Production Manual

MNtech Global 미래나노텍글로벌(주)

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1. Introduction

1-1 Scope of Products

MNTech's retroreflective sheeting is a special cubic microprismatic retroreflective element material used for roadway signs, construction-zone devices and signs for industrial safety, etc.

This manual provides guidelines for the manufacture of signs using the prismatic products of MNTech. It includes factors that might cause problems when manufacturing signs and also provides information that are required to prevent such problems.

Product	Standard	Usage
RS-7000 Series	**PG²: Premium-grade Prismatic Reflective Sheeting** [KS A 3507 Type IX / ASTM D 4956 Table IX]	**Roadway/traffic signs**
RS-5000 Series	**PG¹: Premium-grade Prismatic Reflective Sheeting** [KS A 3507 Type Ⅷ / ASTM D 4956 Table Ⅷ]	**Roadway/traffic signs**
RS-3000 Series	**HIP: High-intensity Prismatic Reflective Sheeting** [KS A 3507 Type IV / ASTM D 4956 Table IV]	**Roadway/traffic signs, road signs, building signs**
RS-1000 Series	**EGP: Engineering-grade Prismatic Reflective Sheeting** [KS A 3507 Type Ⅰ / ASTM D 4956 Table Ⅰ]	**Roadway/traffic signs, commercials, construction-zone signs**

1-2 Colors of Products

1) RS-7000 Series (Watermark: PG²)

Available colors: White, Yellow, Orange, Blue, Green, Red, Brown, Fluorescent Yellow, Fluorescent Green, Fluorescent Orange

2) RS-5000 Series (Watermark: PG¹)

Available colors: White, Yellow, Orange, Blue, Green, Red, Brown, Fluorescent Yellow, Fluorescent Green, Fluorescent Orange

3) RS-3000 Series (Watermark: HIP)

Available colors: White, Yellow, Orange, Blue, Green, Red, Brown, Fluorescent Yellow, Fluorescent Green, Fluorescent Orange

4) RS-1000 Series (Watermark: EGP)

Available colors: White, Yellow, Blue, Green, Red, Brown

※ The retroreflective films of MNTech has tooling lines that show diamond-shaped sealing patterns, which can be optically identified. However, they do not affect reflection performance or shape.

2. Guidelines

1. It is recommended that the surface of retroreflective sheets be cleaned with a piece of cloth or wet fabric. (Using alcoholic detergents might cause stains or deterioration of retroreflective performance due to the nature of the products.)

2. The temperature must be kept between 15℃ and 25℃, and the relative humidity must be maintained at 30%–60% during the construction of retroreflective sheets.

3. Prior to the construction (adhesion of retroreflective sheets), grease on the surface of aluminum, steel, or stainless substrates must be completely removed using removers, such as EAC, MEK, IPA, toluene, or thinner, according to the regulations. Moreover, the construction should be executed under the conditions mentioned above.

4. When it rains, it is recommended for the construction to be executed after 10 a.m. with low humidity in order to avoid foggy weather.

5. The equipment for the construction of retroreflective sheets should be in accordance with the regulations (roller compressor, scraper, cotton flannel or wool, etc.)

6. Do not fold or snap retroreflective sheets. Wrap it in vinyl after tightening the wound roll after use and place them inside a packing box with plastic corks on both ends for storage in a cool and shady place.

7. When retroreflective sheets adhere to an acryl or Foamex substrate (brand new or recycled), try sample sheets after cleaning the substrate for three or more times with alcohol and drying it in order to detect if any problem could possibly occur. Construct retroreflective sheets if no abnormality is detected for at least one day in the test trial.

8. Keep a workbook during the construction to prepare for any possible problem after the construction.

9. In winter, the temperature should be kept as stated above, and the construction of retroreflective sheets should be executed after the substrates (aluminum or stainless) are heated up to 20℃–25℃ (using a heater or a torch). (In addition, because the adhesion of retroreflective sheeting in winter is less than 50% of that in summer, the room temperature should be kept above 20℃ or the temperature of the substrates should be kept as stated above.)

10. It is recommended for finished products to be stored indoors and in a standing position, kept safe from sunlight and rainfall, and properly ventilated. Moreover, they should not be laid out flat or stacked in a pile for storage.

11. The weather resistance of MNTech's retroreflective sheets depends on the storage conditions (exposure, environment, atmosphere), construction procedure, materials, etc.

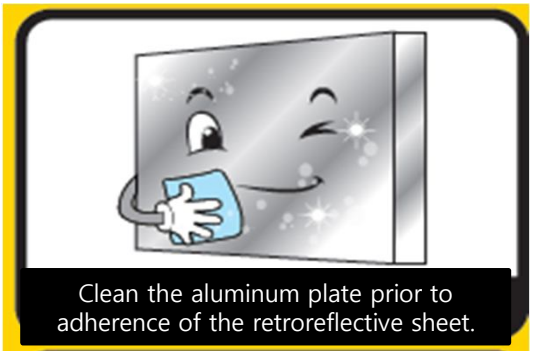
12. The weather resistance of MNTech's retroreflective sheeting can be maximized when it is properly applied in accordance with the product manual.

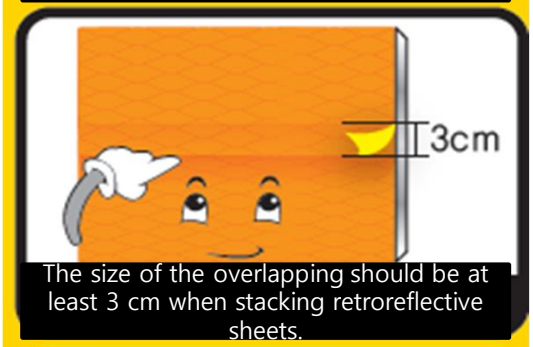
13. Inability to fulfill the instructions with regard to manufacture, storage, handling, and maintenance presented by the manual of MNTech might lower the performance of the products.

14. This manual presents guidelines for manufacturing signs using the prismatic products of MNTech.

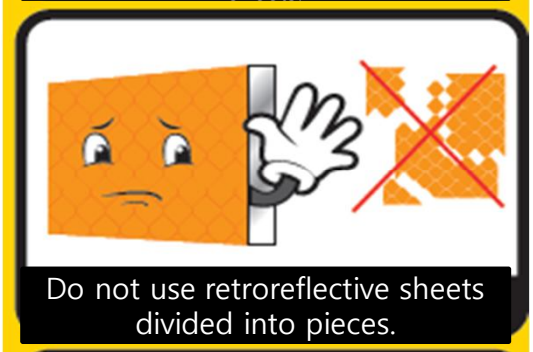
3. Notes

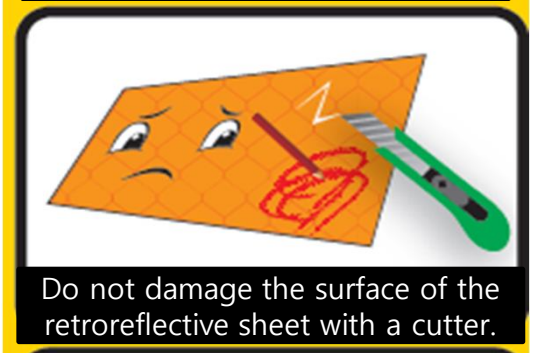
1. After removing grease from the surface of aluminum plates and cleaning their edges, clean and dry the plates to adhere the retroreflective sheeting to them.
2. For the manual adhesion of retroreflective sheeting, a pressure device is recommended to prevent the sheeting from stretching.
3. Stacking retroreflective sheets is permitted only for the background. Moreover, the size of the overlapping should be at least 5 cm, and it should be pressured enough. (Make sure that the retroreflective sheets on the upper part would always overlap those on the lower part.)
4. In case of retroreflective sheets for the background, enough pressure should be applied with a compressor to prevent separation of the overlapped part and the welded part.
5. Separation can be prevented by slicing off bulging parts or applying enough pressure to retroreflective sheets for the copy to be adhered to the overlapped part.
6. The printing and cutting of graphic elements, such as letters, symbols, or arrows, should be automated. Moreover, those elements should be adhered in a way that the reflective performance should be uniform regardless of the directions.
7. Finished signs should be stored indoors in a standing position with the signs not coming into contact with each other to prevent surface wrinkles resulting from being laid out flat.
8. The temperature must be kept between 15℃ and 25℃, and the relative humidity must be maintained at 30%–60% during the construction of retroreflective sheets.
9. Keep a workbook during the construction to prepare for any possible abnormality after the construction. Immediately stop working in case of any abnormality on the products and contact MNTech.


Clean the aluminum plate prior to adherence of the retroreflective sheet.



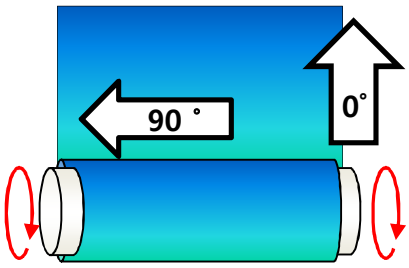
The size of the overlapping should be at least 3 cm when stacking retroreflective sheets.


Do not use retroreflective sheets divided into pieces.


Do not damage the surface of the retroreflective sheet with a cutter.


Store finished signs indoors with proper ventilation in a standing position.

4. Cutting



4-1 Adhesion and Cutting for Large Signs

In planning for and designing signs, there is an important point to consider prior to cutting retroreflective sheets.

For a large sign that uses two sheets or more, the directions should be noticed. HIP and EGP have conspicuous stripes for the identification of the directions (vertical and horizontal).

After the adhesion of sheets, do not cut into layers other than lateral or transverse because there have not been any tests or certifications with regard to other directions.

4-2 Various Ways of Cutting

There are various ways to cut MNTech's retroreflective sheets. Electronic cutting, hand cutting, and roll cutting are available. Band sawing machines and cutting machines can also be used.

4-3 Cutting Method

- For flatbed cutting, sufficient downforce against the lower part should be secured to cut thick sheets.
- Such hardness need not be secured for drum cutting, which is often used for commercial signs.
- A clean and sharp cutting section is guaranteed with a laser cutting machine. However, the edges might be discolored once in a while due to temperature changes.
- Roll plotters cut in a way that **the adhesive section of the product faces upward** in case of copy cutting.
- Cutting should be initiated only after **optimizing the location of the blade** that matches the equipment. (Otherwise, it may cause burr.)

Correct

<Upper Adhesive Section>

Incorrect

<Lower Adhesive Section>

5. Guidelines for Substrate

5-1 Substrate Conditions

For MNTech's prismatic retroreflective products, a strong adhesive should be applied on metallic substrates for the production of signs (aluminum and galvanized steel sheets).

※ Plastic resins, such as polyethylene, polypropylene, and polyester, are not recommended.

※ Stainless steel is also not suitable as a substrate.

- The preparation for the adhesive section is highly important to secure enough adhesive force of the sheets that is applicable to the substrate.

- There should be no bent parts, as well as contaminants or corrosive substances on the surface to which the retroreflective sheets adhere.

- Flatness is highly important to keep the surface of the film of signs uniform.

- Dust, grease, moisture, corrosion, etc., on the surface of substrates might cause deterioration of the adhesive force, which results in separation or cracks after the adhesion of retroreflective sheets.

5-2 Cleansing Substrates

When industrial isopropyl alcohol is used, it should be mixed first with water.

Rubbing alcohol should be used without water. Grease should be removed with a clean lint paper or patch. It should be cleansed with clean patches or papers until all impurities are removed.

The removal of grease should be completed prior to installation to avoid contaminants such as airborne dust.

Keep the surface completely dry by cleaning the substrate prior to installation.

There are two types of tests to figure out whether the surface is clean prior to installation.

1) The substrate is not clean if dust is found on the tape or any visible change is found on the surface after applying Scotch tape or another type of transparent tape to the surface of the substrate and then removing it.

2) Pour water onto the substrate. If water flows without any cloaking on the substrate, it means that the grease is completely removed. If water droplets are formed like glass beads, the grease is not completely removed. (Aluminum is often used for the substrate for permanent signs.)

3) Bubbles (wrinkles) formed due to the revision of a copy or the reuse of a substrate will not be compensated.

5-3 Painting Substrates

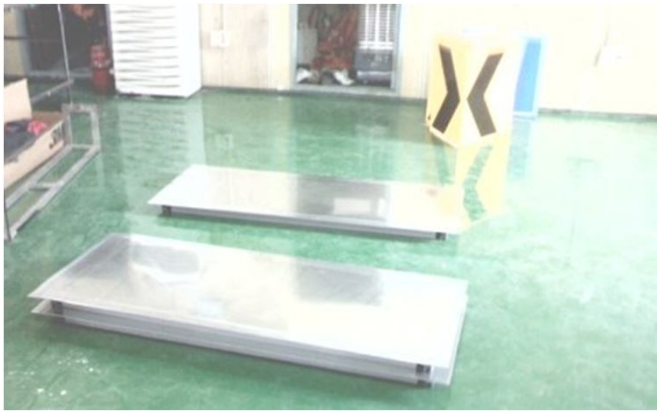
For painting substrates, the optimum weight of the coating is 1.1–3.8 mg/cm^2, and the median value is 2.75 mg/cm^2. If the coating is too thick, dirty, or not adhesive enough for the substrate, the adhesive force of the retroreflective film will decrease.

- Remove corrosion on the surface of the substrate and smoothen it using an excellent-quality abrasive.
- Let the substrate dry after painting.

※ Wax and powder coating where silicon or chlorine is contained as a component of the painting material is prohibited under any circumstances.

(It might deteriorate the adhesive force and surface of the substrate.)

- Adhere retroreflective sheets after inspecting how dry and contaminated the substrate is.



① Remove corrosion and contamination on the surface.

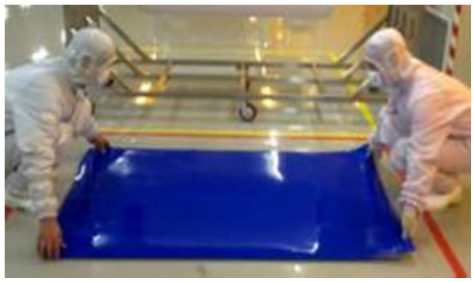
② Let the substrate dry after painting.

③ Adhere retroreflective sheets after the inspection of the painting.

6. Adherence of Retroreflective Sheets

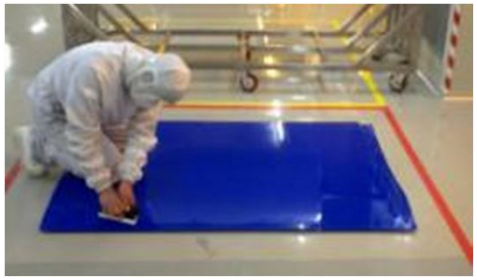
6-1 Manual Adherence of Retroreflective Sheets (Single Substrate)

<Clean the aluminum substrate prior to the adherence of the retroreflective sheet.>



<Cut the retroreflective sheet to the size of the aluminum substrate.>

<Adhere the large retroreflective sheet.>



<Apply 8–10 kg pressure.>

1. **Prior to the adherence of the retroreflective sheet, remove the grease on the surface and clean the edges of the aluminum substrate. Clean it with a piece of dry cloth after completely removing foreign substances using alcoholic detergents.**
   After using alcoholic detergents on the aluminum surface, clean the moisture resulting from surface condensation with a piece of dry cloth.
2. **When cutting retroreflective sheets, be careful not to fold or bend the sheets. Moreover, cutting should always be in accordance with the design.**
   When manufacturing signs, the connection parts should form a plane by connecting substrates.
   The section of the overlapped sheet should face downward considering the installation of signs as a standard.
3. **When adhering large retroreflective sheets, be careful not to fold the sheets or cause bubbling.**
   Folding and bubbling during the work might increase as time goes by and will not be compensated.
4. **After primary adhering, perform secondary adhering with a pressure between 8 and 10 kg.**
   Subsidiary materials with regard to retroreflective sheets should meet the standards.
   (Used tools: roller compressor, scraper, cotton flannel or wool, etc.)
   MNTech's retroreflective sheets require pressures that are 20%–30% higher than those sheets from other companies. (Adhere for at least two times with 8–10 kg pressure.)

※ There will be no compensation when the standards presented by MNTech are not completely fulfilled.

6. Adherence of Retroreflective Sheets

6-2 Adherence of Retroreflective Sheets (Single Substrate)

① Cutting of Large Substrates

- The finish should be of excellent quality and uniform. There should be no twists, dents, cracks, or furrows resulting from cutting, damping, or welding.

② Cleansing of Substrates

- Prior to the adherence of retroreflective sheets, completely remove contaminants, such as dust or grease, using alcoholic detergents and clean it again with a piece of dry cloth.

③ Adherence of Retroreflective Sheets

- For the production of signs, the connection must remain flat, and retroreflective sheets should be adhered using a press without folding or bubbling.

(Minimum pressure: 8–10 kg)

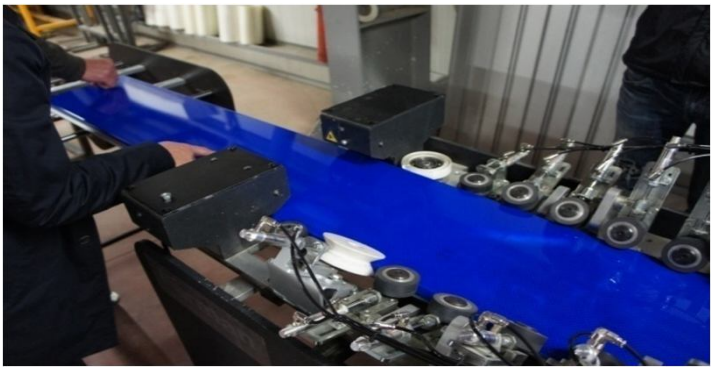
④ Adherence of Copy

Adhere copy in accordance with the drawings and draft plans.

6-3 Adherence of Retroreflective Sheets (Combined Substrate)

① Cutting of Retroreflective Sheets

- Cut retroreflective sheets according to the size of combined types of substrates. (Ensue safety.)



② Adherence of Retroreflective Sheets

- Adhere using compressive rollers.
- Maintain appropriate pressure when adhering side parts.

※ Excessive pressure might cause cracks on the surface of retroreflective sheets.

③ Combination of Substrates

- Combine the bent parts of "ㄴ" shape on the edges.
- Combine the lower and upper parts of a sign in a way that they are interlocked with each other by 1.5 cm.

④ Adherence of Copy

- Adhere copy (letters) in accordance with the drawings and draft plans.

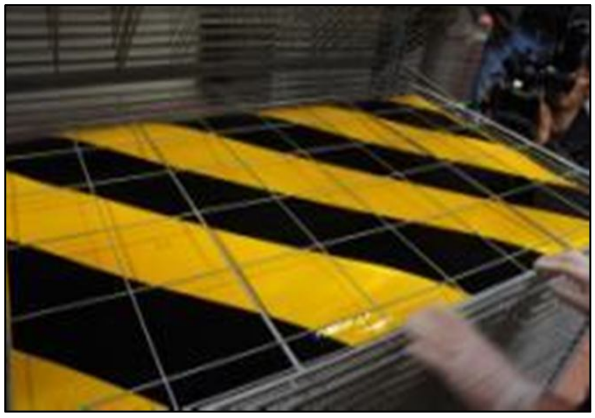
7. Printing

7-1 Printing Condition

It is necessary to maintain a constant temperature for printing.

It is recommended that retroreflective sheets should be manufactured under temperature between 16℃ and 28℃ and relative humidity between 20% and 40%. Moreover, they should be transparent in case of general colors and opaque in case of black color.

<Maintain surface temperature between 16℃ and 28℃>



<Maintain relative humidity equal to or below 60%>

▪ Screen printing is available only for temperature between 16℃ and 28℃.

- Lower temperature deteriorates the adhesiveness of ink such that screen printing is not applicable.

- Screen printing under temperature of 10℃ or lower might cause cracks because the solvent of the ink does not evaporate quickly.

- It is recommended to store products not in use under relative humidity between 20% and 40%. (Relative humidity equal to or higher than 80% delays the drying of the printing and might cause deformations on the surface.)

7-2 Recommendations for Screen Printing

The optimum mixing of ink is achieved by running an ink mixer set for at least 15 min at 1,000–2,000 rpm and then leaving the ink for an hour prior to the next printing.

Air drying, which is advantageous for screen printing, is possible where there is permanent airflow on the printing and proper ventilation, Moreover, it prevents the evaporation of the solvent, which might cause damage to the surface of signs.

Drying Type	Required Time	Item		
		Drying Time between Colors	Drying Time after Painting of the Final Color	Remarks
"Air" dry	Until completed	3 hr	5 hr	- Maintain a distance of at least 5 cm from the drying rack. - Apply a constant air current of 0.5 m/s. - Maintain appropriate temperature and humidity during the drying process.
"Oven" dry	10 min	30 min	30 min	- Maintain a distance of at least 5 cm from the drying rack. - The lower plate should have low heat conduction. - Maintain the temperature inside the oven at 42℃. - Apply a constant air current of 0.5 m/s.
"Conveyor" dry	1 min	- The minimum dried length should be 10m. - Keep the temperature at 55℃ for 3 minutes during printing. - The configuration for conveyor should be optimized.		

※ ***Notes:***

- ***The screen printing should be completely dry prior to the adherence of retroreflective sheets to sig .***
- ***There might be creases on inadherent parts when exposed to moisture during shipping or loading.***

8. Storage

8-1 Storage and Handling of Retroreflective Sheets

- It is recommended to store retroreflective sheets not in use after cutting or dividing it into pieces as shown below.
- It is recommended to store retroreflective sheets indoors with temperature between 18℃ and 24℃ and relative humidity between 30% and 50%.
- Residual sheet rolls should be stored laid out flat or in its original box after use.
- If its original box is not available, the rolls should be kept horizontal with a pipe or a bar placed in its center. (Prevent sheets from unravelling.)
- Rolls that are not stored in a box should be exposed to air. Sheets must be kept clean.
- Sheets should be laid out flat on a flat rack. Do not heap up more than six layers for storage.
  Small cut pieces (letters, symbols, etc.) should be stored in a plastic and kept in a horizontal position.
- Prevent scratches, crashes, and dents during transport.
  Surface damages due to careless handling will not be compensated.

8-2 Storage of Finished Traffic Signs

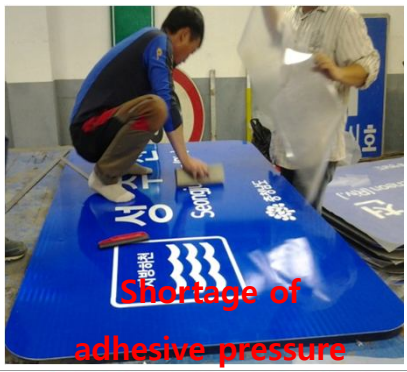
Finished signs should be free from any damages during storage, shipping, handling, and installation.

- When finished signs are stored indoors, they should be stored face to face with each other on a wooden support.
  (To protect edges from damages) Wooden supports should be manufactured in a way that proper ventilation is possible.
- All packing, including slip sheets, should be removed so that could come into contact with the surface of signs when they are stored outdoors or in a closed metal container.
- Signs should be stored on a wooden support with a gap of at least 5 cm between their surfaces.
- Finished signs should be placed where loads are applied by bending, binding, or laminating.
- Do not place signs with its surface facing downward nor put something on the signs.

(If packed signs get wet, remove their packing and repack them after drying.)

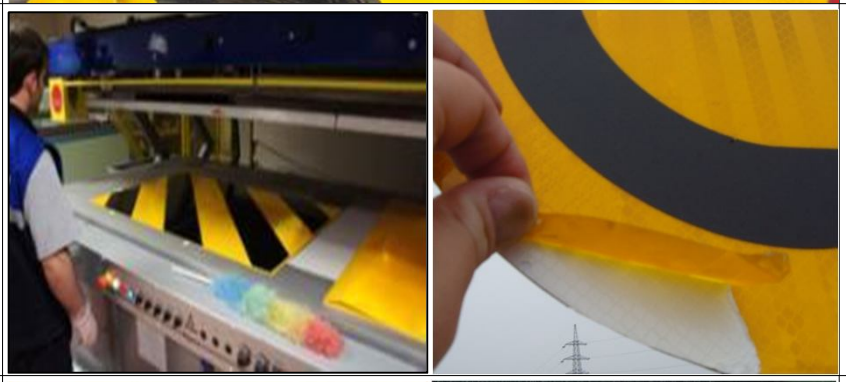
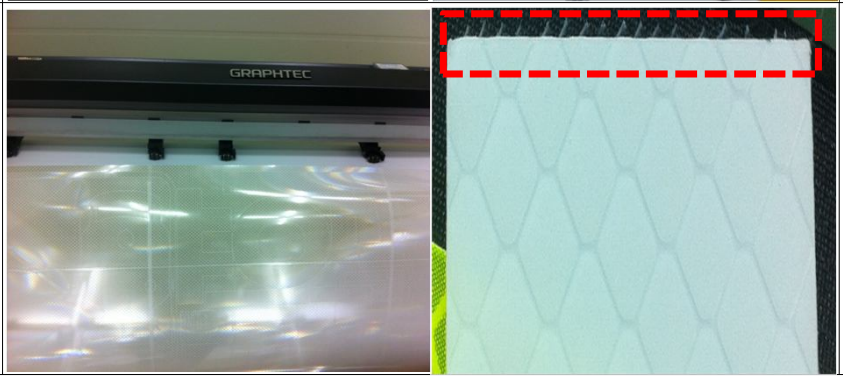
- Materials should be stored under temperature between 16°C and 28°C and relative humidity between 30% and 60%.

9. Failures Due to the Nonfulfillment of Standards

Item	Failure	Cause
"Bubble" shape wrinkles	 	Poor-quality surface of the aluminum plate (Nonfulfillment of Article 6.1.1)
"Line" shape wrinkles	 	Shortage of adhesive pressure (Nonfulfillment of Article 6.4.1)
"Large area" wrinkles	 	Overlapping (revision of copy) (Nonfulfillment of Article 5.2)
Foreign substances infiltration (rainfall)	 	Overlapping (retroreflective sheets for background) / use of retroreflective sheets (Nonfulfillment of Article 3.3)

※ The failures above might occur if the standards that our company presents are not fulfilled, and such failures will not be compensated.

9. Failures Due to the Nonfulfillment of Standards

Item	Failure	Cause
Separation of the sheet		Shortage of adhesive pressure Separation of the sheet (Nonfulfillment of Article 3.3) (Nonfulfillment of Article 6.4.1)
"Embossing" shape wrinkles		High temperature on the surface of the retroreflective sheet (Nonfulfillment of Article 7.1)
Separation of the film		High temperature on the surface of the reflective film (Nonfulfillment of Article 7.1)
Burr on the cutting section		Failure in controlling the cutting blade (Nonfulfillment of Article 4.4.3)

※ The failures above might occur if the standards that our company presents are not fulfilled, and such failures will not be compensated.

Contact Us

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