Equipment and Process Evaluation for Lean Manufacturing.
“Get better at shorter runs or accept lower operating margins”

Lean Manufacturing Definitions and Strategies:

<table>
<thead>
<tr>
<th>Traditional</th>
<th>Lean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>Based on forecast</td>
</tr>
<tr>
<td>Layout</td>
<td>Based on function</td>
</tr>
<tr>
<td>Batch size</td>
<td>Large</td>
</tr>
<tr>
<td>Processing</td>
<td>Batch &amp; queue</td>
</tr>
<tr>
<td>Quality</td>
<td>Lot sampling</td>
</tr>
</tbody>
</table>

Lean manufacturing is a strategy for remaining competitive by identifying and eliminating wasteful steps in products and processes, using the following practices:

- Improvement of equipment reliability
- Quality at the source
- Continuous flow production
- Pull production
- Continuous improvement

The term “lean” is used because lean manufacturing uses less:

- Human effort in the factory
- Manufacturing space
- Capital investment
- Raw materials
- Time between customer order and the product shipment

The basic goal is to get more done with less by:

- Minimizing inventory at all stages of production
- Shortening product cycle times from raw materials to finished goods
- Eliminating waste
Total Productive Maintenance (TPM):

TPM is the philosophy and practice of preventing the loss of productive machine time due to:

- Breakdowns
- Minor stoppages
- Idling
- Operating at less than planned for cycle times
- Changeovers/setups
- Unacceptable quality

TPM involves everyone in identifying, monitoring and correcting the root causes of each of these losses.

Quality at the Source:

- Machines: intelligence to be self-operating and self-stopping when an error occurs
- People: served by machines, not vice versa
- Quality: built/designed in, not inspected-in
- Efficiency: human work separated from machine work
- Reduces the need to rework and prevents further work (and cost)
- Simplifies prevention and repair of defects by placing responsibility on the operator

Elimination of Waste:

<table>
<thead>
<tr>
<th>Types of waste</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overproduction</strong></td>
<td>Producing more, sooner and faster than required by the next process</td>
</tr>
<tr>
<td><strong>Transportation</strong></td>
<td>Any movement that does not add value to the product</td>
</tr>
<tr>
<td><strong>Inventory</strong></td>
<td>Maintaining excess inventory</td>
</tr>
<tr>
<td><strong>Processing</strong></td>
<td>Doing more work than necessary</td>
</tr>
<tr>
<td><strong>Waiting</strong></td>
<td>Operator or machine idle time</td>
</tr>
<tr>
<td><strong>Correction</strong></td>
<td>All repairs to product to fulfill customer requirements</td>
</tr>
<tr>
<td><strong>Motion</strong></td>
<td>Any wasted motion to pick up parts or else stock parts. Also wasted walking.</td>
</tr>
</tbody>
</table>
Implementation of Lean Manufacturing principles:

Services offered by EAS:

- In-plant process/equipment evaluation
- New machinery specification and RFQ
- Bid evaluation and purchase recommendation
- Project engineering
- Production and maintenance personnel training

Extrusion line/plant enhancements:

- Improved raw material utilization
- Improved equipment reliability
- Increase line product yield
- Material handling automation and inventory control
- Scrap reduction and improved scrap handling
- Faster product changeover
- Improved production line flexibility
- Higher production rates

Equipment/Processes Implemented for Lean Manufacturing:

- Weight based blending and extrusion control
- Centralized, plant wide resin handling and visual management
- Performance optimized extruder screw design
- Automatic/continuous melt filtration
- Extrusion gear pump systems
- Automatic die control, with online gauging
- ERP software
- Optimized scrap reclaim systems

Additional results:

- JIT resin/material management
- Shorter production runs with minimal waste
- Consistent on-time product delivery
- More flexibility and increased sales
- Make product to order, not for stock
- Real time production information and costing
- Reduces lead times and production space
- Reduction of operating costs