Nikkalite

Super Engineering Grade 15000 SERIES

1. INTRODUCTION

15000 Series Super Engineering Grade (SEG) retroreflective sheeting is an enclosed lens type high performance retroreflective material. The photometric properties of Nikkalite™ SEG are more than double those of Engineering Grade. SEG was specially developed for use on traffic (regulatory, warning guides etc.) signs and other safety devices that require high reflectance. Traffic signs faced with Nikkalite™ sheeting and screen printed with Nikkalite™ transparent process colors are attractive in appearance and highly visible during both day and night, and contribute greatly to driving safety.

2. DESCRIPTION

Nikkalite™ 15000 Series SEG will bond to clean and smooth surfaces of tested and approved metal, coated metal and plastic sheets. 15000 Series SEG has a high-tack pressure sensitive adhesive for application to the above substrates where an immediate aggressive adhesive is required, or for lower temperature range applications (minimum 15°C (59ºF). Application should be undertaken in an ambient temperature of between 18°C to 25°C (64°F to 77ºF), where the sign face material and substrate has been allowed to condition. Permanent bonding will take place approximately 48 hours after application. DO NOT ALLOW THE ADHESIVE TO FREEZE DURING CURING PERIOD. The material is watermarked (star mark: ☆) in the middle of sheeting layer for identification purposes.

Nikkalite™ 15000 Series SEG retroreflective sheeting offers the following characteristics:

* A full 10-year guarantee in reflectivity except orange color (Orange: 3-year life)
* Colorfast
* Resistance to corrosion
* Resistance to most solvent
* Excellent resistance to weathering
* Excellent adhesion
* Dimensional stability

Available colors, widths and lengths
Colors: White, Yellow, Red, Blue, Orange, Green and Brown
Widths: 24”, 30”, 36” and 48”
Lengths: 50 Yards

3. TECHNICAL DATA

A) Physical Properties of Nikkalite™ 15000 Series SEG Sheeting

Property	Test Method	Results
Average Thickness	Micrometer	0.193mm
Average Gloss	Gloss Meter (85 degrees)	96
Tensile Strength	Instron at 30cm (12”)/minute	38.2 N/25mm
Elongation	Instron at 30cm (12”)/minute	30%

B) The data shown below is based on tests con- ducted on SEG sheeting applied to acid etched aluminum panels and conditioned for 48 hours at a room temperature of 23°C(74°F).

Property	Test Method	Results
Humidity Resistance	100% humidity at 27°C(81 °F) 72 hours	No effect
Cold Resistance	72 hours at -56.6°C(-70°F)	No effect
Heat Resistance	72 hours at 71°C(160°F)	No effect
Adhesion	180 pullback at 30cm(12")/min. at 23°C(74°F)	24.5 N/25mm
90° Peeling Test	0.8Kg(1.8ibs) weight suspended for 5 min.	Less than 3mm
Accelerated Weathering	Sunshine Weather-O-Meter for 2,200 hours 15037 Orange: 600 hours	No effect
Salt Spray Effects	3% concentration at 25°C(95°F) for 500 hours	No effect

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C) Resistance to Chemicals

Chemical Agent	Exposure Time	Results
Water	1 month	No effect
10% Hydrochloric Acid Solution	10 minutes	No effect
10% Sodium Chloride Solution	1 month	No effect
Kerosene	10 minutes	No effect
Turpentine	1 minute	No effect
Xylene	1 minute	No effect

4. RETROREFLECTIVITY

Typical coefficient of reflection for SEG are shown in the table below. (cd/lux/m2)

O.A.	E.A.	White	Yellow	Red	Blue	Orange	Green	Brown
0.2 (12')	-4/5	185	126	44	12.0	76	38	9.0
	15	150	110	34	10.0	65	19	8.0
	30	57	57	25	4.6	45	17	5.0
	40	21	21	13	1.2	16	6	2.5
(20')	130	94	94	31	6.2	54	26	6.5
	121	71	71	27	5.2	50	15	6.0
	90	53	53	26	3.4	20	14	4.5
	34	15	15	12	1.2	15	3	2.0
0.5	72	54	54	18	4.0	30	15	3.0
	68	42	42	17	2.7	28	11	2.8
1.0	22	18	18	6.3	1.3	11	3.1	1.6
	19	14	14	5.5	1.2	10	2.7	1.1
	14	7.0	7.0	3.3	0.4	6.8	1.6	0.7
2.0	9.2	5.8	5.8	3.3	0.6	3.2	1.4	0.6
	8.1	5.7	5.7	2.5	0.4	2.8	1.3	0.4
	6.3	3.4	3.4	2.4	0.3	2.7	0.8	0.3

O.A. = Observation Angle, E.A. = Entrance Angle

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

5. CHROMATICITY COORDINATES

Nikkalite™ SEG sheeting is available in eight colors conforming to all worldwide retroreflective sheeting standards. The pigments used in SEG are highly transparent and durable ensuring long durability without fading.

6. SILK SCREEN PRINTING

Nikkalite™ N3500 single pack and the Nikkalite™ N3600 two pack inks are extremely durable, highly transparent, quick drying and fast curing inks, that bond strongly and permanently to Nikkalite™ retroreflective sheeting. Normally, Nikkalite™ ink does not require dilution with thinner due to its pre-adjusted viscosity. However, when it is necessary, use only Nikkalite™ thinners. Use N3600 two-pack ink (ink and hardener) for situations that require a very hard "Vandal-resistant" finish. This ink is highly scratch resistant and also offers good resistance against most solvents, gasoline, grease and oil's etc.
Clear coating or edge sealing is not normally required for either inks, however, if it is specified use the appropriate N3512 or 3612 clear toner to the relevant series ink being used.
For screen printing Road Traffic Signs a 62T-77T/cm (157-180/in.) polyester mono-filament plain weave mesh is recommended to achieve the correct depth of color and the durability required. Do not print Nikkalite™ N3500 series ink onto Nikkalite™ N3600 series inks or vice versa. When screen printing with other manufacturer's ink, thinner, etc. onto Nikkalite™ sheeting, the user must accept all responsibility

Inks available:

Color	N3500 Series Single Pack	N3600 Series Two Pack
Black (Opaque)	N3503	N3603
Yellow	N3504	N3604
Traffic Sign Red	N3525	N3625
Blue	N3506	N3616
Orange	N3507	N3607
Green	N3508	N3608
Brown	N3529	N3629
Toner	N3512	N3612
Hardener	----	N3631
Thinner	N3511	N3611

Mixing of inks and hardener: Ink: Hardener= 100 parts: 7~8 parts by weight
Mixing of inks and thinner: Ink: Thinner = 100 parts: Up to 10 parts, as necessary

7. COLOR MATCHING

When using more than one piece of retroreflective sheeting together, sheeting from the same roll should be used for uniform color matching and reflectivity. Every other piece of material should be rotated by 180°, so the same roll edges come together. Color matching is the responsibility of the sign manufacturer.

8. SUBSTRATE PREPERATION BEFORE APPLICATION

Nikkalite™ 15000 Series SEG sheeting will bond to clean smooth surface of tested and approved metal, coated metal and plastic sheets. There are many types of plastic sheets available, with new products coming onto the market all the time. Some will emit plasticizer or gas from their surface, which has a detrimental effect on the adhesion of retroreflective materials. You should pre-check the quality and suitability of them before use.

To obtain optimum adhesion and good durability it is necessary to eliminate such problems. This can be done by abrading the surface, by cleaning with solvents or by chemical treatment.

a) For correct application the substrate surface should be:

* Clean and smooth
* Rigid and weather resistant
* Relatively non-porous
* Not emit any release agents from its surface

Suitable smooth clean surfaces, pre-treated to prevent corrosion and allowed to condition for approximately 24 hours at an ambient temperature between 18°C to 25°C (64°F to 77°F), in an area protected from moisture, will provide a durable bond.

b) Treatment Methods:

"A"—Cleaning with solvent

(1) Prepare clean, soft cloth (as clean as possible).
(2) 1st Step: Soak the cloth with any of the solvent described below and wipe the surface completely.
(3) 2nd Step: Soak another piece of cloth with the solvent and wipe the surface once again.
(4) 3rd Step: Wipe the surface again with a dry clean cloth.
(5) You can use the cloth from step 3 again for the 2nd or 15' step but contaminated cloths should always be discarded, as dirty cloths will spread contamination all over the surface.
(6) Confirm that there are no residues of dirt or solvent on the surface.
(7) Suitable solvents: Acetate, Mineral Sprit, Toluene, Xylene
(8) For plastic panels please refer to "B" below and use the minimum amount of solvent for soaking the cloth and wipe the surface swiftly.

"B"—Abrasion Method
(1) Rub the surface of the aluminum plate evenly with sandpaper, No.150-200, or impregnated nylon scouring pads. For plastic surface or painted steel, use No.400 or fine sandpaper.
(2) Ideally the debris should be taken away with a vacuum cleaner.
(3) Wipe the surface as instructed in "A" 2-8 above.
(4) The abrasion method will remove the oxidized surface film or contamination and will leave the surface clean. The abraded roughened surface will also aid adhesion. However, too much abrasion will result in poor adhesion.
(5) The abrasion work should be carried out away from the application and printing areas.

"C"—Chemical Method
(1) Many kinds of treatment agents are available such as sodium dichromate, phosphoric acid, etc. It is important to follow the manufacturers' instructions as to dilution ratio, treatment temperature, treatment time etc.
(2) Care should be taken of the substrate after chemical treatment. Thorough washing should be undertaken with water to eliminate excessive agent from the surface, which will reduce the retroreflective sheeting life.
(3) Before sending the treated substrates to the application areas the surface should be dried thoroughly.
(4) Some treatment agents have a limited effective life when used on the substrates. Therefore, treated substrates should be applied as quickly as possible.

Substrate	Treatment Method	Remarks
Aluminum	A	Aluminum pre-treated by manufacturer
Aluminum	B + C	Not treated
Iron & Steel	B + C	Epoxy powder or melamine thermosetting painted steel is recommended
Stainless Steel		Stainless steel is not recommended as a substrate
Galvanized Iron	C	Adhesion is normally poor
Painted Iron	B	Epoxy powder or melamine thermosetting painted steel is recommended
Glass Plate	A	MEK (Methyl-Ethyl-Ketone) or acetone
Concrete		Pre-treat surface with a suitable primer for concrete and dry thoroughly
Plastics: Polycarbonate Polymethyl Metacrylate PVC	A	1) Wipe with methanol 2) Wipe with methanol, allow to stand, remove the debris and wipe again with methanol
Epoxy, Polyester Melamine, Polyethylene Polypropylene	A	1) Wipe with methanol 2) Wipe with methanol, allow to stand, remove the debris and wipe again with methanol

NOTE: PLASTICS
* When cleaning plastic surfaces with solvent, soak the cloth with a small amount of the solvent and wipe the surface quickly. If solvent remains on the surface, wipe it off with a clean dry cloth.
* Some plastics will develop hairline cracks on the surface after wiping with solvent. Perform a test by trying the solvent on a small panel before full treatment.
* Those plastics which do develop hairline cracks should be wiped with a cloth with mild detergent solution and then washed thoroughly with water and dried.

9. APPLICATION

Nikkalite™ SEG 15000 Series retro- reflective sheeting is coated with pressure sensitive (PS) adhesive that, when applied at room temperature of 18°C to 25°C (64°F to 77°F) is easy to handle and apply. SEG is bonded to the sign substrate by application of pressure with a hand roller, a manual roller applicator or power squeegee roller applicator. Aluminum plate, epoxy powder or backed melamine painted panels normally provides good adhesion properties for retroreflective sheeting. The sheeting does not adhere well to some types of air drying paints, therefore, before applying to painted surfaces care should be taken to test the surface. Plastics that are being used for the first time should be tested to determine whether the sheeting will perform well by exposing a test specimen at 70°C (158°F) for three hours to check bubbles causing out-gassing from plastic and by exposing a test specimen outdoors facing south

at 45 degrees (in the Southern hemisphere, north facing 45 degrees) for at least three months to check adhesion strength to the substrate.

1O. GRAPHIC CUTTING

Friction or sprocket driven rotary plotters, flat bed plotters or craft type cutting knives are all suitable for cutting 15000 Series SEG materials.
The material must be allowed to condition, out of its box and correctly supported, ideally in a room with an ambient temperature of 18°C to 25°C (64°F to 770F). If the entire area cannot be heated to 18°C (64°F or above, use some form of safe heating to provide warm air onto the working area.

11. STORAGE

Retroreflective sheeting should be stored between 15°C to 25°C (59°F to 770F), ideally with a relative humidity of 30% to 60%, and out of direct sunlight. In a horizontal position above the floor, store full and open rolls in the carton that they were shipped in. Make sure rolls are suspended in the box on the plastic supports, or suspended through the core with a suitable bar. Do not leave full or open rolls of material resting on hard surface; this may cause bruising to 18°C to 25°C (64°F to 77°F) reflective material, which may not be seen until exposed to a light source. Do not stand full or part rolls vertically on their end. Retroreflective sheeting should be used within one year after purchased.

12. CLEANING I MAINTENANCE

During its lifetime the sign may require cleaning at some stage. The sign 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 sign first. Never use a strong jet of water. Rubbing the sand/grit into the sign during the cleaning procedure may cause irreparable damage to the sign 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.

13. DURABILITY

When processed and applied in line with the manufacturer's instructions, Nikkalite™ 15000 Series SEG material when exposed vertically under normal weathering conditions can be expected to have a useful life as shown in the table below. However, actual performance depends greatly on type and treatment of substrate and on weathering conditions.

Item Number	Color	Life
15012	White	12 Years
15004	Yellow	12 Years
15035	Red	12 Years
15006	Blue	12 Years
15037	Orange	3 Years
15008	Green	12 Years
15006	Blue	12 Years

That aforementioned information regarding the processing is based on our own experience and experiments. However, these may not be representative of the actual information that can be guaranteed.

14. 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.

15. 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.