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Delivery:
Hot Melt Application Technology

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Courtesy

Nordson
Components of a Hot Melt System

• Melter
  – Melt Supply
  – Pump
  – Temperature Controller
• Hoses
• Applicator Heads
  – Manifold
  – Valves
  – Nozzles
• Pattern Controls/Timers
Melt Supply

Open Tank
• Natural convection is optimum for small units

Grid / Reservoir
• Larger surface area for higher melt rate in large units

Platen
• Demand melter for unloading pails and drums
Common Hot Melt Pumps

**Piston**

- Easy to set pressure
- Simple intermittent operation
- Pump wink and pressure fluctuations

**Spur Gear**

- Constant, even flow
- High metering accuracy possible
- More costly
- Recirculating pressure control required

**Gerotor**

- Constant, even flow
- Better value for high volumes
Versatility of Applicator Heads
Applicator Heads

• Manifold
  — Standard Pressure Fed
  — Metered
• Valves
  — Normal or Snuff-back
  — Pneumatic or Electric
• Nozzles & Applicators
  — Contact
  — Non-contact
Manifolds

Standard Pressure Fed
- Provides uniform fluid distribution and heat

Metered
- Provides gear metering for every valve
- Optimum uniformity for wide high-speed nonwoven applications
Valves

Normal Ball and Seat
- High flow
- Good cut-off
- Good wear

Snuff-back
- Optimum cut-off in slot applications
Valves

Pneumatic
- High repeatability
- High flow
- Wide viscosity range
- Excellent value
- Good life

Electric
- High speed
- Long life
- Driver required
Nozzles and Applicators

- Contact
  - Slot Coaters
  - Roll Coaters

- Non-contact
  - Bead
  - Ribbon
  - Spray
Contact Applicators

Slot Coaters
+ Good high speed
  intermittent performance
+ Flexible patterns

Roll Coaters
+ Economical on wider surfaces
+ Offers 100% coverage
  – Less add-on control
  – More easily contaminated
  – Speed limited
Contour Coating

- **Contour coating** is optimized for hot melt adhesive coating using metering gear pumps
- Used for feminine napkin production
- Handles patterns up to 100 mm
- Runs at speeds 300 to 500 m/min
- Allows 3.5 mm minimum width and gap
- Provides 21 to 48 dpi equivalent resolution capability
- Depends on adhesive rheology
  - 7 of 11 hot melt adhesives tested showed acceptable rheology
High-Speed Slot Coating

- Minimizes tailing using snuff back control
- Enhances accuracy at ±1 msec (5 mm at 300 m/min)
- Applies 25 to 30 mm patches at 300 m/min
Types of Non-Contact Bead and Dot Nozzles

Standard Thread-on
- Most common
- Easily changed
- Wide variety

Zero Cavity
- Minimizes reactive cure
- Self cleaning
- Excellent cut-off

Reduced Cavity
- Improved cut-off
Non-Contact Spray Nozzle Patterns

- **Wide Spiral** – Industry standard
- **Mini-Spiral** – Offers improved control
- **Oscillating** – Offers unique aesthetics
- **Meltblown** – Offers fine fibers for thin substrates. Similar technologies offer wide coverage.
Elastic Wrapping

- Forms distinct bond points
- Coats at speeds over 300 m/min
- Uses adhesive efficiently at 25 to 40 mg/meter/strand
- Produces five to seven knots per inch
- Provides simple setup, robustness and control with one-piece integrated nozzle
Three Rules for Optimum Spray Bonding

• Larger fibers form stronger bonds
• Fiber crossings reinforce bonds for higher bond strength
• Lower variability minimizes waste
Adhesive and Equipment Case Studies

- Adhesive compatibility screening
- Adhesive sprayability
- Placement accuracy
- PUR and reactive adhesive systems

The adhesive and application equipment are a system, and the best results are achieved when they are optimized together.
## Adhesive Compatibility Screening
### Typical Tests

<table>
<thead>
<tr>
<th>Test Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat-age testing</td>
<td>Determines stability for long-term elevated</td>
</tr>
<tr>
<td></td>
<td>temperature, typical of most applications, most</td>
</tr>
<tr>
<td></td>
<td>common failure</td>
</tr>
<tr>
<td>Viscosity vs. temperature</td>
<td>Leading indicator of ease of application</td>
</tr>
<tr>
<td>Acid value</td>
<td>Anticipates corrosive wear</td>
</tr>
<tr>
<td>Lubricity</td>
<td>Anticipates wear</td>
</tr>
<tr>
<td>DSC melting point</td>
<td>Determines ease of melting</td>
</tr>
<tr>
<td>FTIR</td>
<td>Identifies polymer for application suitability</td>
</tr>
</tbody>
</table>
Adhesive Sprayability as Understood by Adhesive Formulators

Dynamic oscillatory measurements

Glassy zone  Plateau zone  Terminal zone

High elastic / viscous ratio at process temperature >
bad spray behavior

T-scan™ Rheological and process behavior of the adhesive

Chart courtesy of Nicolas Sajot - BostikFindley
Adhesive Sprayability as Understood by Customers

- Excellent control
- High repeatability
- Improved product characteristics
- Reduced waste
Placement Accuracy

Pattern Length Histogram

Pattern Length Range (mm)

Frequency (%)

- Electric Mini-Swirl
- Electric Swirl
- Pneumatic Mini Swirl
- Pneumatic Swirl

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric Mini-Swirl</td>
<td>39.1</td>
<td>6.1</td>
</tr>
<tr>
<td>Pneumatic Swirl</td>
<td>109.6</td>
<td>29.7</td>
</tr>
</tbody>
</table>
PUR and Reactive Adhesives

• Excellent performance properties result from cross-linking
• Quick green strength from solidification
• Premature curing must be addressed aggressively
• Customer concerns about safety and complexity must be addressed aggressively with consistent messages
Address Premature Curing Throughout the Whole Process

Manufacturing

Storing

Shipping

Applying

Packaging
Application Equipment Modifications for PUR

- Pressurized inert gas blanket
- Automated gas monitoring system
- Temperature setback
- Zero cavity dispensers
- Easy disassembly and cleaning
- Applications that are robust to viscosity changes resulting from reactivity
PUR Applicators

Moisture Elimination

Sealed Platen System

Sealed Tank (Vacuum) System

Sealed Tank (Gas) System

Gas & Vacuum System
Heat History

The application must still work at increased viscosity
Adhesive and Equipment Case Studies

- Adhesive compatibility screening
- Adhesive sprayability
- Placement accuracy
- PUR and reactive adhesive systems

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Application Videos

- Label Application
- Product assembly
- Disposable diaper elastic wrapping
- Case sealing
- Tray forming
- Pallet stabilization
Label Application
Product assembly
Disposable diaper elastic wrapping
Case sealing
Tray Forming
Pallet Stabilization
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