Terblend®
TECHNICAL REFERENCE GUIDE

Terblend N and Terblend S grades for automotive and other applications
Terblend N (ABS/PA blends) and Terblend S (ASA/PA blends) comprise a family of styrenic grades perfect for a wide range of uses across multiple industries, including automotive, healthcare, construction, household and electronics. This technical guide focuses on Terblend N and Terblend S grades for automotive interior and exterior applications.

### Terblend N
**Terblend N NM-21EF | Terblend N NG-02EF**
**Terblend N 3154 | Terblend N 3158**

Terblend N grades are a cost-effective solution for automotive interiors, featuring a matt surface finish that does not require painting. The EF (Excellent Flow) grades can even be used for structurally complex parts, such as loudspeaker grills, under standard conditions. The mineral-filled grades Terblend N 3154 and Terblend N 3158 offer high dimensional stability at improved isotropy.

**Advantages at a Glance**
- Lower density compared to PC/ABS
- Fast cycle time combined with high dimensional stability
- High-quality, low-gloss surface finish without painting
- System cost advantage of Terblend N and Terblend S

**Design & Molding**
- Mold Shrinkage / Shrinkage after Annealing / Dimensional Stability / Predrying / Mold Surface Temperature / Injection Molding Temperature & Control Profile / Plasticizing Screw Speed / Ribs / Demolding / Mold Venting / Regrind Processing / Avoiding Pressure Marks, Moisture Streaks & Hesitation Marks

**Optimizing Aesthetics**
- PU Adhesion / Partly Decorated / Painted

**Characteristic Properties**
- Grade Overview / Impact Resistance / Easy Processing / Acoustic Dampening / Chemical Resistance / Low-Gloss Surface Finish / Mar Resistance / High-Quality Grain and Texture / Color Variety

**Terblend S**
**Terblend S NM-31**

Similar to Terblend N with regards to mechanical and processing performance (e.g. easy flow, high impact strength), Terblend S provides superior color stability combined with a matt surface appearance. The ASA component stands for higher UV resistance and better color fastness, an excellent solution for interior parts above the belt line, parts exposed to UV in convertibles, or brightly colored assemblies.

**Advantages at a Glance**
- System cost advantage of Terblend N and Terblend S

**Styrolution Infographic & Contacts**
- Less material needed for the same part
- More parts can be manufactured in the same time
- Elimination of painting costs
KEY APPLICATIONS

Thanks to their excellent flow and matt surface finish, Terblend grades are ideal for many automotive interior applications requiring an unpainted high surface quality combined with outstanding acoustic properties, impact resistance and high dimensional stability. In some cases, Terblend may be used for exterior applications which require good paintability in combination with high impact resistance.

EXAMPLES OF AUTOMOTIVE APPLICATIONS WHICH USE TERBLEND N OR TERBLEND S GRADES:
TeRblend’s excellent flowability supports injection molding of very finely meshed or thin-walled structures.

**SEAT TRIMS**

Terblend N NM-21EF is the most popular grade for interior applications, such as unpainted seat trims combining low gloss with an excellent aesthetic appearance, very good acoustic dampening, low emissions and high impact strength suited for the door entry area.

**LOUDSPEAKER GRILLS**

Terblend N NM-21EF enables you to create low-gloss loudspeaker grills with a very fine mesh for a “high-tech” aesthetic. These features are enabled thanks to the polymer’s high impact strength and excellent processing characteristics like easy flowing and low weld line visibility.

Terblend N NG-02EF may also be used for loudspeaker grills requiring additional dimensional stability with reasonable impact strength.

Terblend NM-21EF is the most popular grade for interior applications, such as unpainted seat trims combining low gloss with an excellent aesthetic appearance, very good acoustic dampening, low emissions and high impact strength suited for the door entry area.
OVERHEAD CONSOLES

Terblend N NG-02EF is used for overhead compartments which require a combination of high stiffness, low-gloss, superb aesthetics, excellent processability, and very good acoustic dampening. Furthermore, because of the polyamide component there is no need for a permanent antistatic package.

Terblend N NG-04 provides a higher degree of glass fiber reinforcement. It is used for hidden structural parts like overhead carrier applications due to its high stiffness, good dimensional stability and reduced thermal coefficient of expansion.

CENTER CONSOLE FRAMES

Terblend S NM-31 is ideal for unpainted center console frames that require a low-gloss surface, fine texture, chemical resistance, and enhanced color fastness, in particular for bright colors. A fairly wide, textured frame enables implementation of the part without the need for additional painting.

STEERING COLUMN COVERS

Terblend N NM-21EF produces highly aesthetic unpainted steering column covers with a low-gloss surface, fine texture, chemical resistance, and high impact strength which is critical due to the position and function of the application.

TERBLEND’S LOW-GLOSS SURFACES ARE IDEAL FOR UNPAINTED CAR INTERIOR APPLICATIONS
**OPTIMIZING AESTHETICS**

**FURTHER SOLUTIONS PROVIDED BY TERBLEND N**

**FOR THE OPTIMIZATION OF AESTHETIC APPEARANCE.**

**PARTLY DECORATED**

Due to their high surface polarity, Terblend N grades are ideal for partly decorated parts which are processed via hot stamp decoration or in-mold coating. Furthermore, partly glossy and partly matt surfaces can be easily combined.

**PAINTED**

Terblend N 3158 is currently being used by BMW for exterior online painted fenders, thanks to its good adhesion to paint systems, good impact behavior, and in particular high heat resistance for online painting at 190°C.

**PU ADHESION**

Terblend N grades exhibit excellent adhesion to PU (polyurethane) while also delivering high impact strength and good processability, such as for these head rests made of Terblend N NM-21EF carrier and overmolded by PU.
CHARACTERISTIC PROPERTIES

COMMON TERBLEND PROPERTIES AND DIFFERENTIATION BETWEEN GRADES

- Low-gloss surface finish
- Pleasant haptics and acoustics
- High impact strength
- Easy processing and demolding
- Chemical resistance
- Good adhesion to soft components
- Painting without pre-treatment feasible
- Potential for accelerated cycle times

PHYSICAL AND THERMAL DATA*

<table>
<thead>
<tr>
<th>TEST METHOD</th>
<th>UNIT</th>
<th>THERBLEND N NM21-EF</th>
<th>THERBLEND N NG02-EF</th>
<th>THERBLEND S 3154</th>
<th>THERBLEND N 3158</th>
<th>THERBLEND N 3158</th>
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<tbody>
<tr>
<td><strong>PROPERTIES</strong></td>
<td></td>
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<tr>
<td>POLYMER ABBREVIATION</td>
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<td>ABS / PA</td>
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<td>ASA / PA</td>
<td>ABS / PA MFR</td>
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<td>kg/m³</td>
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<td>1.5</td>
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<td>MELT VOLUME RATE MFR</td>
<td></td>
<td>ISO 1133</td>
<td>cm³/10 min</td>
<td>60</td>
<td>40</td>
<td>60</td>
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<td>ISO 294-4</td>
<td>%</td>
<td>0.7 – 0.8</td>
<td>0.6</td>
<td>0.7 – 0.8</td>
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<td>MECHANICAL PROPERTIES</td>
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<tr>
<td>TENSILE MODULUS</td>
<td></td>
<td>ISO 527-1/-2</td>
<td>MPa</td>
<td>2100</td>
<td>3100</td>
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<td>STRESS AT BREAK</td>
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<td>ISO 527-1/-2</td>
<td>MPa</td>
<td>45</td>
<td>55</td>
<td>55</td>
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<td>STRAIN AT BREAK</td>
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<td>ISO 527-1/-2</td>
<td>%</td>
<td>25</td>
<td>6</td>
<td>25</td>
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<td>FLEXURAL STRENGTH</td>
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<td>ISO 178</td>
<td>MPa</td>
<td>65</td>
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<td>FLEXURAL MODULUS</td>
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<td>ISO 178</td>
<td>MPa</td>
<td>2000</td>
<td>2800</td>
<td>2000</td>
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<td>CHAPPY NOTCHED IMPACT STRENGTH (23°C)</td>
<td>ISO 179/14A</td>
<td>kJ/m²</td>
<td>70</td>
<td>11</td>
<td>70</td>
<td>6</td>
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<td>CHAPPY NOTCHED IMPACT STRENGTH (-30°C)</td>
<td>ISO 179/14A</td>
<td>kJ/m²</td>
<td>12</td>
<td>6</td>
<td>9</td>
<td>8</td>
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<td>THERMAL PROPERTIES</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HEAT DEFLECTION TEMPERATURE HDT A (0.80 MPa)</td>
<td>ISO 75-1/-2</td>
<td>°C</td>
<td>63</td>
<td>80</td>
<td>65</td>
<td>83</td>
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<tr>
<td>HEAT DEFLECTION TEMPERATURE HDT B (0.25 MPa)</td>
<td>ISO 75-1/-2</td>
<td>°C</td>
<td>88</td>
<td>130</td>
<td>92</td>
<td>97</td>
</tr>
<tr>
<td>VICAT SOFTENING TEMPERATURE ISO 306</td>
<td>°C</td>
<td>110</td>
<td>118</td>
<td>110</td>
<td>105</td>
<td>160</td>
</tr>
</tbody>
</table>

* Typical values for uncolored product at 23°C, dry as molded
**Terblend polymers are especially impact resistant due to a compatibilizer technology that optimizes the morphology during the compounding process. Terblend N grades are a ABS/polyamide blend while Terblend S grades are a compound of ASA/polyamide.**

- **Ductile breaking behavior**, even at sub zero temperatures
- **Charpy notched impact strength > 50 kJ/m²**
- **Charpy notched at -30°C > 10 kJ/m²**
- **High energy absorption in case of impact or crash**

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**Impact Resistance**

- **Ductile breaking behavior**, even at sub zero temperatures
- **Charpy notched impact strength > 50 kJ/m²**
- **Charpy notched at -30°C > 10 kJ/m²**
- **High energy absorption in case of impact or crash**

**Easy Processing**

- The processing of Terblend benefits from good flow and demolding characteristics, which enables complex part geometry, such as fine-mesh loudspeaker grills.

**Chemical Resistance**

- All Terblend products exhibit high resistance to media. This has been demonstrated in tests in which Terblend N NM-21EF and S NM-31 were put under flexural stress (with 1% strain) and exposed to different chemical substances for 8 hours. After 24 hours of stress the specimens were tested for impact behavior. None of the chemicals has a negative effect on the impact strength of the specimens, reconfirming the outstanding chemical resistance and robustness of both grades.

**Impact Test Results After Chemical Exposure and Clamping**

<table>
<thead>
<tr>
<th>Control</th>
<th>1% outer fiber strain with the following media</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bassline</td>
</tr>
<tr>
<td>Terblend N NM-21EF</td>
<td>71</td>
</tr>
<tr>
<td>Terblend S NM-31</td>
<td>69</td>
</tr>
</tbody>
</table>

Drying conditions: 4 h / 80°C
Processing conditions: Melt 230°C / Mold 70°C
LOW-GLOSS SURFACE FINISH
Terblend allows for a very matt surface finish. For best results, high injection speed and enhanced mold temperature are to be applied.

TERBLEND GRADES
GOOD REPRODUCIBILITY

- Textured tool surface
- Reproduced surface (low gloss)

OTHER BlENDS
POOR REPRODUCIBILITY

- Textured tool surface
- Reproduced surface (glossy) (or uneven, meaning irregularly partly glossy, partly matte)

MAR RESISTANCE
The resistance of materials and textures to marring can be measured by a variety of test methods. A change in brightness of about 0.5 and less is considered acceptable by most automotive manufacturers. The image shows the surface change after mar resistance testing according to VW PV974. Tests were performed on unpainted, grained Terblend N plaques with a metal disc with rounded edges. Change in brightness and change in surface gloss were determined on selected Terblend N plaques before and after mar resistance testing. The table shows that mar resistance of Terblend depends on the texture and initial gloss level.

<table>
<thead>
<tr>
<th>TERBLEND N NM-21EF (ABS/PA)</th>
<th>GLOSS LEVEL</th>
<th>CHANGE IN BRIGHTNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>before mar</td>
<td>after mar</td>
</tr>
<tr>
<td>Grey medium rough texture 1</td>
<td>4.6</td>
<td>4.9</td>
</tr>
<tr>
<td>Beige medium rough texture 2</td>
<td>2.5</td>
<td>2.8</td>
</tr>
<tr>
<td>Black fine texture 1</td>
<td>3.8</td>
<td>4.2</td>
</tr>
<tr>
<td>Black fine texture 2</td>
<td>2.4</td>
<td>3.3</td>
</tr>
</tbody>
</table>

HIGH-QUALITY GRAIN AND TEXTURE
The basic texture of a part is defined by the OEM. Independent of its basic texture, the microtexture needs to be in a balanced range to enable an even low gloss and good scratch resistance. This requires the microtexture of the cavity surface to be fine-tuned by professional etching (or eroding) in order to achieve the desired gloss level on the final part.

In general, the lower the gloss level, the better the matt surface appearance. However, if the microtexture of the surface is too fine, it will have a dull, low-gloss appearance and be highly scratch sensitive. Further, processing parameters such as tool temperature and injection speed may also influence the gloss level of the plastic part. Another factor which needs to be considered in tool texturing is that eroded mold surfaces are superior to etched mold surfaces in terms of scratch resistance.

At gloss levels below 2, Terblend parts show a certain scratch sensitivity. The best balance between aesthetics and scratch resistance is achieved at gloss levels roughly between 2 and 5.

GLOSS TEST PERFORMED WITH TEXTURED TERBLEND N NM-21EF PLAQUES

<table>
<thead>
<tr>
<th>GLOSS LEVEL OF STEEL INSERT</th>
<th>2.1</th>
<th>4.0</th>
<th>11.5</th>
<th>16.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>GLOSS LEVEL OF TERBLEND N NM-21EF PLAQUE</td>
<td>0.8</td>
<td>1.2</td>
<td>2.9</td>
<td>3.7</td>
</tr>
</tbody>
</table>

Gloss levels measured at a 60° illumination angle by BYK-Gardner Micro-Tri-Gloss. Steel inserts for the family mold were professionally etched with the texture design “Feinfarbe”. The higher the gloss level of the steel insert, the higher the gloss level of the Terblend plaque. Titan-nitride treatment of the tool insert was performed as wear protection during processing. These plaques were injection molded in a family mold with identical molding conditions.
**COLOR FASTNESS**

For dark colors, Terblend N provides good color fastness, making it suitable for many interior applications. In case of applications heavily exposed to sunlight or brightly colored assemblies, Terblend S provides additional benefits.

**COLOR VARIETY**

Styrolution provides custom-made colors for all Terblend grades. The Styrolution CEC (Color Excellence Center) enables prototyping and sampling of customer specific colors. Many OEM interior colors have already been developed for Terblend N and Terblend S. Styrolution also supplies natural Terblend to customers who prefer self-coloring solutions with Terblend N.

### EXAMPLES OF TERBLEND N AND TERBLEND S AUTOMOTIVE COLORS

<table>
<thead>
<tr>
<th>OEM</th>
<th>COLOR NAME</th>
<th>OEM</th>
<th>COLOR NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audi</td>
<td>Soul Black</td>
<td>Landrover</td>
<td>Almond</td>
</tr>
<tr>
<td>Audi</td>
<td>Steinkreide</td>
<td>Landrover</td>
<td>Crem</td>
</tr>
<tr>
<td>BMW</td>
<td>Black</td>
<td>Landrover</td>
<td>Espresso</td>
</tr>
<tr>
<td>BMW</td>
<td>Opal</td>
<td>Landrover</td>
<td>Ivory</td>
</tr>
<tr>
<td>BMW</td>
<td>Verkehrsbeige</td>
<td>Landrover</td>
<td>Luminer</td>
</tr>
<tr>
<td>Daimler</td>
<td>Orion Grey</td>
<td>Landrover</td>
<td>Nattling</td>
</tr>
<tr>
<td>Fiat</td>
<td>Grigio</td>
<td>Porsche</td>
<td>Anthraztrei</td>
</tr>
<tr>
<td>Fiat</td>
<td>Black</td>
<td>Porsche</td>
<td>Carmerat</td>
</tr>
<tr>
<td>Ford</td>
<td>Dark Shadow</td>
<td>Porsche</td>
<td>Cognac</td>
</tr>
<tr>
<td>Ford</td>
<td>Syrius</td>
<td>Porsche</td>
<td>Creme</td>
</tr>
<tr>
<td>Ford</td>
<td>Warm Neutral Grey</td>
<td>Porsche</td>
<td>Espresso</td>
</tr>
<tr>
<td>Opel</td>
<td>Jet Black</td>
<td>Porsche</td>
<td>Luxorbeige</td>
</tr>
<tr>
<td>Opel</td>
<td>Charcoal</td>
<td>Porsche</td>
<td>Plattinggrau</td>
</tr>
<tr>
<td>Opel</td>
<td>Light Neutral Ravenna</td>
<td>Porsche</td>
<td>Schiedt</td>
</tr>
<tr>
<td>Hyundai</td>
<td>Black</td>
<td>Porsche</td>
<td>Titanic</td>
</tr>
<tr>
<td>Kia</td>
<td>Ebony Black</td>
<td>Porsche</td>
<td>Yachtingblau</td>
</tr>
</tbody>
</table>

### ACCELERATED UV EXPOSURE ACCORDING TO SAE J2412 (exemplary measurement)

- Terblend N NM-21EF light beige:
  - Beginning to yellow, better to apply Terblend S
  - No significant color change
  - No visible color change

- Terblend S NM-31 light beige:
  - Beginning to yellow, better to apply Terblend S
  - No significant color change
  - No visible color change
Based on extensive testing and experience, Styrolution recommends design and molding parameters in order to achieve the best possible performance of parts made by Terblend grades, as well as to avoid molding faults like marks and streaks.

**MOLD SHRINKAGE**

Shrinkage behavior of unreinforced Terblend N and unreinforced Terblend S are comparable (N NM-21EF and S NM-31 shown here). Glass-fiber reinforced Terblend grades such as N NG-02EF exhibit lower shrinkage and, as a result, higher dimensional stability.

**MOLD SHRINKAGE AND POST SHRINKAGE OF TERBLEND N NM-21EF AS A FUNCTION OF HOLD PRESSURE AND MOLD SURFACE TEMPERATURE**

<table>
<thead>
<tr>
<th>Mold Shrinkage (%)</th>
<th>Terblend N NM-21EF</th>
<th>Terblend S NM-31</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longitudinal central measured</td>
<td>0.7</td>
<td>0.74</td>
</tr>
<tr>
<td>Transverse central measured</td>
<td>0.86</td>
<td>0.79</td>
</tr>
</tbody>
</table>

**MOLD SHRINKAGE OF GLASS-FIBER REINFORCED TERBLEND N**

<table>
<thead>
<tr>
<th>Mold Shrinkage (%)</th>
<th>Terblend NG-02EF (ABS/PA Gf8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longitudinal central measured</td>
<td>0.6</td>
</tr>
<tr>
<td>Transverse central measured</td>
<td>0.65</td>
</tr>
</tbody>
</table>

Mold shrinkage according to ISO 294
Conditioning: 24h at 23°C / 50% relative humidity
Test plaques 60 x 60 x 2mm
Holding pressure 650 bar
Melt temperature 260°C
Mold temperature 60°C

Other factors affecting shrinkage are the shape of the molding (molding design, wall thickness, gating and processing conditions), particularly hold pressure and mold surface temperature. Besides mold shrinkage, also post mold shrinkage of Terblend grades can be influenced. Mold shrinkage decreases considerably with increasing hold pressure, but post mold shrinkage shows less variation. Higher mold surface temperature leads to higher mold shrinkage and to lower post mold shrinkage.

**SHRINKAGE AFTER ANNEALING**

In the event that finished parts are stored, the storage temperature will affect the total shrinkage. The total shrinkage is the sum of mold shrinkage and post mold shrinkage. In case of glass fiber reinforcement (Terblend N NG-02EF shown here) the total shrinkage after annealing is reduced.

**SHRINKAGE OF UNREINFORCED TERBLEND N AFTER ANNEALING**

<table>
<thead>
<tr>
<th>Condition</th>
<th>6h at 23°C / 50% rel. humidity</th>
<th>6h at 80°C</th>
<th>6h at 100°C</th>
<th>6h at 120°C</th>
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</thead>
<tbody>
<tr>
<td>Longitudinal central measured</td>
<td>0.7</td>
<td>1.17</td>
<td>1.48</td>
<td>1.56</td>
</tr>
<tr>
<td>Transverse central measured</td>
<td>0.86</td>
<td>1.22</td>
<td>1.52</td>
<td>1.62</td>
</tr>
</tbody>
</table>

**SHRINKAGE OF GLASS-FIBER REINFORCED TERBLEND N AFTER ANNEALING**

<table>
<thead>
<tr>
<th>Condition</th>
<th>6h at 23°C / 50% rel. humidity</th>
<th>6h at 80°C</th>
<th>6h at 100°C</th>
<th>6h at 120°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longitudinal central measured</td>
<td>0.6</td>
<td>0.71</td>
<td>0.78</td>
<td>0.82</td>
</tr>
<tr>
<td>Transverse central measured</td>
<td>0.65</td>
<td>0.88</td>
<td>1</td>
<td>1.03</td>
</tr>
</tbody>
</table>
The coefficient of linear thermal expansion describes how the length of an object will change with steadily increasing temperature. The following graphs show the coefficient of linear thermal expansion for Terblend N NM-21 EF, Terblend N NG-02 EF, and Terblend S NM-31. The coefficient of linear thermal expansion of Terblend N and Terblend S is comparable. Only a glass-fiber reinforced blend (represented here by Terblend N NG-02 EF) leads to lower values, resulting in a better dimensional stability.

**Dimensional Stability**

The recommended melt temperature for processing Terblend is 240 – 270 °C. It is advisable to check the melt temperature by using a needle thermometer within the melt downstream of the screw. For reasons of better flowability and to achieve high surface quality and good mechanical properties, the upper range of the relevant temperature range is always preferable.

**Predrying**

Styrolution recommends the following predrying conditions and methods:
- **Moisture content**: In order to prevent moisture streaks on the parts, the moisture content before processing should be less than 0.05%.
- **Drying conditions**: Drying should be performed approximately 4 hours at 80 – 90 °C (freshly opened bags).
- **Sealing & covering**: After removal of pellets, the partly-filled packs need to be immediately and carefully sealed. The hopper on the machine should be covered by a lid.

**Mold Surface Temperature**

Mold surface temperature is one of the most important parameters in the entire injection molding process. For Terblend it should be 50 – 80°C. High mold surface temperature improves the surface quality (even low gloss, pronounced surface structure, low visibility of flowlines) and leads to better weld line strength. The risk of tiger lines is also minimized. Mold surface temperature also affects the dimensional tolerances for the molding. The higher the mold surface temperature, the higher the mold shrinkage and the lower the post shrinkage.

Recommended mold temperature range: 50 – 80 °C

**Injection Molding Temperature & Control Profile**

The peripheral screw speed during plasticizing \( V_U \) should account for 0.05 – 0.2 m/s. The screw rotation speed needs to be adapted to the screw diameter. The higher the screw diameter, the smaller the suitable range of the screw rotation speed. This avoids excessive shear stress during the plasticizing process. The recommended mold temperature range is always preferable.

**Optimal Screw Speed: 0.05 – 0.2 m/s**

\[
V_U = \frac{\pi \cdot D \cdot n}{60,000}
\]

Where: 
- \( V_U \) is the peripheral screw speed in m/s 
- \( n \) is the screw rotation speed in rev/min 
- \( D \) is the screw diameter in mm
**RIBS**

Ribs should have 0.4 – 0.6 times the thickness of the base wall in order to prevent material accumulation. In many cases, material accumulation leads to sink marks. To reduce or eliminate sink marks, the gate should ideally be set into the region of the highest wall thickness.

Radii on the base of a rib are necessary in order to prevent notch effects and flow problems. A radius of about 0.3 – 0.5 mm is sufficient. In case radii are wider, material accumulation could occur.

In visible surface areas, complex rib designs and ribs across the flow direction should be avoided.

**DEMOLDING**

As a rule, the draft on injection molds for Terblend grades should be 1° to 2°. A draft of 2° or more is needed for rough textures. A draft of 1° and less causes an increase in the demolding forces, which could result in pressure marks from the ejector pins.

Ejector pins or stripper plates should be designed with the largest possible area. To reduce demolding forces, it may be helpful to use a PVD (physical vapor deposition) process to apply a surface coating such as TiN or CrN.

**MOLD VENTING**

Venting channels usually need to be incorporated into the injection mold in the mold parting line at the end of the flow path and in weld line areas. Inadequate mold venting can lead to mold filling problems, mold deposit or even a higher tendency for scorch marks, the so-called “Diesel” effect.

Furthermore, good mold venting facilitates fast injection.

**RECOMMENDED VENTING DESIGN**

**REGRIND PROCESSING**

Sprue waste, such as reject parts or cold runners from the processing of Terblend, can be reused in limited amounts. The maximum permissible amount of regrind that can be added should be determined in trials by the customer.

In order to produce defect-free, injection-molded parts containing regrind material, the scrap material must be clean and dry. Moisture can give rise to molecular degradation during processing. It is also essential that no thermal degradation has occurred in the preceding processing.

The addition of regrind material to the original pellets can result in changes in feed and flow properties, as well as affect demolding and shrinkage behavior. Regrind processing may especially change mechanical properties.

**AVOIDING PRESSURE MARKS, MOISTURE STREAKS AND HESITATION MARKS**

Pressure marks are visible surface marks resulting from high holding pressure levels, especially in combination with fine textures. These can be avoided by:

- Reducing the holding pressure and adjusting the holding pressure time
- Avoiding material accumulations and changes in wall thickness
- Avoiding ribs, snap fits, bosses too far from the injection point
- Gating the part in the thick walled area
- Opting for a medium rough or rough texture

Moisture streaks appear in the opposite direction of the flow. These can be avoided by:

- Adequately predrying material to a residual moisture content of < 0.05%
- Drying for 4 hours at 80 – 90°C (freshly opened bags)
- Increasing the back pressure

Hesitation marks and lines on the part that cross the flow direction. These can be avoided by:

- Enlarging the sprue and/or runner cross section
- Reducing pressure losses in the machine and hot runner nozzle
- Employing a better flowing material grade
- Optimizing the processing parameters (high melt temperature, high mold surface temperature, medium to low injection speed and high holding pressure)
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