simply the better solution

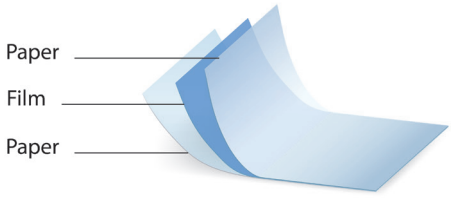
# ENDURO Ice

## Recommendations for printing and processing

ENDURO Ice products are durable and hardwearing: this is made possible by a special compound construction of the product, a film core sandwiched between wafer-thin, white natural paper surfaces. The three-layer product structure is resistant to edge tearing and water impermeable. It gives all ENDURO Ice grades identical translucency with an elegant feel and a finely ribbed appearance. This enables applications in areas where conventional translucent papers reach their limits by comparison. ENDURO Ice is FSC®-certified and PVC-free.

Although the paper surfaces are identical for all ENDURO Ice grades, the film core is different. This means the different grades differ in terms of their product properties:

- **ENDURO Ice 80** – with 50 µm PP film core, this results in a durable material composition
- **ENDURO Ice 90 sustainable** – with 40 µm PLA film core made from bio-based raw materials, this has a slightly lower tear resistance
- **ENDURO Ice 135** – with more heat-stable 75 µm PET film core, this has higher reset forces
- **ENDURO Ice 260** – with 250 µm PP film core, this gives the material a higher stability and stiffness




## General information on printing

All ENDURO Ice grades can be printed without restriction in conventional printing processes (offset printing, flexo printing, screen printing). You can find an overview showing which types are suitable for the different printing technologies in our table in the Appendix "Suitability of Printing Technologies".

For processing ENDURO Ice we basically recommend advance testing in all production processes followed by a corresponding application test.

**OFFSET PRINTING (web/sheet offset)**
ENDURO Ice can be printed in both sheet offset and web offset printing with conventional absorbing print inks as well as with oxidatively drying or UV/LED-reactive inks. Owing to the relatively thin paper layer and non-absorbent film core, however, the absorption properties of the printing ink are limited and a longer drying time is to be expected.

An optimised ink-water balance with low water flow as well as inks free of mineral oil are generally recommended, while additives that retard drying (roller freshness retainers) should be avoided. At high ink application, we recommend the use of purely oxidative printing inks or UV/LED-reactive inks.

Practical tip: A single-sided printing of ENDURO Ice with high ink, water or coating application can result in drying with increased curling of the printed sheets through to the printed image. The reason for this is the barrier function of the film core, which favours a one-sided elongation during moisture absorption and subsequent shrinkage during drying. This is a familiar, undesirable effect for wall calendars in particular. In this case, we recommend moistening the rear also in order to ensure a balanced, even drying process for both sides.

**FLEXO PRINTING**
Suitable for printing with UV-reactive and water-based flexographic inks.

## DRY TONER-BASED PRINTING SYSTEMS (laser/LED printers)

Owing to the large number of toner-based printing systems in different performance classes, a general processing recommendation is not possible. Generally, the printing systems can be divided into two categories:

- Office printers, multifunction printers, desktop laser/LED printers
  Only a limited selection option of preset media types is available for these models. As a rule, copy papers can be processed with a maximum grammage of 220 g/m². Neither the fixing temperature nor the toner transfer voltage can be adjusted separately manually. ENDURO Ice 80 can be printed without problem, while toner transfer voltage might be too low for ENDURO Ice 135 here. Test either the media type with the highest grammage or the setting for film (overhead transparency) in the printer settings. ENDURO Ice 260 is not suitable for these printers owing to its high grammage.
- Industrial printers, production machines, professional colour laser printers, web-fed laser printers
  With these professional printing systems, a higher grammage is basically possible and own media profiles can be created or, in some cases, downloaded from the media database. The toner transfer voltage and fixing temperature can be adapted to the material, which is necessary for ENDURO Ice 260. ENDURO Ice 80 and 135 can be printed without any problem.

ENDURO Ice 90 sustainable is only suitable for laser printing to a limited extent owing to the low heat stability of the bio-based PLA film. The fixing temperature must be reduced to a minimum in order to keep the shrinkage of the film as low as possible.

As a high paper moisture impairs the voltage flow in laser printing, please always make sure that unprinted papers are always well packed and protected against a high ambient moisture.

The combination of paper and film can result in a rounding of the sheets (curl) during or directly after laser printing. Owing to the high fixing temperatures of 130 to 200°C (depending on the type of printer), the paper loses moisture and shrinks, while the film core does not react. The resultant curl often disappears after some time if the sheets are remoistened above the ambient moisture. We therefore recommend leaving the print stack for 24 hours in an air-conditioned environment.

In a dry room climate, an increased static charge can result between the sheets after laser printing. Experience has shown that this charge abates by itself after some time, whereby fanning out the sheets assists the process. We therefore recommend leaving the printed stack for several hours in an air-conditioned environment before processing further (ideal room climate 20 ± 5°C and 50 ± 10 % rel. humidity) here too.

## LIQUID TONER-BASED PRINTING SYSTEMS (HP Indigo)

As a rule, we recommend first primering the paper surfaces of the ENDURO Ice grades or carrying out tests with the HP Indigo ElectroInk Primer in order to improve the ink adhesion.

## INKJET PRINTING

ENDURO Ice grades are only suitable to a limited extent for aqueous inkjet printing, as the paper surface only has a low ink absorption capacity.

In UV inkjet printing good printing results are possible with all ENDURO Ice grades.

Only ENDURO Ice 135 with the more heat-stable PET film core as well as ENDURO Ice 260 with the thicker PP film core have proven suitable for inkjet printing with latex inks, on account of the device-specific heat drying. We do not provide printer profiles for this and recommend that you carry out your own tests.

The ENDURO Ice grades are not suitable for printing with solvent inks.

## THERMAL TRANSFER PRNTING (flat-head/near-edge printers)

The ENDURO Ice grades are only suitable for thermal transfer printing to a limited extent owing to the rough natural paper surfaces. Fine grids and lines (barcodes) are to be avoided in the layout.

## General information on processing

ENDURO Ice can be processed like paper: cutting, punching, perforating, drilling, folding, tacking, gluing, stamping etc. However, the material composition means a few points have to be observed during processing:

### CUTTING

The tear resistance is only retained if the cut edge is neat and smooth. Knives and cutting tools should be ground sharp so that the cutting edges do not squeeze and fray. Such irregularities lead to defined breaking points that tear easily. Separating cuts behind the knife should be provided with a neat counter-cut.

### FOLDING

In comparison to conventional transparent papers, ENDURO Ice does not break in the score lines, nor does it exhibit any white scoring. The film core means that ENDURO Ice achieves a high fold strength and tear resistance and has slightly higher reset forces than paper. The running direction of the paper needs to be considered, ideally with folding parallel to the running direction. We recommend scoring the fold for ENDURO Ice 135 and 260.

### SCORING

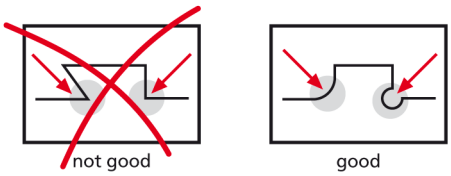
As the film core cannot be compressed, it must be ensured that the scoring tools do not have any sharp edges and that the paper surfaces are not squeezed. As a rule, scoring should be done with a slightly wider and deeper scoring groove appropriate to the respective sheet thickness. For ENDURO Ice 260, a fold with an outside scoring groove leads to a better result.

Instead of scoring, ENDURO Ice 260 can be carved slightly in the folding line, whereby intact gutters of approx. 2 mm have to be retained on the sheet edge and cross-lines in order to prevent tearing of the film at the sheet edge or cross-points.

### PUNCHING

All corners should be rounded during punching, as sharp corners or notches mean a predetermined breaking point where the material may tear easily. Carbide punching knives are recommended (e.g. made from chrome-alloyed or high-frequency welded steel).

ENDURO Ice is only suitable for laser punching to a limited extent. As there are different manufacturers for this method, it is necessary to clarify in advance whether and what film products are actually permitted.

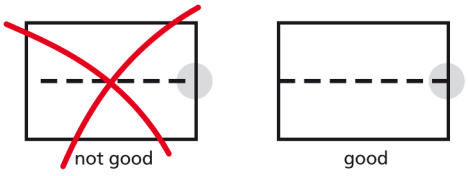



### STAMPING

ENDURO Ice is ideally suitable for hot-foil stamping. For relief embossing, we recommend carrying out tests in advance as the material composition is only deformable to a certain extent.

### PERFORATING

As ENDURO Ice has increased tear resistance, the first cut must always begin at the edge of the sheet.




### BONDING

For bonding the paper surfaces when manufacturing envelopes or folders, all dispersion and hot-melt adhesives can basically be used. Prolonged drying times are to be expected owing to the barrier function of the film core. Make sure that transparent adhesives free of yellowing are used, which do not impair the transparency. For adhesive bindings for book or writing pad production, we recommend corresponding tests and consultation with the glue supplier.

## DRILLING

It is essential to control the drilling stroke speed and drill speed during drilling. The drill must not overheat and should be well lubricated, for instance by pulse lubrication with wax paper. To prevent the drill from overheating and hence melting of the material, it is necessary to work with low stacks, high stroke speed and a low drill speed. Teflon-coated drills are recommended and should be sharpened regularly be professionals.

## STORAGE

Storage should be in the original packaging, if possible. Please pack remaining sheets airtight again.

The ideal room climate for converting and storage is 20 ± 5°C and 50 ± 10 % relative humidity. Store the sheets unopened for least 24 hours after delivery for acclimatisation in the printer room and do not open the packaging until shortly before printing. In a very dry room climate, the sheets tend to curl. We therefore recommend that you do not unpack the sheets until shortly before printing.

## DISPOSAL & RECYCLING

You can find detailed information on this in our relevant safety instructions, which our Customer Service will be pleased to send you. By email at: CustomerService.Dueren@sihl.com

# ENDURO

## Suitability of printing technologies

| | Quality | g/m² | µm | Surface papers | Film core | Thermal transfer printing | Dot Matrix printer | Inkjet waterbased inks dye/pigment | Inkjet with UV-inks | Office & Multifunction Printer Dry Toner · Laser · LED | Production Print Press Dry Toner · Laser · LED | HP Indigo | Conventional offset / litho printing | UV-offset / litho printing | Flexo printing (UV & waterbased) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **6901** | **ENDURO Classic 90 L** | 95 | 100 | uncoated | PP 28 µm | T | ✓ | T | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **6903** | **ENDURO Classic 100 L** | 100 | 115 | uncoated | PP 40 µm | T | ✓ | T | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **6946** | **ENDURO Classic 145 K** | 145 | 160 | uncoated | PET 23 µm | T | ✓ | T | ✓ | ✓ | ✓ | P | ✓ | ✓ | ✓ |
| **6921** | **ENDURO Classic 150 K** | 145 | 175 | uncoated | PP 40 µm | T | ✓ | T | ✓ | ✓ | ✓ | P | ✓ | ✓ | ✓ |
| **6948** | **ENDURO Classic 175 K** | 180 | 185 | uncoated | PET 50 µm | T | ✓ | T | ✓ | Δ | ✓ | P | ✓ | ✓ | ✓ |
| **6950** | **ENDURO Classic 255 K** | 255 | 235 | uncoated | PET 100 µm | T | ✓ | T | ✓ | Δ | ✓ | P | ✓ | ✓ | ✓ |
| **6970** | **ENDURO Classic 345 A** | 345 | 345 | uncoated | PET 100 µm | T | ✓ | T | ✓ | Δ | ✓ | P | ✓ | ✓ | ✓ |
| **6977** | **ENDURO Classic Plus 190 G** | 185 | 170 | calendered | PP 40 µm | ✓ | ○ | ○ | ✓ | ✓ | ✓ | P | ✓ | ✓ | ✓ |
| **6925** | **ENDURO Classic Plus 200 J** | 205 | 215 | calendered | PP 40 µm | ✓ | ○ | ○ | ✓ | Δ | ✓ | P | ✓ | ✓ | ✓ |
| **6978** | **ENDURO Classic Plus 225 G** | 220 | 185 | calendered | PET 50 µm | ✓ | ○ | ○ | ✓ | Δ | ✓ | P | ✓ | ✓ | ✓ |
| **6979** | **ENDURO Classic Plus 285 G** | 290 | 240 | calendered | PET 100 µm | ✓ | ○ | ○ | ✓ | Δ | ✓ | P | ✓ | ✓ | ✓ |
| **6900** | **ENDURO Premium 150 matt** | 150 | 140 | matt-coated | PP 40 µm | ✓ | ○ | ○ | ✓ | ✓ | ✓ | P | ✓ | ✓ | ✓ |
| **6989** | **ENDURO Premium 155 matt** | 160 | 135 | matt-coated | PET 36 µm | ✓ | ○ | ○ | ✓ | ✓ | ✓ | P | ✓ | ✓ | ✓ |
| **6703** | **ENDURO Premium 210 gloss** | 205 | 175 | gloss-coated | PP 40 µm | ✓ | ○ | ○ | ✓ | Δ | ✓ | P | ✓ | ✓ | ✓ |
| **6958** | **ENDURO Premium 280 matt** | 280 | 230 | matt-coated | PP 40 µm | ✓ | ○ | ○ | ✓ | Δ | ✓ | ✓✓ | ✓ | ✓ | ✓ |
| **6981** | **ENDURO Effect 100 Water improved** | 105 | 100 | impregnated | PP 28 µm | ○ | ○ | ○ | ✓ | ✓ | ✓ | ○ | ✓ | ✓ | ✓ |
| **6670** | **ENDURO Effect 120 Opaque white** | 125 | 150 | uncoated | PP + AL 35 µm | T | ✓ | T | ✓ | ○ | T | P | ✓ | ✓ | ✓ |
| **6688** | **ENDURO Effect 130 Opaque silver** | 130 | 150 | uncoated | PP + AL 30 µm | T | ✓ | T | ✓ | ○ | T | P | ✓ | ✓ | ✓ |
| **6912** | **ENDURO Effect 140 Water improved** | 145 | 190 | impregnated | PP 28 µm | ○ | ○ | ○ | ✓ | ✓ | ✓ | ○ | ✓ | ✓ | ✓ |
| **6821** | **ENDURO Effect 155 RFID shield** | 155 | 145 | uncoated | PET + AL 32 µm | T | ✓ | T | ✓ | ○ | T | P | ✓ | ✓ | ✓ |
| **6918** | **ENDURO Effect 245 Metal detectable** | 240 | 235 | uncoated | PET + AL 59 µm | T | ✓ | T | ✓ | ○ | T | P | ✓ | ✓ | ✓ |
| **6902** | **ENDURO Extra 120 K** | 125 | 145 | uncoated | PP 40 µm | T | ✓ | T | ✓ | ✓ | ✓ | P | ✓ | ✓ | ✓ |
| **6938** | **ENDURO Ice 80** | 80 | 100 | uncoated | PP 50 µm | T | T | ○ | ✓ | ✓ | ✓ | P | ✓* | ✓ | ✓ |
| **6962** | **ENDURO Ice 90 sustainable** | 85 | 100 | uncoated | PLA 40 µm | T | T | ○ | ✓ | ○ | ○ | P | ✓* | ✓ | ✓ |
| **6952** | **ENDURO Ice 135** | 140 | 130 | uncoated | PET 75 µm | T | T | ○ | ✓ | ✓ | ✓ | P | ✓* | ✓ | ✓ |
| **6955** | **ENDURO Ice 260** | 260 | 300 | uncoated | PP 250 µm | T | T | ○ | ✓ | ○ | ✓ | P | ✓* | ✓ | ✓ |
| **6995** | **ENDURO Inkjet 110 Classic 2s** | 110 | 130 | surface treated | PP 28 µm | T | ✓ | ✓ | ✓ | ✓ | ✓ | P | ✓ | ✓ | ✓ |
| **6993** | **ENDURO Inkjet 225 Premium gloss 1s** | 220 | 225 | one-side gloss-coated | PET 36 µm | ✓ | ✓ | ✓ | ✓ | ○ | T | ○ | T | T | T |
| **6971** | **ENDURO Inkjet 615 Premium matt 2s** | 615 | 535 | matt-coated | PET 250 µm | ✓ | ✓ | ✓ | ✓ | ○ | T | Δ | T | T | T |

○ not suitable / **Δ** check printer specifications / **T** to be tested in advance / ✓ proven · suitable / ✓* suitable with inks drying by oxidation
✓✓ HP Indigo certified surface paper / **P** Tests with prior primer application or HP ElectroInk Primer required

The values stated above are only for orientation. Before using our print media please check its compatibility for your prinitng system and the intended application. Please consider our recommendation for printing and processing.

# ENDURO

## Product properties and resistances

| | Quality | g/m² | µm | Surface papers | Film core | Opacity | Stiffness | Initial tear resistance | Durability | Foldability | Fold strength / rating | Abrasion resistance wet | Outdoor resistance | Recyclable | Food contact |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **6901** | **ENDURO Classic 90 L** | 95 | 100 | uncoated | PP 28 µm | ++ | + | + | + | +++ | ++ | + | + | ✓[2] | (–) |
| **6903** | **ENDURO Classic 100 L** | 100 | 115 | uncoated | PP 40 µm | ++ | + | + | + | +++ | ++ | + | + | ✓[2] | (–) |
| **6946** | **ENDURO Classic 145 K** | 145 | 160 | uncoated | PET 23 µm | ++ | ++ | + | + | ++ | ++ | + | + | ✓[2] | ✓[3] |
| **6921** | **ENDURO Classic 150 K** | 145 | 175 | uncoated | PP 40 µm | ++ | ++ | + | + | ++ | ++ | + | + | ✓[2] | ✓[3] |
| **6948** | **ENDURO Classic 175 K** | 180 | 185 | uncoated | PET 50 µm | ++ | ++ | ++ | ++ | +[1] | ++ | + | ++ | ✓[2] | ✓[3] |
| **6950** | **ENDURO Classic 255 K** | 255 | 235 | uncoated | PET 100 µm | ++ | +++ | +++ | +++ | +[1] | ++ | + | ++ | ✓[2] | ✓[3] |
| **6970** | **ENDURO Classic 345 A** | 345 | 345 | uncoated | PET 100 µm | +++ | +++ | +++ | +++ | +[1] | ++ | + | ++ | ✓[2] | ✓[3] |
| **6977** | **ENDURO Classic Plus 190 G** | 185 | 170 | calendered | PP 40 µm | ++ | ++ | + | + | +[1] | ++ | + | + | ✓[2] | ✓[3] |
| **6925** | **ENDURO Classic Plus 200 J** | 205 | 215 | calendered | PP 40 µm | ++ | ++ | + | + | +[1] | ++ | + | + | ✓[2] | ✓[3] |
| **6978** | **ENDURO Classic Plus 225 G** | 220 | 185 | calendered | PET 50 µm | ++ | ++ | ++ | ++ | +[1] | ++ | + | ++ | ✓[2] | ✓[3] |
| **6979** | **ENDURO Classic Plus 285 G** | 290 | 240 | calendered | PET 100 µm | ++ | +++ | +++ | +++ | +[1] | ++ | + | ++ | ✓[2] | ✓[3] |
| **6900** | **ENDURO Premium 150 matt** | 150 | 140 | matt-coated | PP 40 µm | ++ | ++ | + | + | ++ | ++ | + | + | ✓[2] | ✓[3] |
| **6989** | **ENDURO Premium 155 matt** | 160 | 135 | matt-coated | PET 36 µm | ++ | ++ | ++ | ++ | ++[1] | ++ | + | + | ✓[2] | ✓[3] |
| **6703** | **ENDURO Premium 210 gloss** | 205 | 175 | gloss-coated | PP 40 µm | ++ | ++ | + | + | ++[1] | ++ | + | + | ✓[2] | ✓[3] |
| **6958** | **ENDURO Premium 280 matt** | 280 | 230 | matt-coated | PP 40 µm | +++ | +++ | + | + | ++[1] | ++ | + | + | ✓[2] | (–) |
| **6981** | **ENDURO Effect 100 Water improved** | 105 | 100 | impregnated | PP 28 µm | + | + | + | + | +++ | ++ | ++ | +++ | ✓[2] | (–) |
| **6670** | **ENDURO Effect 120 Opaque white** | 125 | 150 | uncoated | PP + AL 35 µm | +++ | ++ | + | + | ++ | ++ | + | + | ✓[2] | ✓[3] |
| **6688** | **ENDURO Effect 130 Opaque silver** | 130 | 150 | uncoated | PP + AL 30 µm | +++ | + | + | + | ++ | ++ | + | + | — | ✓[3] |
| **6912** | **ENDURO Effect 140 Water improved** | 145 | 190 | impregnated | PP 28 µm | + | ++ | ++ | + | ++ | ++ | +++ | +++ | — | (–) |
| **6821** | **ENDURO Effect 155 RFID shield** | 155 | 145 | uncoated | PET + AL 32 µm | +++ | ++ | + | + | ++ | ++ | + | + | ✓[2] | ✓[3] |
| **6918** | **ENDURO Effect 245 Metal detectable** | 240 | 235 | uncoated | PET + AL 59 µm | +++ | +++ | ++ | ++ | +[1] | ++ | + | ++ | ✓[2] | ✓[3] |
| **6902** | **ENDURO Extra 120 K** | 125 | 145 | uncoated | PP 40 µm | ++ | + | + | + | ++ | ++ | + | + | ✓[2] | (–) |
| **6938** | **ENDURO Ice 80** | 80 | 100 | uncoated | PP 50 µm | — | + | ++ | + | +++ | ++ | + | + | — | ✓[3] |
| **6962** | **ENDURO Ice 90 sustainable** | 85 | 100 | uncoated | PLA 40 µm | — | + | + | + | ++ | ++ | + | + | — | ✓[3] |
| **6952** | **ENDURO Ice 135** | 140 | 130 | uncoated | PET 75 µm | — | ++ | ++ | ++ | ++[1] | ++ | + | ++ | — | ✓[3] |
| **6955** | **ENDURO Ice 260** | 260 | 300 | uncoated | PP 250 µm | — | +++ | +++ | ++ | +[1] | ++ | + | ++ | — | ✓[3] |
| **6995** | **ENDURO Inkjet 110 Classic 2s** | 110 | 130 | surface treated | PP 28 µm | ++ | + | + | + | ++ | ++ | + | + | ✓[2] | (–) |
| **6993** | **ENDURO Inkjet 225 Premium gloss 1s** | 220 | 225 | one-side gloss-coated | PET 36 µm | ++ | ++ | ++ | + | +[1] | ++ | + | + | ✓[2] | (–) |
| **6971** | **ENDURO Inkjet 615 Premium matt 2s** | 615 | 535 | matt-coated | PET 250 µm | +++ | +++ | +++ | +++ | — | ++ | + | ++ | ✓[2] | (–) |

**+** standard, good / **++** high, better / **+++** very high, very good
✓ applicable / **—** not applicable / **(–)** not tested
**+**[1] Creasing before folding recommended
✓[2] Paper fibers recoverable trough standard paper-recycling, more details you can find in our Media Safety Information
✓[3] For application with food-contact please inform us in advance. We check suitability and provide you with a Declaration of Compliance

The values stated above are only for orientation. Before using our print media please check its compatibility for your printing system and the intended application. Please consider our recommendation for printing and processing.