Coil Fed Laser Blanking Systems

Jim Russell
RDI Laser Blanking Systems/Chicago Slitter
Coil Fed Laser Blanking

A revolutionary system combining 3 lines into 1

Blanking press line + Sheet fed laser + Cut to length = Coil fed laser blanking
Coil Fed Laser Blanking

A new innovative way to produce blanks
Coil Fed Laser Blanking

A new innovative way to produce blanks

- Lower cost per part
- Lower energy consumption per part
- Greater flexibility
- Lower space requirements
- High quality
Laser Blanking: Key Advantages

- High powered fiber laser
- No die, die changeover & die maintenance cost
- No sheet change – cut continuously from coil
- Low installation cost and floor space
- Highly flexible
  - Low or high volume
  - Range of materials, High or low strength steel
  - Decrease time to market launch
- Less scrap with nesting capabilities
- Low power consumption
Coil Fed Laser Blanking

Lower Cost per Part

Laser Blanking

Mechanical Press Blanking
Coil Fed Laser Blanking

Lower Cost per Part – Compared to Mechanical Blanking

- Dies - for each part (with spare die in some or most cases)
- Die maintenance & storage
- Die changeover time
- Press foundation
- Building size, height
- Power requirement

Blanking press
Coil Fed Laser Blanking

Lower Cost per Part

Laser Blanking vs. Mechanical Blanking

- Galvanized cold rolled
- 0.030” thick
- 60” wide x 84” long
Coil Fed Laser Blanking

Lower Cost per Part

Laser Blanking vs. Mechanical Blanking

- Galvanized cold rolled
- 0.030” thick
- 60” wide x 84” long
## Lower Cost per Part

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Press Blanking line</th>
<th>Laser Blanking line</th>
</tr>
</thead>
<tbody>
<tr>
<td>Die cost</td>
<td>$250,000</td>
<td>$0</td>
</tr>
<tr>
<td>Line set-up time</td>
<td>15 min</td>
<td>less than 2 min</td>
</tr>
<tr>
<td>Number of parts</td>
<td>1,250</td>
<td>1,250</td>
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<tr>
<td>Parts per minute</td>
<td>20</td>
<td>6</td>
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<tr>
<td>Run time</td>
<td>80 min</td>
<td>215 min</td>
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<tr>
<td>Cost per blank</td>
<td>$21.35</td>
<td>$20.15</td>
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</table>
### Lower Energy Consumption per Part

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Press Blanking Line</th>
<th>Laser Blanking Line</th>
</tr>
</thead>
<tbody>
<tr>
<td>Press (kW)</td>
<td>75</td>
<td>-</td>
</tr>
<tr>
<td>Laser (kW)</td>
<td>-</td>
<td>4</td>
</tr>
<tr>
<td>Chiller (kW)</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>Cost per (kW/hr)</td>
<td>$0.09</td>
<td>$0.09</td>
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<tr>
<td>Cost (per hr)</td>
<td>$6.75</td>
<td>$0.81</td>
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<tr>
<td>Production rate</td>
<td>80</td>
<td>215</td>
</tr>
<tr>
<td>Total cost (per hr)</td>
<td>$9</td>
<td>$2.90</td>
</tr>
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</table>
Greater Flexibility

- Change-over time to download a new part
- No die changeover time
- Make changes to nesting program vs. hard tooling
- Material changes, manufacturing change
- Low, medium or high volume part platforms
- Low, medium or high strength steel
- Faster to market vs. traditional die development timeline
Coil Fed Laser Blanking

Lower Cost per Part - Compared to Sheet Fed Lasers

- Purchase cut to length sheets vs. coil
- Inventory of sheets
- Change over of sheets
- Material utilization with sheet vs. coil
Coil Fed Laser Blanking

Lower Cost per Part

Coil Fed Laser vs. Sheet Fed Laser

Run sequentially from coil

Material – 18ga (.048”) Steel
Part size: 27” x 39”

Production Run – 1,300 Pieces

Nested on a 5’ x 10’ sheet
Coil Fed Laser Blanking

Lower Cost per Part

Coil Fed Laser vs. Sheet Fed Laser
## Lower Cost per Part

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Sheet Fed Laser</th>
<th>Laser Blanking Line</th>
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</thead>
<tbody>
<tr>
<td>Hours to complete production</td>
<td>31.25</td>
<td>8.67</td>
</tr>
<tr>
<td>Material cost</td>
<td>$9,102</td>
<td>$7,283</td>
</tr>
<tr>
<td>Labor cost to stack cut parts</td>
<td>$1,356</td>
<td>$0</td>
</tr>
<tr>
<td>Scrap rate</td>
<td>19%</td>
<td>6%</td>
</tr>
<tr>
<td>Cost per part</td>
<td>$8.02</td>
<td>$5.68</td>
</tr>
</tbody>
</table>
Coil Fed Laser Blanking

Lower Cost per Part

Coil Fed Laser vs. Automated Sheet Fed Laser
## Lower Cost per Part

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Automated Sheet Fed Laser</th>
<th>Laser Blanking Line</th>
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</thead>
<tbody>
<tr>
<td>Hours to complete production</td>
<td>13.18</td>
<td>8.67</td>
</tr>
<tr>
<td>Material cost</td>
<td>$9,102</td>
<td>$7,283</td>
</tr>
<tr>
<td>Labor cost to stack cut parts</td>
<td>$1,085</td>
<td>$0</td>
</tr>
<tr>
<td>Scrap rate</td>
<td>19%</td>
<td>6%</td>
</tr>
<tr>
<td>Cost per part</td>
<td>$7.82</td>
<td>$5.68</td>
</tr>
</tbody>
</table>
Coil Fed Laser Blanking

Greater Flexibility

Part Nesting

- Nest parts by parameters
  - Coil Width, OD, ID
  - Optimal coil width
  - Optimal material utilization

- Calculated Outputs
  - Part cycle time
  - Total coil cycle time
  - Parts per coil
  - Scrap usage
Coil Fed Laser Blanking

Greater Flexibility

Part Nesting

- Import CAD drawings
- Multiple part nesting
- Coil & scrap optimization
- Part cutting simulation
- Standard or custom reports
Greater Flexibility

Part Nesting Reduction Analysis

- Sheet Fed vs. Coil Fed – Round disc
  - Based on number of sheets vs. single coil
- Reduce scrap by 7.5-10% (from 24-14%)
- Cost savings approximately $2,500

Scrap w/sheet
Coil Fed Laser Blanking

Greater Flexibility

Traditional Blanking Line & High Strength Steel

- Die maintenance + more wear = less die life
- Up to 50 - 75% less die life
- Increased press tonnage required
Lower Space Requirements

- Standard building height
- 30% Less floor space
- No die storage or maintenance area
Lower Space Requirements

Laser Blanking compared to Press Blanking

800 ton Blanking press

Laser module
## Lower Space Requirements

<table>
<thead>
<tr>
<th></th>
<th>Laser Blanking Line</th>
<th>Press Blanking Line</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line footprint (sq. ft)</td>
<td>6,250</td>
<td>8,000</td>
</tr>
<tr>
<td>Die maintenance area (sq. ft)</td>
<td>0</td>
<td>2,000</td>
</tr>
<tr>
<td>Total square feet</td>
<td>6,250</td>
<td>10,000</td>
</tr>
<tr>
<td>Cost per sq. ft ($5.00)</td>
<td>$31,250</td>
<td>$50,000</td>
</tr>
<tr>
<td>Savings</td>
<td>$18,750</td>
<td></td>
</tr>
<tr>
<td>Less space required</td>
<td>38%</td>
<td></td>
</tr>
<tr>
<td>Building Height (ft)</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>Press Foundation depth (ft)</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>Looping Pit (ft)</td>
<td>15</td>
<td>15</td>
</tr>
</tbody>
</table>
High Quality

- Cut quality monitoring
- Laser never wears out
- Process consistency
- Cutting high strength steel vs. mechanical blanking
RDI Laser Blanking Line - Key Features

- Coil fed fully integrated solution
- Patented laser cutting process
  - Combination roll feed and laser traverse
  - Eliminates flash back on the bottom of the part
- Fumes and contaminants removed via vacuum/exhaust system
- Trap door-scrap or “side out” parts
- Integrated high speed shear
  - Line processes configured and sheared blanks
- Integrated finished part handling
How It Works

1. Parts nesting via CAD/CAM download
2. Coil feeding
3. Roll feed integration with laser module
4. Laser cutting (roll feed and laser axis)
5. Prime part handling
6. Scrap handling

US Patent # 6,563,081  Italian Patent # 1,316,478
Coil Fed Laser Blanking

Coil Handling & Coil Feed-up

- Resembling traditional blanking lines
- Coil cars, unwinds, levelers, wash units
- Consistent cycle times with automatic feed up
- Bar code scanning and integration to MRP/ERP system
Coil Fed Laser Blanking

Laser Cutting Module: Key Innovations

- Tandem servo controlled roll feed
- High speed, high efficiency fiber laser
- Multi-axis laser head control
  - Y, X and X1
- Closed loop control system
Laser Cutting Module

- Roll feed traverses sheet in “X” axis
- Laser traverses in “Y” axis
  - No Flashback due to sheet support table
  - Higher quality cut
Laser Cutting Module

Roll Feed & Sheet Guide:
- Servo driven
- Precision anti-backlash gearbox and servo couplings
- Feed rolls with anti-slip covering
- Servo roll pressure adjustment (closed loop)
- Full contact sheet guide
Coil Fed Laser Blanking

Laser Cutting Module

Sheet guide

Catenary
Laser Cutting Module

- Exit sheet guide after roll feed
- Ensures cutting accuracy

Sheet direction
Laser Cutting Module

Laser Gantry Axis:

- Linear bearings and servo driven
- Linear bearing for Y and X1 axis
- Robust structure to reduce vibration
Laser Cutting Module

- Fast, short strokes for local movements
  - Addition of X1 drive axes

- Capable of wide speed ranges
  - Y axis 4700 ipm (120m/min)
  - X axis 2800 ipm (70m/min)

- Seamless CNC integration
Processing Head

- Light weight
- Closed-loop height sensing
- Protection glass
- Range of nozzle options
- Crash protection
- High pressure assist gas
- Precision focal adjustment
Fiber Lasers Key Attributes

- Faster cutting speed at thin gauges (< 2mm)
- Low maintenance (50,000+ hrs), reliable solid state design.
- No optics or mirrors to align, no gases to regulate
- Energy efficient, 70% less power consumption
- Lower cost of ownership
- More efficient coupling of energy into material

Cold Rolled steel absorption: CO2 – 15% vs. Fiber – 25%
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Cutting with Fiber Lasers

Comparison of max. cutting speeds with different lasers

Source: IPG Photonics
CNC Control System

- PC based CNC controller
- Repeatability and accuracy
- Standard M and G codes
Sheet Position Feedback

- Close loop CNC axis control for precise sheet length accuracy & realtime verification of actual material movement
- Non-contact based methods:
  - Laser Surface Velocimeter - LSVs
    - Reliability & consistency
    - Commercially available components
  - Optical/Vision System
    - Higher resolution/accuracy
    - Configured system
Laser Cutting Module

Fume handling system:

- System integrated into base weldment
  - Internal exhaust
  - External exhaust
- Easily maintained
- Scrap conveyor used to remove large pieces.

L.E.V.

Coil Fed Laser Blanking
Safety Systems

- “Class I” Enclosure
- Design based on fiber laser beam intensity
- Control measures determined by ANSI Z136.1 and IEC 60825
Laser Cutting Module

Prime/Scrap removal

- Powered conveyor removes prime parts and keeps laser continually cutting.
- Scrap door enables side-out scrap handling.
- System fully integrated and CNC controlled.
Prime Part Handling

- Magnetic or Vacuum stacking
- Robotic stacking
  - Gantry
  - Articulated
- Flipper stacker
**Prime Part Dual Robotic**

- Utilize *dual* articulated robots for cycle times less than 5-7 seconds
- Dual robots enable stacking of Offal nested parts
- Conveyor System enables load/unload of pallets/prime parts
- Inverted robot mounting enables pallet in/out to stacking position
Prime Part Gantry Robot

- Pick and place gantry stacker
- Stacking speeds for 10 seconds or greater
Scrap and Offal Handling

- Cutting in one plane enables scrap handling similar to traditional blanking/stamping press
- Trap door-bottom drop, eject side out
- Robot removal – for large scrap or offal
Coil Fed Laser Blanking

3 lines into 1

Blanking press line + Sheet fed laser + Cut to length = Coil fed laser blanking
Coil Fed Laser Blanking

Summary of Benefits

- Lower cost per part (equipment, no dies and die maintenance)
- Optimized part nesting results in less scrap
- Immediate change of part geometry vs. hard tooling die
- Flexible production, blanks or sheared parts
- Quick changer over, change from part to part with a button
- Improved profitability through a range of production rates
Our focus is simple... **Build Great Machines**

Questions?

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