

Nikkalite™ Brand Retroreflective Sheeting T4400 Series

for Use on Car License Plates

1. INTRODUCTION

Nikkalite™ Brand T4400 Series retroreflective sheeting was specifically developed for use in reflective Car License Plates (CLP), and can also be used on motorcycle or truck license plates. Nikkalite™ T4400 Series sheeting is all-weather, bright, durable, sheeting consisting of glass beads embedded with a transparent film. It is pre-coated with a permanent pressure sensitive adhesive protected by easily removable liner that will provide a secure bond for many years. After

T4400 sheeting is applied to the base plates, the sheeting of character part is embossed and peeled off to produce attractive license plates. When it is properly applied, the Nikkalite™ T4400 sheeting will result in a bright and highly legible license plate during the daytime and nighttime when viewed from the car. The combination of these qualities will contribute to traffic safety.

2. PERFORMANCE MEASUREMENTS

The minimum retroreflective values of the Nikkalite™ T4400 sheeting are given in Table-1.

Measurements shall be conducted in accordance with ISO 7591 (Road vehicles – Retro-reflective registration plates for motor vehicles and trailers – Specification). The reflective value of T4400 series sheeting, totally

wet by rain, will not be reduced by more than 10% of the values specified in Table-1 below. Rainfall performance measurement shall be conducted at 0°20' observation and 5° entrance angle in accordance with ISO 7591.

Table-1 Minimum values of retroreflectivity*

Color	Observation Angle	Entrance Angle			
		5°	30°	40°	45°
White	0°12'	70.00	30.00		6.00
	0°20'	50.00	25.00		3.00
	1°30'	5.00	2.00		1.00
Red	0°12'	10.00	4.00	1.40	
	0°20'	7.00	2.50	1.20	
	1°30'	0.60	0.30	0.20	
Green	0°12'	9.00	3.00	1.00	
	0°20'	7.00	2.30	0.90	
	1°30'	0.60	0.15	0.08	
Yellow	0°12'	40.00	16.00	7.00	
	0°20'	28.00	11.00	5.00	
	1°30'	3.00	2.00	1.00	

* Minimum coefficient of retroreflection (R_A) cd/lux/m².

Table-2 Color limits (Daytime)

(CIE Standard Illuminant D₆₅, 45°/0° geometry)

Color	Item No.	1		2		3		4		Luminance factor (β)
		x	y	x	y	x	y	x	y	
White	T4412	0.355	0.355	0.305	0.305	0.285	0.325	0.335	0.375	≥0.35
Red	T4405	0.690	0.310	0.595	0.315	0.569	0.341	0.655	0.345	≥0.05
Green	T4408	0.007	0.703	0.248	0.409	0.177	0.362	0.026	0.399	≥0.04
Yellow	T4404	0.545	0.454	0.487	0.423	0.427	0.483	0.465	0.534	≥0.27

Color coordinates of Nikkalite™ T4400 Series conforming to the color limits of Table-2 above. (The four pairs of chromaticity coordinates determine the acceptable color in terms of the CIE 1931 Standard Colorimetric System measured with CIE Standard Illuminant D₆₅.)

Table-3 Chemical Tests Performance (After applied to the aluminum plate)

Chemical Composition	Test Performed	Results
Water resistance	24 hours at 23±5°C, ⇒ drying 48 Hours	No defects
Cleaning	Wipe with heptane after smeared with a mixture of lubricating oil and graphite.	No defects
Resistance to fuel	Immerse the sample for 1 min. in 70% n-heptane + 30% toluene	No defects
Saline mist test	According to ISO 7591, Item 15: Resistance to saline mist	No corrosion and no defects

Table-4 Physical Properties of the sheeting (After applied to the aluminum plate)

Type of Test	Test Method	Results
Temperature resistance	7 hours in 65±2°C, RH 10±5% ⇒ 1 hour in 23±5°C, RH 50±10% ⇒ 15 hours in -20°C	No peeling, cracking, blistering and discoloration
Adhesion	Peel sheeting after 1 hour, -20°C	Sheet can not peel without breaking

The test of Table-3 and Table-4 above are based on tests conducted on **Nikkalite™** T4400 sheeting applied to chemically treated aluminum panels and conditioned for 24 hours at a temperature 23±2°C and 50±5% relative humidity before testing.

All the aforementioned figures in the tables are based on our experience and actual measurements based on our own tests. However, these figures may not be guaranteed.

3. EFFECTIVE PERFORMANCE LIFE

Based on numerous tests and past experience, finished license plates of **Nikkalite™** T4400 Series sheeting, applied on the treated aluminum plate and processed

as recommended, will perform effectively without remarkable color fading, sheet peeling, blistering, or cracking, for 5 years.

4. FABRICATION of RETROREFLECTIVE LICENSE PLATES

(1) Substrates

Nikkalite™ T4400 Series sheeting will form a durable bond to aluminum sheeting which have treated with “Anodizing” or the other suitable treatment. Many kinds of treatment agents are available in the market such as sodium dichromate, phosphoric acid, sulfuric acid, etc. It is important to follow the manufacturer’s instructions

as to dilution ratio, treatment temperature, treatment time, etc. Care should be taken to the substrate after chemical treatment. Thorough washing should be done with water to eliminate excessive agents from the surface, which will reduce the retroreflective sheeting performance.

(2) Application

Nikkalite™ T4400 Series sheeting can be applied directly to the aluminum surface treated with one of above method with a continuous squeeze roll applicator. The CLP sheeting has a pre-coated pressure sensitive

adhesive that bonds securely to the substrate. Since the quality of the adhesion is influenced by the temperature, application at a temperature of 20°C to 30°C is recommended.

(3) Embossing

Nikkalite™ T4400 Series sheeting should be conditioned at 25°C to 30°C for 2 hours after it is applied to the substrate and before it is embossed or

de- bossed. Standard embossing machines presently available may be used.

5. CLEANING

During its lifetime the CLP may require cleaning at some stage. The CLP will probably have sand/grit within the surface dirt, therefore it is recommended that a low-pressure flow of water is used to help remove this loose dirt and sand/grit from the CLP first. Never use a strong jet of water. Rubbing the sand/grit into the CLP during the cleaning procedure may cause irreparable damage to the CLP material. Therefore, care must be taken during the cleaning process. A small solution of a

mild detergent in clean warm water is recommended for cleaning the material surface. The detergent and cloth must be non-abrasive, free of any strong aromatic solvents or alcohols and be chemically neutral. Rinse the whole area thoroughly after washing and allow to dry naturally or use a lint free cloth. Tar or similar deposits can be removed by a light application of turpentine, following with the washing instructions above.

6. STORAGE

Retroreflective sheeting, inks, thinner, etc. should be stored between 15°C to 25°C, ideally with a relative humidity of 30% to 60%, and out of direct sunlight. Retroreflective sheeting and inks should be used within one year after purchased. Do not leave full or open rolls

of material resting on hard surfaces; this may cause bruising to the retroreflective material, which may not be seen until exposed to a light source. The material has a 1 year shelf life from date of purchase.

7. CAUTION

Read through First Aid, Health Hazard and Precautionary statements mentioned in the Material Safety Data Sheet (MSDS) of correlated products

such as printing inks, thinner, treatment agents, etc. prior to handling or use.

8. RELIABILITY

All recommendations and technical information contained herein are based on experience and tests, which the manufacturer believes to be reliable, but their accuracy and completion are not warranted. The user

is cautioned to undertake their own test/tests to determine the suitability of a particular product for the intended application.

9. WARRANTY

Nikkalite™ Products are warranted to be free from defects in materials and workmanship at the time of their sale. Except as herein above expressly warranted, **Nikkalite™** products are sold without any warranty whatsoever, including warranties of merchantability or fitness for a purpose. The sole remedy for failure of

Nikkalite™ products to conform to said warranty is the replacement of the defective products; neither the manufacturer nor the seller shall be liable for any loss, damage or injury, direct or indirect or incidental, arising from the use or inability to use said **Nikkalite™** products.

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