SciCron Technologies

Technical Information

Technical Bulletin MP-02

Fabrication of Mar-Con® 551 FG Hard Coated Plastics

SciCron Technologies Forming Grade Mar-Con® 551 FG abrasion resistant coating for plastic substrates is a polymeric, crosslinked coating which combines superior mar resistance, chemical resistance, and clarity with suitable bending properties to facilitate the fabrication of heat formed and bent plastic parts having soft radius shapes. These applications include formed equipment covers, display components, safety shields, and curved machine guards. Ideal for thin gauge sheets also.

This Bulletin suggests fabrication guidelines for Forming Grade Mar-Con® 551 coated plastic sheet products.

General Precautions

Although the Mar-Con® 551 FG coated surface is more abrasion resistant than the base plastic, the polymer coating can be damaged if the plastic sheet is handled roughly or carelessly. As a general rule, all fabrication of Mar-Con 551 FG coated plastics should be undertaken as carefully as is practical to avoid unintended damage. Whenever possible, fabrication procedures should be carried out with the protective masking left on the sheet surfaces to minimize the possibility of damage, **however, paper masking must be removed before any heat forming procedure**. Work surfaces should be free of chips and debris which might scratch the plastic.

Note: Some plastic substrates occasionally contain internal stresses which can cause cracks or crazing during fabrication. In such cases, it may be necessary to anneal the plastic before fabrication.

Cutting and Machining

It is unlikely that the presence of the Mar-Con® 551 FG coated surface would necessitate any significant change in typical cutting and machining procedures during fabrication. Generally, the same techniques, cutting blades, machining tools and tool speeds are used as would be used normally with the base plastic. Wet sanding, buffing, and scraping procedures can be used for edge finishing but flame polishing is not recommended for finishing Mar-Con 551 FG coated plastics.

Caution!

1.0 Use of inappropriate equipment and tools, not designed for plastic fabrication, can result in melting, cracking, or shattering of the plastic substrate during fabrication procedures. This can damage the plastic permanently and could result in serious injury to equipment operators. **Always observe appropriate safety precautions when fabricating SciCron Technologies products.**

Contact SciCron Technologies or your distributor for information about appropriate equipment and fabrication procedures.

2.0 Procedures that excessively heat the plastic, like laser cutting and flame polishing of cut edges, can induce stresses in the plastic. This can cause cracking or crazing at the cut edges if the edges subsequently come into contact with solvents. Therefore, these fabrication techniques should be avoided, particularly if the edges are to be glued with a solvent cement. Flame over-spray during flame polishing can also cause immediate cracking or crazing of the coating at the sheet edge leading to delamination of the coating at that edge.

3.0 If the Mar-Con® 551 FG coating is stretched thinner (drawn) during bending or forming, that part of the coated surface may have noticeably reduced abrasion resistance. This can be particularly so in areas over small radii bends.

Heat Bending

Mar-Con® 551 FG coated plastics are designed to be heat formed and bent but care must be taken to avoid inducing damage to the abrasion resistant coating by applying an excessive amount of heat or by forming tight radius bends. These actions can cause the coating to be cracked or crazed in the overheated/bent area, leading to possible coating delamination.

For optimum bends, observe the following guidelines:

- Use conventional wire line heaters, rod heaters, or bar heaters **but keep the heat to a minimum** to avoid damaging the Mar-Con 551 FG coating.
- Keep the heat source at least 1/2 inch (13mm) away from the Mar-Con 551 FG coated surface.
- Bend at these maximum recommended temperatures:
  275°F (135°C) for acrylic substrates
  300°F (150°C) for polycarbonate substrates
  250°F (120°C) for PVC substrates
  (as measured with an infrared heat probe)
- Dry polycarbonate at 250°F (120°C) before bending to prevent bubbles in sheets thicker than 1/8 inch (3mm).
- **Apply heat to the outside radius surface only**, especially when forming smaller radii. For thicknesses over 1/4 inch (6mm) it may be necessary to apply some heat to the inside radius surface also, particularly when bending polycarbonate.

(continued below)

Heat Bending (continued)

- **Do not heat until the plastic becomes soft and limp!** Bend when the plastic first starts to yield to firm pressure. Remove from the heat source as quickly as possible. Restrain until the bent contour is cool.

Employing these techniques usually produces a smooth, clear, uniform bend, unless the bend radius is small. Some slight distortion in the bend area is normal. On tight bends, particularly in thicker materials, there may be some very fine craze lines in the sharpest part of the bend.

Note: *The cured Mar-Con® 551 FG coated surfaces do not stretch or flow as much as the thermoplastic substrate at elevated temperatures. Consequently, the higher the temperature during bending the greater the potential for distortion and crazing of the surfaces.* ***Use the minimum amount of heat to obtain the best bends.***

Drape Forming

Mar-Con® 551 FG plastic sheet products are designed to be drape formed but are **not designed for vacuum formed or drawn configurations.** Typical procedures used for forming such configurations will irreversibly damage the abrasion resistant coating.

For optimum drape forming results observe the following guidelines.

- Use conventional circulating-air oven equipment and standard drape forming processing techniques to form these materials, **but keep the heat to a minimum** to avoid damaging the Mar-Con® 551 FG coating.
- Heat the sheet evenly employing precise temperature control and accurate temperature monitoring.
- Drape form at these recommended temperatures:
  - 275°F - 300°F (135°C - 150°C) for acrylic
  - 300°F - 320°F (150°C - 160°C) for polycarbonate
  - 250°F - 275°F (120°C - 135°C) for PVC
- If bubbles are encountered during heating in polycarbonate sheets thicker than 1/8 inch (3mm), dry at 250°F (120°) before forming.

Note*: Parts (particularly polycarbonate), which have been formed at relatively low temperatures, may require annealing to relieve post forming stresses and reduce the potential for crazing from exposure to crazing agents such as cleaning liquids or solvents.*

Solvent Welding

Because the Mar-Con® 551 FG coated surface is very chemical resistant it is not softened or removed by short-term contact with solvents commonly used in solvent based cements. As a result, the Mar-Con 551 FG coating **must be mechanically removed** from the substrate to achieve a good adhesive bond. Sanding or routing techniques can be used to remove the coating and prepare the substrate surface for a solvent cement.

Acrylic and polycarbonate substrates can be bonded with methylene chloride based cements while PVC substrates can be bonded with cements containing acetone, methyl ethyl ketone (MEK) and tetrahydrofuran (THF).

Note: Welding techniques using 100% solvent welding liquids (e.g. 100% methylene chloride) often do not yield strong bonds due to rapid evaporation of the solvent. For improved bond strengths, the cement can be formulated with some dissolved plastic content. This slows evaporation allowing the solvent time to bite into the substrate to make the bond.

For best results, note the following recommendations:

- **Observe appropriate safety precautions when using solvent cements. Provide adequate ventilation during application.**
- Cut edges should be flat, square and smooth and should fit together well. If the edges contain stresses induced by cutting or machining it may be necessary to anneal the plastic before allowing the stressed edges to come in contact with a solvent cement.
- Clean the surfaces to be bonded with isopropyl alcohol (IPA), if necessary, to remove any residue.
- Apply the welding liquid to both surfaces. Join quickly (a few seconds) after application.
- Clamp the pieces together and hold for one to three hours allowing the bond to develop some green strength. The length of time needed to achieve enough green strength to move the pieces will vary with cement type and ambient conditions. Although high bond strength is achieved in 24 to 48 hours, the bond continues to strengthen for several weeks.