is considered to describe typical minimum requirements for an effective reflective license plate material. As such, the information may 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.

Warranty

3M warrants that 3M™ Preclear Reflective License Plate Sheeting Series 4780E/4780T (with Ensure™ Warranty Mark) sold by 3M for fabrication of reflective safety plates in the United States, Mexico and Canada will remain effective for its intended use and retain a coefficient of retroreflection of at least nine (9) candlepower per foot candle per plate³ for the number of years indicated in the following table and subject to the following provisions:

<u>Sheeting Color</u>	<u>Years</u>
White	5
Yellow	5

Note: All measurements are at 0.2 degrees observation angle and -4 degrees entrance angle.

All measurements shall be made after cleaning the plate according to 3M recommendations and in accordance with ASTM E 810 “Standard Test Method of Coefficient of Retroreflective Sheeting,” except that the coefficient of luminous intensity shall be determined in accordance with ASTM E 808-01 Para. 3.2.2 and ASTM E 809-02 Para. 12.3.

If 3M preclear reflective license plate sheeting is applied to 3M-approved substrate materials in accordance with all 3M application procedures found in 3M’s product bulletins, information folders, and technical memos (which will be furnished to the agency upon request), including the appropriate use of 3M matched component systems, roll coat inks, roll coat foils and recommended application equipment; and if at any time during the period specified in the table above: a) plates show fading, cracking, blistering or peeling which will significantly impair the intended visibility or legibility of the plate; or b) a one-half of one

percent sample of clean, rear plates provided from a given production run (which is identified by the integral Ensure warranty mark) reveals that 10 percent sample fails to retain at least nine (9) candlepower per foot candle per plate³ (0.84 candelas per lux per plate) as defined herein; 3M will at its expense, replace all of the plates manufactured from that specific lot of material, up to a maximum of \$5.00 per plate.

Reimbursement to the using agency will be in dollars and/or materials, as determined by the needs of the using agency.

³Graphic printed reflective plates may not meet this requirement as large graphic printed areas can affect the reflectivity values of the finished license plates.

Conditions

Such failure must be solely the result of design or manufacturing defects in the 3M preclear reflective license plate sheeting and not of outside causes such as: improper fabrication, handling, maintenance or installation; use of roll coat inks or overlay films and sheetings not made by 3M; exposure to excessively high oven temperatures; use of a reflective sheeting applicator, stretch control mechanism, brake table or corresponding registry feed controls not provided and installed by 3M; failure of plate substrate; exposure to chemicals, abrasion, or damage from fasteners used to mount the plate; collisions, vandalism or malicious mischief.

Replacement sheeting will carry the unexpired warranty of the sheeting it replaces.

Claims made under this warranty will be honored only if the plates have been marked with the Ensure™ Warranty Mark so as to be traceable to the specific 3M production run numbers from which the materials originated.

Claims made under this warranty will be honored only if 3M is notified of a failure within a reasonable time, reasonable information requested by 3M is provided and 3M is permitted to verify the cause of the failure.

Limitation and Liability

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FOR INFORMATION OR ASSISTANCE

CALL:
1-877-777-3571

IN CANADA CALL:
1-800-265-1840

Internet:
www.3M.com/mvss

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Traffic Safety and Security Division

3M Center, Building 225-4N-14
P.O. Box 33225
St. Paul, MN 55133-3225
www.3m.com/mvss

3M Canada Company

P.O. Box 5757
London, Ontario N6A 4T1
1-800-3MHHELPS

3M México, S.A. de C.V.

Av. Santa Fe No. 55
Col. Santa Fe, Del. Alvaro Obregón
México, D.F. 01210

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