GRAVURE PRINTING TECHNOLOGY A TO Z
and Quality Trouble Shooting Tips

at Hotel Mulia Senayan - Jakarta

Nov 19, 2013

ORIENT SOGYO CO., LTD.
Hidenori Harada
What is happening in Japan Gravure printing industry?

What do we foresee in Indonesian Gravure printing industry?

ORIENT new direction & proposals

Gravure Printing : A to Z
  - Principal of Web handling and Gravure Printing
  - Quality trouble shooting Tips
INTRODUCTION – BUSINESS ENVIRONMENT

USDJPY
= 100.1 as of Nov 18, 2013
= 77.5 as of Nov 30, 2011
JAPAN Gravure - Business Environment

Japan Gravure Printing Association [JGPA] (Federal)

➤ KANTO (Tokyo area) district
➤ TOKAI (Nagoya area) district
➤ KANSAI (Osaka area) district
➤ and so on...

== Over 350 mid - small size companies joined!!
(including Suppliers)
**JAPAN GRAVURE – BUSINESS ENVIRONMENT**

*Establish – Activities and Benefit of JGPA*

- Against Two Mega-size companies (D & T)
- Negotiate (Lobbying) with Government
- Benefit – bank loans
- Claim & Suggestions to Packaging customers/users
JAPAN GRAVURE – BUSINESS ENVIRONMENT

Achievements

- VOC emit regulation
  - More than 30% reduction from year 2000!

- “Green Printing Certificated Factory”
  - Green Printing Criteria
  - 43 factories are Certified (as of Oct 2013)

- Regular seminars and Leadership development
INTRODUCTION – GP ASSOCIATION

Common topics at JGPA

- Energy Saving (esp. Electricity saving)
- Labor health
- Carbon-foot print (Life Cycle Assessment)
- Countermeasure to Short-run jobs and Private Brand items
What is *Short – run job*?
What is *Short-run job*?

Only 2kg rice consumption!

Job become Shorter than shorter ➔ 2000m/job ??
What is **Private brand items**?

Private brand items are sold cheaper than National brand!!
JAPAN GRAVURE – BUSINESS ENVIRONMENT

<Summary>

- Environmental regulation
- Cost-wise competition
- Super Short-run
- Private brand

➤ Business Weather Forecast

Highest: 20°C
Lowest: 10°C
Chance of rain: 30%
INDONESIA — BUSINESS ENVIRONMENT

- INDONESIA’s GDP per Person

- Expected constant growth and Very rapid Inflation
INDONESIA – BUSINESS ENVIRONMENT

- INDONESIA’s GDP growth per Person

→ Rich natural resources, 200 million population!

~ 21th century Most attractive investing Target!

Raise values of Country, Companies and People … NOW
PRODUCTS DESIGN BACKGROUND

Gravure Printing

Laminating

Slitting

Bag-Making
PRODUCTS DESIGN BACKGROUND

Japanese unique mentality, culture ➔ Man & Method

⇒ You can BUY machine & material but …
# Products Design Background

<table>
<thead>
<tr>
<th>European</th>
<th>Japanese ~ Asian</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top-down decision making</td>
<td>Bottom-up activity</td>
</tr>
<tr>
<td>Conquering (Hunting culture)</td>
<td>Co-exist (Farming culture)</td>
</tr>
<tr>
<td>Bigger size Factory</td>
<td>Compact size Factory</td>
</tr>
<tr>
<td>Safety &amp; speed oriented</td>
<td>Operation oriented</td>
</tr>
<tr>
<td>Industrial standard – Contract absolute</td>
<td>Human (customer) relationship</td>
</tr>
<tr>
<td>Outlook &amp; theory oriented Design</td>
<td>Practical &amp; experience oriented design</td>
</tr>
<tr>
<td>Drastic change (break-through)</td>
<td>KAIZEN change</td>
</tr>
<tr>
<td>Automation is cool!</td>
<td>Automation + Manual</td>
</tr>
</tbody>
</table>

Output (machine) is *reflection* of Cultural background
Trolley system has been very common

Gravure cylinder is Shafted type

Register-control within the same group (BOBST)
Max Speed: 450m/min
Wed width: 800 - 1300mm

Concentrated Operation desk

Air (Mecha) shaft is common
For web roll loading

Wide web Flexo: CI drum is common

~ W&H: HELIOSTAR (quote from Web site) ~

~ CI Drum Flexo (F&K) ~
ABOUT EUROPEAN DESIGN

- **HP**: Indigo 20000

  - **Web width**: 720mm
  - **Speed**: 26.2m/min (5color)

**Middle web for Flexible Packaging**

**Click Charge**: different print design but same expense

**Customer**: “Brand-owner” can be a printing house!
RE: ORIENT SOGYO CO., LTD.

【Innovative – Research and Development】

a) Twin-Impression Dry laminator
b) Triple-Cylinder built-in Gravure printing press
c) Computer-Color Matching (CCM) system
d) Compensator-free Sectional Drive Type VLS

Not always success, but never stop CHALLENGING!
ADVANTAGES OF TYPE VLS!

Advantage (1) Very precise “Start up (initial) register”
Advantage (2) Quick response register at speed increasing
Advantage (3) Stable web running even at Web splicing
Advantage (4) Accurate and reliable performance at Constant speed operation

Sectional Drive System bring Quality and Waste-minimizing
RE : ORIENT SOGYO CO., LTD.

【Innovative – Research and Development】
e) Water-base Gravure Printing press **OSG-SDX VLS**

**FUJITOKU (Nagoya)** *highly reputed in Water-base Gravure*
Drying Energy consumption: about 40% down!
## K2 Dryer ~ Energy Saving Dryer ~ (PR)

### K2 Dryer 【Conditions of Running Cost Simulation】@ Max 250m/min

<table>
<thead>
<tr>
<th></th>
<th>Conventional</th>
<th>K2 dryer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat source</td>
<td>No of colors</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Max temp.</td>
<td>60 (℃)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>63 (℃)</td>
</tr>
<tr>
<td></td>
<td>Air volume</td>
<td>72 m³/color</td>
</tr>
<tr>
<td></td>
<td></td>
<td>70 m³/color</td>
</tr>
<tr>
<td></td>
<td>(kcal/h)</td>
<td>224,787 (*Cir 15%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>131,047 (kcal/h)</td>
</tr>
<tr>
<td>Total of Heat volume</td>
<td>261 kw</td>
<td>152 kw</td>
</tr>
<tr>
<td>Total of Supply+Exhaust blower</td>
<td>66 (kw)</td>
<td>46 (kw)</td>
</tr>
<tr>
<td>Operational hours (H/day)</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Operation days (days/year)</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>Net Production rate (%)</td>
<td>60%</td>
<td></td>
</tr>
<tr>
<td>Net Operational (H/year)</td>
<td>4,320</td>
<td></td>
</tr>
<tr>
<td>Electric unit price (JPY/kwh)</td>
<td>18</td>
<td></td>
</tr>
</tbody>
</table>

| Energy cost (JPY/year) | JPY 20,324,946 | JPY 11,849,102 |
| Gap                    | JPY 8,475,844  |          |
| Electric cost (JPY/year)| JPY 5,132,160 | JPY 3,592,512 |
| Gap                    | JPY 1,539,648  |          |
| Yearly Sum of gaps     | JPY 10,015,492 /year |

- **Approx. 40% energy saving!!**
- **Approx 30% saving blower max capacity!!**

**IMPORTANT**
- Local Exhasut is separate route
- Bottom zone temperature is depending on Top zone temperature
- This simulation is reference only. ORIENT does NOT provide any Warranty for the practical results.
**Split System**

e.g. 8-color split type

- 4+4, 5+3, 6+2, 7+1 color at the same time!
- or even Starlight mode operation

~ This is the technology based on Well sophisticated Web handling and Sequential program

**New Trend in INDONESIA (South East Asia) Market**
Re: ORIENT SOGYO CO., LTD.

【KAIZEN base – improvement】
- Fire Accident measurement

- Extinguish nozzle
- Plastic tube melts be heat
- Fire extinguisher
Re: ORIENT SOGYO CO., LTD.

【KAIZEN base – improvement】
- New *Mechanical chuck* for minimize paper core damage

*New Chucking method of Paper core*
Face to Face Cylinder chucking

- For Easy tape rewinding
- For less ink invasion inside of cylinders
- For faster cleaning at cylinder flange
GRAVURE PRINTING QUALITY PROBLEMS MAP

- Structural / Inevitable / Complex
  - Fogging
  - Doctor streak
  - Unsmooth Half tone
  - Trapping
  - Wrinkle
  - Blocking
  - Mismatch register
  - Color deviation
  - Foreign matter
  - Solvent retention
  - Pitch variation

- Accidental / Unpredictable / Simple
  - Ink splash
  - Static squeeze out
  - Wrinkle
  - Blocking
  - Mismatch register
  - Color deviation
  - Foreign matter
  - Solvent retention
  - Pitch variation
**Typical Problem (1) : Mismatching Register**
**Typical Problem(1): Mismatching Register**

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Potential causes &amp; Countermeasures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Images look inferior and losing recognition of packaging</td>
<td>a) Film elongation, Unevenness (\Rightarrow) know “film”</td>
</tr>
<tr>
<td></td>
<td>b) Mechanical resistance (\Rightarrow) Buy ORIENT</td>
</tr>
<tr>
<td></td>
<td>c) Poor cylinder accuracy (circum) (\Rightarrow) Aim bounce / roundness less than 0.05mm</td>
</tr>
<tr>
<td></td>
<td>d) Improper Tension controls (\Rightarrow) ref. “Pitch” variation</td>
</tr>
<tr>
<td></td>
<td>e) Exceeding temperature setting (\Rightarrow) Solvent retention</td>
</tr>
<tr>
<td></td>
<td>f) Marks mis-sensing etc</td>
</tr>
</tbody>
</table>
IMPRESSION EXPANSION

Film width
Impression Nip

Normal

Abnormal

Impression touch at RIGHT angle to Gravure cylinder
→ Evenly pressurized
→ Stable register
**SKewing Roll (Eccentric Roll)**

Skewed

- Zero
- Center
- Narrower
- Wider
② FREE ROLL SLIPPING

When Line speed increase  Film speed  >  Roll rotation speed

⇒ B side tension get tighten

When line speed decrease  Film speed  <  Roll rotation speed

⇒ B side tension get loosen

Impression rolls, guide rolls etc
If dynamic balance is poor ...
Causing machine vibration, mechanical resistance
**WEB TENSION CHART**

e.g. when web width is 1000mm

<table>
<thead>
<tr>
<th>Kind</th>
<th>Thick</th>
<th>Unwindner</th>
<th>Infeed</th>
<th>Outfeed</th>
<th>Rewinder</th>
<th>RW Taper</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPP</td>
<td>20μ</td>
<td>80N</td>
<td>100N</td>
<td>120N</td>
<td>50N</td>
<td>20~30%</td>
</tr>
<tr>
<td></td>
<td>30μ</td>
<td>100N</td>
<td>120N</td>
<td>140N</td>
<td>60~80N</td>
<td>20~30%</td>
</tr>
<tr>
<td></td>
<td>40μ</td>
<td>120N</td>
<td>140N</td>
<td>160N</td>
<td>100~120N</td>
<td>20~30%</td>
</tr>
<tr>
<td></td>
<td>50μ</td>
<td>120~140N</td>
<td>160N</td>
<td>180N</td>
<td>120~140N</td>
<td>20~30%</td>
</tr>
<tr>
<td>PET</td>
<td>12μ</td>
<td>100~120N</td>
<td>120~160N</td>
<td>120~160N</td>
<td>70~80N</td>
<td>10~20%</td>
</tr>
<tr>
<td></td>
<td>16μ</td>
<td>100~150N</td>
<td>150~200N</td>
<td>150~200N</td>
<td>80~100N</td>
<td>10~20%</td>
</tr>
<tr>
<td>NY</td>
<td>12μ</td>
<td>80N</td>
<td>120N</td>
<td>120N</td>
<td>60~80N</td>
<td>20~30%</td>
</tr>
<tr>
<td></td>
<td>15μ</td>
<td>100~120N</td>
<td>120~140N</td>
<td>120~140N</td>
<td>70~90N</td>
<td>20~30%</td>
</tr>
</tbody>
</table>

*Only for Reference*
Coffee break

**SNAKE RUN**

~ Edge film top and bottom: different diameter, color and density

**OPP • CPP**

*Cause film run not straight*
TYPICAL PROBLEM(2) : DOCTOR STREAKING
**Typical Problem (2) : Doctor Streaking**

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Potential causes &amp; counter measures</th>
</tr>
</thead>
</table>
| Streak lines appear on the printed image. The position may be randomly or regularly | a) Foreign matter stuck between blade & cylinder  
  ➔ *where are those foreign matters from?*  
  a) Not filtered well during ink circulation  
  b) Ink resin condensation (esp. recycled ink), poor ink circulation  
  c) Poor ink re-wetting |

“*Ink splash left on machine*” resolve into ink-tray all of sudden

Esp. Black half tone more likely streaks
Typical Problem (3): Missing Dot

Dot reproduce = Stable & Efficient ink transfer
**TYPICAL PROBLEM(3) : MISSING DOT**

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Potential causes &amp; counter measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gravure lower % screen dots can not be printed at all or stably.</td>
<td>1) Doctor angle, blade contact point ➔ Match wt Line speed</td>
</tr>
<tr>
<td></td>
<td>2) Poor film wettability ➔ Corona treat</td>
</tr>
<tr>
<td></td>
<td>3) Uneven Impression rubber hardness, pressure</td>
</tr>
<tr>
<td></td>
<td>4) Inefficient inking to gravure cells ➔ Cell shape / Too high Viscosity - Furnisher use</td>
</tr>
<tr>
<td></td>
<td>5) Improper Solvent type – mixture rate ➔ Too fast dry</td>
</tr>
<tr>
<td></td>
<td>6) Printing room environment ➔ Air-conditioned room</td>
</tr>
</tbody>
</table>

- ➔ Printed image has poor gradation or color reproducing
# Typical Problem (4) : Blocking – Roll Wrinkle

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Potential causes &amp; counter measures</th>
</tr>
</thead>
</table>
| Film and film get stuck after rewound. Ink surface damages the printed image, or effects to the following process Unwinding. | a) Ink not dried sufficiently, or dried surface only. Readjust nozzle speed, temp. or line speed.  
   b) Not enough film cooling before rewound. Retained heat in rewound web roll causes excess shrinkage / physical stress in the web roll.  
   c) Too high retain tension rewound web roll Excess shrinkage and physical stress in the web roll. |

<Ref : Dry lamination>
- Retaining web tension or heat (uneven tension between Main and Sealant web)  
  ➔ Web wrinkle, tunneling, or telescoping during/after Curing.
### Typical Problem (4) : Solvent Retention

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Potential causes &amp; counter measures</th>
</tr>
</thead>
</table>
| Solvent retention after print or laminate is not in allowance value | 1) Dryer capability – Line speed not match ➔ Filter clogging cause nozzle speed decrease  
2) Gravure cell depth – viscosity – solvent mixture rate ➔ Toluene is the last solvent to be dried.  
3) Solvent tucks into film excessively  
4) Adhesive tucks into ink excessively  
5) Too high coating volume – too low viscosity |

#### Tips for efficient drying

1) Not exceeding heat charge  
2) Not exceeding air velocity
# Typical Problem (5) : Static

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Potential causes &amp; counter measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inferior image by ink squeeze out. Excess static may cause sparking.</td>
<td>1) Contact (e.g. Web running)</td>
</tr>
<tr>
<td></td>
<td>2) Friction (e.g. Nip roll, Furnisher, Smoothing, Speed accel.)</td>
</tr>
<tr>
<td></td>
<td>3) Pressure (e.g. Nip roll, RW touch roll, inside web roll)</td>
</tr>
<tr>
<td></td>
<td>4) Release (e.g. Nip roll, web running)</td>
</tr>
<tr>
<td></td>
<td>5) Room humidity – environment</td>
</tr>
</tbody>
</table>

A) Reduce : Rubber roll

↔ “rubber” = character change by time

= Not perfect choice

B) Eliminate : Self discharge – Active

= Performance change by time + Safety (cost)
Typical problem(5) : Static

Air-con outlets and Dry-Fog sprinkle nozzles

Clean floor immediately when Ink dripped.

~ Whole Stainless Floor (Mirror-finish) ~

Pic : SEIKO Co.,Ltd. (Tsukuba Fac)
<table>
<thead>
<tr>
<th>Symptom</th>
<th>Potential causes &amp; counter measures</th>
</tr>
</thead>
</table>
| Objects invade and contaminate the film, printed image, or machine. (Hair, dusts, bugs) | 1) From operator  
2) From factory environment / floor plan  
3) From previous process, jobs  
4) From machine (Gas burner, air filter, dryer, impress, oil)  
5) From Film  
6) From Ink, resin  
7) From Doctor blade, Taper-con, Paper-core |
Inline Unit type Mid-web FLEXO printing press

**XPRESS with S.W.I.M. CONCEPT**

<Xpress Main feature>
- Machine speed : 200m/min
- Web width : 300-620m
- Structure : Inline Unit type
- Print repeat : 280-600mm
- Drive system : Sectional drive
- Kiss touch : All AC servo motor
- Drying : By Hot air blowing
- Dimension : (L)14000mm x(W)2800mm x(H)2800mm (at 6C straight)
  (*excl. blowers*)

**Xpress** = Unknown **X** + Printing **Press**

= **Orient Express** *(Train between Asia to Europe)*
NEW ERA OF FLEXO PRINTING PRESS
S.W.I.M. CONCEPT

- Unique concept FLEXO can co-exist with Gravure

Super short run

Inline unit

Water based ink

Mid width web

Not CI drum, Not UV...

new achievement from ORIENT, Japan
**EXPAND FLEXIBLE PACKAGING DEMANDS**

**<former>** Not necessary all the packaging design would not become actual package...

**<New>** Showing more choices to Consumer and they will determine what is the best!

**New key:** [Re-active idea] [Premium marketing] And [Local-intimacy marketing]
MINIMUM QUANTITY OF BAGS SUPPLIED

JUST IN TIME practice at Flexible Packaging
コンセプト：水性インキ＆インラインユニット型

【水性】+【インライン】は日本発のフレキソの象徴として！
## Gravure vs. Flexo

<table>
<thead>
<tr>
<th>Color-reproduce range / Resolution</th>
<th>Gravure &gt; Flexo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ink &amp; Solvent usage</td>
<td>Gravure &gt; Flexo</td>
</tr>
</tbody>
</table>
なぜ インラインユニット型？(2)

2.
3.

間接時間の削減、残インキ・廃液少量化は、ユニット型とCIドラムとの差が顕著に見えやすい！
網点再現の安定化 逆掻きチャンバー

わずかな違いが生む、大きな品質の差！
1. 基本原理: 三角マークによる隣色ツーマーク制御
2. 貼込みプレート原点(トンボ) = 駆動系(回転位相) 原点
**Gravure vs. Flexo**

**Pros and Cons. ➔ Can go either!**
Printing Samples

Machine viewing tour are available upon request
FLEXIBLE PACKAGING SEMINAR
AT HOTEL MULIA JAKARTA Nov 19, 2013

THANK YOU FOR LISTNING

ありがとうございました
terima kasih