Printing Technologies
– Flexo Printing
– Gravure Printing

Letterpress
Printing technology using the higher parts of the printing block for ink transfer.

Example:
– potato printing
– flexo printing

General Terms in the Field of Printing Technology
The process of information reproduction by printing is divided in the sections:

- plate making
- cylinder preparation
- printing
- finishing

Components of a Flexo Printing Unit
Gravure roll with doctor blade
– 100 to 600 lines/cm screen ruling
– ceramic or hard chrome coating
– printing thickness depends on cell volume

Printing cylinder
– (elastic) printing block
  – plate
  – cylinder
  – sleeve

Impression steel cylinder
– kiss printing

Curing
– thermal curing
– UV curing

Prof. Dr. Ulrich Moosheimer
Basics of flexo printing

Printing setup

- anilox roller
- doctor blade
- impression cylinder
- ink reservoir
- printing cylinder with plate

Printing block

cured printing plate mounted on cylinder by self adhesive tape

Flexo Printing Plate Production: CtP (Computer-to-Plate) – Schematic

- back side curing UVA
- digital engraving
- front side curing UVA
- development
  - solvent-based plus drying
  - thermal (Cyrel Fast)
- post curing UVA and UVC

Flexo Printing Plate Production - live

potato printing

Method Murmelgruppe

Prepare a printing plate containing the elements

- quadrates as large as possible
- 3 dots as small as possible

- discussion of the printing quality
- Proposal for improving the printing quality

Flexo Printing Plate Production: CtP (Computer-to-Plate)

Best practice results:

- minimum dot size 0.030 – 0.05 mm
- separation of printing plates according to
  - areas and
  - small dots or fonts
Laser Engraving of Flexo Cylinders
- Base Material
  - rubber on fiber-reinforced plastic sleeve
- stone polishing of the sleeves
  - true running accuracy of 0.02 mm
  - circumference tolerance of +/-0.05 mm
- CO₂ high speed laser
  - 1000 Watt
  - dot frequency of 7000 Hertz
- Direct engraving into the rubber
- Screen ruling
  - 54 lines / cm
  - 80 lines / cm

Laser Engraving of Flexo Cylinders

Printing Blocks for Flexo Printing plate

Flexo Printing Blocks
Plates (thickness 0.76 – 6.35 mm)
- mounting on printing cylinder by pressure sensitive tapes

Sleeves
- rubber coated sleeves plus direct engraving
- photopolymer-sleeve with base roll

Cylinder
- gravure into the cylinder

<table>
<thead>
<tr>
<th>Plates</th>
<th>Sleeves</th>
<th>Cylinders</th>
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<tbody>
<tr>
<td>Storage volume</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Costs</td>
<td>++</td>
<td>-</td>
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<tr>
<td>Print quality</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Mounting</td>
<td>--</td>
<td>+</td>
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<tr>
<td>Accuracy of print length</td>
<td>-</td>
<td>++</td>
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Flexo Printing
Identification
- dot fringe
- dot structure of the anilox roll
- missing dots at highlight areas

Identification
- dot fringe
- dot structure of the anilox roll
- missing dots at highlight areas
### Substrates for Flexo Printing

**Printing materials**
- absorbent (paper)
- non-absorbent (polymer films, metal plates)
- rough surface (cardboard, corrugated board)

**Printing inks**
- solvent based
- solvent free (water based)
- UV curable inks
- no thermal heat load on the materials
- improved printing quality
- reduced dot growth
- off-ordre reduced by inert gas curing (nitrogen atmosphere)
- higher costs

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### Gravure printing

Printing Technology using the lower parts of the printing block for ink transfer.

**Types of gravure printing block**
- plate
- cylinder

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### Gravure Printing

- manually, art techniques
- copperplate engraving
- copperplate etching
- industrial technology
- gravure printing
- pad printing

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### Gravure printing: Componentes

**Printing block with engraved printing**
- screen ruling 40 to 200 lines/cm
- cell wall between the cells 0.003 – 0.005 mm
- cell depth 0.01 – max. 0.05 mm
- cell width 0.03 – 0.230 mm
- cell volume and density determine the final ink thickness

**doctor blade**
- removes ink from non-printing parts

**Soft impression cylinder**
- ink transferred from printing block to substrate material
- electrostatical support
- pressure 1.5 – 5 Mpa
- small diameter for small contact zone
Gravure Printings - Schematic

- filling of the cells
- doctor blading
- transfer to the substrate

Typs of Cells

differences
- depth variable cells
  - constant cell area
  - variable cell depth
- area variable cells
  (autotypicall)
  - variable cell area
  - constant cell depth
- depth and area variable cells
  (semi-autotypic)
  - variable cell area
  - variable cell depth

Engraving Technology

Direct engraving

Types of Gravure Printings Blocks

Plates
- copper plates
- steel plates

Gravure printing cylinder
- steel base cylinder
- copper base layer
- polishing for high true running accuracy
- copper engraving layer
- chrom layer for high abrasion resistance
Printing Block Production: Gravure Printing

- electro-mechanical gravure
  semi-autotypic

Mechanical Engraving of the Gravure Cylinder

Engraving Technology
Direct laser engraving
Copper or zinc cylinder
Direct engraving
Screen ruled cells
half cells
smooth lines
variable cell depth

Screen lines:
1,000 l/cm / 2,540 dpi

Comparison: Direct Laser to Electromechanical Engraving

Direct Laser Engraving

Electromechanical Laser Engraving

Comparison: Direct Laser to Electromechanical Engraving

Elektromechanichal Gravure

<table>
<thead>
<tr>
<th>Screening lines</th>
<th>70 L/cm</th>
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<tr>
<td>Gravure speed</td>
<td>11,000 dots/s</td>
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<tr>
<td>Abrasion</td>
<td>gravure head</td>
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<td>Dot form</td>
<td>given by gravure head and variable in size</td>
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<table>
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<tbody>
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<tr>
<td>70,000 dot/s</td>
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<tr>
<td>None</td>
</tr>
<tr>
<td>variable in form and size</td>
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</tbody>
</table>
Markets: Direct Laser to Electromechanical Engraving

Direct engraving
- packaging
- decor
- illustration

Direct laser engraving
- packaging
- decor
- illustration
- security elements

Comparison: Gravure to Flexo Printing

Gravure printing
- fine dots
- saw-tooth effect

Flexo printing
- dot fringes

Comparison: Gravure to Flexo Printing

Gravure printing
- fine dots
- saw-tooth effect

Flexo printing
- dot fringes
Gravure Printing Machine for Packaging

Flexo Printing Machine for Packaging

Flexo Printing Machines
- central cylinder a)
- unit construction b)
- compact construction c)

Summery
Printing process:
plate making and cylinder preparation
printing
finishing

Gravure printing:
high printing quality

Flexo printing:
cost advantage