

Traffic Safety and Security Division

# 3M™ Digital License Plate Reflective License Plate Sheeting Series 9250E/9250T

**For use on Multi-Year License Plates With Ensure™ Image**

**Product Bulletin Series 9250E/9250T  
April 2017**

Replaces PB Series 9250E/9250T dated August 2016

## **Description**

3M™ Digital License Plate (DLP) Reflective License Plate Sheeting Series 9250E/9250T consists of lens elements enclosed within a transparent resin. The sheeting is designed for use in the fabrication of multi-year reflective license plates using the DLP System.

The sheeting can be digitally printed with background graphics and variable plate messages, with background graphics only, or with variable plate messages on pre-printed background graphics using 3M™ Thermal Transfer Ribbons Series TTR1300. 3M™ Clear Protective Film 9097 is applied in the DLP Print Station after printing. After application to aluminum substrate, plates may be blanked flat or with a debossed rim. Plates may optionally be embossed with plate messages and coated using 3M™ Roll Coat Colors Series 4850 or 4950, or 3M™ HSF 100/200 and DRF 300/400 Series hot stamp foils.

Finished license plates made with the 3M DLP System function 24 hours a day to enhance nighttime visibility and 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 aluminum license plate substrates.

Series 9250E/9250T sheeting is available with pre-printed graphics that offer a unique opportunity to promote a country, state or national attraction, event or image while continuing to provide the driving public with the safety aspects of fully reflective license plates.

### 3M™ Ensure™ Image

Series 9250E sheeting with 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 generic, or a custom design mutually agreed upon by the purchaser and 3M. The Ensure image size and spacing depend on the width of the sheeting purchased. Contact your 3M Traffic Safety and Security Division application development engineer for further information.

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

- A. The centermost mark on the plate is visible to a viewer standing directly in front of the plate at a distance of 4-8 feet (1.2-2.5 meters). This represents an angle of 30° above the perpendicular to the plate.
- B. The centermost mark on the plate is not visible to a viewer:
  - 1. Standing at a distance of either 2 feet (0.6 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 are visible in either diffuse daylight or by retroreflected light at night. The marks do 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. 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 9250T sheeting with Ensure Virtual Security Thread 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 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 inside a standard police vehicle under high beam headlight illumination, as well as outside of the vehicle, on a license plate properly affixed to a 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 from 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. The virtual security thread is visible in all standard sheeting colors.

## Performance Characteristics

### Reflectivity

The minimum reflectivity values of Series 9250E/9250T sheeting covered with 3M™ DLP Clear Protective Film Series 9097 are given below in terms of candlepower per foot-candle per square foot (Candelas per lux per square meter (cd/lux/m<sup>2</sup>)). Measurements should be conducted in accordance with ASTM E810, “Standard Test Method for Coefficient of Retroreflection of Retroreflective Sheeting Utilizing the Coplanar Geometry.”

To measure the reflectivity values of applied sheeting and clear protective film, 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 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 ± 3° C) and 50 ± 5% relative humidity (R.H.) prior to testing and each plate must be thoroughly hand washed (see Cleaning) prior to testing.

Measurements on reflective sheeting with a preprinted graphic design should be taken in an unprinted sheeting area.

When subjected to a simulated rainfall, the reflectivity of the retroreflective surface of the plate shall not be less than 90% of the values specified in Table 1 below.

### Coefficient of Retroreflection

**Table 1. Minimum Coefficient of Retroreflection**  
[Candlepower per Foot Candle per Square Foot,  
or Candelas per Lux per Square Meter] (cd/lux/m<sup>2</sup>)

Ob. Angle <sup>1</sup>	Entr. Angle <sup>2</sup>	White 9250E/ 9250T	Yellow 9251E/ 9251T	Red 9252E/ 9252T	Gold 9253E/ 9253T	Orange 9254E/ 9254T	Blue 9256E/ 9256T	Green 9257E/ 9257T	Lemon Yellow 9259E/ 9259T
0.2°	-4°	50	25	9	25	25	18	18	25
	40°	16	10	3	10	10	7	7	10

*Note: All measurements shall be conducted in accordance with ASTM E810, “Standard Test Method for Coefficient of Retroreflection of Retroreflective Sheeting.” All sheetings covered by 3M Series 9097 film.*

### Adhesive

Test plates as prepared above will resist peeling, scuffing, and marring during normal handling.

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/cm<sup>2</sup>).

## Fabrication of Reflective License Plates

### Substrates

The pre-coated adhesive will form a durable bond to properly cleaned, chemically treated aluminum surfaces normally used in the manufacture of license plates. Contact your 3M Traffic Safety and Security Division application development engineer for specific substrate information.

<sup>1</sup> Observation Angle – The angle between the illumination axis and the observation axis.

<sup>2</sup> Entrance Angle – The angle from the illumination axis to the retroreflector axis. The retroreflector axis is an axis perpendicular to the retroreflective surface.

## Application

DLP sheeting Series 9250E/9250T, with Protective Film Series 9097 applied, is designed for application to flat coil or sheet stock by continuous squeeze roll application. Sheeting should be stretched to a maximum of 1% during application to the substrate. A minimum of 48 hours of storage after application of sheeting is recommended before the embossing of legends. Laminated blanks must be stored on edge and used within one year after date of receipt of the sheeting for best embossing results.

## Embossing and Debossing

The reflective sheeting as applied to flat metal is sufficiently flexible to permit the embossing or de-bossing requirements of most conventional license plate designs. Sheeting may be embossed up to 1.7 mm (0.067 inches) with standard embossing equipment and dies used for license plate production. Minimum embossing temperature is 70° F (21° C).

## Color Processing

The legend is applied to the sheeting primarily by digital printing in the DLP Print Station with the thermal transfer ribbons described below. A secondary method would be to digitally print the background graphic only and then emboss and coat the legends with the 3M™ recommended inks or foils described below.

**Note:** Care should be taken in choosing color combinations to ensure 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 digitally printed or coated characters on a white or yellow reflective sheeting background. If coated, the license plates need to be cooled to room temperature before packaging.

## Thermal Transfer Ribbons:

### 3M™ Thermal Transfer Ribbons Series TTR1300

For specific color availability, refer to [Product Bulletin TTR1300](#).

## Oven Dried Inks:

### 3M™ Roll Coat Inks Series 4850 Opaque and 3M™ Roll Coat Inks Series 4950 Transparent

For specific color availability or for assistance with roll coat processing and oven drying, refer to [Product Bulletin 4850/4950](#), or contact your 3M application development engineer.

## Dry Roll Coat Foils

### 3M™ Dry Roller Coat Foil Series HSF 100/200 and DRF 300/400

For specific color availability or for assistance with roll coat processing and oven drying, refer to [Product Bulletin HSF 100/200 and DRF 300/400](#), or contact your 3M application development engineer.

## Printer and Ribbon Compatibility

The Sheeting is compatible with printers and ribbons as shown in Table 2.

**Table 2. Ribbons Qualified under 3M™ Warranty**

3M DLP Printer TTR Ribbons		Matan SpringG3 Printing System IIMAK 12" Ribbons (for Digitag 1650)	
ITEM NUMBER	DESCRIPTION	ITEM NUMBER	DESCRIPTION
TTR 1303	Process Black	MAT-AR12PC56	Process CYAN
TTR 1304	Process Cyan	MAT-AR12PK56	Process BLACK
TTR 1305	Process Magenta	MAT-AR12PM56	Process MAGENTA
TTR 1306	Process Yellow	MAT-AR12PY56	Process YELLOW
TTR 1301	SPOT Dark Blue	MAT-AR12SSB56	SPOT Sapphire Blue
TTR 1302	SPOT Dark Red	MAT-AR12SIR56	SPOT Intense Red
TTR 1307	SPOT Forest Green	MAT-AR12SG56	SPOT Green

<b>TTR 1308</b>	SPOT Bright Blue	<b>MAT-AR12SRR56</b>	SPOT Ruby Red
<b>TTR 1309</b>	SPOT Ocean Blue	<b>MAT-AR12STR56</b>	SPOT Tomato Red
<b>TTR 1310</b>	SPOT Blue	<b>MAT-AR12SBY56</b>	SPOT Burgundy
<b>TTR 1312</b>	SPOT Green	<b>MAT-AR12SB56</b>	SPOT Blue
<b>TTR 1313</b>	SPOT Pine Green	<b>MAT-AR12SBB56</b>	SPOT Bright Blue
<b>TTR 1314</b>	SPOT Leaf Green	<b>MAT-AR12SRB56</b>	SPOT Reflex Blue
<b>TTR 1315</b>	SPOT Orange	<b>MAT-AR12SOB56</b>	SPOT Ocean Blue
<b>TTR 1316</b>	SPOT Intense red	<b>MAT-AR12OLB56</b>	SPOT Olympic Blue
<b>TTR 1317</b>	SPOT Tomato Red	<b>MAT-AR12SPG56</b>	SPOT Pine Green
<b>TTR 1318</b>	SPOT Burgundy	<b>MAT-AR12SFG56</b>	SPOT Forest Green
<b>TTR 1319</b>	SPOT Light Gray	<b>MAT-AR12SLG56</b>	SPOT Leaf Green
<b>TTR 1321</b>	SPOT White	<b>MAT-AR12SO56</b>	SPOT Orange
<b>TTR 1322</b>	SPOT Golden Yellow	<b>MAT-AR12SDG56</b>	SPOT Dark Gray
<b>TTR 1323</b>	SPOT Sunflower Yellow	<b>MAT-AR12SGR56</b>	SPOT Gray (AKA Light Gray)
		<b>MAT-AR12SY56</b>	SPOT Yellow
		<b>MAT-AR12SSY56</b>	SPOT Sunflower Yellow
		<b>MAT-AR12UVY56</b>	SPOT Ultra UV Yellow
		<b>MAT-AR12SGY56</b>	SPOT Golden Yellow
		<b>MAT-AR12SW40</b>	SPOT WHITE

## 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 can be cleaned of normal use dirt accumulation by washing with a mild detergent and water using a soft bristle brush or cloth.

To remove tar, oil, or road dirt, 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. Following cleaning, the plate should be thoroughly rinsed with water.

## Storage

DLP sheeting, clear protective film and thermal transfer ribbons must be stored in their original package in a cool, dry area and should be used within one year after date of receipt. For best printing results, it is recommended that the sheeting be digitally printed in the DLP Print Station within 6 months of 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 will be spliced for continuous roll application. Additional sheeting is supplied to compensate for splices.

## Specifications

The information contained herein on reflective sheeting series 9250E/9250T 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 Safety Data Sheets, Article Information Sheets, and/or product label of chemicals prior to handling or use. Consult local regulations and authorities for possible restrictions. To obtain SDS sheets for 3M™ products, go to 3M.com/SDS, or by mail, or for more information, call 1-800-3MHELPS (1-800-364-3577).

## Warranty

3M Company warrants that (“3M Warranty”), Digital License Plate (DLP) Reflective License Plate Sheeting Series 9250E/9250T (“Sheeting”) imaged as recommended by 3M in this product bulletin, and overlaminated with 3M™ Digital License Plate Clear Protective Film 9097 (“Overlamine”) as recommended by 3M, will:

- remain legible by resisting excessive fading, cracking, blistering or peeling, and
- the unprinted areas<sup>3</sup> of the Sheeting applied on a license plate (“Plate”) will retain a coefficient of retroreflection for the number of years (“Warranty Period”) as given in Table 3 measured from the Plate fabrication date (“Fabrication Date”).

**Table 3. Sheeting Colors and Warranty Period<sup>†</sup>**

Base Sheeting Color	Retained Coefficient of Retroreflection* [cd/m <sup>2</sup> /lux]	Warranty Period (Years)
White	18	5
Gold	18	3
Yellow	18	5
Lemon Yellow	18	5
Orange	18	3
Blue	18	2
Green	18	2
Red	6	1

*\*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 E810 “Standard Test Method of Coefficient of Retroreflective Sheeting,” except that the coefficient of luminous intensity shall be determined in accordance with ASTM E808-01 Para. 3.2.2 and ASTM E809-02 Para. 12.3.*

## Warranty Terms and Conditions

- A failure to meet the 3M™ Warranty must be solely the result of design or manufacturing defects in the Sheeting and not of (a) outside causes including: improper fabrication, handling, maintenance or installation; (b) use of inks, roll coat inks, overlay films, sheetings or other components not listed as a component of 3M system of matched components; (c) exposure to temperatures beyond 3M recommendations; (d) use of a reflective sheeting applicator, brake table or corresponding registry feed controls not provided and installed by 3M; (e) stretching more than the maximum percent recommended by 3M during application; (f) failure of plate substrate; (g) exposure to chemicals, abrasion, or damage from fasteners used to mount the plate; (h) collisions, vandalism or malicious mischief; (i) or an act of God.
- All 3M recommendations in this bulletin and relevant 3M Information Folders, 3M Technical Memos and Manufacturing Manuals must be followed for all 3M components involved in the 3M Warranty.
- Claims made under this warranty will be honored only if the Plates have been marked with a 3M Ensure™ Image that includes 3M production run numbers from which the material originated or the Plates must have a clear record of the Fabrication Date either on the Plate or in an auditable records database.
- Claims made under this warranty will be honored only if 3M is notified of a failure within 30 days, reasonable information requested by 3M is provided, and 3M is permitted to verify the cause of the failure.

<sup>3</sup> Areas of the sheeting without preprinted graphics, or customer digitally printed graphics.

## Exclusive Limited Remedy

If the Sheeting on a Plate is shown to not meet the 3M Warranty during the Warranty Period, 3M's sole and exclusive remedy is, at 3M's option, to replace the Plate, or reimburse the Plate's issuing agency ("Agency") up to a maximum of \$5.00 per Plate. Reimbursement to the Agency will be in dollars and/or materials, as determined by the needs of the Agency. Replacement Sheeting will carry the unexpired warranty period of the Sheeting it replaces.

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## Literature Reference

<a href="#">PB 9097</a>	3M™ Digital License Plate Clear Protective Film 9097 for use on Multi-Year License Plates
<a href="#">PB TTR1300</a>	3M™ Digital License Plate Thermal Transfer Ribbons Series TTR1300 for use on Multi-Year License Plates
<a href="#">PB Chiller</a>	3M™ DLP Cooling System for use on DLP Printing Systems
<a href="#">PB 4850/4950</a>	3M™ Roll Coat Inks
<a href="#">PB HSF 100/200</a> <a href="#">DRF 300/400</a>	3M™ Dry Roller Coat Foils

## For Information or Assistance

Call: 1-800-553-1380

In Canada Call:

1-800-265-1840

## Internet:

<http://www.3m.com/roadwaysafety>

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