

2201 - RETROREFLECTIVE SHEETING

SECTION 2201

RETROREFLECTIVE SHEETING

2201.1 DESCRIPTION

This specification covers Type I and all Types of High Intensity retroreflective sheeting. This includes both non-exposed glass bead lens and microprismatic sheeting.

2201.2 REQUIREMENTS

a. General. Provide retroreflective sheeting that complies with ASTM D 4956 (latest revision) except for the color limits as specified in **subsection 2201.2b**. The type to be provided will be shown in the Contract Documents. Types and classes are as defined in ASTM D 4956.

b. Color. The colors of the retroreflective sheeting are white, yellow, red, orange, green, blue, brown, fluorescent orange, fluorescent yellow, and fluorescent yellow-green. Provide colors that comply with the chromaticity limits as shown in **TABLE 2201-1** for both Type I and Type III sheeting and **TABLE 2201-2** for all other Types of High Intensity sheeting (Type IV through Type X). Provide fluorescent colors that comply with the chromaticity limits in ASTM D 4956 (latest revision).

TABLE 2201-1: COLOR SPECIFICATION (Type I and Type III)								
COLOR	Chromaticity Coordinates							
	1		2		3		4	
	x	y	x	y	x	y	x	y
White	0.310	0.313	0.338	0.342	0.325	0.355	0.300	0.327
Yellow	0.496	0.503	0.545	0.454	0.505	0.433	0.460	0.474
Red	0.574	0.337	0.665	0.345	0.708	0.292	0.613	0.297
Orange	0.558	0.352	0.636	0.364	0.570	0.429	0.506	0.404
Green	0.130	0.387	0.180	0.410	0.140	0.521	0.098	0.490
Blue	0.138	0.065	0.112	0.135	0.160	0.170	0.176	0.120
Brown	0.430	0.340	0.610	0.390	0.550	0.450	0.430	0.390

TABLE 2201-2: COLOR SPECIFICATION (Type IV – Type X)								
COLOR	Chromaticity Coordinates							
	1		2		3		4	
	x	y	x	y	x	y	x	y
White	0.310	0.313	0.328	0.331	0.316	0.345	0.300	0.327
Yellow	0.515	0.484	0.545	0.454	0.505	0.433	0.475	0.460
Red	0.586	0.324	0.664	0.336	0.708	0.292	0.613	0.297
Orange	0.558	0.352	0.636	0.364	0.570	0.429	0.506	0.404
Green	0.130	0.387	0.180	0.410	0.155	0.478	0.107	0.457
Blue	0.138	0.065	0.112	0.135	0.160	0.170	0.176	0.120
Brown	0.430	0.340	0.610	0.390	0.550	0.450	0.430	0.390

c. Conformable Retroreflective Sheeting. Provide High Intensity retroreflective sheeting that has a conformable aluminum foil backing with an aggressive pressure sensitive adhesive. This material is designed for application to moderately rough or porous metal, wood or masonry surfaces. Provide material that complies with ASTM D 4956 (latest revision) with the following exceptions and additions:

- (1) Conformable aluminum backing thickness – 0.005 inches to 0.010 inches.
- (2) Follow all manufacturers' recommendations for application procedures and temperatures.

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2201.3 MANUFACTURER WARRANTY

The following warranty conditions apply only to the retroreflective sheeting manufacturer. Provide a product warranty for a minimum period of 10 years on all Types of High Intensity retroreflective sheeting, for placement on permanent signing. Failure to comply with this warranty may be cause for removal from the prequalified list.

The High Intensity retroreflective sheeting warranty must comply with the following requirements and obligations:

- Certification: Submit with each lot or shipment, a certification which states that the material supplied is subject to and complies with the requirements. Include in the certification, the manufacturer's office, address, phone number and the contact for potential claims under the provisions of this warranty. Provide documentation as to which signs were fabricated from each lot.
- Field Performance: Field Performance applies to retroreflective sheeting applied to sign blank materials or overlaid on existing signs. The field performance obligation period begins with the date of erection. The sheeting is considered unsatisfactory if it has deteriorated due to natural causes to the extent that the sign is ineffective for its intended purpose when viewed from a moving vehicle under normal day and night driving conditions or shows any of the following defects:
 - Cracking discernible with the unaided eye from a driver's position at a distance of 50 feet or greater from the sign;
 - More than 25% loss of specular gloss and cracking, scaling, pitting, orange peel, delamination, edge lifting or curling;
 - Peeling in excess of 3/8 inch;
 - Shrinkage in excess of 3/16 inch total per yard of sheeting width;
 - Fading or loss of color to the extent that retroreflective sheeting color fails to comply with the **subsection 2201.2b.**, or;
 - Loss of retroreflectivity reducing the coefficient of retroreflection as measured by a retroreflectometer to less than the minimum specified in **TABLE 2201-3** at 0.2° observation and -4° entrance angles. Make all measurements after cleaning the sign.

Sheeting Color	Min. Coefficient
White	200
Yellow	136
Green	36
Red	36
Blue	16
Brown	9

Defective Material Replacement: When traffic signs with High Intensity sheeting fail to comply with the field performance requirements, re-sheet or replace the signs at no cost to the KDOT for materials and labor. Employ a contractor qualified by the KDOT to perform signing work. Install highway signs, as shown in the Contract Documents and the M.U.T.C.D. (latest edition) and provide proper traffic control.

Replace all defective material within 60 days after written notification by the KDOT. Signs not corrected within 60 days, will be removed and replaced by the KDOT. Signs removed by KDOT will be placed in storage for inspections by the manufacturer, and the manufacturer will be billed for all costs of replacement of the sheeting.

When more than 25% of the signs within a lot fail to comply with the requirements, replace all signs made from that lot.

2201.4 PREQUALIFICATION

Manufacturers desiring to provide material under this specification are to submit prequalification samples of each type, class and color covered by this specification which they wish to prequalify. Each sample consists of 3 pieces 24 inches square.

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Forward the prequalification samples to the Engineer of Tests, Materials and Research Center, 2300 Van Buren, Topeka, KS 66611. Samples will be tested for compliance with all requirements of this specification. Each Manufacturer will be notified of the test results.

If the prequalification samples of retroreflective sheeting comply with this specification, the product will be placed on a list of prequalified products maintained by the Bureau of Materials and Research. No retroreflective sheeting will be used on KDOT projects unless it has been prequalified. Manufacturers will be required to requalify at intervals determined by the Engineer of Tests.

Testing and evaluation by KDOT may be waived if complete testing has been performed on the identical product by AASHTO National Transportation Product Evaluation Program (NTPEP). Forward an official copy of the test report along with evidence that the product referenced is identical to that submitted for prequalification, to the Engineer of Tests for evaluation.

2201.5 METHODS OF TESTS

All tests will be conducted in accordance with ASTM D 4956 with the exception of artificial weathering. Artificial weathering will be conducted according to ASTM G 155, Cycle 1, with the following additions and exceptions:

- At the end of each 20 hour cycle, the panels will be placed in a cold cabinet at approximately 0°F for one hour. After removal from the cold cabinet, panels will be returned to the weatherometer to await the start of the next cycle.
- Water used in the weatherometer will be city water softened to a total hardness content of less than 5 parts per million expressed as calcium carbonate.

2201.6 BASIS OF ACCEPTANCE

a. Permanent Sheeting.

- (1) Prequalification as required by **subsection 2201.4**.
- (2) Satisfactory results of tests conducted at MRC. Each lot of sheeting will be sampled at destination by a representative of the KDOT and will be subjected to a visual examination and tested for physical properties as necessary to verify that the sheeting complies with this specification.
- (3) Receipt of the warranty certification as specified in **subsection 2201.3** by the Project Engineer.

b. Temporary Sheeting. Retroreflective sheeting used to manufacture temporary traffic control signs will be accepted on the basis of a certification prepared by the contractor stating that the retroreflective sheeting used to manufacture the signs was prequalified under this specification, and visual inspection by the Engineer for condition and other requirements.