Océ Paper Specification

Océ VarioStream 7100
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1 Introduction

Printing forms manufacturing needs a lot of cost for keeping paper properties within allowed range in order to assure paper quality. Therefore, cheaper papers are often to be chosen to reduce the running cost, so it may cause unexpected trouble because of bad quality control and it may result in increasing the printing system down period, and then the loss of time may cancel the save of money by purchasing cheaper forms.

On the contrary, even the use of expensive forms might also cause problems. The important point is whether the forms have the features conformable to purpose. Forms have to be designed so that it has properties suitable for the electrophotographic printing in order to get high reliability and good print quality.

This guide brings advices for forms design suitable for the printing system. In order to make these printing systems' performance fully effective, it is necessary to meet the all conditions described below. Océ Printing Systems GmbH cannot be responsible for the trouble caused by not-accordance with this guide and for the damage by it.

The most appropriate judgement method is to discuss with printing system forms vendors or manufacturers well beforehand and to make printing test (pretest) with enough number of forms using the actual machines before purchasing large number of forms. (Please note that paper features and properties are subject to change by paper vendors, and the Océ Printing Systems GmbH has no control over such changes.) Especially, this kind of pretest is very important when using special forms including preprinted forms. Furthermore, even though the result of the pretest is good, the forms of another manufacturing lot might have some problems because of some dispersion of the manufacturing process. Therefore it is recommended to use the forms whose manufacturing process is fully controlled.
The following sections contain:

- **Section 2: Specified Data**
  This section contains the specified data on forms:
  — Properties
  — Measures and tolerances
  — Package
  — Print areas
  — Notes on document design

- **Section 3: Forms fundamentals**
  This section contains notes on design and handling of forms:
  — General notes on forms (types, forming, feed holes, perforations, moisture content, package …)
  — Notes on design and handling of forms
  — Notes on design and handling of special forms (label forms, preprinted forms, forms with intermediate perforations, holed forms, sealing forms and other forms)
2 Specified Data

2.1 Basic requirements

Tabelle 1 contains the basic requirements on the forms:

<table>
<thead>
<tr>
<th>Item</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper quality</td>
<td>High-grade paper or recycling paper 1)</td>
</tr>
<tr>
<td>Shape</td>
<td>Folded continuous forms with feed holes</td>
</tr>
<tr>
<td>Size</td>
<td>Horizontal: 165.1 mm to 457.2 mm (6.5&quot; to 18&quot;)</td>
</tr>
<tr>
<td></td>
<td>Vertical: 177.8 mm to 355.6 mm (7&quot; to 14&quot;) in 4.23 mm (1/6&quot;) steps, if folded</td>
</tr>
<tr>
<td>Basis weight</td>
<td>64 to 157 g/m² (ream weight: 55 to 135 kg); For labels on the backing sheet</td>
</tr>
<tr>
<td></td>
<td>this is the total basis weight of pasted labels on the backing sheet. 3)</td>
</tr>
<tr>
<td>Thickness</td>
<td>84 - 196 μm (JIS P118)</td>
</tr>
<tr>
<td>Electrical resistance</td>
<td>$1 \times 10^9$ to $1 \times 10^{12}$ Ω (surface resistance/volume resistance)</td>
</tr>
<tr>
<td></td>
<td>according to storage conditions 2)):</td>
</tr>
<tr>
<td>Opacity</td>
<td>&gt; 80% (JIS P8128)</td>
</tr>
<tr>
<td>Number of layers</td>
<td>1</td>
</tr>
<tr>
<td>Paper box size</td>
<td>Box height: max. 300 mm</td>
</tr>
<tr>
<td>Storage conditions</td>
<td>• Temperature: 10 to 30 °C</td>
</tr>
<tr>
<td></td>
<td>• Rel. humidity: 30 to 70%</td>
</tr>
<tr>
<td></td>
<td>• Not exposed to direct sunlight</td>
</tr>
<tr>
<td></td>
<td>• Condensation must be avoided under any conditions</td>
</tr>
<tr>
<td></td>
<td>• Do not leave paper unpacked for a long time</td>
</tr>
<tr>
<td></td>
<td>Paper that has been stored under the above conditions may be used in</td>
</tr>
<tr>
<td></td>
<td>extremely different environments. In this case, the paper must become</td>
</tr>
<tr>
<td></td>
<td>accustomed to the using environment before being used. 4)</td>
</tr>
</tbody>
</table>

1) Printing performance is not ensured for art paper, coated paper, and pressure-sensitive forms which are not high-grade paper.
2) See section "Forms surface specific resistance" on page 18
3) See section 3.2.2 on page 30
4) See also section 3.1.9.2 on page 26

Tabelle 1 Basic requirements on the paper
## 2.2 Forms Properties

Following table contains the properties of forms:

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incomplete punched feed holes</td>
<td>Do not use forms with incomplete punched feed holes. Possible printing problems:</td>
<td>1: Incomplete punched feedholes</td>
</tr>
<tr>
<td></td>
<td>• Paper run errors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Light patches, voids</td>
<td></td>
</tr>
<tr>
<td>Curled forms</td>
<td>Do not use sharply curled forms. Possible printing problems:</td>
<td>1: Curled forms</td>
</tr>
<tr>
<td></td>
<td>• Paper jams</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Voids by incorrect transfer</td>
<td></td>
</tr>
<tr>
<td>Shrunk or creased</td>
<td>Do not use forms shrunk or creased in other way than folding. Possible printing problems:</td>
<td>1: Shrink forms</td>
</tr>
<tr>
<td></td>
<td>• Voids by incorrect transfer</td>
<td>2: Creased form</td>
</tr>
</tbody>
</table>

1: Incomplete punched feedholes
2: Creased form
The thickness of paper must be within the specified range (see table 1, page 7). Do not use thicker or thinner paper.

Possible printing problems:
- Thicker paper: Voids and smudge
- Thinner paper: Torn and incorrect paper transport

To check paper stiffness, fold down two sheets of paper along the horizontal perforation, and support the paper on a support rod with 10 mm diameter.

The following values are desirable as the dimensions of the hanging area. If these values are not met, the paper is not folded down easily after printing.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness (basis weight)</td>
<td>The thickness of paper must be within the specified range (see table 1, page 7). Do not use thicker or thinner paper. Possible printing problems: Thicker paper: Voids and smudge Thinner paper: Torn and incorrect paper transport</td>
<td></td>
</tr>
<tr>
<td>Paper stiffness</td>
<td>To check paper stiffness, fold down two sheets of paper along the horizontal perforation, and support the paper on a support rod with 10 mm diameter. The following values are desirable as the dimensions of the hanging area. If these values are not met, the paper is not folded down easily after printing.</td>
<td></td>
</tr>
</tbody>
</table>
| Fold spacing          | Value "X"
| 279.4 to 355.6 mm (11" to 14") | ≥ 178 mm (7")   |        |
| 117.8 to 266.7 mm (7" to 10.5") | ≥ 153 mm (6")   |        |

1: Edges of cut
2: Perforation
3: Fold spacing
4: Support rod (Ø = 10 mm)
X: Space between edges of cuts (permissible values see table left)
## Specified Data

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal perforations and feed hole positions</td>
<td>If feed holes contact the horizontal perforations, paper may be torn. Keep away the feed holes from the horizontal perforations (see section 2.3). Possible printing problems: Paper is torn</td>
<td>![Figure 2] (1: Feed holes 2: Perforation)</td>
</tr>
<tr>
<td>Quality of perforations</td>
<td>Tolerance of stock warping: Base weight of 64 g/m², 2000 sheet, warping &lt;15mm. Possible printing problems: Poor runability</td>
<td>![Figure 3] (Warping)</td>
</tr>
<tr>
<td>Item</td>
<td>Description</td>
<td>Figure</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>Feed hole shape and position</td>
<td>If the feed hole is deformed, or the left and right feed holes are misaligned, paper tension or printing may be defective. Misalignment shall be up to 0.15 mm. Possible printing problems: Distorted printing and incorrect paper transport</td>
<td></td>
</tr>
</tbody>
</table>

1: Misalignment of feed holes (x: 0.15 mm max.)
2: Badly shaped feed holes
<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper box shape</td>
<td>The paper box shall be constructed so that paper is fed smoothly from the paper box to the printing system. For this, the following four items shall be taken into consideration:</td>
<td>1: Paper box with separate cover&lt;br&gt;2: Paper box (plan view)&lt;br&gt;3: Paper box (cross section)&lt;br&gt;x: 4 to 7 mm&lt;br&gt;y: Space between paper and cover (y = 0)&lt;br&gt;z: &lt; 300 mm</td>
</tr>
<tr>
<td></td>
<td>1. Provide the paper box with a separate cover.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. The height of the paper box without cover must be less than 300 mm.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Paper to be used should allow an inner margin of 4 to 7 mm for the vertical and horizontal dimensions.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. The bottom side of the paper box shall be flat to prevent paper distortion.</td>
<td></td>
</tr>
<tr>
<td>Paper with holes</td>
<td>Do not use paper with holes made 110 to 150 mm from the left end.</td>
<td>x: 110 mm&lt;br&gt;y: 40 mm</td>
</tr>
<tr>
<td>Item</td>
<td>Description</td>
<td>Figure</td>
</tr>
<tr>
<td>------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>--------</td>
</tr>
</tbody>
</table>
| Left end of paper| Do not use paper with holes made  
• 90 mm to 105 mm from the center line of the feed holes on the left edge of the paper  
• 0 mm and 15 mm from the perforations  
The paper must not be preprinted within this area. | ![Diagram](attachment:image.png) |

Tabelle 2  Properties
To feed forms precisely, forms have two rows of feed holes near at the both edges of forms. The dimensions and tolerances for feed holes are, based upon ISO 2784, as follows.

### Definition Standards

<table>
<thead>
<tr>
<th>Definition</th>
<th>Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>a Horizontal deviation of center of feed holes</td>
<td>&lt; 0.1 mm</td>
</tr>
<tr>
<td>b Diameter of feed holes</td>
<td></td>
</tr>
<tr>
<td>• round feed holes</td>
<td></td>
</tr>
<tr>
<td>• serrated feed holes</td>
<td></td>
</tr>
<tr>
<td>– inner diameter</td>
<td></td>
</tr>
<tr>
<td>– outer diameter</td>
<td></td>
</tr>
<tr>
<td>• 4.0 mm ±0.1 mm</td>
<td>• Standards:</td>
</tr>
<tr>
<td>• 4.0 mm ±0.1 mm</td>
<td>– 4.0 mm ±0.1</td>
</tr>
<tr>
<td>• &lt; 4.5 mm</td>
<td>– &lt; 4.5 mm</td>
</tr>
<tr>
<td>c Vertical deviation of corresponding left and right feed holes</td>
<td>&lt; 0.15 mm</td>
</tr>
<tr>
<td>d Distance between the center of feed holes and the folding perforations</td>
<td>6.35 mm ±0.1 mm</td>
</tr>
<tr>
<td>e Distance between the center of feed holes and the edge of form</td>
<td>6.0 mm ±0.7 mm</td>
</tr>
<tr>
<td>f Distance between two consecutive feed holes</td>
<td>12.7 mm ±0.05 mm</td>
</tr>
<tr>
<td>g Deviation of distance between two feed holes</td>
<td>&lt; ±0.7 mm within 254 mm</td>
</tr>
<tr>
<td>h Angle between the common center line of feed holes and the folding perforations</td>
<td>90°</td>
</tr>
</tbody>
</table>

Forms forming accuracy
2.4 Perforations

For folding and/or post-processing, forms have perforations. The folding perforations are horizontal ones made for folding and stacking of forms. The intermediate horizontal perforations are additional horizontal ones in between the folding perforations, made for post-processing of forms. The intermediate vertical perforations including right and/or left margin perforation(s) are made for separations of the hole margin or post-processing of forms.

The values (ex. the tie/cut ratio) for each type of perforations are defined individually. Other perforations and perforations with burring or distortion may cause tearing or misfolding and so on. Be sure to use one of the defined perforations of forms.

Tabelle 3 contains recommendations on perforations.

<table>
<thead>
<tr>
<th>Perforation type</th>
<th>Base weight (ream weight)</th>
<th>Over 81 g/m² (70 kg) to 105 g/m² (90 kg)</th>
<th>Over 105 g/m² (90 kg) to 128 g/m² (110 kg)</th>
<th>Over 128 g/m² (110 kg) to 157 g/m² (135 kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Folding perforation</td>
<td>0820</td>
<td>0815</td>
<td>0820</td>
<td>1010</td>
</tr>
<tr>
<td></td>
<td>0825</td>
<td></td>
<td>0815</td>
<td>1015</td>
</tr>
<tr>
<td></td>
<td>0830</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intermediate horizontal</td>
<td>0815</td>
<td>1010</td>
<td>1010</td>
<td></td>
</tr>
<tr>
<td>perforation</td>
<td>0820</td>
<td></td>
<td>0815</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0825</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intermediate vertical</td>
<td>1020</td>
<td>0815</td>
<td></td>
<td></td>
</tr>
<tr>
<td>perforation</td>
<td>1030</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1040</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Tabelle 3 Perforations

When intermediate perforations are to be made by page, the perforation length must be set to the page length in 0.5 inch steps.

- The meaning of values of the tie/cut-ratio is as follows:
  - e.g. 0815: Length of cut = 1.5 mm
  - Length of tie = 0.8 mm

- Even for the same values, folding characteristics may differ with the brand of each forms. Conduct pretest before use.

- For the intermediate perforations, select a tie/cut ratio to make the folding characteristic weaker than that at folding perforations (smaller cut length).
Specified Data

- Forms with the intermediate perforations see section 3.2.3, page 33
- The folding perforations and intermediate horizontal perforations should be arranged in such a way that at least 2 to 5 mm of tie is left at both outer edges. The intersections of perforations also should be tie part.

OCR paper is stiffer than general high-quality paper, so the tie-to-cut ratio should be lower than this standard.
2.5 Notes on document design

2.5.1 Print area

The following areas of a physical page are not guaranteed for good print quality. Overlays must not be printed within these areas:

- 0.5" (12.7 mm) before and after a horizontal perforation (in the figure: y)
- 0.5" (12.7 mm) from the forms edges (in the figure: x)

If the form has perforations or a cutting section within the print area, 2 mm preceding or following the perforation or cutting line is print-inhibited.

Considering by control of the printing system and forms size variations, the inner area excluding 0.5 inch from the top and 0.5 inch from the bottom of specified forms is assumed to be the printing range. There must be no perforations within the printing range.
Specified Data

Character and halftone pattern

Set for bold characters and dense halftone patterns a dark contrast.

2.5.2 Miscellaneous

Pattern Print Forms

If data is printed on the pattern printed paper, fusing may be degraded a little by the effect of pattern print ink. Therefore, check fusing in advance.

Back Side Printing

If data is printed on the both sides of the form, the form transfer route may be stained. Thus, printing on the back side is not recommended.

Notes on document design

- Standard printing width:
  - 136-column pitch: 342.9 ±0.3 mm (at 23.5 °C and 55% rel. humidity)
- Forms expansion and shrinkage by surrounding environmental change
  - Change/temperature: 0.040 mm/°C
  - Change/humidity: 0.054 mm/% rel. humidity
    (Base weight 64 g/m²; high-grade paper)

Remember the changes above when designing documents.

Forms surface specific resistance

If the forms surface resistance is out of specification, it causes the following faults to occur.

- If the resistance is low (< $1 \times 10^9 \Omega$):
  - uneven printing contrast by poor toner transfer
- If the resistance is high (> $1 \times 10^{12} \Omega$):
  - the upper parts of characters become splashed with toner
  - particle filter becomes clogged
  - fusing station glass becomes stained
  - forms are torn by electrostatic attraction
The following figure shows the relationship among general surface resistances, storage conditions (rel. humidity), and printing quality.

<table>
<thead>
<tr>
<th>rel. humidity</th>
<th>Surface specific resistance</th>
<th>Printing quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>ca. 80%</td>
<td>$1 \times 10^9 \Omega$</td>
<td>Fault occurrence zone (poor toner transfer)</td>
</tr>
<tr>
<td></td>
<td>$1 \times 10^{12} \Omega$</td>
<td>Printing quality stable zone</td>
</tr>
<tr>
<td>ca. 20%</td>
<td></td>
<td>Fault occurrence zone</td>
</tr>
</tbody>
</table>
3 Design and Handling of Forms

3.1 Fundamentals

3.1.1 Types of Forms

The printing system can be used with paper produced for electrophotographic printing or forms made from such paper. The forms must be produced according to the conditions described below.

Using forms that are not designed for electrophotographic printing may cause damage to the printing system due to additives in the forms or cause deterioration in print quality. Be sure to use forms produced for electrophotographic printing.

The forms suitable for electrophotographic printing are the ones whose properties were adjusted considering the electrophotographic characteristics. The remarkable points comparing with the ordinary forms are as follows:

- The curl of forms after printing
- The stiffness of forms
- The print permanency of toner (fusibility of toner on forms)
- The reliability for forms feeding
- The electronic resistance
- The properties difference between front and back side of forms
- Humidity
- The ash content
- The packing and storage of forms

At any type of forms, do not attempt the duplex printing (printing on both sides of forms). The duplex printing causes the deterioration of print quality such as insufficient toner image transfer.
Design and Handling of Forms

Section 2 describes the following important details about paper and forms:

- Basic requirements of paper (section 2.1, page 7)
- Forms properties (section 2.2, page 8-13)
- Forms forming (feedholes) (section 2.3, page 14)
- Perforations (section 2.4, page 15-16)

3.1.2 Base Weight and Additives

The weight per unit area is used as a basic value when forms are defined. These values can roughly determine the thickness of forms. The base weight which indicates the weight (gram) per 1 m² (one square-meter), is used as the standard value. The ream weight indicates the weight (kilogram) per 1000 duodecimo (31" x 43") forms, can also be used.

The weight of forms usable for the printing systems have to be within the defined range (see section 2.1 on page 7). Other light forms may cause wrinkling, misfolding and so on. Other heavy forms may cause misfeeding because the forms are too stiff and strong. Be sure to use one of the defined base weight values.

Papers contain many kinds of additives and fillers besides pulp to control the electric resistance or to improve the surface smoothness. Even if the base weight meets the defined value, the stiffness of forms with many fillers and little pulp becomes weaker, causing jam, misfolding, wrinkling and so on. These forms are usually thin even with their base weight values.

The normal thickness of forms at 64 g/m² is 95 μm. The stiffness of forms have to be within the defined range (see section 2.2 on page 9).

The form which contains a large amount of talc (magnesium oxide) may also cause print quality deteriorations or damage of printing system. It is recommended that the filler (like talc) content (ash content) is 5% or less.

Paper containing the AKD sizing agent, always conduct a pretest and select a brand that offers reliability quality control.

3.1.3 Faults of Forms

Faults of the forms are major factors which deteriorate print quality and forms feed reliability. Therefore the forms to be used with the printing systems must be confirmed that the forms do not have the following faults:

- Forms are folded or have folds.
- Forms are torn or have irregular holes.
• The edges or corners of the forms are damaged.
• The forms have pieces of forms, punched paper from feeding holes, other odds and ends, or any foreign particles.
• The glue or adhesive tape sticks to the forms.
• Obliquely stacked forms
• Forms with high flourescence

3.1.4 Cutting Face of Forms

The shape of the cutting face of forms is very important for obtaining good print quality and feeding. Therefore, when manufacturing printing system forms, abrasions of the cutter blade must be controlled sufficiently, and no burrs must be made. For that purpose, rotary cutters are usually used. If a burr is made on the cutting face, it may cause multiple forms to stick together, causing multiple feeding. Be sure to use forms with no burrs.

A large number of paper particles and dusts are created from the cutting faces and may cause jam or deterioration in print quality. Use a sharp cutter to prevent the occurrence of paper particles as much as possible.

3.1.5 Curling, Wrinkling, Waves, and Slant

Curling, wrinkling, or waves cause jam or deterioration in print quality because the forms stick to the photoconductor drum weakly. Do not use forms which show curling, wrinkling, or waves.

There are forms which do not have curls, wrinkles or waves before printing, but they may become curling or waving during the fusing process. Such forms cause paper jam or stacking error (misfolding). Do not use such forms.

Forms which have slant in fan-folded format also cause improper feeding or misfolding. Do not use forms showing slant.
3.1.6 Form Moisture and Print Quality

Electrostatic force is used for transferring process (toner image on the photoconductor drum transferred to paper) during electrophotographic printing. If moisture is little and electric resistance is too high, electrostatic charge tends to remain on the forms. This may cause the misfolding, jam and so on.

If moisture is high and electric resistance is too low, the appropriate electrostatic charge cannot maintain during transferring process, causing deterioration in print quality.

Therefore, the moisture of forms for electrophotographic printing must be controlled properly. The reference value for moisture content is 5 ±1% (abs.), but this value depends on the filler or rheostatic control agent in the forms.

Moreover, moisture content of forms affects the electric resistance. Then, the electric resistance of forms affects to print quality largely. The electric resistance value of forms suitable for electrophotography with standard moisture content is from 1x10^9 to 1x10^12 Ω as reference, but this value also depends on the filler or rheostatic control agent in the forms.

3.1.7 Form Moisture and Curling

Intense heat is added to the forms during fusing process (fusing and fixing toner to forms) in electrophotographic printing. In this case, curling and waves readily appear in forms because the moisture in the forms evaporates quickly. Forms with too much moisture often suffer from jam or misfolding due to the presence of curling or waves. The moisture in forms must be controlled properly in electrophotographic printing.

If moisture distribution is uneven in a form (such as when the forms have been preprinted), the forms may partially shrink, causing uneven surfaces. This deteriorates print quality, causing defects such as blurring of print.

3.1.8 Foreign Particles Sticking on Forms

The foreign particles sticking on forms make the printing system inside dirty because they separate from the forms and fall or stay inside the printing system. Then, the performance of printing system degrades, and in the worst case, it reaches to damage. For example, when there are paper pieces on feeding path, forms are caught by them and paper jam occurs. And much of paper dust on feeding path makes forms slip and paper feeding trouble occurs.

When rigid particles stick on papers, they give unrecoverable damages to photoconductor drum severely and deteriorate the print quality. Especially, because electrophotography utilizes electronic force to change electric signal to visible image, electric conductive particles sticking on forms make the force weaker and deteriorate print quality, or bring serious da-
mage to the printing system. E.g. the chips of a wire brush, used to remove static electricity may cause such a damage to the printer. Therefore, do not use the forms on which foreign particles are sticking.

3.1.9 Storage of Forms

The properties of forms can change rapidly because forms easily absorb moisture. Therefore, if the storage conditions are bad, the properties of forms (even those were manufactured under well-controlled conditions) change, causing jam or deterioration in print quality. Be careful to store forms correctly.

3.1.9.1 Notes on packaging during storage

To prevent the forms from curling, wrinkling, drying or moistening too much, the forms must be wrapped in moisture-proof film and be put in strong cartons that are flat inside. Purchase such forms only. For detailed information for materials of cartons and wrapping films, contact and discuss to paper manufacturer.

The carton of forms should be constructed so that forms are fed smoothly from the carton to the printing system. For this, the following items are supposed to be taken into consideration.

• Because of mechanical structure of the printing system, there is a limit for the height of the carton of forms. Be sure to use one of the carton within the defined height (see section 2.2 on page 12).
• Because of the same reason above, the carton with a separate cover is recommended.

— The carton to be used should allow inner margins for the vertical and horizontal dimensions of forms (see section 2.2 on page 12).
— The bottom side of the carton should be flat to prevent paper distortion.

• The carton of forms should be constructed strongly enough for stack.
• The manufacturer name and lot number are supposed to be noted on the carton.
3.1.9.2 Notes on storing forms

- Do not store the forms directly on the floor. The forms placed directly on the floor are easy to absorb moisture. Store the forms horizontally on flat and even shelves or pallets.
- Do not stack the forms high to prevent forms distortion. Even if the forms are stored in cartons, do not stack these cartons too high. For reference, avoid stacking the cartons 1 m high or more.
- To prevent drying or moisture absorption by the forms, basically store the forms at 10 to 30 °C and 30 to 70% rel. humidity (maximum wet-bulb temperature of 29 °C) even when the forms are sealed in cartons.
- If dryness is a problem or moisture-proofing is inadequate when cartons are opened, store them in a better environment. In this case, basically store them at 15 to 25 °C and 40 to 50% rel. humidity. Even if the dryness, moisture-proofing and the storage environment are appropriate, avoid the storage for 6 months or more.
- To prevent drying or moisture absorption by the forms, unsealed forms must be packaged in moisture-proof film or moisture-proof packaging.
- Do not subject the forms to sudden temperature changes to prevent drying and moisture absorption by the forms. Carry the cartons to the place of use. Allow the forms time to adjust to the temperature of the new location, then unseal them. The table below lists the times needed for the forms to adjust to changes in environment for reference.

<table>
<thead>
<tr>
<th>Temperature Difference</th>
<th>Necessary Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 °C</td>
<td>6 h</td>
</tr>
<tr>
<td>10 °C</td>
<td>12 h</td>
</tr>
<tr>
<td>20 °C</td>
<td>24 h</td>
</tr>
</tbody>
</table>

When forms are carried from normal temperature and humidity ambient to high temperature and humidity, waving may occur after moisture absorption.

When forms are carried from normal temperature and humidity ambient to low temperature and humidity, upward curling may occur after forms are dried.
3.1.10 Recycled Forms

As shown below, there are some different properties between new and recycled forms. When recycled forms are used, note the following points. Prechecking is important. Pre-checking is also recommended whenever a lot is changed.

Differences in properties:
- Low density. Forms are comparatively thick for the same basis weight.
- Low paper whiteness.
- Low stiffness.
- Weak tensile strength and folding endurance.
- Easy to curl.
- Varying quality depending on the type of old forms used.

Notes on handling:
- More paper dusts are made during printing than from new forms. These dusts stick to the roller, sensor, feeding path, fusing station, or drum and may cause various problems. Remove these paper dust frequently.
- Jam may occur frequently. Recycled forms easily absorb moisture and easily curl.
- Large curls after printing may cause problems such as misfolding.
- Forms with too low stiffness may cause misfolding and frequent jam.
- Print quality may be lower on rough surfaces.
- Variations in properties of forms for each lot may cause differences in feeding or print quality.

Precheck:
- Before actual printing, make forms on an experimental basis and use them for trial printing.
- After accepting the trial printing, keep contact and discuss to the paper manufacturer to confirm the maintained and well-controlled quality of forms.
3.2 Special Forms

3.2.1 Preprinted Forms

Notes on Design

- Use the forms which meet the basic requirements (see section 2.1 on page 7) and forms properties (section 2.2 on page 8-13).

- As little ink as possible should be used. To increase print density, do not increase the ink but use a darker ink. Keep the amount of ink small.

- Use heat-resistant UV ink for flash fusing.

- Use heat-resistant oxidized polymerization ink if no UV ink facilities are available. When oxidation polymerization ink is used, make sure it is dried completely. Do not use dry powder because it may cause problems with the printing system. After printing, dry the forms appropriately to dry the ink and to control the moisture content in the forms. The time required for drying the oxidized polymerization ink is usually 5 to 7 days as reference.

- If ink with low heat resistance is used, the quality of the ink changes due to the heat applied during fusing or the ink sticks to the fusing station, causing deterioration in print quality or jam. Use ink which can stand temperature up to 200 °C.

- Never use ink with metals, conductive ink, cold-set ink, or rubber-based ink.

- Preprinting ink may cause deterioration in print quality. Design the form so that the area for important data is not preprinted.

- Solid preprinting greatly affects print quality, because ink covers the entire surface of forms. Avoid solid printing for background colors or for background pattern printing. Use screen (dot) printing for larger area.

- Preprinted frames make printing misalignment obviously. Avoid frame printing as much as possible. Use background pattern printing or print frames on pattern-printed forms using overlays. If a preprinted frame is necessary, make the frame 1 mm large enough as reference to allow limited printing accuracy.

- The moisture of forms may increase after preprinting because water is used in offset printing. The moisture content must be 5 ±1% (abs.) even after preprinting.

- The repeated printing of vertical, solid lines may transfer ink to unexpected areas. This may adversely affect print quality and cause smearing.
Notes on Handling

- If the preprint ink does not dry, it may stick to the fusing station, photoconductor drum, and rollers, causing deterioration in print quality, jam, or damage to the printing system. Therefore, use preprint forms on which the ink has completely dried.

- Make sure that there are no mixing or sticking of foreign particles on forms. Foreign particle might stick to form surface during preprint process. Pretest is necessary for choice of the manufacturer.

- Some of preprint forms are coated after preprinting. Coating material may cause deterioration in print quality, therefore please contact and discuss to paper manufacturer for the coating and check whether the coating is suitable for electrophotography or not.

Precheck

- Before actual printing, make forms on an experimental basis and use them for trial printing.

- After accepting the trial printing, keep contact and discuss to the paper manufacturer to confirm the maintained and well-controlled quality of forms.
3.2.2 Label Forms

Notes on Design

- Use the forms which meet the basic requirements (see section 2.1 on page 7) and forms properties (section 2.2 on page 8-13).
- The print quality of label sheets may be deteriorated by cutting. Do not print near the cut edges. The margin is about 2 mm as reference in consideration of the accuracy of the printing position.
- Base weights:
  - labels: from 52 to 64 g/m² (recommended)
  - carrier sheets: from 81 to 93 g/m² (recommended)
- Because forms are not stiff at the cut edge, forms with many cut edges may cause trouble during form feeding. Therefore, enlarge the size of labels as much as possible. The minimum size for reference is 30 mm for horizontal and vertical direction.
- To maintain the stiffness of the form and to prevent labels self-peel, do not remove face sheets between labels.
- Folding perforation is supposed to be 1030.
- No intermediate perforations are allowed on the carrier sheet.
- The leakage of adhesive from label edge causes damage to print quality and the printing system. Adhesive must not leak and labels must not lose adhesion after forms pass through the fusing station. Use acrylic adhesive which are not easily affected by heat. The strength of the adhesives must be 30 g/inch or more with the 180-degree peeling method.
- If there are differences in the quality or thickness of labels and carrier sheets, heat will cause curling during fusing process. Therefore, labels and carrier sheets must be designed for electrophotographic printing. The moisture content also must be 5 ±1% (abs.).

The air permeability of label forms may be very poor generally because their carrier sheets have release agent layers, then sticking between the forms becomes very strong, causing multi-feeding from the carton of forms. High smoothness of label itself also causes strong sticking, so avoid using label forms with high smoothness.

- See table 4: Recommended label forms specifications on page 32.
Special Forms

Notes on Handling

- Use forms with no adhesive leakage or no peeled labels. They may cause multi-feeding, jam, or damage of the printing system.

- Too many cartons of label forms are stacked, leakage of adhesive may appear on the forms near the bottom of the stack. Please confirm to the paper manufacturer about the limit of amount or height with which the carton can be stacked.

- Some of label forms cannot be stored for a long time other than the normal forms. Please confirm to the paper manufacturer about the terms and conditions for storage of label forms.

Precheck

- Before actual printing, make forms on an experimental basis and use them for trial printing.

- After accepting the trial printing, keep contact and discuss to the paper manufacturer to confirm the maintained and well-controlled quality of forms.
### Tabelle 4  Recommended label forms specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Forms</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Label Quality</td>
<td>High-grade paper</td>
<td></td>
</tr>
<tr>
<td>Base weight</td>
<td>52 g/m² to 64 g/m²</td>
<td></td>
</tr>
<tr>
<td>Base paper Quality</td>
<td>Glassine paper</td>
<td></td>
</tr>
<tr>
<td>Base weight</td>
<td>81 g/m² to 93 g/m²</td>
<td></td>
</tr>
<tr>
<td>Glue</td>
<td>Acrylic solvent</td>
<td></td>
</tr>
<tr>
<td><strong>Forms size</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Width</td>
<td>6.5 to 18 inches</td>
<td></td>
</tr>
<tr>
<td>Folded length</td>
<td>7 to 14 inches</td>
<td></td>
</tr>
<tr>
<td><strong>Label size</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feed direction dimension</td>
<td>≥ 30 mm</td>
<td></td>
</tr>
<tr>
<td>Lateral dimension</td>
<td>≥ 30 mm</td>
<td></td>
</tr>
<tr>
<td><strong>Glue</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glue refuse must not be removed</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Adhesive strength of glue</strong></td>
<td>Peeling resistance (P)</td>
<td>0.3 N or more/inch, measured in 180° peeling test</td>
</tr>
<tr>
<td>Tie-to-cut ratio of folding perforation</td>
<td>1030 (1:3)</td>
<td></td>
</tr>
<tr>
<td>Base paper intermediate perforation</td>
<td>Not allowed</td>
<td></td>
</tr>
</tbody>
</table>

Label forms shall be stored at a temperature of 15 to 32 °C and a relative humidity of 40 to 70%. The standard service life shall be one year after production. Label forms shall be packed in vinyl sheet completely as soon as possible after production to prevent moisture problems.
3.2.3 Forms with Intermediate Perforations

Notes for intermediate horizontal and vertical perforations are described below. For the folding perforations, please refer to section 2.4 on page 15.

Notes on Design

- Use the forms which meet the basic requirements (see section 2.1 on page 7) and forms properties (section 2.2 on page 8-13).
- Unevenness or burrs caused by perforations may cause deterioration in print quality. Use smooth forms or forms with no burrs. Avoid printing near the perforations. The margin is about 2 mm as reference in consideration of the accuracy of printing positions.
- Do not print important data near the perforations so that the data is not removed when cutting the forms from the perforations. The margin is 2 mm as reference in consideration of the accuracy of printing positions.
- There is a vertical-perforation-inhibited area for reasons of feeding control.
- To use roll paper or long fold-spacing forms contact to forms manufacturer or pre-processing manufacturer.
- The "minipitch" perforation or the "micro" perforation is recommended for intermediate perforations because it has few burrs and good feeding characteristics. The micro perforation can maintain forms strength, however, if they are used for thick forms, the forms are easily torn.
- The stiffness of the perforated area should be as close to that of the original forms as possible. The cuts should be as short as possible compared to the ties to make the forms stronger.

Normal perforation standard (for reference):
- Thick forms (81 g/m² or more) Ties = 0.8 mm, Tie/Cut ratio = 1:2 to 1:3
- Thin forms (less than 81 g/m²) Ties = 1.0 mm, Tie/Cut ratio = 1:2 to 1:3

Micro perforation standard (for reference):
- Ties = 0.23 mm, Cuts = 0.28 mm
Special Forms

- The ties must come at the ends of the forms and the intersections of the vertical and the horizontal perforations. If the cuts come at the ends of the forms or the intersections, the forms will more readily peel off. This cause jam or deterioration in print quality.

![Diagram showing correct and incorrect tie parts](image)

- Inappropriate perforation methods may cause a large number of paper pieces and dusts may cause jam or deterioration in print quality. Use a sharp cutter to perforate the forms, and remove paper pieces and dusts as needed.

Notes on handling

- When stacked, forms which do not lie flat because of swelling due to perforations may cause jam or deterioration in print quality. Do not use forms with swollen perforations.
- Unevenness, burrs, or residue in the feeding holes causes jam or deterioration in print quality. Do not use forms with such defect.

Precheck

- Before actual printing, make forms on an experimental basis and use them for trial printing.
- After accepting the trial printing, keep contact and discuss to the paper manufacturer to confirm the maintained and well-controlled quality of forms.

3.2.4 Holed Forms

Notes for holed forms (for binding and so on) are described below. For the feed holes, please refer to section 2.3 on page 14.
Special Forms

Notes on Design

- Use the forms which meet the basic requirements (see section 2.1 on page 7) and forms properties (section 2.2 on page 8-13).
- Distortions, burrs, or residue in the holes causes multi-feeding from the carton of form or deterioration in print quality. Use smooth forms or forms without burrs.
- Avoid printing near the holes. The margin is 3.5 mm in consideration of the accuracy of printing positions.
- When making forms with holes, punch each sheet and check the sharpness of the cutter regularly. Do not punch the forms together with a drill because the punched parts will be distorted.
- The optical sensors to control the forms feeding are installed inside of the printing systems. When the holes are caught by the sensor, form-feeding errors or paper jam might occur. Therefore, there are hole-inhibited area (see section 2.2).

Precheck

- Before actual printing, make forms on an experimental basis and use them for trial printing.
- After accepting the trial printing, keep contact and discuss to the paper manufacturer to confirm the maintained and well-controlled quality of forms.

3.2.5 Sealing Mail Forms

The sealing mail ones are forms that can be folded and sealed by pressure, not by heat to envelope like format after printing.

Notes on Design

- Use the forms which meet the basic requirements (see section 2.1 on page 7) and forms properties (section 2.2 on page 8-13).
- The swollen adhesive causes jam or deterioration in print quality. Use forms with no swollen adhesive. Do not print important data near the adhesive. The margin is 3.5 mm as reference in consideration of the accuracy of printing positions. This applies also for forms where adhesive is applied to the back.
- Sticking of adhesive to the photoconductor drum or fusing station or feeding path causes jam, deterioration in print quality or damage to the printing system. Use adhesive developed for flash fusing and for electrophotographic printing. And check no adhesive sticking to photoconductor drum or fusing station or feeding path before using.
**Notes on handling**

- Too many cartons of sealing mail forms are stacked, adhesives may stick each other at the bottom of stack. Please confirm to the paper manufacturer about the limit of amount or height with which the carton can be stacked.
- Some of sealing mail forms cannot be stored for a long time other than the normal forms. Please confirm to the paper manufacturer about the terms and conditions for storage of sealing mail forms.

**Precheck**

- Before actual printing, make forms on an experimental basis and use them for trial printing.
- After accepting the trial printing, keep contact and discuss to the paper manufacturer to confirm the maintained and well-controlled quality of forms.

### 3.2.6 Sealing Postcard Forms

The sealing postcard forms are forms that can be folded and sealed by pressure, not by heat to postcard format after printing.

**Notes on design**

- Use the forms which meet the basic requirements (see section 2.1 on page 7) and forms properties (section 2.2 on page 8-13).
- Do not design preprint and printing symmetrically for each surface faced each other at folding. A symmetrical preprint and printing may cause insufficient adhesion.
- Avoid the solid printing and screen printing more than 10%. They also may cause insufficient adhesion.
- The adhesion is varied by pattern of preprinting and amount of characters printed by the printing system. Too much adhesion causes tearing or curling when postcards are opened. Too weak adhesion causes incidental peeling. Please confirm to the paper manufacturer about the appropriate pressure for sealing.

**Notes on handling**

- Refer to section 3.2.5 on page 35.
- Humidity may cause sealing postcard forms sticked each other. Store within moisture proof package (ex. vinyl bag).
• Too many cartons of sealing postcard forms are stacked, adhesive may stick each other the bottom of stack. Please confirm to the paper manufacturer about the limit of amount or height with which the carton can be stacked.

• Some of sealing postcard forms cannot be stored for a long time other than the normal forms. Please confirm to the paper manufacturer about the terms and conditions for storage of sealing postcard forms. Note that adhesion is often lost by oxidation with heat or air exposure.

Precheck

• Before actual printing, make forms on an experimental basis and use them for trial printing.

• After accepting the trial printing, keep contact and discuss to the paper manufacturer to confirm the maintained and well-controlled quality of forms.

3.2.7 Postcard Printing

The size and weight values for postcard are defined in each country. Ordinary postcards cannot be used.

However forms cut into postcard format in post-processing can be used. Use forms whose base weight is 128.3 g/m² or more, and cut them using any commercially available cutter to postcard format after printing.

A few postcards can be printed using perforated forms and cutting them by hand. However, not-perforated forms are recommended to avoid problem caused by perforations.

3.2.8 Embossed Forms

Forms embossed with company logos and so on are called embossed forms. Differences in thickness or unevenness in parts of forms may cause jam or deterioration in print quality. Embossed forms or similar forms (ex. forms that vary in thickness) cannot be used.

3.2.9 Confidential Forms

To make postcards confidential, "confidential labels" are attached to parts of postcards. The cover labels can be peeled off and cannot be reattached. Forms for these confidential postcards are called confidential forms.

Forms with "confidential labels" attached beforehand cannot be used in the printing system. Attach "confidential labels" as post-processing after printed in the printing system.
Special Forms

Two types of equipment are commercially available:

• one is used to attach labels after cutting the forms into postcard format
• the other is used to attach labels before cutting the forms. Choose the equipment suitable for your needs.

3.2.10 Watermarked Forms

Generally, watermarked forms are produced in two-stage process. Therefore, there are differences between the front and back of forms, causing curling or deterioration in print quality. The print quality in the watermarked parts cannot be guaranteed. In most cases, watermarked forms cannot be used.

If watermarked forms must be used as documents for public agencies, recheck all settings carefully.

3.2.11 Transparencies

Transparencies cannot be used.

3.2.12 Coated Forms

Some of the forms coated with resins and others have bad print permanency of toner generally, then the print quality is deteriorated. Especially silicone-coated forms have poor conditions for electrophotographic printing and cannot be used. Please contact and discuss to the paper manufacturer about availability for electrophotography.

3.2.13 Color Paper

Color paper could have a smoother surface than general paper because colorant and fixing agent (resin) penetrate the fibers of the paper. Therefore, toner fixing strength may be lower, especially when the affinity between fixing agent and toner is low. Since normal print quality cannot be assured when using color paper, check carefully the print conditions beforehand to determine the degree of reduced fixing strength.
### 3.2.14 Tip-on Paper

Table 5 contains the Recommendations for Tip-on Paper.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Possible problems by using forms except from specified forms</th>
</tr>
</thead>
</table>
| Card part Material    | Ethylene-vinyl acetate, PET (Poly Ethylene Terephthalate) have been tested with positive result, others might be possible | • Print defect  
• Fusing defect                                                  |
| Thickness             | Up to 0.3 mm                                                                | • Print defect (Print density)  
• Form transportation defect                                        |
| Fixing                | The cards must be fixed on complete area (punctate fixing causes air inclusions between card and carrier paper) | • Printout error (unequal coloration)                                |
| Card numbers          | Under 4 cards (below 340 mm) temperature more then 15°C                      | • Transfer unit alarm  
• Form transportation defect                                         |
| Limits of card positioning | [Diagram showing card movement]  
A: more than 19.0 mm  
B: more than 38.5 mm  
C: more than 20.0 mm  
D: more than 26.5 mm | • Print defect  
• Form transportation defect                                        |
### Special Forms

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Possible problems by using forms except from specified forms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base form</td>
<td>Paper weight (just form without card)</td>
<td>Print defect, Form transportation defect</td>
</tr>
<tr>
<td>Print region</td>
<td>Intermediate region between two cards</td>
<td>Impossible to print</td>
</tr>
<tr>
<td>Around card</td>
<td>Approx. 30mm around the card print quality will be influenced; In case of very stiff papers (110 g/m² and above) the area of disturbance might be larger than 30 mm.</td>
<td></td>
</tr>
</tbody>
</table>

### Precheck

- Before starting regular printing, trial-manufacture the label forms and carefully test the printing.
- For the confirmed Tip-on Papers, consult the paper manufacturer to confirm that forms of a certain grade will be supplied.

### 3.2.15 Other Special Forms

When the special forms like glued forms (for envelopes), forms with film pocket, non-carbon forms, artificial forms are used, they might be damaged or damage the printing system and print quality during electrophotography process. Please contact and discuss to the paper manufacturer about availability for electrophotography.
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