1.Processing instructions for ORALITE® reflective films of reflection class RA2, B

These processing instructions apply to the following ORALITE® reflective films of reflection class RA2, grade B (DIN 67520:2008-11):

ORALITE® 5800 High Intensity Grade
ORALITE® 5810 High Intensity Grade
ORALITE® 5830 High Intensity Construction Grade
ORALITE® 5860 High Intensity Construction Grade
ORALITE® 5865 High Intensity Construction Grade

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® reflective films of reflection class RA2,B.

Specific knowledge and skills of sign producers are prerequisites for the processing of ORALITE® reflective films of reflection class RA2,B. 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® reflective films of reflection class RA2,B should be stored in a cool, dry indoor area that is protected from direct sunlight.

Recommend temperatures for storage are from 20° C to 24° C and relative air humidity of 40% to 60%.

Rolled material should be stored in the original carton. The rolls have standard spacers (core plugs) 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® reflective films of class RA2,B can be screen-printed with ORALITE® 5018 Screen Printing Ink, ORALITE® 5010 Screen Printing Ink (two component) or digitally printed with ORALITE® 5019i UV Digital Ink and the ORALITE® UV Traffic Sign Printer. Moreover, ORALITE® 5865 is printable with solvent based digital printers.

3.1 Screen printing process

ORALITE® 5018 screen printing inks are a solvent based, one component, 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 (one-component ink) is available in the following transparent colours and opaque black;

Yellow	(020)
Red	(030)
Orange	(035)
Blue	(050)
Green	(060)
Brown	(080)
Grey	(073)
Black (opaque)	(070)

ORALITE® 5018 is supplied ready for printing in a container with a capacity of 800 ml, 2400 ml, one gallon and 5 litres. 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.

A unit of the two-component system ORALITE® 5010 consists of 630g ink and 150g hardening agent H5010.

Caution! The hardening agent H5010 is sensitive to moisture and therefore must be stored in a dry place.

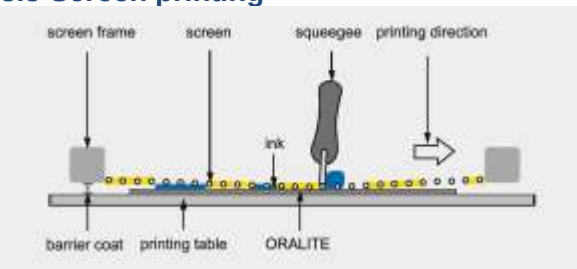
The specified mixture ratio is 4.2 parts by weight of ink and 1 part by weight of hardening agent. This ratio is guaranteed if both components of a unit are completely used for preparing the mixture. Both components must be stirred thoroughly. After stirring, let the mixture rest for 10 min so that trapped air can escape.
When a complete unit is prepared, the pot-life of the ink (applicability of the mixture ready for printing) is about 8 hours at a room temperature of 20° C.

3.2 Preparation of the screen

It is recommended using polyester fabric with a mesh count of 61 to 64 [155 to 163 mesh] as printing screens. When such screen and ORALITE® screen printing inks are used, ORAFOL guarantees that prints onto ORALITE® films permanent and temporary traffic control products comply with the specifications for chromaticity and specific retroreflectivity provided that the printing process is carried out correctly.

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 wider 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 0.75 m/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 10 mm. 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 and a humidity of 35% to 50%. Unfavourable ambient conditions may require the use of additives to adjust the ink for processing. To meet the required specification values for colour and retroreflection, it is crucial to ensure that no more than 3% thinner or not more than 1.5% retarder and not more than 0.5% print modifier are added to ORALITE® 5018 Screen Printing Ink. Humidity at or below 30% can lead to unsatisfactory printing results and long term stability of prints and is not recommended or warranted.

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.

When using fans and drying at room temperature, we recommend that prints are individually placed on a rack or a similar shelf system as pictured below. To ensure adequate air circulation, a distance of at least 5 cm 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. 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 rack 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 vapours.

The following drying times are general guidelines:

ORALITE® 5018 Screen Printing Ink

Drying Condition	Over printable		Stackable (max. 40 sheets)		Notes
	Temp.	Time	Temp.	Time	
Air Drying	20° C	60 minutes	20° C	3 to 4 hours	RH 40-60%
Oven Drying	60° C	5 minutes	60° C	30 minutes	

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

At an ambient temperature of 20° C 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® 5019i 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.

Lamination with clear protective laminates shall be done at a maximum temperature of 37°C [100F] and 0.6 m/min [2 ft./min] to yield a good lay flatness and stress free laminated product

4. Cutting, die cutting, plotting

ORALITE® reflective films of the reflection class RA2,B 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® reflective films of reflection class RA2,B is not required.

If ORALITE® reflective 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® reflective films of the reflection class RA2,B in a small series and/or with variable lettering, ORAFOL offers the ORALITE® 5061 Transparent Film series in all common traffic sign colours. 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.

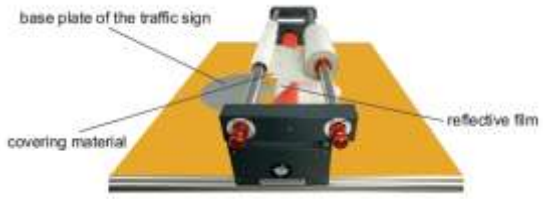
For the application of cut films ORAFOL offers the ORATAPE® MT95 transfer film or ORATAPE® MT72, LT72 and MT52 application tapes. The application can be done by film laminating machine or hand roller.

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 bonding films to metallic substrates, slight grinding of the surfaces is advantageous.

ORALITE® reflective films series 5800 and 5810 have been optimized for application onto flat substrates of aluminium alloys or galvanized steel. ORALITE® High Intensity Grade film series 5830, 5860, 5865 are also suitable for bonding to polyolefin or coated substrates such as polyethylene and polypropylene or containers. However, the installer should perform own tests in each case.

Lamination should not be carried out at air and material temperatures of less than 15° C. The optimum bonding temperature is about 21° C. 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 escaping solvent may cause blistering and even tearing of the films. If you intend to use a film-laminating machine, a controllable unwinding and 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. It is recommended that a flatbed roll applicator for the bonding of larger film webs.



If it is necessary to apply two pieces of 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.

ORALITE® High Intensity Grade films comply with the relevant minimum reflective data in all directions (ε angels).

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 5 mm 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 of the protective paper or film from the ORALITE® reflective 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 any ORALITE® film to a substrate, please make sure it is dry!

6. Colour adjustment

If several film sheets or film webs of ORALITE® reflective films of the reflection class RA2,B are to be bonded to a substrate, they should be colour-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, thinner or abrasive cleaning agents for the cleaning of reflective films! We also do not recommend the use of power washers for cleaning of read signs.

8. Intermediate storage of traffic signs

ORAFOL recommends indoor storage of signfaces or finished signs in an upright vertical position, with 2 cm [1 inch] spacers between the signs in an area protected from excessive moisture or overheating. Outdoor storage should be done in a vertical position with 10 cm [4 inches] spacers between the signs. The spacers should not touch the reflective surface. If a wrapping is done, the material used shall allow air circulation and be removed when wet.

9. Durability of traffic signs

The durability of the sign will depend upon substrate and sheeting selection, preparation, application, maintenance, and exposure conditions. Lifetime statements in the technical data sheets and warranty documents refer to signs that were produced and applied according to above recommendations, the application/processing described in the technical data sheet and the warranty documents issued by ORAFOL. Sign failures caused by improper preparation, application or maintenance are not the responsibility of ORAFOL. A reduced service life or sign failure might be caused by snow packing or any other sign burial, improperly selected or prepared substrate, exposure to extreme atmospheric conditions in certain geographic areas, mechanical abrasion, exposure to aggressive chemicals, non-vertical application, use of other than the recommended ORAFOL products (inks, laminate films, lettering films etc.).

These instructions apply to the following materials:

High Intensity retroreflective films

ORALITE® 5800 High Intensity Grade
ORALITE® 5810 High Intensity Grade
ORALITE® 5830 High Intensity Construction Grade
ORALITE® 5860 High Intensity Construction Grade
ORALITE® 5865 High Intensity Construction Grade

Colour laminates
ORALITE® 5061 Transparent Film

Lettering materials
ORALITE® 5081 Lettering Film

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

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

Inks
ORALITE® 5018 Screen Printing Ink
ORALITE® 5010 Screen Printing Ink
ORALITE® 5019i UV Digital Printing Ink

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

IMPORTANT NOTE

All ORAFOL products are subject to careful quality control throughout the entire manufacturing process, and it is ensured that they are of merchantable quality and free from manufacturing defects. The information published is based on our analyses and studies and does not constitute any warranted properties or any agreement as to quality. Due to the diverse possibilities of use of ORAFOL products and the constant development of new applications, the buyer should carefully consider the suitability and performance of the product for the respective purpose; it bears all risks associated with such use. No warranty is given for purposes other than those listed in the Technical Data Sheet or for applications that are not processed in accordance with ORAFOL's processing instructions.

The durability of the end product depends upon a variety of factors, including but not limited to substrate selection and preparation, compliance with the recommended application guidelines, geographical area, exposure conditions and maintenance of the ORAFOL material and of the end product. Product defects caused by the substrate or improper surface preparation do not lie within ORAFOL’s sphere of responsibility.

When using ORAFOL products, the pertinent national regulations are to be observed. ORAFOL recommends that you obtain the current stipulations from your local authority and ensure that the product meets these requirements. Please contact ORAFOL for further information.