Tooling and Machinery **Technology** for Optimized Productivity
Leitz
Leitz

Worldwide sales/service coverage in over 100 countries and 5 US regional service centers

Complete product offering

Industry-leading R&D, technical support, and production optimization consulting
Technology & Innovation

- Continuous research for innovative solutions
- Application testing to customer requirements
- Innovation focuses
Optimized Production Efficiency

- Process consulting for optimal manufacturing process
- Tool Management for improved efficiency in the process chain
- Employee training
Batch Size One & Mass Customization
Continuous Improvement Focus

- Optimal quality
- Optimized throughput
- Flexible machinery
- Fast tool changes
- Fast material changes
Tooling Purchase
Productivity & Quality
Efficiency
Machinery Purchase

$90  $150
The Leitz product is ~50% more expensive, but offers three times greater productivity and reduces required tool changes and tool service by 66%.
Cost Justification

Cost Comparison

- Calculate current production costs over time
- Estimate future production costs based on new technology
- Demonstrate payback timeframe

### Machining cost comparison

<table>
<thead>
<tr>
<th>Tool No.</th>
<th>Description or style</th>
<th>Profilcut</th>
<th>Carbide Tipped</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial tool cost per tool body (complete)</td>
<td>$1,000.00</td>
<td>$300.00</td>
<td></td>
</tr>
<tr>
<td>Number of tool bodies required for continuous operation</td>
<td>1,000</td>
<td>2,000</td>
<td></td>
</tr>
<tr>
<td>Minimum initial investment</td>
<td>$1,000.00</td>
<td>$600.00</td>
<td></td>
</tr>
<tr>
<td>Number of tools necessary to match capabilities</td>
<td>1,000</td>
<td>8,000</td>
<td></td>
</tr>
<tr>
<td>Initial cost of comparable tool packages</td>
<td>$1,000.00</td>
<td>$1,800.00</td>
<td></td>
</tr>
</tbody>
</table>

**Tool life calculation**

| Possible # of regrinds/knife changes per head (insert tools=500) | 600 | 8 |
| Performance per service cycle (meters), (inserts=1.5x TCT, PCD=30*Inserts) | 45,000 | 30,000 |
| Total output per tool life in meters | 22,500,000 | 240,000 |

**Cost for knife change (including labor and machine down-time)**

| Cost of knife set or sharpening (per 2 wings) | $60.00 | $20.00 |
| Time for tool or knife change | 5 | 15 |
| Labour cost / min | 1.00 | 1.00 |
| Cost for knife change | $65.00 | $35.00 |

**Material to be processed**

| Production speed in meters per minute | 25 | 25 |
| Working time / shift in hours | 8 | 8 |
| No of shifts / day | 1 | 1 |
| No of working days / year | 250 | 250 |
| Machine utilisation | 80.00% | 80.00% |
| Total material processed per year (meters) | 2,400,000 | 2,400,000 |

**Annual cost of operation**

| Annual # of knife changes/sharpenings | 53 | 80 |
| Single profile | $3,573.33 | $6,100.00 |
| Multiple profiles | $3,573.33 | $7,300.00 |

Note: Worksheet does not take into account reductions in labor and supply costs (sanding, finishing, quality control), due to improved finish quality achieved through the use of precision tooling solutions.
Tool Performance
Rim Speed

\[ 3.14 \times D \times \text{n} / 60000 \text{ [m/s]} \]

Cutters:
- soft wood: 60-90 m/s
- hardwood: 50-80 m/s
- particleboard: 60-80 m/s

Saw blades:
- soft woods: 70-100 m/s
- hardwoods: 70-90 m/s
- particleboard: 60-80 m/s
Chip Load

Chip Load = thickness of chip removed per knife rotation

\[
\text{CHIP LOAD} = \frac{\text{FEED RATE}}{\text{RPM} \times \text{FLUTES}}
\]

- To **INCREASE** chip load:
  - Increase FEED RATE
  - Decrease RPM
  - Use less FLUTES

- To **DECREASE** chip load:
  - Decrease FEED RATE
  - Increase RPM
  - Use more FLUTES
Performance Calculations

Chip load = \( \frac{\text{Feed speed}}{\text{RPM} \times \text{wings}} \)

Wings = \( \frac{\text{Feed speed}}{\text{RPM} \times \text{chip load}} \)

RPM = \( \frac{\text{Feed speed}}{\text{Wings} \times \text{chip load}} \)

Feed Speed = \( \text{RPM} \times \text{wings} \times \text{Chip load} \)

Avg. Target CL = .4mm - .8 mm (0.012” - 0.032”)
Excessive heat generated in the cutting process leads to dissipation of the cobalt binder and erosion of the carbide or PCD particles. This mechanical corrosion can be slowed by running the tools as cool as possible; generally fast enough to produce a chip with sufficient mass to absorb the excess heat.
Chip Load

A broad range of chip loads (feed rates) will achieve an acceptable edge finish.

Typical ranges are from .002" to over .030"
Tool Safety
Safe Tool Design

- Tool Design is based on machine constraints and desired output
- Collision diameter and spindle weight constraints are paramount
- Tool designs must be tested and approved, using approved components
- All tools must be marked with max RPM rating
- Closed body design and reduces likelihood of injury
- Tools should be designed around feed/speed and target chip-load requirements
- Tight tolerances result in optimal finish quality and service life
- Tools must be dynamically balanced
Service Life

- Inspect tools frequently for signs of dullness and wear
- Monitor work-piece quality, but understand that tools will oftentimes cut well until they fail
- The dulling process results in dramatically increased cutting pressure, which can lead to catastrophic tool failure
- Sharpening tools more frequently will greatly enhance tool service life and value
- Properly sharpened tooling should run virtually as long as the new tool
Leitz Technology
ThermoGrip

Design:

• Balanced design for RPM up to n 36000 min⁻¹

• Highest rigidity of any tool clamping systems

• Optimized concentricity and rigidity yields improved tool life, cut quality and optimal feed rates

• Zero maintenance and unlimited service life
Optimal Results

Trespa

Acrylcs
Fibercut – Fiber composites

*Carbon composites – CFRP*
Fibercut – Fiber composites

*Fiberglass – GFRP*
Fibercut – Fiber composites

Aramid fiber - AFRP
Dust Flow Control

Z2+2 PCD router
1,500 IPM @ 24,000 RPM
Without Turbine
Dust Flow Control

Leitz Z2 PCD Router
1,500 IPM @ 24,000 RPM
With Turbine

Lack of suction at edge of board

parts in place - using turbine cutter

spoil board with parts removed - using turbine cutter to assist in dust removal

ThermoGrip

Turbine

Lack of suction at edge of board
# ThermoGrip Savings

## Annualized CNC Machining Costs

<table>
<thead>
<tr>
<th></th>
<th>Collet/Hydro Chucks</th>
<th>ThermoGrip</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Qty</strong></td>
<td><strong>Cost</strong></td>
<td><strong>Total</strong></td>
</tr>
<tr>
<td>Hourly CNC operating cost</td>
<td>$60</td>
<td></td>
</tr>
<tr>
<td>CNC utilization (hours per week)</td>
<td>35</td>
<td>$105,000</td>
</tr>
<tr>
<td>Total number of CNC Routers</td>
<td>1</td>
<td>$95,455</td>
</tr>
</tbody>
</table>

**Thermogrip Improvements**
- Machine feed speed increase: 10%
- Tool life increase: 25%

**Annual tooling spend per CNC**
- New collet chucks: 6 / $250 = $1,500
- New Hydro chucks: 2 / $600 = $1,200
- New collets: 25 / $30 = $750
- New carbide routers: 120 / $60 = $7,200
- New PCD routers: 3 / $250 = $750
- Tool change & set-up time (min.): 10 / $10.00 = $4,860
- Carbide & PCD service costs: 75% / $5,963 = $4,472
  - Tooling cost per CNC: $22,223
  - Total tooling costs: $22,223

**Total CNC Operating costs**
- $127,223
- $111,678

**ThermoGrip Savings**
- $15,545
Induction Heaters

**ISG 2200** – Base machine for solid carbide tools $7,500
- solid carbide tools up to 3/4" diameter.
- Programmable Heat cycle
- Air cooled or manually cool in separate coolant tank.

**ISG 3400** - Base machine for HSS and carbide tools $14,350
- Programmable heat cycle
- Profile tool shrinking setting possible
- Air cool or manually cool in separate coolant tank

**ISG 3400 TWK** - Water cooled ISG3400 (Manual) $17,550
- Manually operated coolant screen
- Suitable for carbide or steel shank tools
- Improved operator safety
World Tungsten & Cobalt Markets
Performance Coatings

- Relatively inexpensive tool coatings can extend the service-life of HSS tooling to nearly that of carbide, and significantly increase the life of carbide tooling.

- The coatings will generally be effective through several service cycles, and oftentimes last throughout the life of the tool.
Advancements in Boring
PCD Nesting Tools

- Small diameter Z2+2 & Z3+3
- Highest efficiency and productivity
- Lower inventory and service costs
- Lowest manufacturing costs
- Highest overall value
Edge Expert Advantages

Edge Expert Tooling

• Knife shear set at ~54°
• Cutting action converted from chiseling to cutting/shearing resulting in greatly reduced cutting pressure
• Reduced cutting pressure protects tool and work-piece
• Optimized cut quality in the most difficult laminates
• Tool life extended 30%-70%
• Greatly enhanced machine and operator productivity due to greatly reduced tool changes
• Edge Expert tools can be sharpened in the USA, sometimes off the cutter-head
ProfilCut Insert Tooling

- Precision knife locating against centrifugal force
- Exceptional cut and fit quality
- Reduced repair, sanding and scrap loss
- Polish ground micro-grain carbide for maximum service life
- Modular body design with shear and compression shear
ProfilCut Q Premium

The new benchmark in safe tool speed 120 M/S = (+50% feed speeds)

Don’t let tooling restrict your machinery,
Turbo-charge your production with Profilcut Q Premium!
ProfilCut Q Premium

- Dual knife location ensures precision positioning in two planes
- Reverse knife seat for optimal positioning under centrifugal forces
- Dual knife seating ensure safe operation at high speeds
- Profiled-safety seated wedge provides optimal knife support
- Standard Marathon coated knives extend service life (+35%)
Industry 4.0 Smart Manufacturing
Network Ready Tooling
Smart Tooling

• Tool information uploaded from chip
  – Diameter, length, rotation, feed speed, service data
• Tool position recognized in ATC
• Eliminated risk of manual input error
• Precise dimension parts without set-up scrap loss
• Improved machine throughput
Summary

In order to survive and prosper in an increasingly competitive global economy, we must:

• Continually investigate and implement new process technologies.
• Understand that relatively small improvements can have significant financial impact over the long-term.
• Recognize that optimized efficiency is always a moving target.
• Always look beyond initial costs and implement technology based on operational savings.
• Never become complacent.

Technologies ➔ Efficiency ➔ Profitability
Contact Leitz

US Headquarters
4301 East Paris Ave SE
Grand Rapids MI 49512
p. 800.253.6070

North Carolina
401 Interstate Dr.
Archdale, NC 27263
p. 800.860.8848

Texas
2721 Market St
Garland, TX 75041
p. 214.703.9314

California
1145 East Orange Show Rd.
Units E & F
San Bernardino, CA 92408
p. 800.548.1535

Washington
8607 South 212th St.
Kent, WA 98031
p. 253.395.1012

Nevada
155 Glendale Ave.
Sparks, NV 89431
p. 800.548.1535