

Transportation Safety Division

# 3M™ High Definition Reflective License Plate Sheeting Series 6700

With Optional Dynamic Security Script Technology for Use on  
Multi-Year License Plates

Product Bulletin Series 6700  
August 2021

Replaces Product Bulletins 6700 Dated January 2020

## 1 Description

3M™ High Definition License Plate Sheeting Series 6700 (“**Sheeting**”) is a durable, all-weather, retroreflective sheeting consisting of micro-replicated optical elements protected by a durable top film. The Sheeting has been designed for use in the fabrication of multi-year reflective license plates that help enhance the nighttime visibility and legibility of the vehicle identification system. Sheeting appears similar during the day and at night (when viewed by reflected light) and is highly reflective when viewed both head-on and at entrance angles important for safety and legibility. 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. Personalized graphic designs are available for the Sheeting and offer a unique opportunity to promote a county, 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.

Plates can be embossed and roll coated with either transparent or opaque roll coating inks.

When printed with the 3M Digital License Plate System, TTR1300 Ribbons will be used with the Sheeting to print background graphics and variable plate messages, background graphics only, or variable plate message only. 3M Digital License Plate Clear Protective Film 9097 must be applied after printing. Plates may optionally be rim embossed or debossed.

## 2 Dynamic Security Script Technology

Sheeting with Dynamic Security Script Technology can include a range of very secure, tamper-resistant retroreflective security marks that can help defend against counterfeiting, provide production traceability, and help authorities assure authenticity. Under retroreflection, some elements of the security mark will appear slightly brighter than the background Sheeting while other elements will appear slightly darker than the background Sheeting. This property remains but shows a reversal of contrast under daylight viewing conditions. This contrast property also allows security marks to be seen from long distances (greater than 20 ft.) using a standard light source (i.e. headlights or flashlights).

Dynamic Security Script Technology is a unique feature that is very difficult to duplicate. The marks are integral to the reflective layer of the Sheeting, can only be introduced at the time of Sheeting manufacture, and cannot be modified without damaging the Sheeting.

Sheeting can be provided with no mark, a standard mark, or a mark that has been designed with specific customer input. Dynamic Security Script Technology marks will have a repeat pattern in the roll direction.

## 3 Performance Considerations

The Sheeting has been 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 the period specified in Section 11.

### 3.1 Retroreflectivity

The typical minimum coefficients of retroreflection of White Sheeting are shown in Table 1. The Coefficients of Retroreflection of Gold, Orange, Blue, Yellow, Green, and Red are available upon request. Finished license plates fabricated per 3M recommendations ([3M Information Folder 9.8](#)) shall meet the retroreflectivity requirements of ISO 7591.

**Note:** Please contact your 3M representative if your agency's license plate requirements differ from ISO 7591. The Sheeting is also available in high-brightness configurations that exceed the maximum coefficient of retroreflection specified by ISO 7591.

**Table 1.** Typical Minimum Coefficient of Retroreflection  $R_A$  [cd/lux/m<sup>2</sup>] (Average of 0° and 90° values)

Observation Angle <sup>a</sup>	Entrance Angle <sup>b</sup>	White
		Min
0.2°	-4°	150
	30°	26
0.5°	-4°	45
	30°	13
1.0°	-4°	20
	30°	7

- a. Observation Angle - The angle between the illumination axis and the observation axis.
- b. Entrance 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 E810, "Standard Test Method for Coefficient of Retroreflection of Retroreflective Sheeting."

### 3.2 Daytime Color (x,y,Y)

The chromaticity coordinates and total luminance factors of the Sheeting conform to the limits presented in Table 2.

**Table 2.** CIE Daytime Chromaticity Coordinate Limits<sup>a</sup> and Total Luminance Factor Minimum

Color	1		2		3		4		Daytime Luminance Limit (Y%)
	x	y	x	y	x	y	x	y	Min.
White	0.355	0.355	0.305	0.305	0.285	0.325	0.335	0.375	55

- a. The four pairs of chromaticity coordinates define the acceptable color limits for CIE D65 illumination in terms of the CIE 1931 Standard Colorimetric System, when measured using a 2-monochromator spectrophotometer employing an annular 45/0 illuminating and viewing geometry.

### 3.3 Adhesive

The Sheeting is provided with a pressure sensitive adhesive and an easy to remove liner that protects the adhesive until it can be laminated to the license plate substrate.

## 4 Fabrication of Reflective License Plates

For recommended license plate manufacturing procedures, refer to [3M Information Folder 9.8](#).

### 4.1 Substrates

The pre-coated adhesive will form a permanent bond to the surfaces of clean, chemically treated or conversion coated aluminum substrates normally used in the manufacture of license plates and as recommended by 3M.

### 4.2 Application

The Sheeting has been designed for application to clean, flat coil or sheet stock by continuous squeeze roll application.

Sheeting should be stretched to a maximum of 1% during application to the substrate. Once the Sheeting has been applied, it is recommended that laminated blanks be stored for a minimum of 48 hours before being embossed or debossed. For best embossing results, laminated blanks must be stored on edge and used within one year of date of receipt of Sheeting.

### 4.3 Embossing and Debossing

Sheeting, as applied to flat metal, is sufficiently flexible to satisfy the embossing and debossing requirements of most conventional license plate designs. Sheeting may be embossed or debossed to a height of up to 0.080" (2 mm) using standard embossing equipment and dies used for license plate production. Maintain a minimum clearance distance of 0.030" (0.75 mm) around the sides of both the male and female embossing dies. Align male and female embossing dies as well as possible; the Sheeting can tolerate misalignment of not more than 0.010" (0.25 mm) without significant negative effects. Minimum embossing temperature is 70 °F (21 °C).

Roll coating embossed or debossed license plates within 24 hours of embossing or debossing greatly improves license plate printability and quality.

### 4.4 Color Processing

Apply legends to embossed or debossed plates by roller coating with the 3M recommended high quality transparent or opaque inks listed in Section 4.5.

**Note:** Care should be taken when 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 the use of dark color roll coated characters on a white or yellow reflective sheeting background. Opaque inks are preferred for use with camera reading systems.

## 4.5 Oven Dried Inks

3M Series 4850 Opaque

3M Series 4950 Transparent

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

## 4.6 Dry Roll Coat Foils

For recommended dry roller coating practices refer to [3M Product Bulletin HSF100/200 and DRF 300/400](#).

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

## 4.7 Printer Ribbon Compatibility

Sheeting is compatible with the printers and ribbons shown in Table 3.

**Table 3.** Ribbons Qualified Under the 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
TTR 1308	SPOT Bright Blue	MAT-AR12SRR56	SPOT Ruby Red
TTR 1309	SPOT Ocean Blue	MAT-AR12STR56	SPOT Tomato Red
TTR 1310	SPOT Blue	MAT-AR12SBY56	SPOT Burgundy
TTR 1312	SPOT Green	MAT-AR12SB56	SPOT Blue
TTR 1313	SPOT Pine Green	MAT-AR12SBB56	SPOT Bright Blue
TTR 1314	SPOT Leaf Green	MAT-AR12SRB56	SPOT Reflex Blue
TTR 1315	SPOT Orange	MAT-AR12SOB56	SPOT Ocean Blue
TTR 1316	SPOT Intense red	MAT-AR12OLB56	SPOT Olympic Blue
TTR 1317	SPOT Tomato Red	MAT-AR12SPG56	SPOT Pine Green
TTR 1318	SPOT Burgundy	MAT-AR12SFG56	SPOT Forest Green
TTR 1319	SPOT Light Gray	MAT-AR12SLG56	SPOT Leaf Green
TTR 1321	SPOT White	MAT-AR12SO56	SPOT Orange
TTR 1322	SPOT Golden Yellow	MAT-AR12SDG56	SPOT Dark Gray
TTR 1323	SPOT Sunflower Yellow	MAT-AR12SGR56	SPOT Gray (AKA Light Gray)
		MAT-AR12SY56	SPOT Yellow
		MAT-AR12SSY56	SPOT Sunflower Yellow
		MAT-AR12UVY56	SPOT Ultra UV Yellow
		MAT-AR12SGY56	SPOT Golden Yellow
		MAT-AR12SW40	SPOT WHITE

## 5 Cleaning

For maximum service life, do not use abrasive or chemically concentrated harsh cleaners. Use the same care as is used in cleaning the paint surface on the vehicle. License plate surfaces 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, plates 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.

## 6 Storage

Sheeting must be stored in its original package in a dry area, at a temperature of  $73 \pm 9$  °F ( $23 \pm 5$  °C), and used within one year of date of receipt.

## 7 General Characteristics and Packaging

As supplied, Sheeting shall be of good appearance, free from ragged edges and cracks, and packaged according to commercial standards. Rolls of Sheeting contain splices for continuous roll application. Additional Sheeting is supplied to compensate for splices.

## 8 Specifications

The information contained herein concerning the Sheeting 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. For detailed product specifications, contact your 3M Technical Representative.

## 9 Fabrication Lines

The manufacturing process for the Sheeting results in periodic lines in the product. Fabrication lines may be noticeable in shop light but do not impact license plate functionality on the road, either in daylight or at night, under typical use conditions.

## 10 Health and Safety Information

Read all health hazard, precautionary, and first aid statements found in the Safety Data Sheets, and product labels for all chemical products prior to handling or use.

The Sheeting does not require a Safety Data Sheet, however, an Article Information Letter is available upon request.

## 11 Warranty Information

### 11.1 3M Warranty

3M warrants (“3M Warranty”) that Sheeting imaged as recommended by 3M in this product bulletin will:

- o Remain legible by resisting excessive fading, cracking, blistering or peeling, and
- o The unprinted areas of the Sheeting (those without preprinted graphics or customer-printed graphics) applied on a license plate (“Plate”) will retain a coefficient of retroreflection for the number of years (“Warranty Period”) as given in Table 4, measured from the Plate fabrication date (“Fabrication Date”).

**Table 4.** Warranty periods of Sheeting, by Color.

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

- a. All measurements taken at 2° 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.

### 11.2 Warranty Terms and Conditions

- o 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, storage, maintenance or installation; (b) use of roll coat pastes, overlay films, or sheetings not listed herein; (c) Plate exposure to temperatures beyond 3M’s recommendations; (d) use of a reflective Sheeting applicator, stretch control mechanism, brake table, or corresponding registry feed controls not provided and installed by 3M; (e) failure of Plate substrate; (f) exposure to chemicals, abrasion, or damage from fasteners used to mount the Plate; (g) collisions, vandalism, or malicious mischief; or (h) an act of God.
- o Claims made under this warranty will be honored only if the Plates have been marked with a Dynamic Security Script mark that includes the month/year date that the material originated from 3M or there is a clear record of the Fabrication Date either on the Plate or in an auditable records database; records must be maintained showing that the profile settings and procedures used in the production of the Plates conform to 3M recommendations.
- o Sheeting must be stored, applied, installed, processed, and used in accordance with all 3M application procedures found in 3M’s product bulletins, information folders, manufacturing manuals, Digital License Plate System User Manual, and technical memos (which will be furnished upon request), including the appropriate use of components listed in Section 13 of this product bulletin and recommended application equipment.
- o Claims made under this warranty will be honored only if 3M is notified of a failure within 30 days, reasonable information or samples as requested by 3M are provided, and 3M is permitted to verify the cause of the failure.

### 11.3 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”) at a rate of no more than \$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.

## 11.4 Disclaimer

THE 3M WARRANTY IS MADE IN LIEU OF ALL OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OR CONDITION OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE, OR ANY IMPLIED WARRANTY ARISING OUT OF A COURSE OF DEALING OR OF PERFORMANCE, CUSTOM, OR USAGE OF TRADE.

## 11.5 Limitation of Liability

Except for the limited remedy stated above, and except where prohibited by law, 3M will not be liable for any loss or damage arising from the Sheeting or any 3M product, whether direct, indirect, special, incidental, or consequential damages (including but not limited to lost profits, business, or revenue in any way), regardless of the legal theory asserted including warranty, contract, negligence, or strict liability.

## 12 Other Product Information

Always confirm that you have the most current version of the applicable product bulletin, information folder, or other product information from 3M's Website at <http://www.3M.com/vehicleregistration>.

## 13 Literature References

<a href="#">3M IF 9.8</a>	Preclear Reflective License Plate Sheeting Recommended Manufacturing Procedures
<a href="#">3M PB HSF100/200</a> <a href="#">and DFR 300/400</a>	Dry Roller Coat Foil Series HSF100/200 and DRF300/400
<a href="#">3M PB 4850/4950</a>	Roll Coat Inks Series 4850/4950
<a href="#">3M PB 9097</a>	3M™ Digital License Plate Clear Protective Film 9097 for Use on Multi-Year License Plates

ASTM Test Methods are available from ASTM International, West Conshohocken, PA.

## For Information or Assistance

Call: 1-800-553-1380

In Canada Call:

1-800-3M HELPS (1-800-364-3577)

## Internet:

<http://www.3M.com/vehicleregistration>

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