

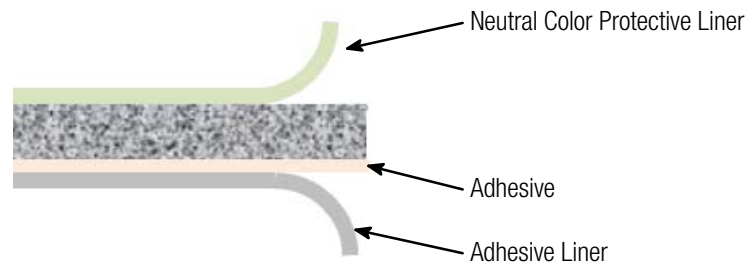
# 3M™ Specular Film DF2000MA

Technical Data Sheet: DF2000MA  
Release B, March 10, 2015

## 1. Product Description

3M™ Specular Film DF2000MA (the “Product”) is a polymeric film providing specular reflection with greater than 99% photopic reflectivity. This metal-free, non-corroding and non-conducting Product is well-suited for daylighting applications. It has a pressure-sensitive adhesive for a secure bond and a polyethylene liner to protect its reflective surface during installation.

## 2. Product Construction



## 3. Characteristics

The following characteristics are typical values for the Product. These are based on test data deemed reliable, but are not warranted. See Warranted Characteristics, Section 8., for warranted values.

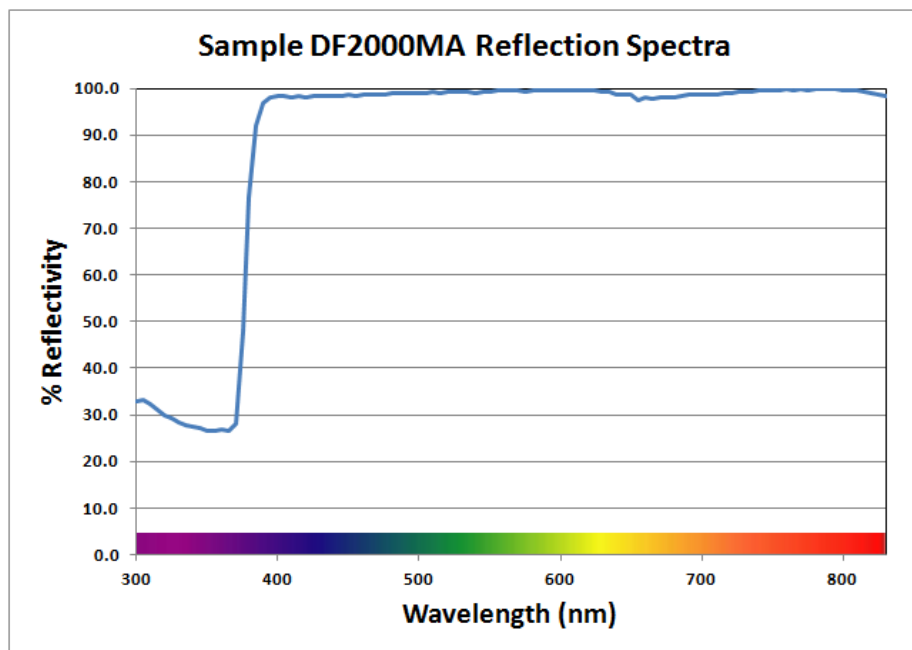
### A. Optical Characteristics

Characteristic	Value	Test Method
Photopic Reflectivity	> 99%	ASTM E1164/E308
Reflected Color/Shift		ASTM E1164/E308
CIE a*, b*	<= ± 2	4000K LED or D65, 2° Observer
CIE u, v	<= ± 0.001	
Bandwidth, 90% Reflectivity (0 to 80° angle of incidence)	400 to 775 nm	3M
Wavelengths Transmitted (0 to 80° angle of incidence)	> 775 nm	3M
Wavelengths Absorbed	< 400 nm	3M
Usage Angle	0 to 90 degrees	3M

## B. Physical Characteristics

Characteristic	Value	Test Method
Film	Polymeric	-
Liner, Adhesive	Paper	-
Adhesive	Pressure-sensitive	-
Width		-
Film and Liners	51 inches (130 cm)	
Adhesive	> 49 inches (125 cm)	
Total Thickness ( <i>nominal</i> )		3M
Film	8.1 mils (206 $\mu\text{m}$ )	
Adhesive	2.6 mils (66 $\mu\text{m}$ )	
Liner, Adhesive	1.5 mils (38 $\mu\text{m}$ )	
Liner, Adhesive	2.9 mils (74 $\mu\text{m}$ )	
Liner, Protective	1.1 mils (28 $\mu\text{m}$ )	
Total Density ( <i>film layer, adhesive and liners</i> )	20 ft <sup>2</sup> /lb (4 m <sup>2</sup> /kg)	3M
Tensile Strength ( <i>film layer</i> )	> 35 lb/in (6.2 kg/cm)	ASTM D-882
Elongation at Break ( <i>film layer</i> )	> 60%	ASTM D-882
Modulus ( <i>film layer</i> )	> 550 lb/in <sup>2</sup> (39 kg/cm <sup>2</sup> )	ASTM D-882
Heat Shrinkage ( <i>film layer</i> )	< 1% at 302°F (150°C), 15 minutes	ASTM D-1204-02

## C. Typical Normal Angle Spectral Response



#### D. Application Characteristics

Characteristic	Description
Surface Type	Flat and simple curved surfaces
Substrate Type	<ul style="list-style-type: none"><li>Laminated on any substrate the user tests and approves</li><li>Cold formed on aluminum sheeting</li></ul>
Application Temperature	72°F (22°C) <i>minimum</i>

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### 4. UV & Environmental Durability

#### A. High Intensity Radiant Flux

When using high intensity radiant light sources such as LED's, designs should be considered that minimize radiant flux density, time of exposure and heat. In high irradiance applications, The Product can begin to yellow and brown in time. Initial models estimate that the first onset of yellowing will occur after a blue radiant exposure of 50kJ/mm<sup>2</sup> at 122°F (50°C). For example, the Product placed 0.2 inches (5 mm) from the edge, and perpendicular to the base, of a typical 100 lm (4000K) LED, is estimated to remain colorless for at least 115K hours at 122°F (50°C). Higher operating temperatures are expected to shorten this lifetime.

#### B. UV Irradiance

The Product should not be used as a reflector for light sources with measurable UV irradiation without a UV absorbing filter. Sources would include but not be limited to: solar direct or indirect and fluorescent.

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### 5. Handling and Fabrication



#### CAUTION: Handling and Fabrication

Before using any equipment, always follow the manufacturers' instructions for safe operation.

**Handling.** If purchased in a roll, its weight typically exceeds 1000 pounds (454 kg). Lifting equipment is required when handling rolls to avoid injury.

**Application Temperature.** 72°F (22°C) *minimum*

**Protective Blue Liner.** To prevent scratching or marking the Product's reflective surface during installation, do not remove the protective liner until all fabrication and installation processes are finished. When ready, carefully remove the protective liner.

**Protect from Abrasion During Use.** To further prevent scratching or marking the Product's reflective surface, do not expose to abrasive environments.

**Lamination.** This Product can be applied with a roll laminator. Use a dry application method only. Keep the protective liner on the Product during the entire lamination process.

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### 6. Cleaning

This product is not intended for use in environments that require cleaning. Doing so can damage the Product's reflective surface.

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## 7. Shelf Life, Storage and Shipping

### A. Shelf Life

Use within one year from date of shipment from 3M.

### B. Storage

- 40° to 100°F (4° to 38°C)
  - Out of sunlight
  - Clean dry area
  - Original container
- 

## 8. Warranted Characteristics

Characteristic	Value	Test Method
Photopic Reflectivity <sup>1</sup>	> 99%	ASTM E1164/E308
Reflected Color/Shift CIE u, v	$\leq \pm 0.002$	ASTM E1164/E308 4000K LED or D65, 2° Observer

<sup>1</sup> Average of 1ft<sup>2</sup> (0.2 m<sup>2</sup>) spectra acquired using a PerkinElmer® LAMBDA™ Spectrophotometer Model 1050 and normalized with a traceable specular reference standard from OMT Solutions BV.

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## 9. Limited Warranty and Limited Remedy

### A. Limited Warranty

1. 3M warrants that on 3M's date of Product shipment to the Buyer, the Product will have the stated Warranted Characteristics (the "3M Warranty"). EXCEPT TO THE EXTENT PROHIBITED BY APPLICABLE LAW, THE 3M WARRANTY IS MADE IN LIEU OF ALL OTHER WARRANTIES, RIGHTS OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND THOSE ARISING FROM A COURSE OF DEALING, CUSTOM OR USAGE OF TRADE. THE BUYER IS RESPONSIBLE FOR DETERMINING IF A PRODUCT IS SUITABLE FOR ITS PARTICULAR PURPOSE AND APPLICATION METHODS.

2. For a buyer's convenience, 3M may provide engineering or technical information, recommendations, installation instructions, and other information or materials relating to Product ("Other Product Information"), but 3M makes only the 3M Warranty and does not warrant any Other Product Information.

3. 3M has no obligation under the 3M Warranty as to Product that has been: (a) modified, altered or processed in any manner; (b) stored, applied, installed, or used in a manner other than that 3M recommends in this Product Bulletin/Technical Data Sheet and in all Other Product Information; (c) damaged through contact with a person or thing, misuse, accident, neglect, or other action by anyone other than 3M; or (d) affected by environmental forces or stresses, including but not limited to, high intensity visible light, excessive heat, UV radiation, or water exposure.

### B. Limited Remedy

If any Product is proven not to have met the 3M Warranty on the buyer's receipt, then **the buyer's exclusive remedy, and 3M's sole obligation, will be, at 3M's option, to replace that Product quantity or refund the applicable purchase price.**

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## 10. Limitation of Liability

3M WILL NOT UNDER ANY CIRCUMSTANCES BE LIABLE TO A BUYER FOR DIRECT (other than the Limited Remedy stated above), SPECIAL, INCIDENTAL, INDIRECT OR CONSEQUENTIAL DAMAGES (INCLUDING, WITHOUT LIMITATION, LOSS OF PROFITS) IN ANY WAY RELATED TO A PRODUCT, THIS PRODUCT BULLETIN/TECHNICAL DATA SHEET, OR OTHER PRODUCT INFORMATION, REGARDLESS OF THE LEGAL OR EQUITABLE THEORY ON WHICH SUCH DAMAGES ARE SOUGHT.

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