Practical Information

ORALITE® Reflective Films of Reflection Class RA2, Grade C
for Traffic Security

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Version 2014/11
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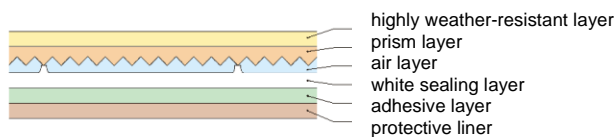
1. Processing instructions for ORALITE® High Intensity Prismatic Grade Films

These processing instructions apply to the following ORALITE® High Intensity Prismatic Grade films, Reflection Class CUAP R2, DIN 67520:2008-11 RA2, Design C, ASTM D4946-11a Type IV Sheeting and AASHTO M268 Type B.

ORALITE® 5900 High Intensity Prismatic Grade
ORALITE® 5910 High Intensity Prismatic Grade
ORALITE® 5930 Prismatic Construction Grade
ORALITE® 5931 Prismatic Construction Grade
ORALITE® 5960 High Intensity Prismatic Construction Grade

The basic composition of ORALITE® High Intensity Prismatic Grade film is shown in the scheme below:

highly weather-resistant layer
prism layer
air layer
white sealing layer
adhesive layer
protective liner

The information within this document is based on our knowledge, experience and application tests. Its purpose is to provide suggestions and support to practitioners. Even though it is not possible to explain all aspects that need to be taken into account, this guideline comprises a large number of useful tips for handling ORALITE® High Intensity Prismatic Grade films.

Specific knowledge and skills of sign producers are prerequisites for the processing of ORALITE® High Intensity Prismatic Grade film. On account of the large number of conditions that may influence the processing, adhesive bonding and use of the films, the sign producer should carefully consider the suitability and performance of the product for each intended use and perform their own tests.

2. Storage and Transportation

ORALITE® High Intensity Prismatic Grade film should be stored in a cool and dry, indoor area that is protected from direct sunlight. Recommend temperatures for storage are from 18°C to 24°C [65°F to 75°F] and air humidity of 40% to 60%.

Rolls should be stored in the original carton. The rolls have standard spacers [core plug] that prevent contact between the roll surface and the carton and thus the formation of pressure marks and surface damage. Please make sure that partly processed rolls are never stored without spacers.

When making the rolls available for processing, it is advisable to use a horizontal suspension system. If the rolls are stored in a vertical, freestanding position, a negative influence on the film's characteristics is not expected. It is crucial to place the roll on the spacer so as to avoid breakage at the edges and contamination.

Blank or printed film sheets are supplied in cartons that have been specifically designed to the sheet dimensions. There are 50 sheets per carton. If the sheets are stored outside the carton, please make sure to put individual sheets on a flat and stable support so that they do not adjoin or overlap at the edges. Sheets may be stacked. However, in order to limit the weight load not more than 40 to 50 sheets should be stacked.

3. Printing

ORALITE® High Intensity Prismatic Grade films surface can be screen-printed with ORALITE® 5018 Screen Printing Ink or digitally printed with ORALITE® 5019 UV Digital Ink and the ORALITE® UV Traffic Sign Printer.

3.1 Screen Printing process

ORALITE® 5018 silk-screen inks are a one-component, solvent based and quick drying color system. The resulting surface is glossy and exceptionally weather resistant. After proper curing, the ink is extremely resistant to mechanical stresses such as those caused by cleaning brushes, etc. The application of an additional clear topcoat is not necessary for these ink systems.

ORALITE® 5018 Screen Printing Ink is available in the following transparent colors and opaque black:

Yellow   (020)
Red   (030)
Orange   (035)
Blue   (050)
Green   (060)
Brown   (080)
Black (opaque)   (070)

ORALITE® 5018 is supplied ready for printing in containers with a capacity of 800 ml [27 oz] and 5 kg [1.1 gallon]. Before application, the ink must be stirred and allowed to stand for at least 10 minutes so that the trapped air can escape. Opened containers must be closed tightly immediately after use. This helps prevent solvent evaporation, so that the ink remains suitable for future printing.

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3.2 Preparation of the screen

It is recommend to use polyester fabric with a mesh count of 61 to 64 [155 to 163 mesh], as screen-printing stencils. When such screen-printing stencils and ORALITE® screen printing inks are used, ORAFOL guarantees that prints onto ORALITE® films 5900, 5910, and 5930, color 010 (white) comply with the required chromaticity and specific retroreflective values called for in international specifications for reflective materials of these classes provided that the printing process is correctly carried out.

Manual printing tables or automatic printing systems may be used. The screen-printing table must be flat and mechanically stable. Vacuum conveying is required for printing film sheets. The hardness or elasticity of squeegees has a decisive influence on the printing result. Squeegee rubbers with Shore hardness of 65 to 75 are recommended. Checking and surface grinding, if required, of the squeegees is crucial. The squeegees should be 7 to 10 cm [2.75 to 4 inches] bigger than the printing format.

3.3 Screen printing

Before starting the screen printing process, the screen, squeegee and flood bar must be cleaned with a suitable solvent. In addition, each film should be wiped with an anti-dust or anti-static cloth prior to printing.
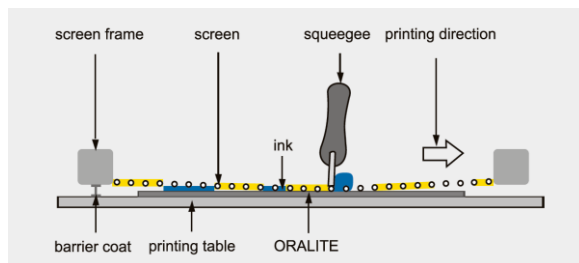
For printing, it is recommend maintaining a medium squeegee speed of approximately 0.75m/s [2.5 ft/s] and the squeegee should be applied at an angle of 30° to the print surface.

The distance between the screen and the film surface should be set to about 10mm [0.375 inches]. If the distance is too short, the screen does not come off the substrate neatly, which results in poor print quality. Excessive squeegee pressure can result in smearing or blurred contours and edges. The ink containers must be closed immediately after use.

Optimum conditions for the printing process require an air temperature ranging from 20°C to 24°C [68°F to 76°F] and humidity of 20% to 50%. Unfavorable ambient conditions may require the use of thinning or retarding agents to adjust the ink for processing.

To meet the required specification values for color and retroreflection, it is crucial to ensure that no more than 3% thinner and not more than 1.5% retarding agent are used in the ORALITE® 5018 Screen Printing Ink.

3.4 Drying after Screen printing

The drying time of the prints depends on the type of sheet or ink used, and specific local conditions such as the positioning of the prints, ambient temperature, air humidity, etc. **To facilitate quick and economical processing of the sheets after printing, forced drying is recommended by means of fans or drying in a convection oven at 40°C to 50°C [104°F to 122°F] is utilized.** Furthermore, forced drying prevents formation of cracks in the films after printing.

The following procedure has proved successful in air-drying by means of fans:
It is recommended that the prints are individually placed on a platform rack truck or a similar shelf system. To ensure adequate air circulation, a distance of at least 5 cm [2 inches] should be kept between the storage levels. Furthermore, it is recommended to use at least three or four fans for drying. The fans are best arranged one above the other in a movable manner on a trolley that can be driven up to the sheets from a distance of 1 to 2 m [3 to 6 ft]. Immediately after printing, the fans should run at a higher speed for about 30 minutes, after that normal speed for another 30 minutes should be sufficient.

The use of a heatable drying tray results in a temperature increase and thus a substantially reduced drying time.

Drying conditions can be further optimized by using convection ovens. These closed systems permit a low-dust drying phase at constant temperature, low air humidity and do not subject the operator to solvent vapors.

The following drying times are general guidelines for ORALITE® 5018 Screen Printing Ink:

Drying Conditions	Over printable		Stackable (pay attention to max. number)		Notes
	Temp.	Time	Temp.	Time	
Air Drying	20°C [68°F]	60 min	20°C [68°F]	3 to 4 h	RH 40-60%
Oven Drying	60°C [140°F]	5 min	60°C [140°F]	30 min	

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In case the sheets are printed in an overlapping manner, please make sure that the lower ink layer is not fully cured yet and that overprinting must take place within 12 hours after the first printing.

At an ambient temperature of 20°C [68°F] and an average relative air humidity of 40 to 60%, printed traffic signs can be shipped after a drying time of 48 hours. Prints made with the two ink series are fully cured after approximately 8 days.

3.5 Storage and Transportation of printed sheets and traffic signs

When the inks are cured (see Table above), printed sheets can be stored horizontally. Please note that the maximum number of sheets stacked should not exceed 40 to 50 sheets. Prints on pre-laminated traffic sign substrates should be stored vertically and separated by an intermediate layer of suitable paper or support film. A low pressure load is crucial.

3.6 UV digital printing

ORAFOL's UV digital printing system, especially designed for but not limited to the manufacturing of traffic signs, consists of ORALITE® UV Traffic Sign Printer using the supplied RIP software, ORALITE® 5019 UV Digital Ink and our recommended ORALITE® overlay films. Clear lamination after printing yields films with long term outdoor stability that meets the requirements of reflection class RA2.

The printing process requires an air and material temperature between 20 °C and 26 °C as well as air humidity between 40 - 60 %. The room should be free from dust to prevent entrapment of dust during printing. The surface of the ORALITE® reflective film requires cotton gloves to prevent contamination of the surface and to allow a flawless print image.

For further details on printing preparation, cleaning and care intervals please refer to the handbooks and documentations of the ORALITE® UV Digital Traffic Sign Printer and the RIP software.

4. Cutting, die cutting, plotting

ORALITE® High Intensity Prismatic Grade films can be cut by means of a commercial stack cutter. The holding-down clamp should be set to very low pressure and, as an additional measure, the film should be protected from compression. It is recommended to limit the stacking height to 40 to 50 sheets (see Storage and Transportation). Sealing cut edges of ORALITE® High Intensity Prismatic Grade films is not required.

If ORALITE® High Intensity Prismatic Grade films are die-cut by means of steel strip tools, it is not recommended to place several sheets on the platen at the same time.

Commercial cutting plotters with tangential blades, preferably of the flatbed type, should be used as plotter systems. Tangential control ensures high-quality cut edges. The cutting depth can be adjusted, from starting a cut, to cutting through. Systems with a pneumatically controlled die head, where the cutting pressure can be adjusted precisely in accordance with the specific material used, are highly recommended. The use of drag-knife systems is not recommended. The respective cutting or processing speed depends on the complexity of the cutting pattern and the applied cutting system.

For the manufacturing of traffic signs with ORALITE® High Intensity Prismatic Grade films in a small series and/or with variable lettering, ORAFOL offers the ORALITE® 5061 Transparent Film series in all common traffic sign colors. For black letterings, markings and symbols the ORALITE® 5081 Lettering Film is recommended. Additional laminates are the ORALITE® 5090 Anti-Dew Film and ORALITE® 5095 Anti-Graffiti Film, as well as the transparent film of the series ORALITE® 5061 Transparent Film.

For the application of cut films ORAFOL offers the ORATAPE® MT95 transfer film or ORATAPE® MT72, LT72 and MT52 application tapes. The application can be done by film laminating machine or hand roller.

5. Adhesive bonding and laminating

In order to achieve proper adhesion of the films, the substrate must be dry and free of dust, oil, fats, silicon or other contamination. If the substrate needs to be treated with a solvent, the next processing step cannot be carried out until the solvent is completely evaporated. When films are adhered to metallic substrates, fine grinding of the surfaces is advantageous.

ORALITE® High Intensity Prismatic Grade film series 5900, 5910, and 5930 have been optimized for application onto flat substrates such as aluminum alloys or galvanized steel. ORALITE® High Intensity Prismatic Grade film series 5930 are also suitable for bonding to polyolefinic substrates such as polyethylene and polypropylene. However, the installer should perform own tests in each case.

Laminating should not be carried out at air and material temperatures of less than 15°C [60°F]. The optimum temperature is about 21°C [70°F]. The films should be stored in the rooms in which they will be processed for at least 48 hours. Adequate curing of the ink is a prerequisite for any further processing of printed reflective films as otherwise the evaporating solvent may cause blistering and even tearing of the films. If you intend to use a film-laminating machine, a controllable unwinding and

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winding motor is recommended. The upper roller should be rubber coated with Shore hardness 65 to 75. The optimum roll gap should be adjusted over the entire width. A flatbed roll applicator is recommended for the lamination of larger webs.
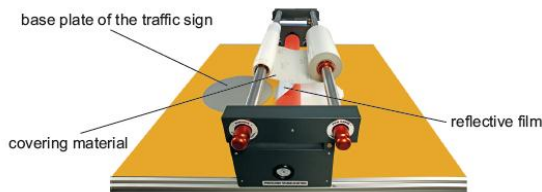
If it is necessary to apply two pieces of prismatic sheeting side by side (splicing), they must not overlap. Depending on the format, the gap should be approximately 1 mm [0.04 inches]. Please make sure that a right side of the film web is always bonded to a left side, thus ensuring the uniform orientation of the film's honeycomb structure (shown below).

honeycomb/cell structure (schematic)

Machine direction

Transverse direction
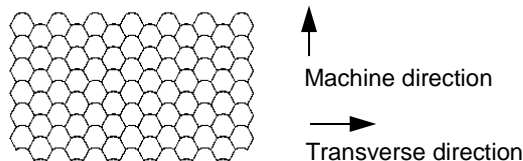
ORALITE® High Intensity Prismatic Grade films comply with the relevant minimum reflective data in machine direction as well as in transverse direction.

When a hand roller is used for lamination, the film must be placed on the sheet in such a way that it protrudes at least 5mm [0.25 inches] from the surface on all sides. It is recommended to proceed as follows to ensure the accurate positioning of the sheet: In a first step, peel off 60 to 80 cm [24 to 32 inches] of the protective paper or film from the ORALITE® High Intensity Prismatic Grade film. Align the sheet on the substrate and press down the area where the adhesive is exposed. Then get hold of the folded-over protective paper underneath the sheet and slowly peel it off further, while pressing down the sheet with the rubber hand roller. Finally, the edges of the traffic sign sheet should be trimmed with a **sharp knife** applied at a 30° angle.

Caution! Before laminating printed ORALITE® High Intensity Prismatic Grade films to a substrate, please make sure it is dry!

6. Color adjustment

If several film sheets or film webs of ORALITE® High Intensity Prismatic Grade films are to be bonded to a substrate, they should be color-matched in daylight and when illuminated in retroreflection. It is preferable to use only films from the same roll. If more than one roll is required, only material from the same production lot should be used.

7. Cleaning of the applied products

Surfaces should only be cleaned with clear water, water/isopropanol (80/20%) or diluted soap solution. Please do not use any solvents or abrasive cleaning agents like sand for the cleaning of reflective films!

These instructions apply to the following materials:

Microprismatic Retroreflective films

ORALITE® 5910 High Intensity Prismatic Grade
ORALITE® 5900 High Intensity Prismatic Grade
ORALITE® 5930 Prismatic Construction Grade
ORALITE® 5931 Prismatic Construction Grade

Color laminates
ORALITE® 5061 Transparent Film

Clear laminates
ORALITE® 5061 Transparent Film, transparent
ORALITE® 5090 Anti-Dew Film
ORALITE® 5095 Anti-Graffiti Film

Lettering materials
ORALITE® 5081 Lettering Film

Transfer materials
ORATAPE® MT 95
ORATAPE® MT 72
ORATAPE® LT 72
ORATAPE® MT 52

Inks
ORALITE® 5018 Screen Printing Ink
ORALITE® 5019 UV Digital Printing Ink

For further information on the above materials, please visit www.orafol.com.