Specifying a Hot Melt Coating Line

The following is detailed information to help you put together a specification for a hot melt coating line. Although the web handling equipment is just as important for the sake of time we will focus this presentation on the critical areas of the die area and the hot melt system.

Common mistakes in specifying a system

1. Making the specification too broad without understanding the cost ramifications of what you are asking
2. Trying to buy a new die and not related critical equipment
3. Trying to make a new system be all things to all people

The first step in putting together a good specification is to understand the general information that is needed. This chart will help you understand the critical parameters for this task.

General Specifications

<table>
<thead>
<tr>
<th>General specifications for hot melt coating line</th>
<th>Value</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GENERAL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>line speed</td>
<td>FPM</td>
<td>300FPM</td>
</tr>
<tr>
<td>coat weight</td>
<td>G5M</td>
<td>25 G5M</td>
</tr>
<tr>
<td>coating width</td>
<td>inches</td>
<td>60”</td>
</tr>
<tr>
<td>Expected Tolerances</td>
<td>± %</td>
<td>± 5%</td>
</tr>
<tr>
<td><strong>ADHESIVE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>adhesive type</td>
<td></td>
<td>SBS PSA</td>
</tr>
<tr>
<td>adhesive form</td>
<td></td>
<td>drums</td>
</tr>
<tr>
<td>adhesive application temp</td>
<td>Fahrenheit</td>
<td>375°F</td>
</tr>
<tr>
<td>adhesive viscosity at temp</td>
<td>CPS</td>
<td>8,000CPS</td>
</tr>
<tr>
<td>adhesive softening point</td>
<td>Fahrenheit</td>
<td>275°F</td>
</tr>
<tr>
<td><strong>SUBSTRATE/S</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td></td>
<td>polyester film</td>
</tr>
<tr>
<td>thickness</td>
<td>MIL</td>
<td>2 MIL</td>
</tr>
<tr>
<td>tolerance</td>
<td>± %</td>
<td>± .2 MIL</td>
</tr>
</tbody>
</table>

The next basic task is to understand your adhesive usage for the products you want to run. This is not only critical to specifying a system and what equipment is need but it also instrumental in establishing materials costs on your product.
**Adhesive Usage Formulas**

Coating width (inches) x web speed (FPM) x coating thickness (MIL's) x .026 = lbs/hour

Note: Based on a specific gravity of 1, equation will vary slightly based on the specific gravity

Example: 60" x 300 FPM x 1 MIL x .026 = 468 lbs/hr

Footnote: 1 MIL is equal to 23.75 GSM

There are many challenges when the parameters are too broad in the specification.

**Coat weight range change**

If looking for coat weight range:
Example: 12 GSM – 75 GSM, this could affect shims for the die and could also affect the pump size or speed of the feed system.

Note: coat weights less than 24 GSM will require thorough lab tests to verify the viability of thin coat weights with a particular formulation.

**Coating width change**

If we change the width range:
Example: 30” to 60” wide, this affects the Die system. 50% change and more requires a second die.

Any width change greater than 20% requires filler blocks in addition to shims, which will change adhesive output and may make the adhesive equipment change.

Be specific on expected speed with a particular coat width.
Example: 30” wide run is 600 FPM

60” wide run is 300 FPM

Plan the product matrix ahead of time. Result: additional die equipment and cost Δ

**Adhesive information**

Another item to focus on is understanding adhesive changes and what that does to set up time and down time. How many adhesives may run in the system, how similar are the adhesives, and how often will you change adhesives? If you only change adhesive once a month then set up time may not be as critical. If there will be adhesive changes carefully plan how often these may take place based on product matrix and run times.
If there are two predominant adhesives used and there is frequent changeover then you may want to specify dedicated tanks for each adhesive with valves for changeover. This will minimize changeover time as well as cross contamination of adhesive.

The next critical item to a good specification is to understand the product matrix. You don’t want to make the mistake about building into your specification a parameter for a low runner if it will make a significant cost change to the system. This is important to know the product matrix before building a specification.

**Product Matrix**

<table>
<thead>
<tr>
<th>Product number</th>
<th>Coating Width</th>
<th>Coating thickness</th>
<th>run hours per Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>M13789</td>
<td>56”</td>
<td>25 GSM</td>
<td>38</td>
</tr>
<tr>
<td>L99274</td>
<td>60”</td>
<td>30 GSM</td>
<td>80</td>
</tr>
<tr>
<td>B38491</td>
<td>32”</td>
<td>25 GSM</td>
<td>2</td>
</tr>
<tr>
<td>G53891</td>
<td>48”</td>
<td>100 GSM</td>
<td>40</td>
</tr>
</tbody>
</table>

Based on 20 work days/month & 8 hrs/day

- Plan your product matrix before you develop your specifications
- Be careful to develop a specification range around a very low runner without understanding the cost ramifications of both equipment and set up time
- Set up time can be further complicated with adhesive changes.

**DIE COMPONENT RELATIONSHIP**

Three Key Components

1. Backing Roll
2. The Die Itself
3. The Precision Positioner

It is critical that all three work in harmony with each other in order to guarantee a good consistent coating. Any attempt to try and replace only one of these
components will limit your ability to offer consistent quality.

“Consistent quality requires repeatable process and repeatable process requires repeatable parameters”

In this case, component dimensions and consistent location.

**Specifying the die**

- Die body flatness/straightness tolerance = 0.0005 inch (12.7 microns) maximum deviation over the entire length of each die half
- Die Hinge – hinge connected to upper and lower halves to allow for opening and cleaning in place
- Flexible lip design
- Temperature controls to ±3°F
- When coating 24-75 GSM utilize rotary rod lip design
- When coating greater coat weights regular flex lip design
- Thermally isolated and insulated
- Coat weight accuracy to within 5%

**Specifying the Positioner**

- Repeatability and accuracy within 0.0001 inch (2.54 microns)
- On/off coating control
- Slot die to roll adjustment via precision micro adjusters
- Stainless steel or powder coated structural steel construction
- Precision linear bearings for slot die movement
- Pneumatic actuation
- Roll and free span interface capability
- Die attack angle adjustment (+/- 5 degrees)
- Linear Scales indicators – one on each side for precise indication of slot die to substrate coating gap

**Specifying the roll**

- TIR (Total Indicated Runout) < 0.0005 in (12.7 micron)
- Concentricity < 0.0005 in (12.7 micron)
- Cylindricity < 0.001 in (25 micron)
- 15-25 Ra (u in) or better
- Nitrile coated with 80-90 Durometer “A”
Specifying the die block

Heated block attached to the entrance port of the slot die.

Block assembly contains:
- Air actuated ball valve
- Short stop virtual instantaneous good coating
- In flow temperature probe
- Pressure transducer

Real time monitoring with PID loops for auto adjusting

What does this mean?
Less scrap, more up time, precise automatic control on critical parameters which result in consistent quality

Specifying the melt equipment

It is important to note that you ideally want a single feed from the melt system to the precision slot die. The specification needs to read, “It must be capable of maintaining the application temperature at the volume required in the specification”. The type of equipment is based on what form the adhesive comes in and the volume requirements.

If a drum unloader is to be provided you cannot feed directly to the die because there is not enough resonance time to heat stabilize the fluid before entering the die.

Tank system
- Must have continuous level control system
- Precision pump/s accurate within 1%
- Safeguards to prevent grid exposure resulting in Char
- PID loops for both Temperature and Pressure

Adhesive Specification

Specifications on the adhesive needed.
- Adhesive Type
- Example: SBS PSA, EVA, UV Acrylates
Softening point
Application Temperature
Viscosity at temperature
TDS- temperature versus viscosity curve
Adhesive form
Example: Drums, pellets, pillows, blocks, etc
All of this information is critical to the adhesive equipment supplier to spec. the right equipment and make sure it is sized properly for the application.

Example: If the application does require 468 Lbs/hr it must be supplied by the adhesive supply system to the die at constant temperature.

In conclusion, if these simple rules are followed on the front end it will help you write a good specification for a hot melt coating line.

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