ADVANCEMENTS IN TITANIUM CONDITIONING

Paul Cross & Dave Sullivan - Vulcan Engineering Co.
Brian Vanasse - Norton Abrasives
Grinding Methods

Spiral

Longitudinal

Metal Conditioning Machines

Grinders

Machine and Operational Parameters

Safety Parameters

Wheel Performance

Wheel Performance Parameters

Safety Parameters
METAL CONDITIONING

Metal Conditioning

- Process of removing defects such as scale, cracks, forge marks from ingots, billets, blooms etc. prior to further processing.
**GRINDING METHODS**

### Longitudinal Grinding
- Grinding wheel moves along the length of the work piece
- Face and edge grinding

### Spot Grinding
- Removes small cracks or imperfections along the work piece
- Feathering for longitudinal spot grinding
- Quick rotational jogging of the work piece for rotational spot grinding
GRINDING METHODS

Spiral Grinding

- Work piece rotates continuously
- Grinding wheel slowly moves along length of work piece
- Prevents “scallop effect” seen in longitudinal grinding
TRAVELING GRINDERS

20th Century Machines

21st Century Machines
STATIONARY GRINDERS
**MACHINE PARAMETERS**

- 150HP – 300HP
- 24” Ø x 3”-4” wheels
- 16,500 SFPM
- Designed to accommodate variety of material sizes
- Constructed with heavy-duty structural steel for increased rigidity
OPERATIONAL PARAMETERS

- PLC & Touch screen HMI controls
- Double joystick high response operator controls for grinder and material handling equipment
- Pressure scale to set grinding force
- Ability to monitor multiple operation parameters

21st Century Controls

20th Century Controls
SAFETY

Operator’s Cab
- Bullet resistant window and replaceable splatter shield
- Insulated steel walls to reduce noise levels to 85dBA or less
- Ergonomic operator’s seat
- Air conditioned for operator comfort

Dust Collection
- Heavy duty swarf booth to capture larger particles
- Manual or automatic dumping of heavies
- Easily ties into existing baghouse
- Designed for stationary or traveling grinders.
WHEEL PERFORMANCE

Metal Removal General Trends

- Titanium: 2-3 lb/hr
- Stainless Steel: 4-5 lb/hr
- Carbon Steel: 6-8 lb/hr
- Inverse relationship between horsepower and grit size
WHEEL PERFORMANCE PARAMETERS

Large Grit Size
- Positively impacts performance (Q-Ratio & MRR)
- Negatively impacts surface finish
- Reduces maximum rated wheel speed

Small Grit Size
- Negatively impacts performance (Q-Ratio & MRR)
- Positively impacts surface finish
- Increases maximum rated wheel speed

<table>
<thead>
<tr>
<th>Grit Size</th>
<th>Wheel Life</th>
<th>MRR</th>
<th>Finish</th>
<th>Yield Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 – 10</td>
<td>High</td>
<td>Lower</td>
<td>Coarse</td>
<td>High</td>
</tr>
<tr>
<td>12 -14</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>16 - 24</td>
<td>Low</td>
<td>High</td>
<td>Fine</td>
<td>Low</td>
</tr>
<tr>
<td>24 - 30</td>
<td>Lowest</td>
<td>Highest</td>
<td>Best</td>
<td>Least</td>
</tr>
</tbody>
</table>
WHEEL SAFETY

Wheel Safety Procedures

• Never over-speed wheels
• Always follow proper mounting procedures
• Never over-torque flange bolts
• Always inspect flanges for flatness, debris, gouges, abrasions, or excessive wear before mounting wheel
Summary

Out Dated Technologies

- Smaller and less productive grinding machines
- Unreliable finishes due to machine and operator inconsistencies
- Uncomfortable and dirty environment for operators

Modern Technologies

- Fully digital controls allow for greater mastery over entire grinding process
- Machines are equipped with sound proof, ergonomic operator stations
- New age of information allows for more reliable data to improve wheel life and MRR
- Higher flexibility for one machine to grind many material shapes and sizes