Deburring and chamfering machine
LD 180/280 C
The ChamferCut technology

This is the chamfering process
After chamfering with the patented ChamferCut technology, no additional machining is necessary. There is no need for a second cut, which is often required during the deformation-based deburring process for the removal of build-up material. With the chamfering process, the exact chamfer form is produced. In contrast to deformation-based processes, the material structure is not affected. An optimal starting point is created for the subsequent finishing of hardened gears, particularly gear honing. The quality of such chamfers defines a new standard – with maximum repetitive accuracy.

Advantages of this process
• Very precise chamfer geometry
• Premium chamfer quality and reproducibility
• No bulging or material deformation
• Standard tooth-root chamfering
• Established process in gear production
• Very long tool life
• ChamferCut tools can be re-sharpened approx. 20 times easily and cost-effectively
• Lower tool costs compared to alternative processes
• Short amortization period due to low tool costs
• Applications for gears with module 0.8 – 42 mm
• 2nd cut not needed for gear hobbing – longer tool life for the hobbing tool
• Short setup times

Profitability analysis

Workpiece (chamfering)
<table>
<thead>
<tr>
<th>Workpiece</th>
<th>speed gear</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module</td>
<td>2.7 mm</td>
</tr>
<tr>
<td>Number of teeth</td>
<td>41</td>
</tr>
<tr>
<td>Helix angle</td>
<td>24.5°</td>
</tr>
</tbody>
</table>

Press chamfering (with burnishing)

<table>
<thead>
<tr>
<th>Press chamfering tool</th>
<th>€ 4,700</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of re-sharpenings</td>
<td>1</td>
</tr>
<tr>
<td>Total workpieces</td>
<td>95,445</td>
</tr>
<tr>
<td>Tool costs/workpiece</td>
<td>6.7 cents</td>
</tr>
</tbody>
</table>

ChamferCut

<table>
<thead>
<tr>
<th>Chamfer cutter (set)</th>
<th>€ 3,600</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of re-sharpenings</td>
<td>23</td>
</tr>
<tr>
<td>Total workpieces</td>
<td>468,293</td>
</tr>
<tr>
<td>Tool costs/workpiece</td>
<td>1.5 cents</td>
</tr>
</tbody>
</table>

23,400 €
Savings per year
(with 450,000 units)

Press chamfering (with burnishing) → ChamferCut
Precise, compact and cost-effective

Why chamfering gears?
Chamfered edges of gears prevent damage during workpiece transport, heat treatment cracks and gear wear. They facilitate the assembly process and improve the tool life. Chamfering with ChamferCut delivers a high-quality chamfer with repetitive accuracy – and is more cost-effective compared to press deburring and deburring with end mills. Chamfering is very popular among car and commercial vehicle manufacturers, as well as in gear and engine manufacturing. The process can also be integrated into existing production systems.

Machine concept
The LD 180/280 C is the most powerful and most compact stand-alone chamfering machine on the market. Workpieces with a diameter of up to 280 mm and up to module 6 mm can be chamfered down to the tooth root easily and with precision. The machine is very easy to operate, and first centring is automatic.
For increased ergonomic and simplified set-up, it is possible to swivel the chamfer hob head by 90 degrees so that the tool can be easily inserted from either operator side.

Technical data

<table>
<thead>
<tr>
<th></th>
<th>LD 180 C</th>
<th>LD 280 C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min. workpiece</td>
<td>mm</td>
<td>15</td>
</tr>
<tr>
<td>Max. workpiece</td>
<td>mm</td>
<td>180</td>
</tr>
<tr>
<td>Max. workpiece weight</td>
<td>kg</td>
<td>8</td>
</tr>
<tr>
<td>Min. module</td>
<td>mm</td>
<td>0.8</td>
</tr>
<tr>
<td>Max. module</td>
<td>mm</td>
<td>4.5 (6)</td>
</tr>
<tr>
<td>Min./max. tool</td>
<td>mm</td>
<td>30/130</td>
</tr>
<tr>
<td>Dimensions* (L x W x H)</td>
<td>mm</td>
<td>1.730 x 1.300 x 2.454</td>
</tr>
</tbody>
</table>

*Compact design: 2.25 m² of floor space
If space a constrain, the control cabinet can also be set up separately.

Video:
Deburring with ChamferCut
https://go.liebherr.com/mFEftB
The LD 180/280 C is available in two different versions. In the first version, without internal lift/tilt loader, the workpieces are loaded directly onto the machine table. Loading is possible manually or using a robot. The integrated lift/tilt loader allows for removing workpieces from various transfer positions. External transfer positions can be, for example, various conveyor systems. All drives of the lift/tilt loader are equipped with NC drives. There for set-up and difficult adjustments are reduced to a minimum.

**Optional:**
- Dry and wet machining
- Left/right-handed operation
- Counter column
- Chip conveyor
- Centrifugal function using the machine table
- Additional stationary sensor for meshing

X1: Radial movement of machining head
Z1: Swivel movement of tool
Y1: Tangential tool movement
A1: Swivel axis of machining head
B1: Rotary movement of tool
C2: Rotary movement of workpiece
Z4: Vertical movement of counter column
Z6: Vertical movement of lift/tilt loader
C3: Rotary movement of lift/tilt loader
X8: Radial movement of lift/tilt loader
1. Insert the workpiece, tool and clamping data or load the set-up data sheets automatically

2. Insert the meshing disc into the tool interface of the ChamferCut hob head

3. Select the teach-in cycle for determining the workpiece-specific gap position. Automatic positional orientation detection by the machine

4. Change over to new ChamferCut tool in an ergonomic position and acknowledge. Start automatic cycle. Enter correction values for optimizing the chamfer using the CNC controls system.

**Options for automation**

**LD 180/280 C with robot loading**
Using a robot, workpieces can be loaded directly onto the table through to a fast lifting door. The solution can be implemented very easily, e.g. in cell concepts.

**LD 180/280 C with plastic chain conveyor**
The LD 180/280 C can also be combined with various conveyor designs. The integrated lift/tilt loader allows for removing workpieces from various belt heights. This flexibility makes it possible to integrate the LD 180 C/280 C into existing manufacturing systems quickly and easily.

**LD 180/280 C with palletizing cells (LPC)**
The LD 180/280 C can also be combined with a palletizing cell. Thanks to this solution, the combination is a perfect fit for a manufacturing concept with basket logistics.

**LD 180/280 C with adaptable swivel loader**
The swivel loader (SSL) is designed for optimum productivity and large batch sizes. The SSL ensures fast and safe loading and unloading of workpieces and additionally provides the best possible gripping of the workpiece. The SSL is typically used for workpieces with short cycle times.
Interruction into existing production concepts

**Option: cellular manufacturing**
Cellular manufacturing in combination with a gear hobbing machine, a workpiece infeed and outfeed and a robot for handling workpieces.

**Option: production line**
The LD 180 C can be installed downstream of the gear hobbing machine. This allows for chamfering workpieces economically and with precision.
The Liebherr solution:
Simultaneous chamfering

Chamfering made easy:
- User-friendly software
- Simple adjustment of corrections via CNC axes
- Simple corrections at varying flank modifications
- Dry and wet machining possible
- Automatic loading with flexible loader principle (robot loading also possible)
- Flexible automation, e.g. via plastic chain conveyor, palletizing cell

Gear hobbing machine LC 180 DC / LC 280 DC
The established LC 180 DC / LC 280 DC with integrated ChamferCut unit is a very compact gear hobbing machine. This integrated automation solution enables hobbing and chamfering of workpieces with a maximum diameter of 180/280 mm and a module of 5 mm during the machining process.

Gear hobbing machine LC 300 DC
With the LC 300 DC gear hobbing machine, workpieces with a maximum diameter of 300 mm can be produced very economically, with good gear quality and precise chamfer quality. Workpieces up to module 6.5 mm can be hobbed and simultaneously chamfered.

Chamfering machines LD 180 C and LD 280 C
The LD 180 C and LD 280 C are compact stand-alone machines whose main task is the chamfering of gears. They can be integrated easily, quickly and cost-effectively into all existing manufacturing lines.

Chamfering in the working area
The classic ChamferCut process with the chamfer cutters on the hob arbor can be retrofitted on all existing Liebherr gear hobbing machines with the Siemens 840 D generation of control systems and higher.