Chamfering and Deburring Machine

LD 180/280 C smallest solution in the market

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Liebherr-Verzahntechnik GmbH

LD 180/280 C Chamfer Cut

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LD 180/280 C Chamfer Cut

LD 180/280 C Chamfer Cut

Standalone machine for high chamfer quality, and for integration in existing manufacturing systems

Workpiece: Max. Ø 280 mm
Module: 5 mm (opt. 6)

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Advantages of LD 180/280 C Chamfer Cut

- Smallest footprint in the market
- Suitable for integration in existing manufacturing plants
- Optimized workpiece clamping
- Fast Set-up
- Dry machining
- Hydraulic free machine

- Simple adjustment of corrections via CNC axes
- Simple corrections at varying flank modifications
- Chamfering possible on both sides

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Technical specifications LD 180/280 C Chamfer Cut

Specification	LD180 C	LD 280 C
min. workpiece diameter	ø 15mm	ø 15mm
max. workpiece diameter	ø 180mm	ø 280mm
max. workpiece weight	8 kg	15 kg
min. module	0,8mm	0,8mm
max. module	5 mm (6 Option)	5 mm (6 Option)
cycle time (gear-related)	< 12s	*reduced rotation speed
tool diameter min. / max.	Ø30mm / ø130mm	Ø30mm / ø130mm

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LD 180 / 280 C

LD 180 / 280 C with plastic chain conveyor

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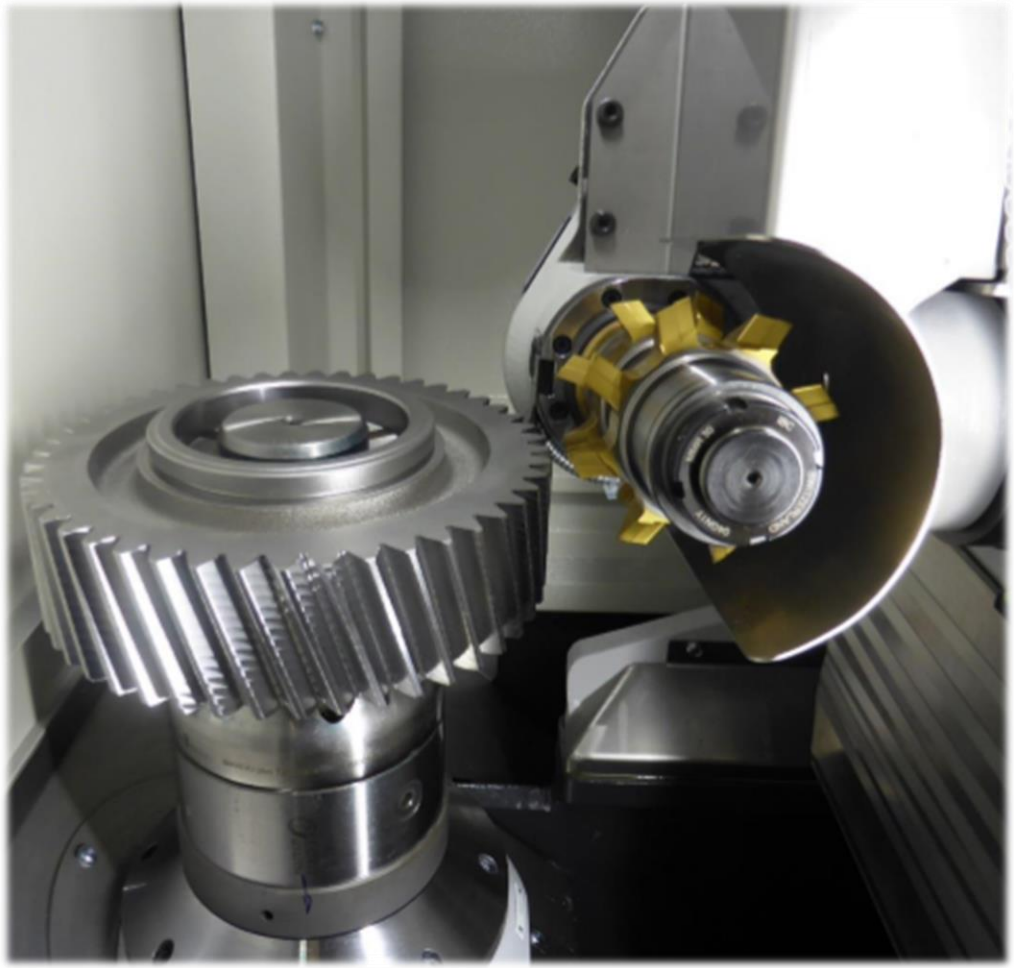
LD 180 / 280 C – Highlights for operating

Ergonomic tool change

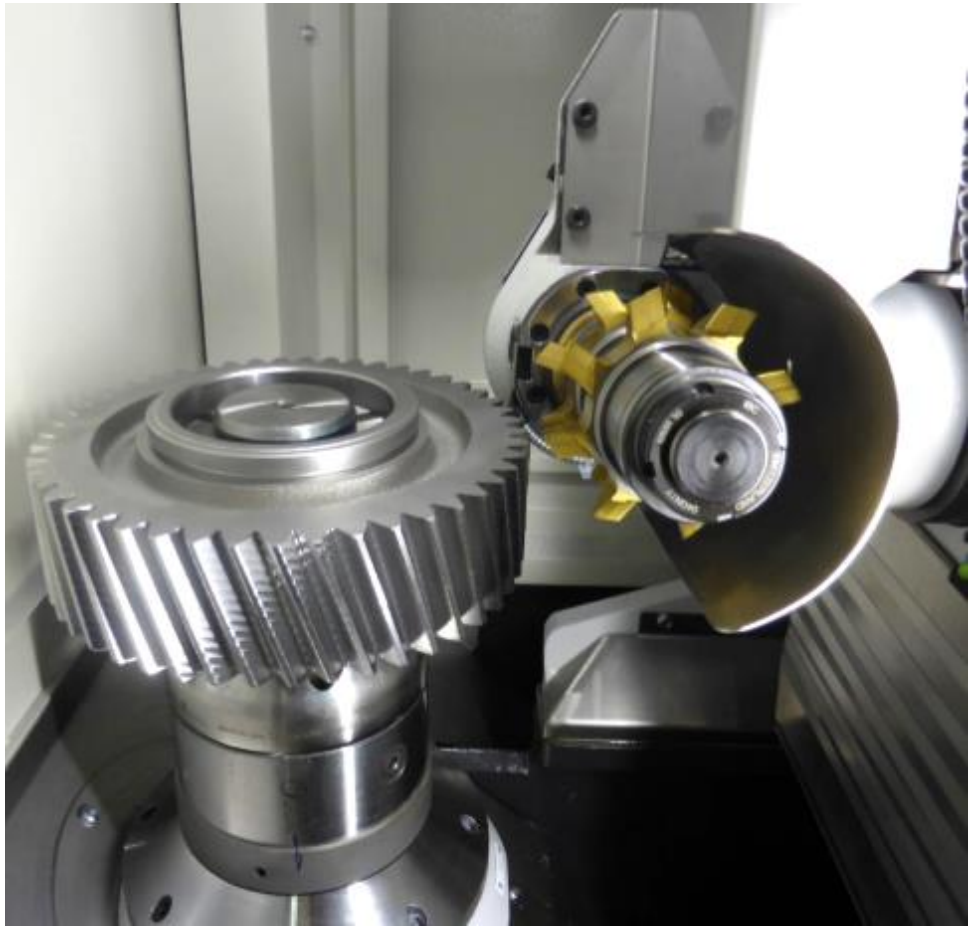
LD 180 / 280 is designed for ergonomic operation

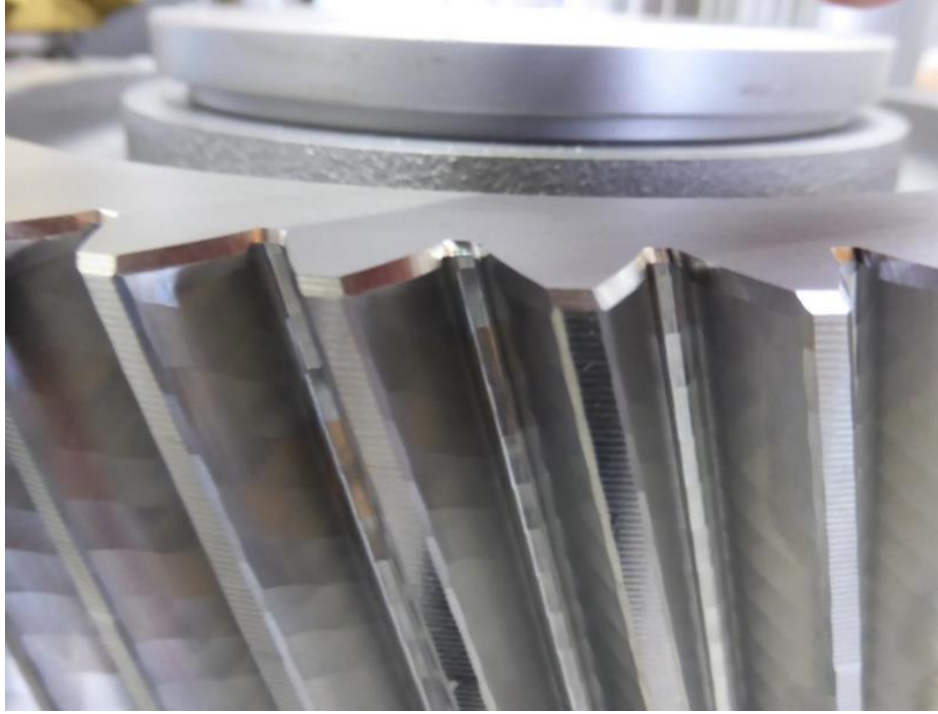
– The chamfer cut head can be swiveled to the 90° position (see besides picture)
– Therefore, the Chamfer cut tool can be easily set-up in an operator-friendly position
– Shortest distance from the operator door to the Chamfer Cut head (one arm length)
– Good access to the machine table, to exchange the clamping fixture

Application Examples

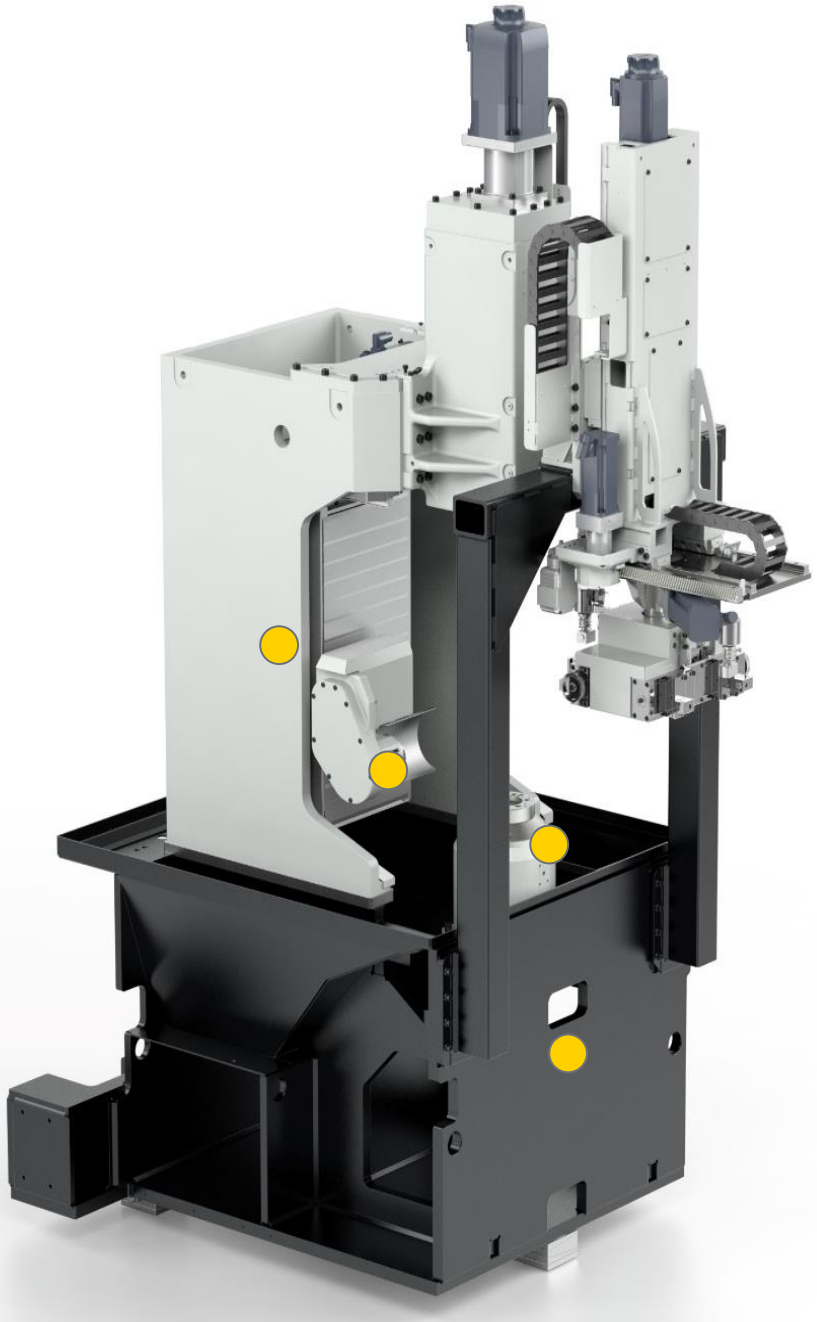


Application Examples





LD 180/280 C provided for EATON - confidential use



LD 180/280 C Chamfer Cut Machine Design

– extremely precise chamfer geometry, no bulging's, ideal for honing
– root chamfering easily possible (standard)
– Good maintenance access
– setup via CNC-axes, easy changeover

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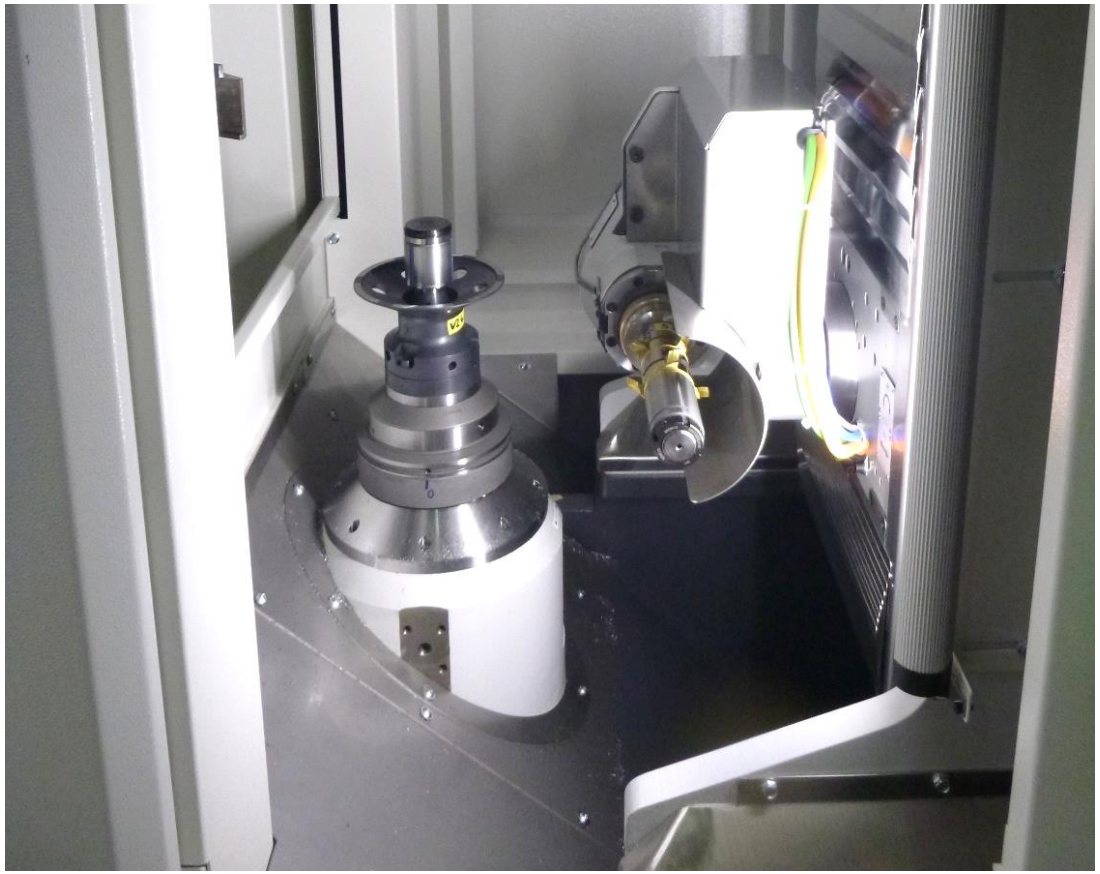
Advantages of LD 180/280 C – ChamferCut



Perfect chip removal concept

Available with chip conveyor

Technology

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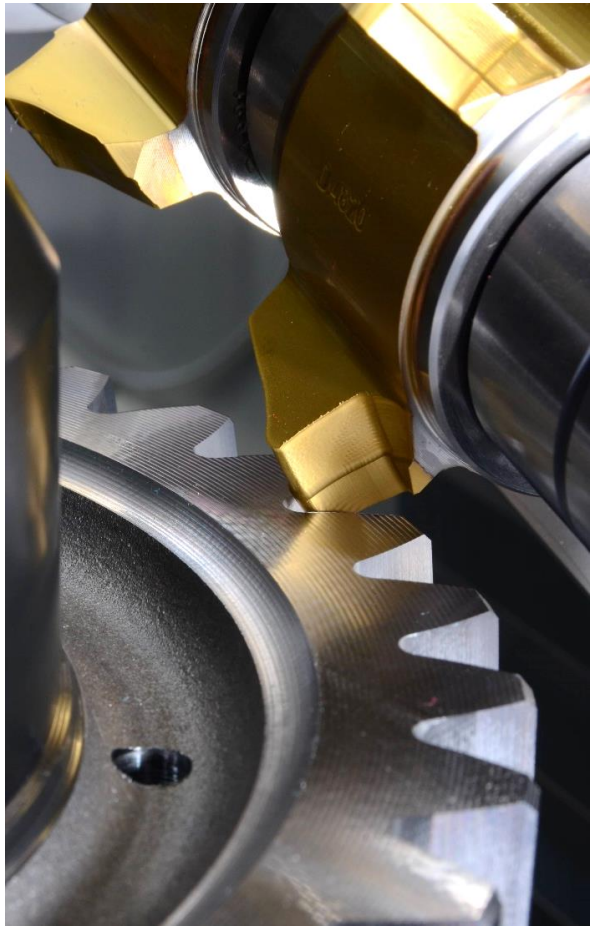
Chamfer Technologies on the LD 180/280 C



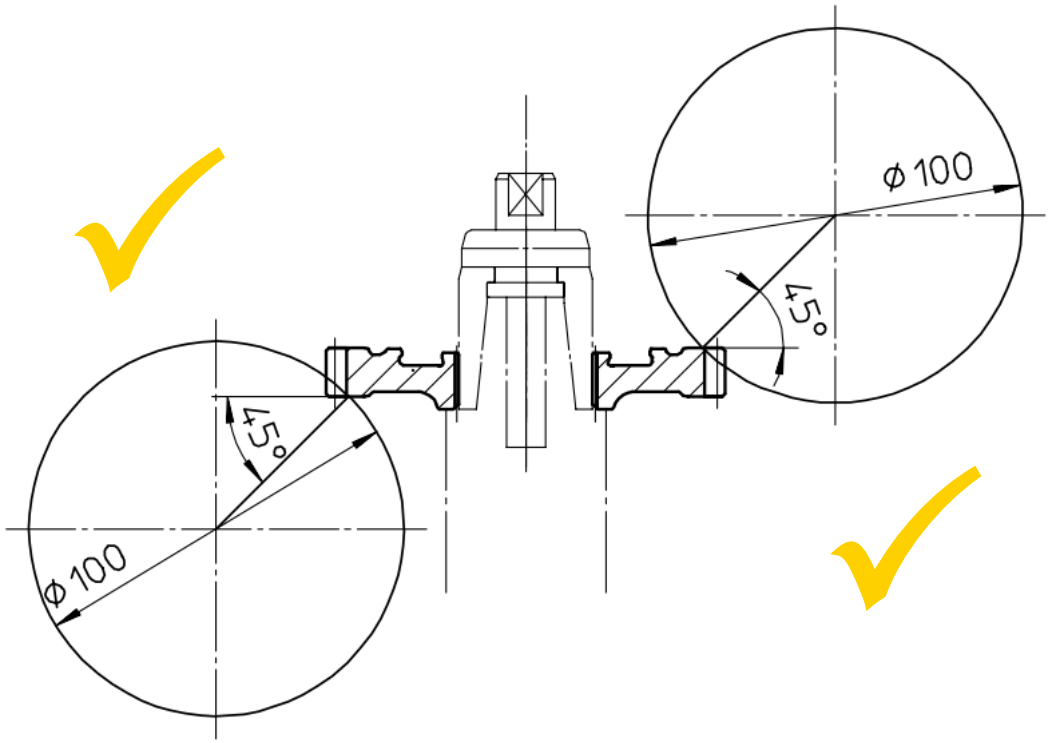
ChamferCut

ChamferCut - CG

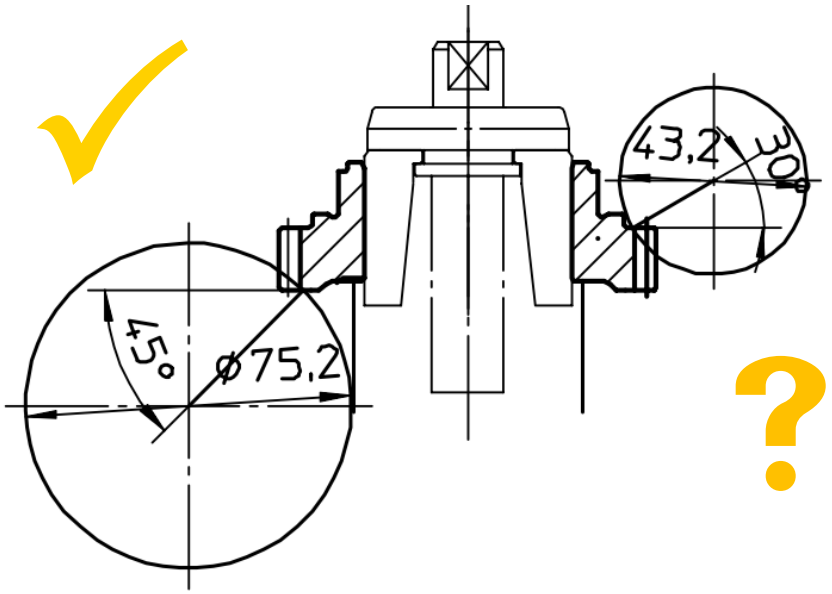
FlexChamfer

ChamferCut: Impact of the part geometry

ideal geometry for ChamferCut



critical geometry due to interference



parts are critical, if there is a interference contour near the root diameter

ChamferCut Chamfering despite Interference Contours

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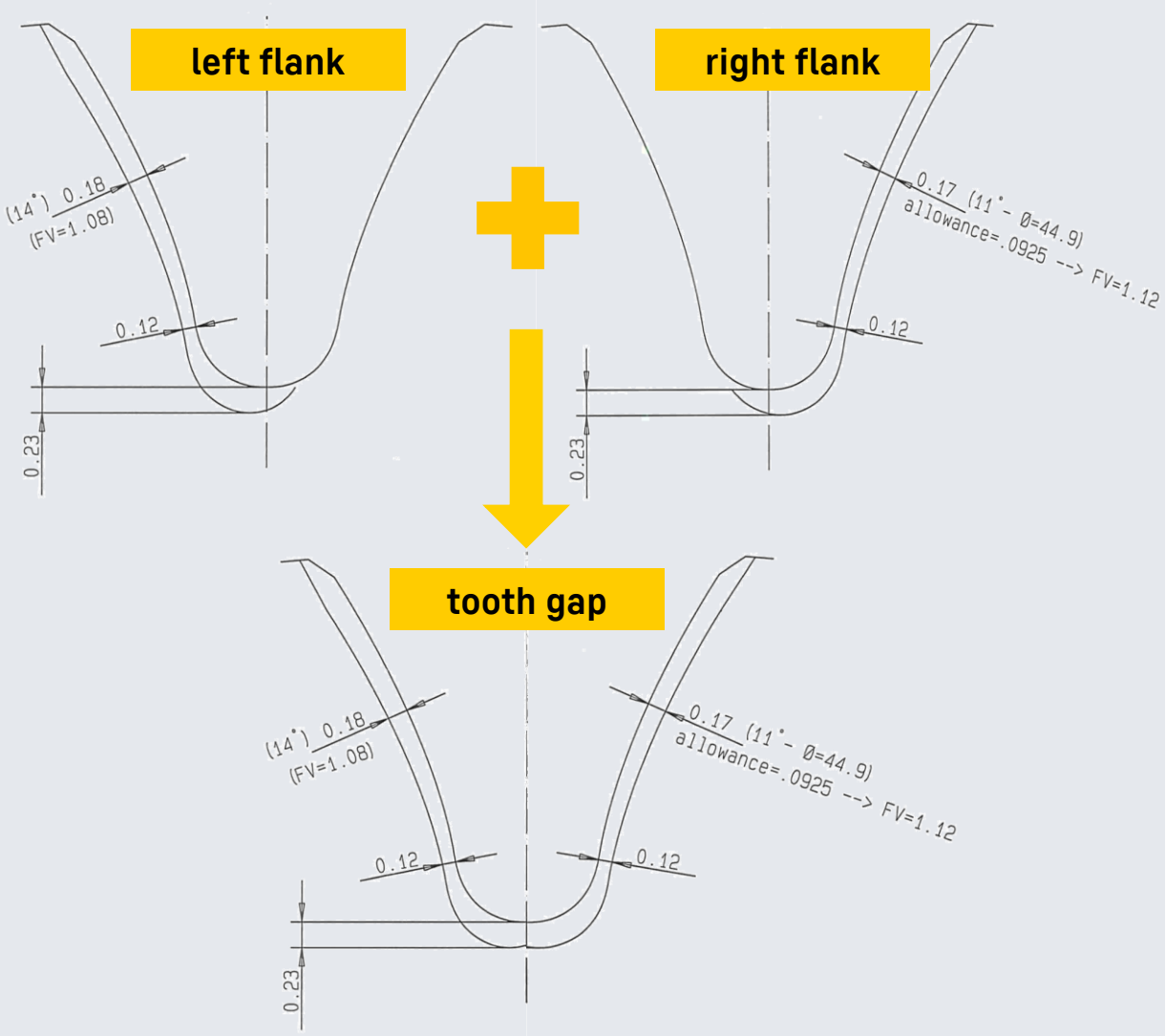
ChamferCut

ChamferCut 2018 – A new approach



- separate chamfering of left and right flank
- creation of the chamfer angle by swivelling off the vertical
- almost the same centre distance as in hobbing
- chamfering despite interference possible
  - wider applicability of the process
  - more degress of freedom for the chamfer design

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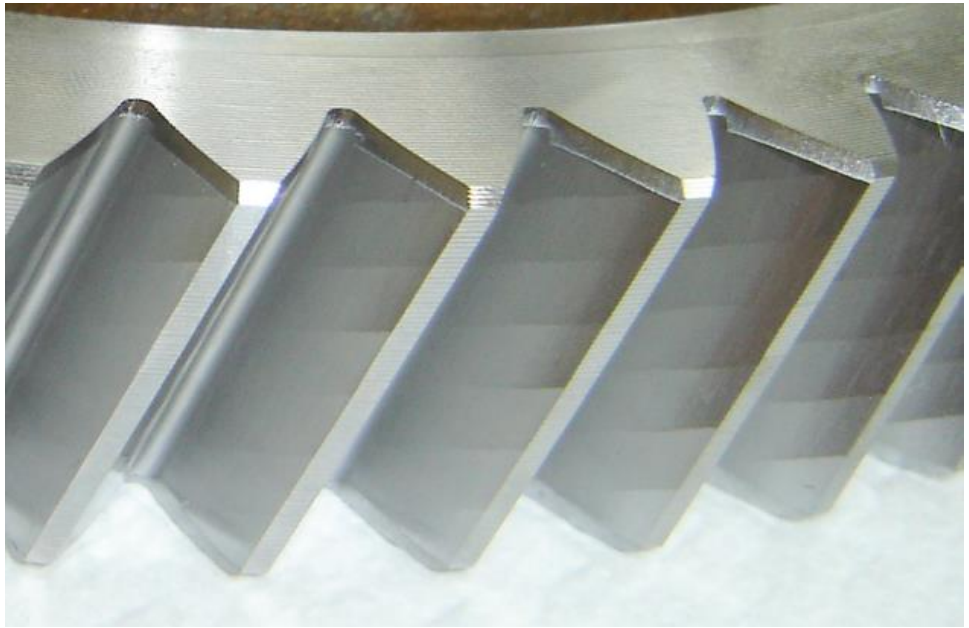
Chamfering Quality and Chips

Chamfer formation

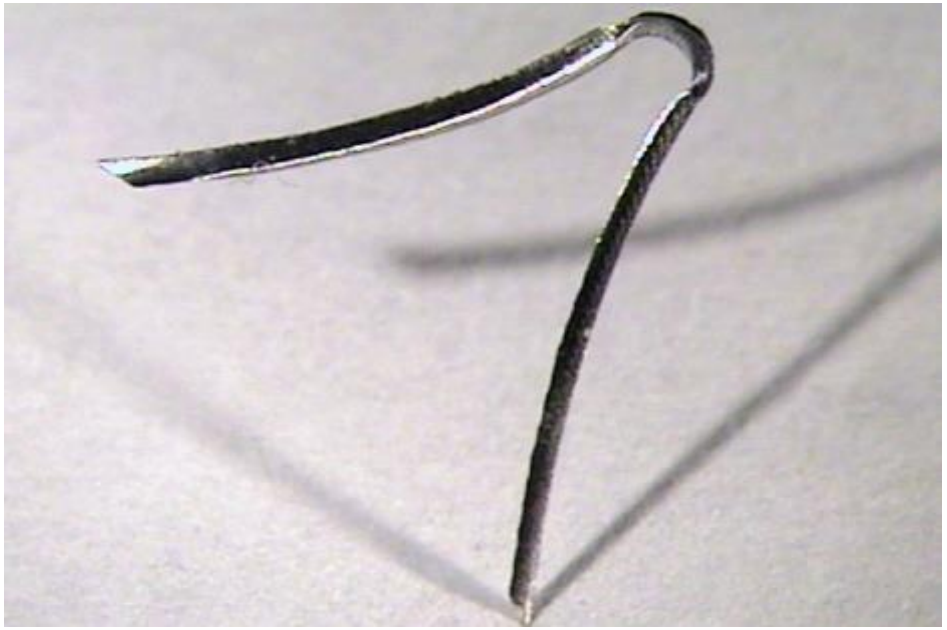
A homogeneous chamfer along the whole contour of the gap is created. The chamfering of the tooth root is also easily possible.



Chip of the ChamferCut

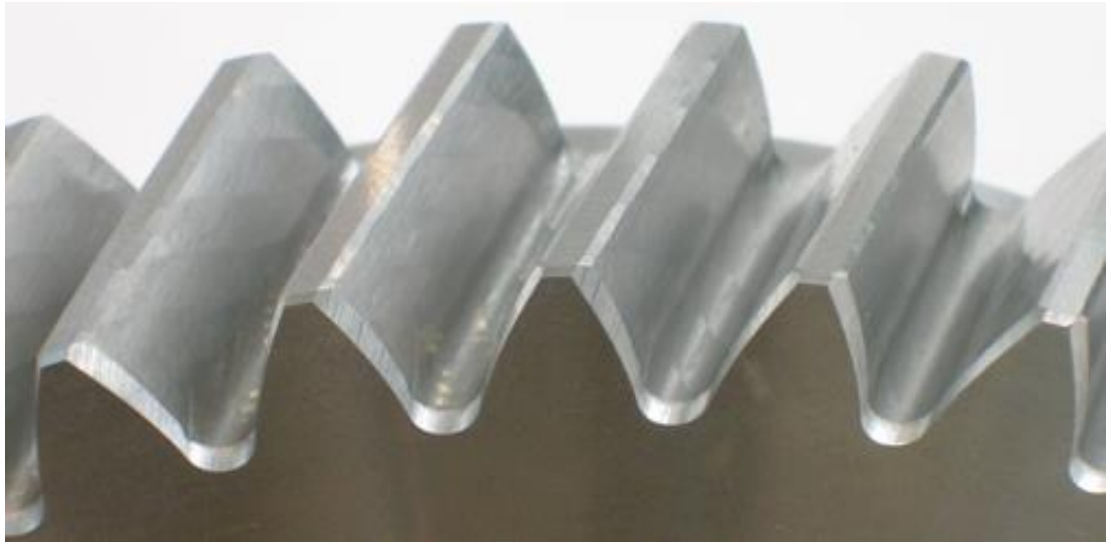
The whole contour is created in a single cut.

There are no generating flats.

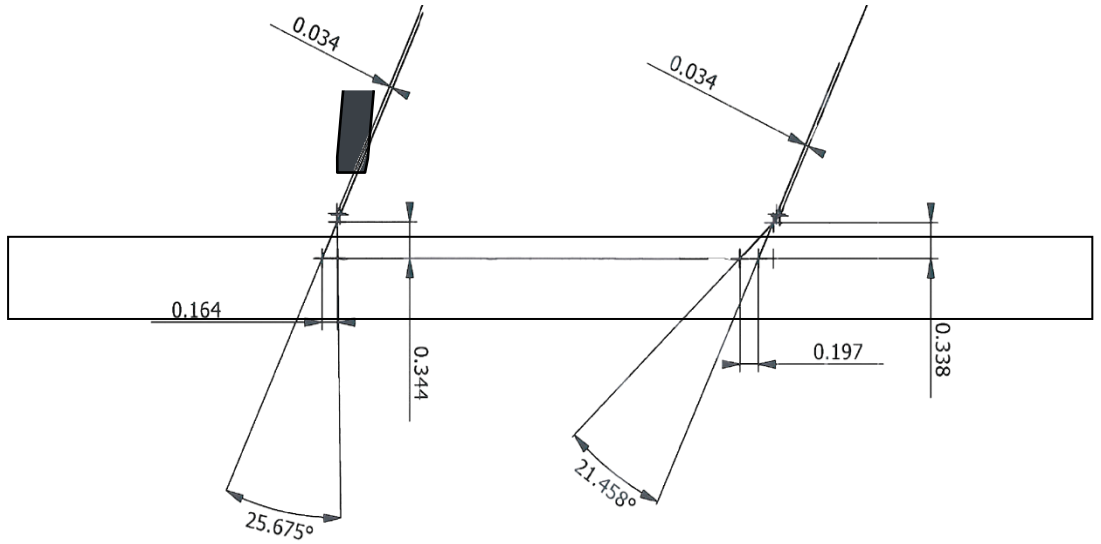


Chamfer Formation

chamfer form



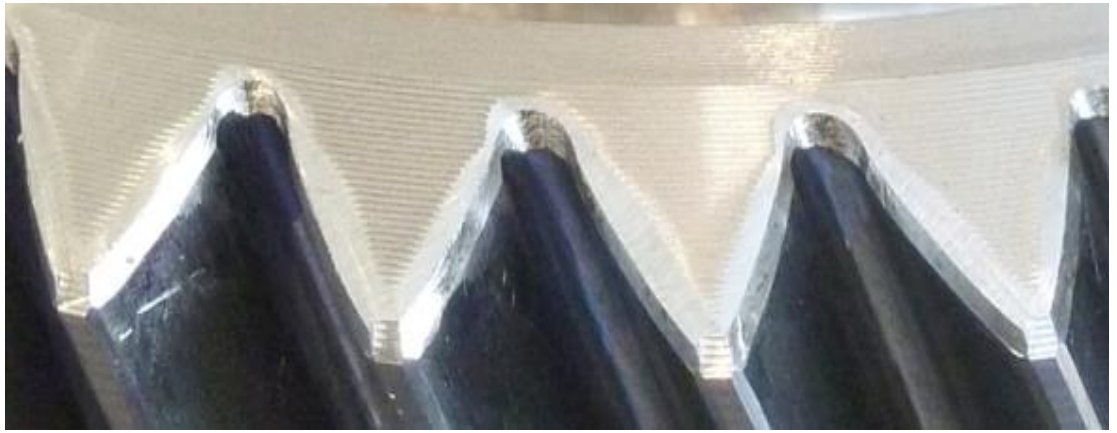
chamfer size



Chamfering Quality (Process Comparison)

ChamferCut

press deburring



Application example

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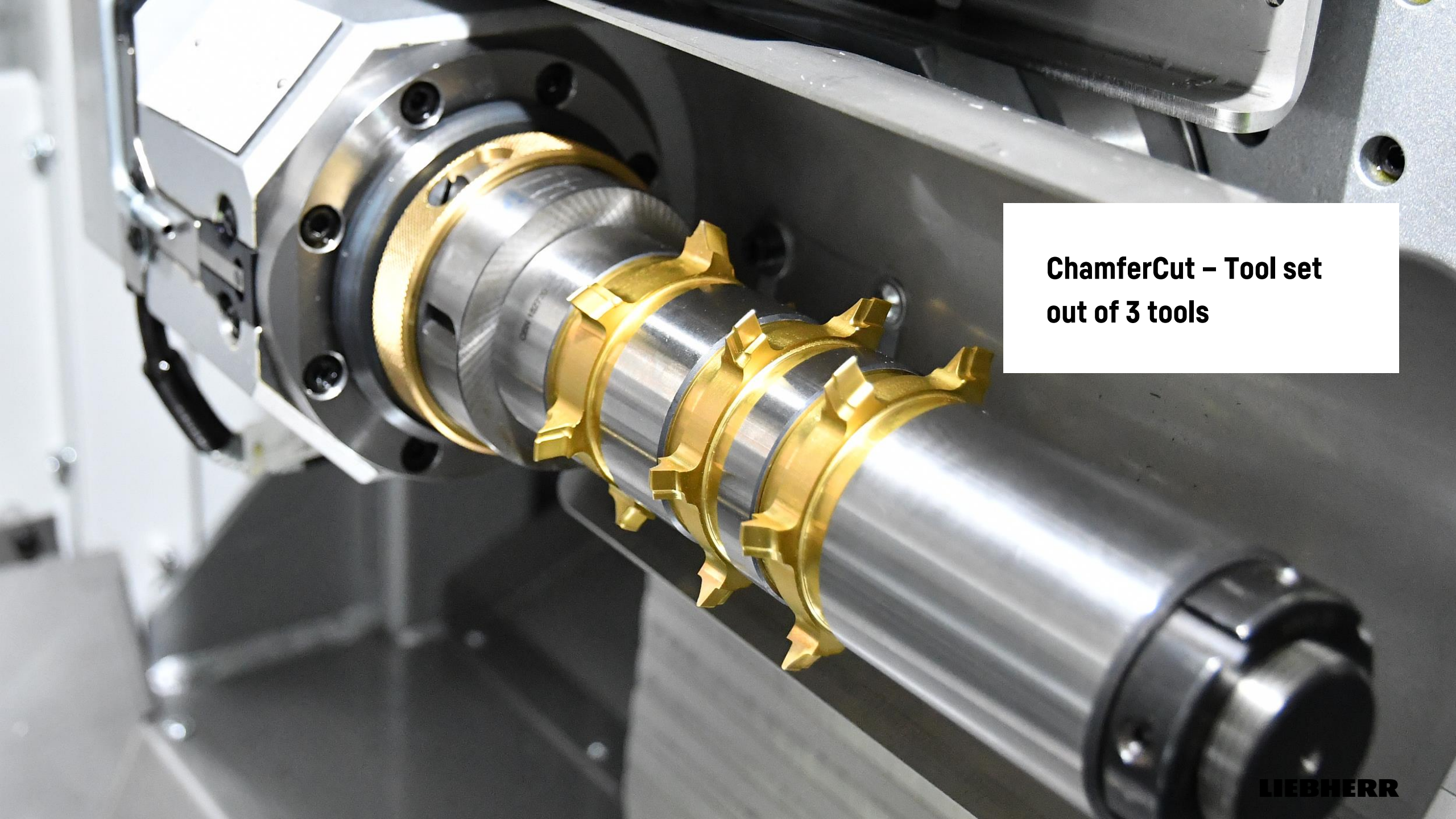
ChamferCut – Tool set
out of 3 tools
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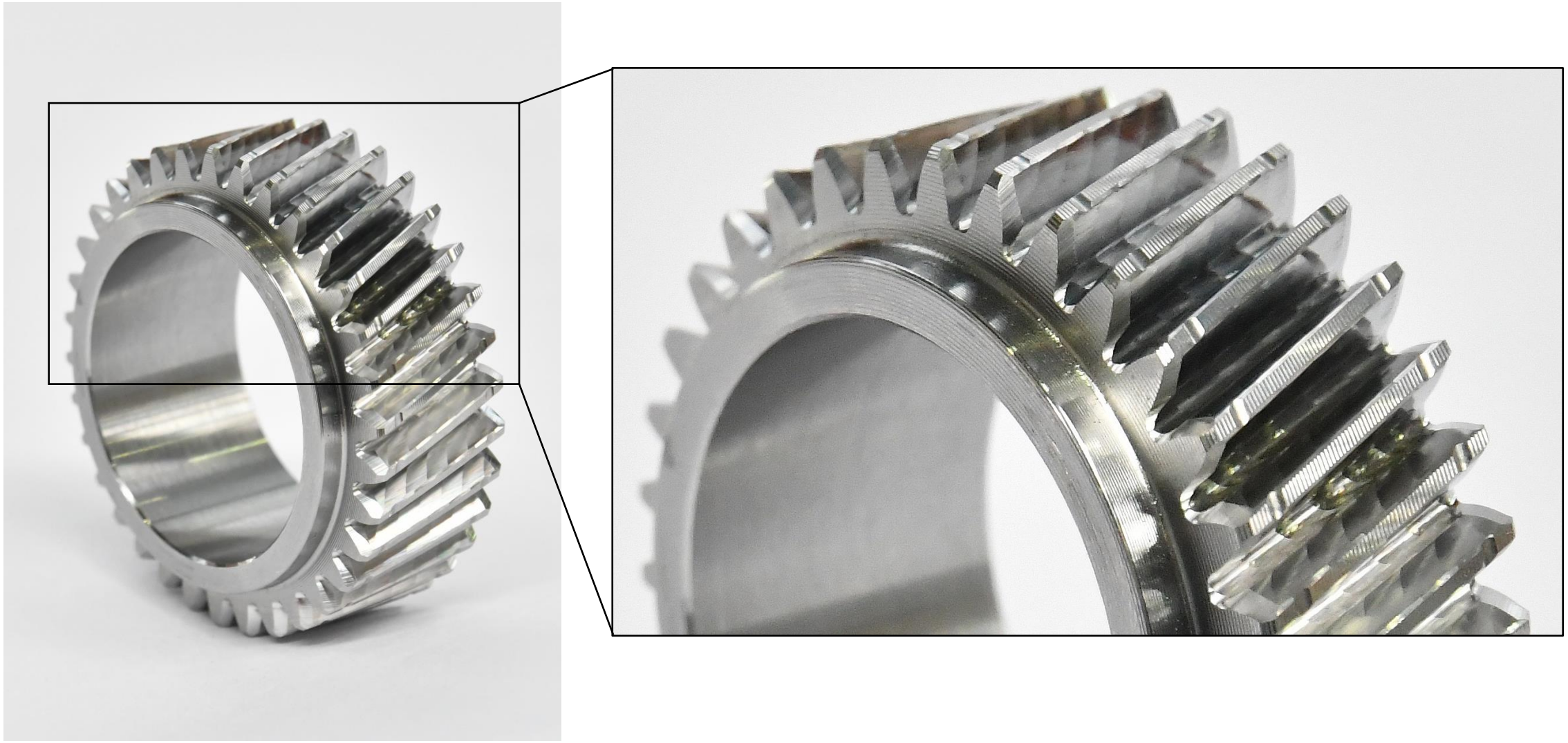
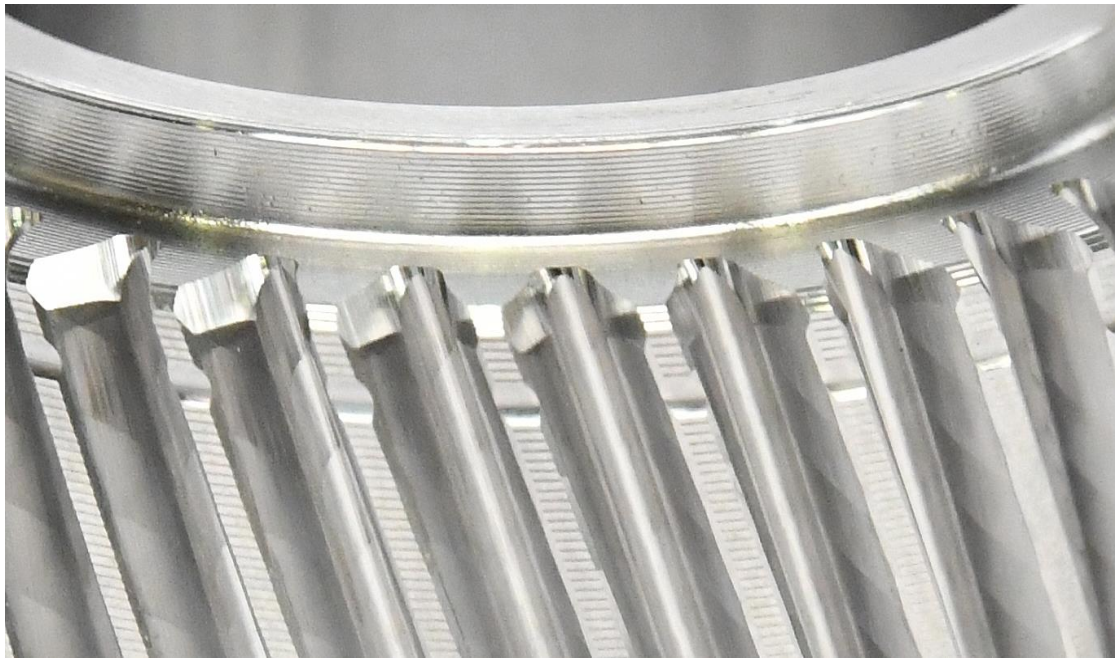
Chamfer formation (form)

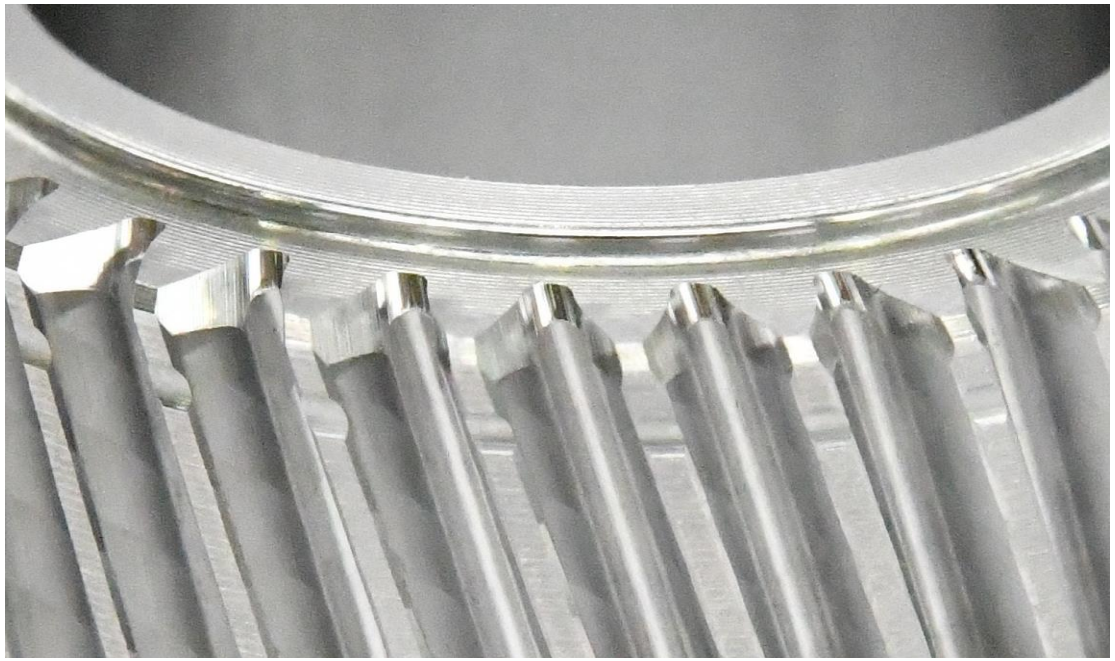


Chamfer formation (form)

Top (high interference)

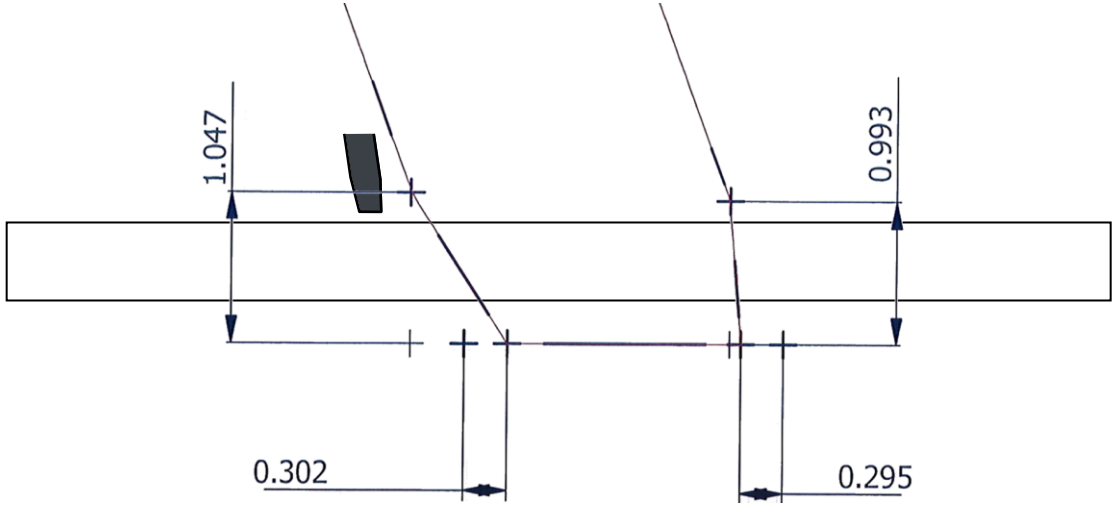


Bottom (low interference)

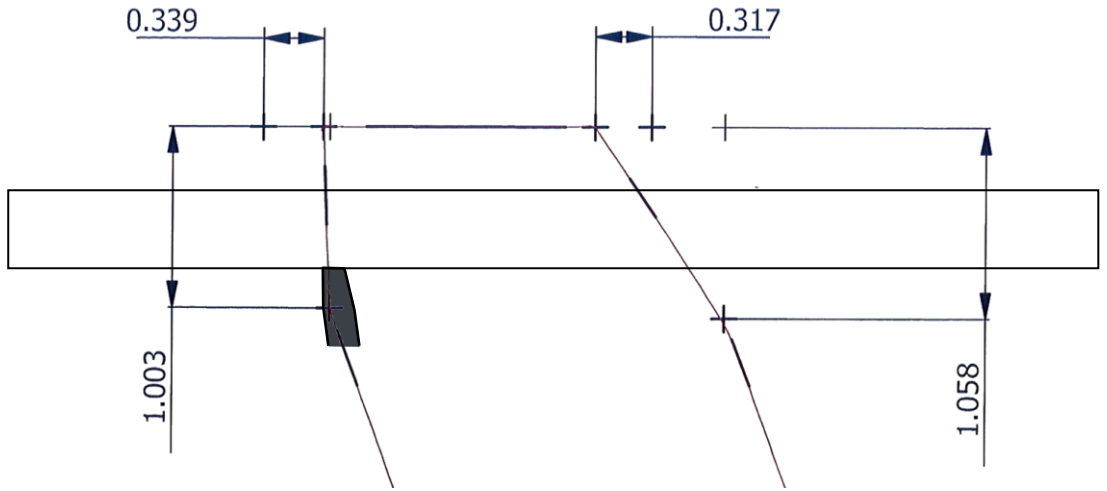


Chamfer formation (size)

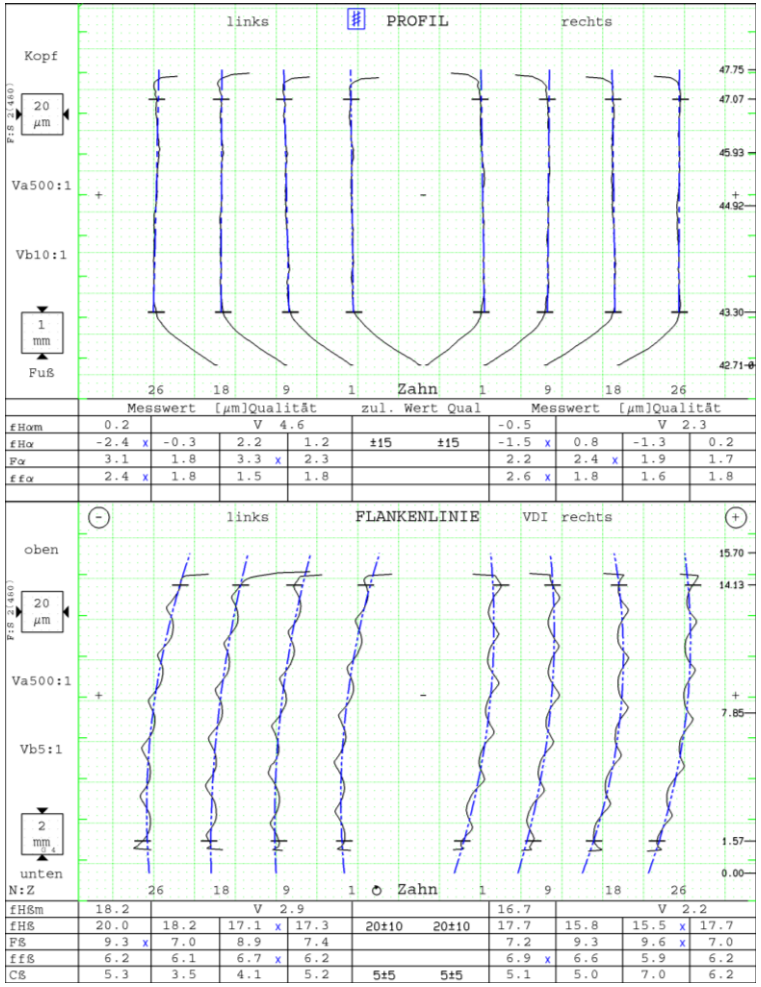
Top (high interference)

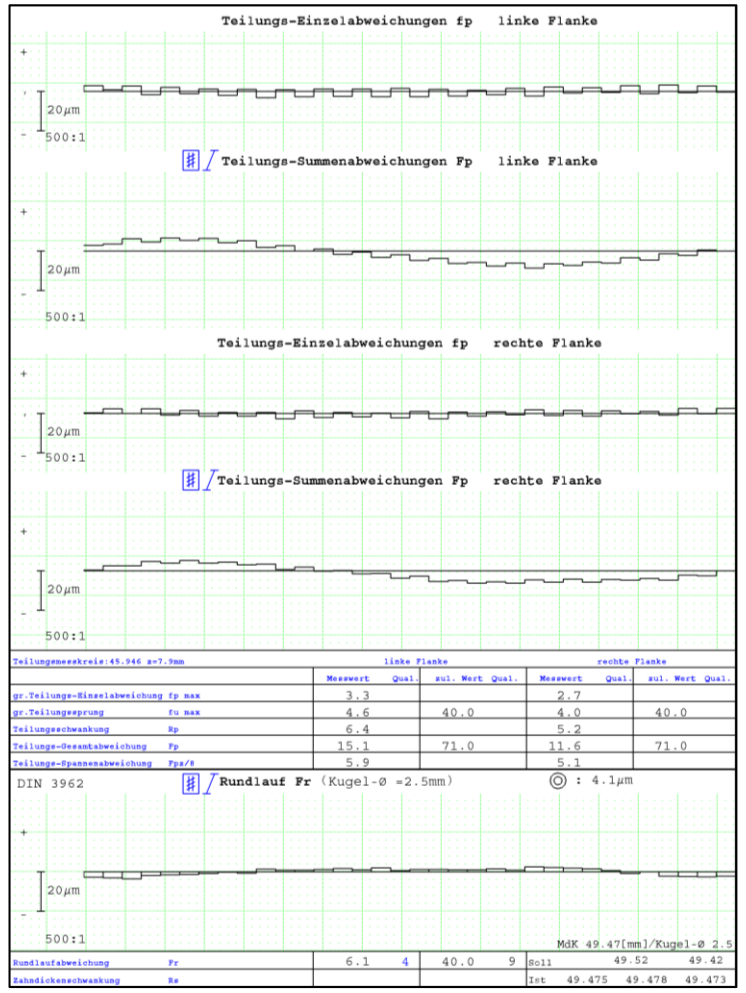


Bottom (low interference)

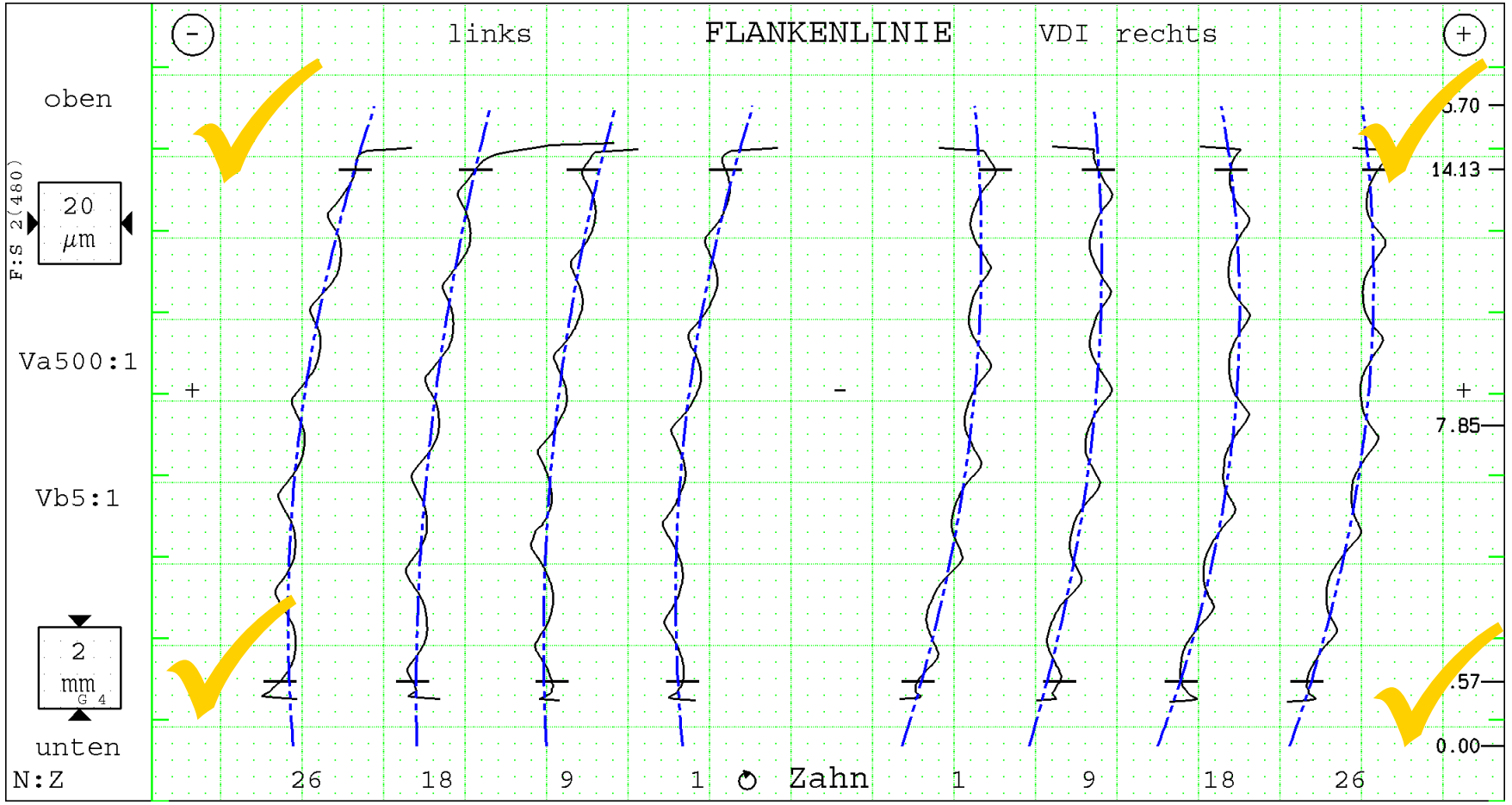


Gear quality





ChamferCut: Chamfering without deformations



due to the cutting principle, there are no bulgings in the lead or deformations on the part

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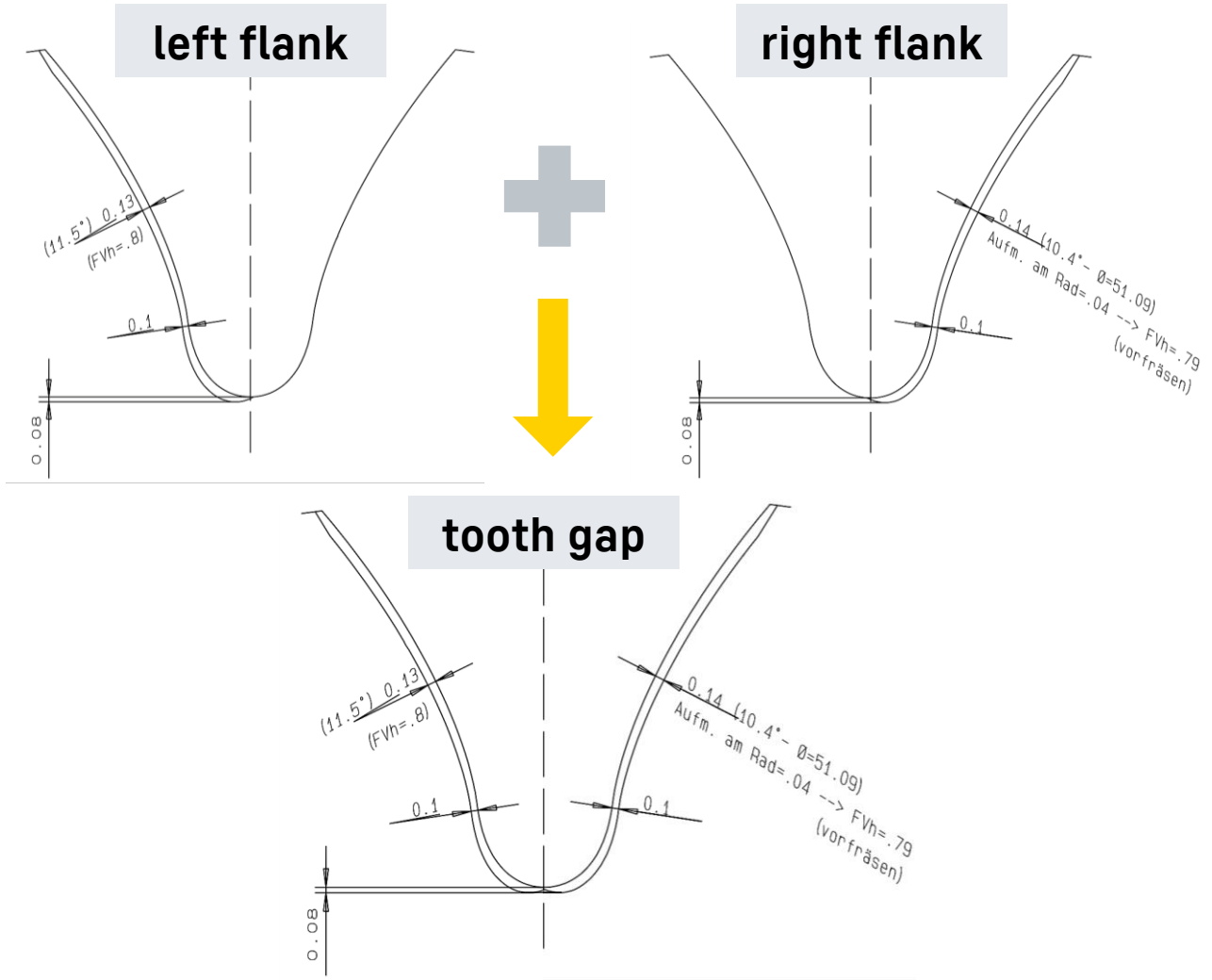
Application example – Shaft

ChamferCut CG – A new approach (2018)



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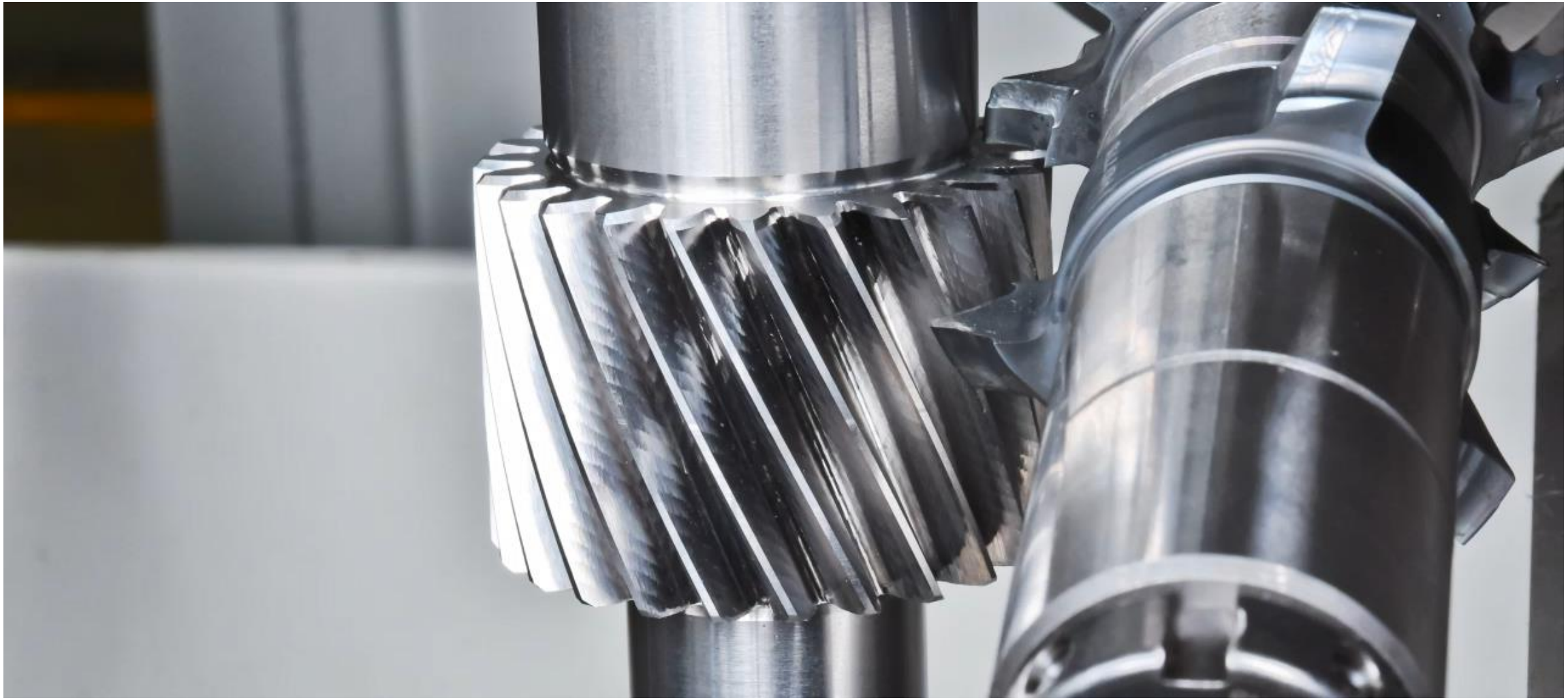
ChamferCut CG – Chamfering of Shafts



ChamferCut CG – Application Examples

Speed Gear (Car)

Shaft (Truck)

Reference parts for all typical applications and high volume manufacturers

ChamferCut CG – Chamfering despite interference contours

- new approach for chamfering with the ChamferCut principle despite interference contours
- one chamfering tool per each flank
- up to 4 tools on the arbor are possible
- wider applicability of the process
- just minimal longer chamfering times in the range of a few seconds
- very precise setup of the chamfers via CNC corrections

What about volumes?

And what if my batch sizes do not allow part specific chamfering tools?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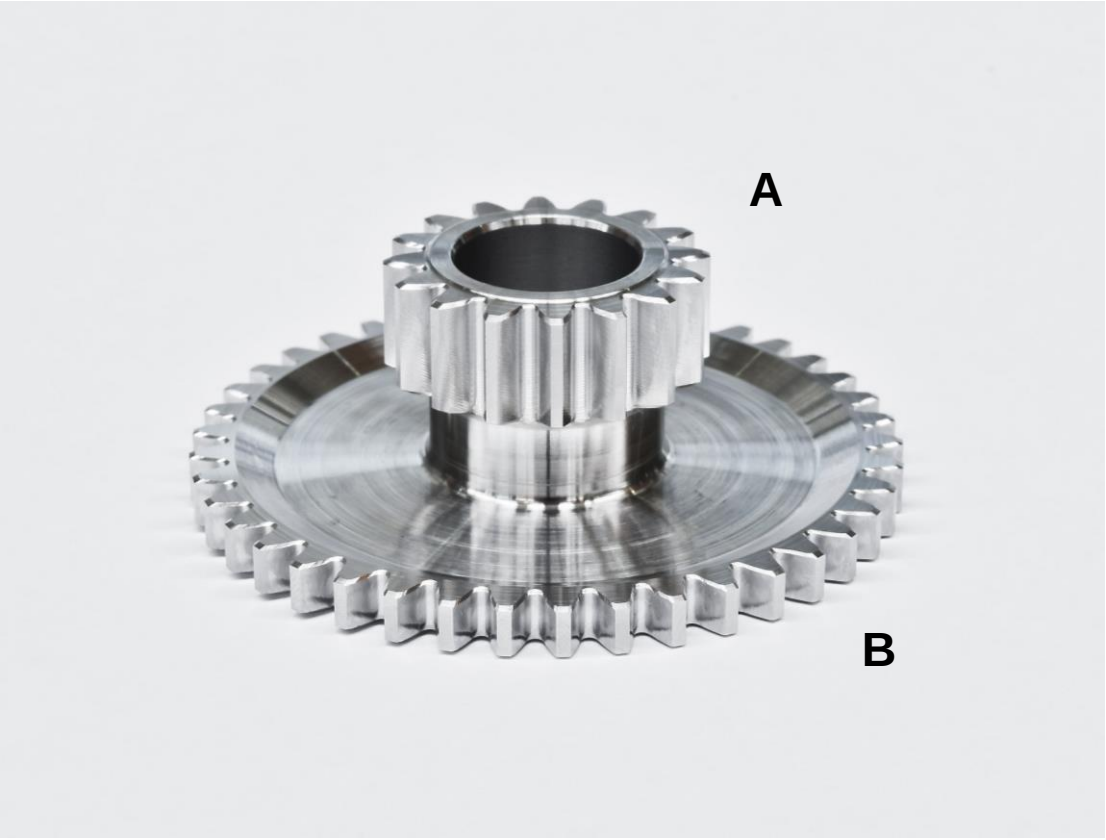
Application Example – Planetary Gear

Planetary gear

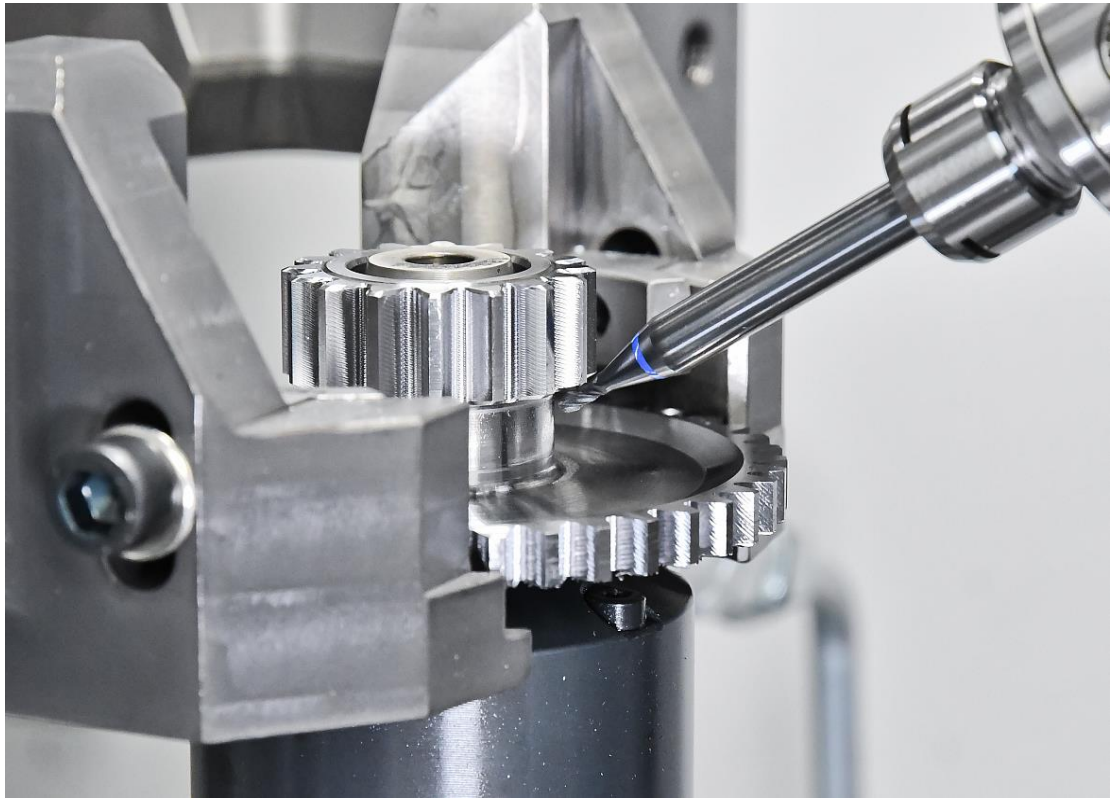


Workpiece

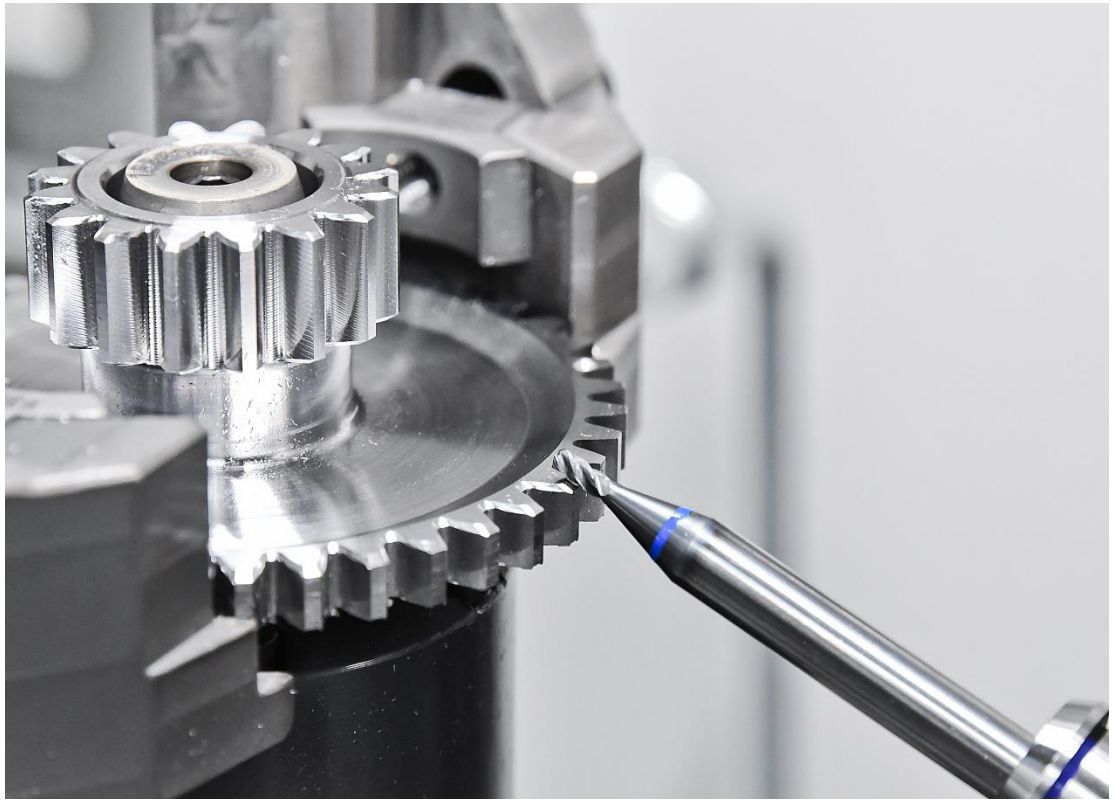
		A	B	
–	Module	1.635	1.57	mm
–	Number of teeth	16	41	
–	Pressure angle	22°	22°	
–	Helix angle	0°	0°	
–	Tip diameter	30.1	66.7	mm
–	Tooth width	11.5	5.0	mm
–	Material	32CDV12		
–	Tensile strength	1,270 N/mm²		
–	Finish skiving			

FlexChamfer – Skiving and Chamfering time-parallel

gear A



gear B



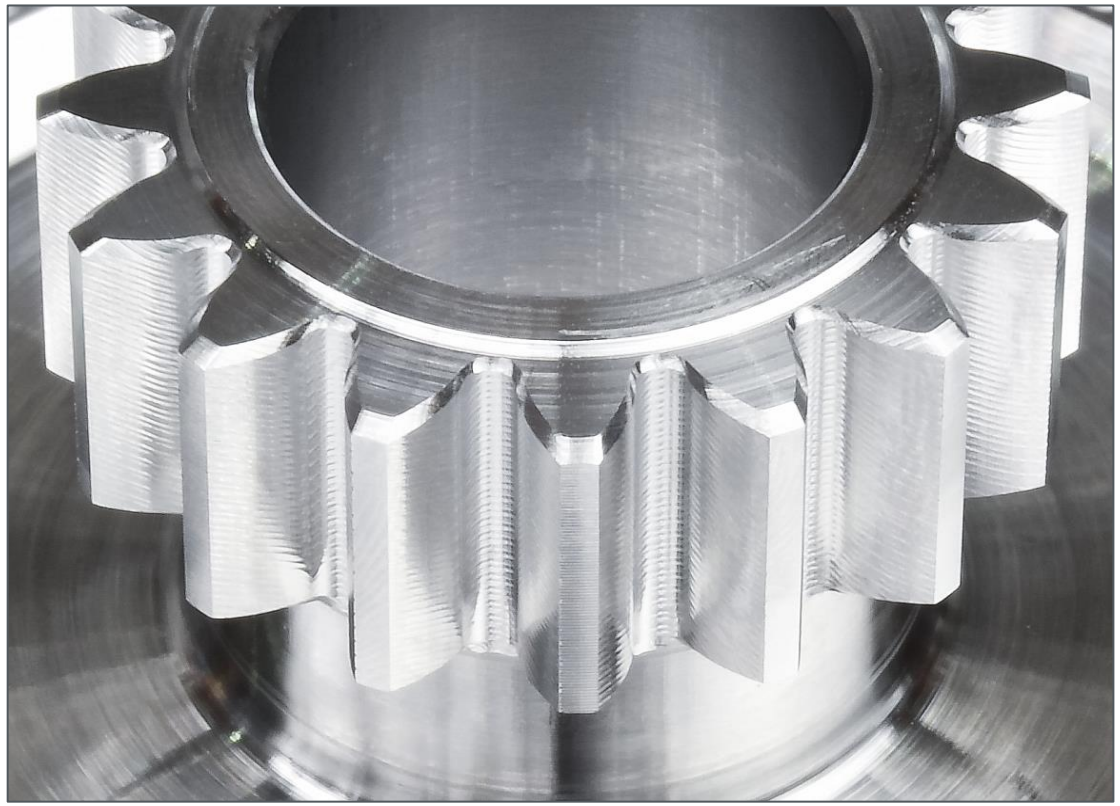
CNC-controlled and flexible chamfering of two gears in one clamping setup

FlexChamfer – Stepped Pinion (Aerospace)

FlexChamfer: precise chamfers with stock tools (also applicable on collision gears)

FlexChamfer – Chamfer Formation (Form)

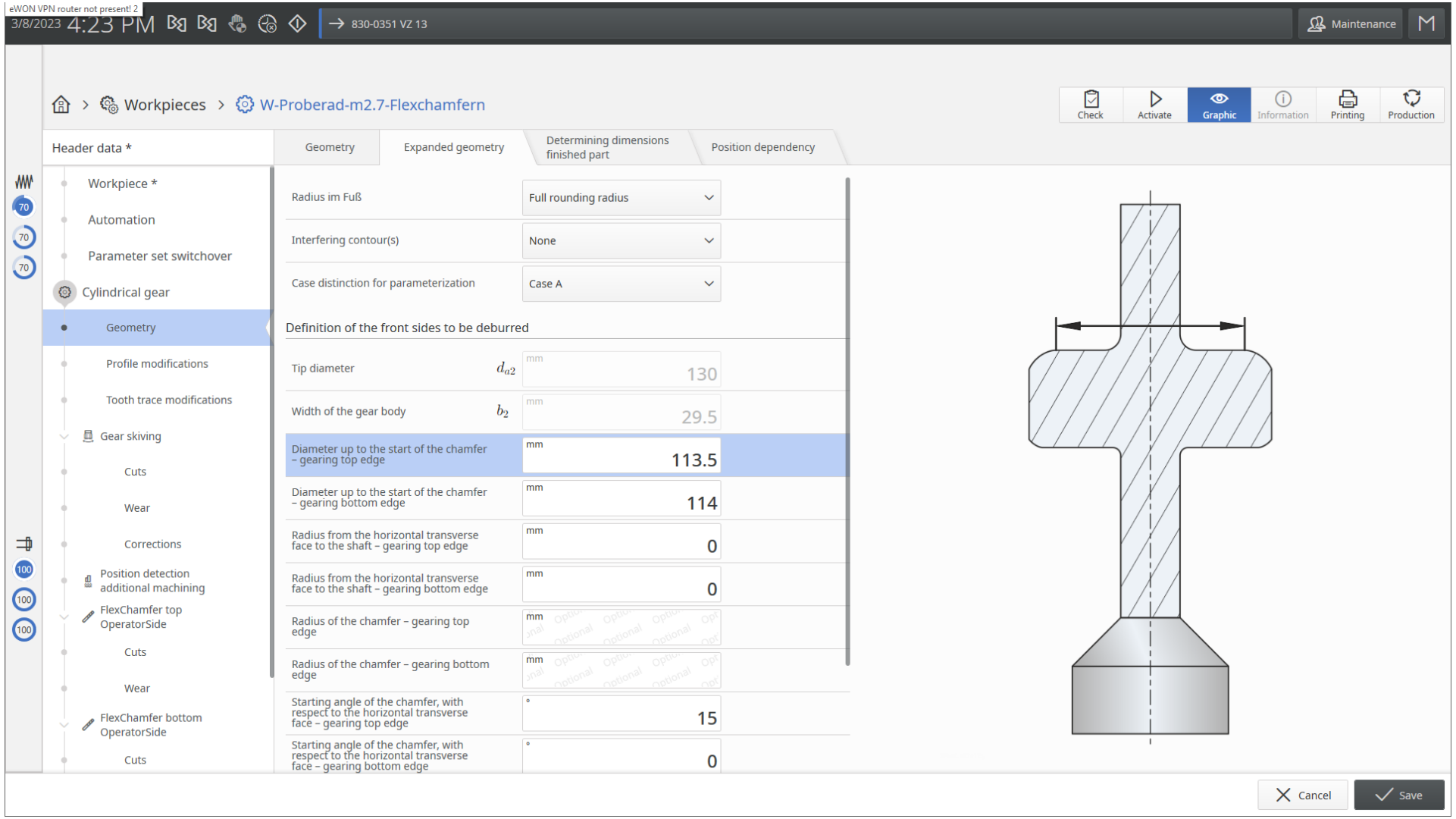
gear A (top)



gear B (top)

/// precise and flexible chamfering with standard tools

LH GearTec – Dedicated HMI for FlexChamfer (workpiece geometry)



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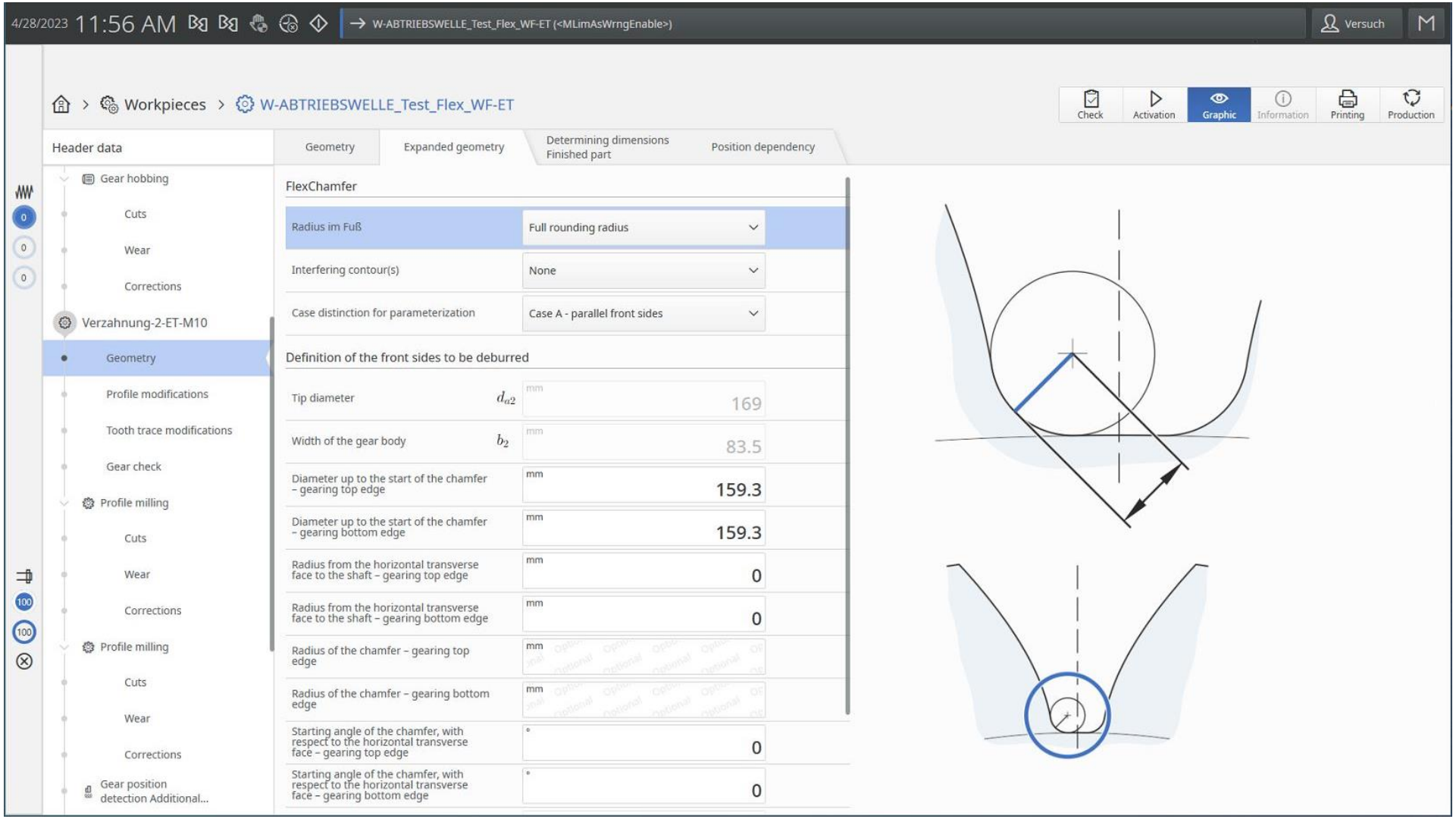
LH GearTec – Dedicated HMI for FlexChamfer (root fillet)



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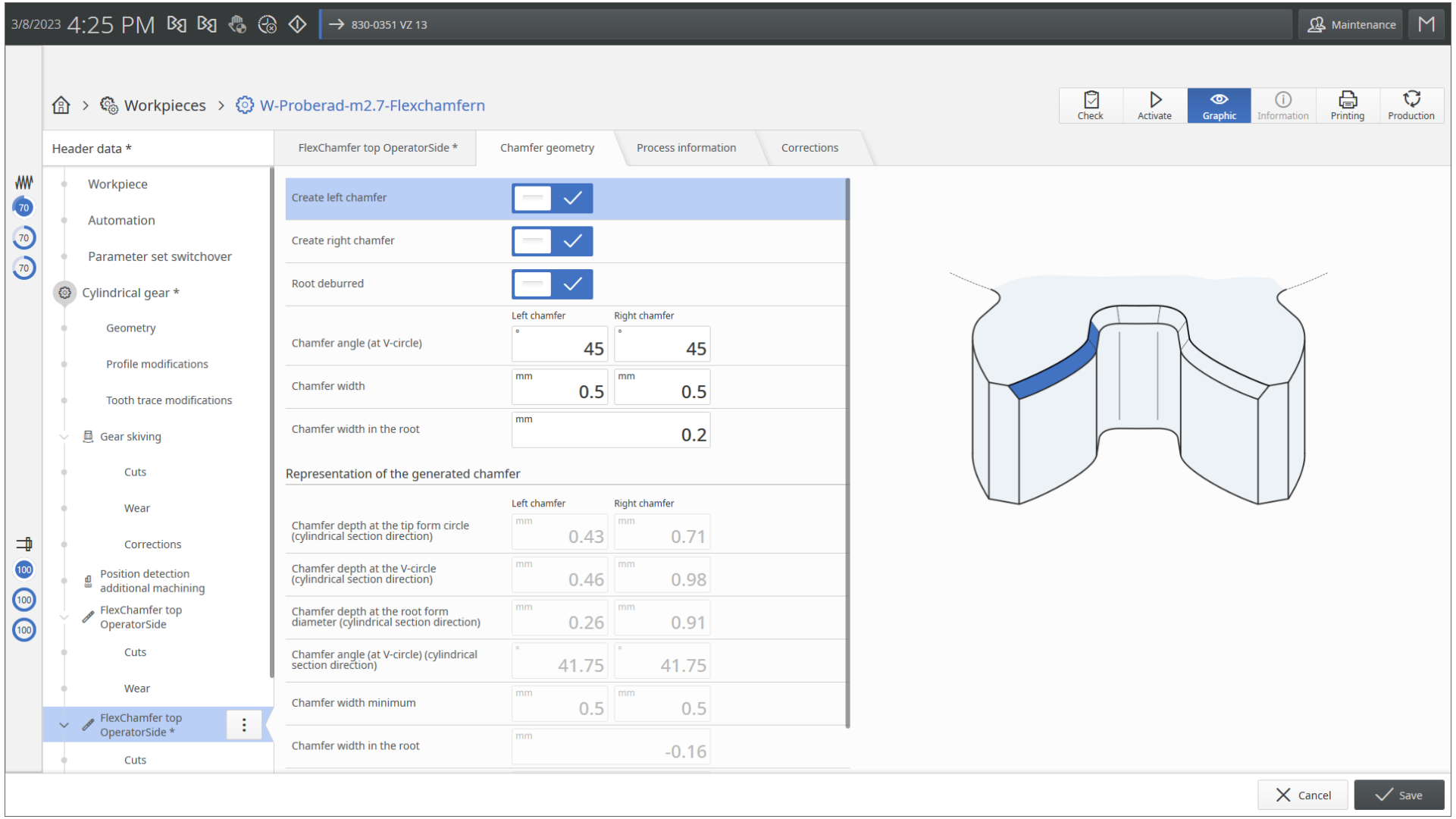
LH GearTec – Dedicated HMI for FlexChamfer (chamfer geometry)



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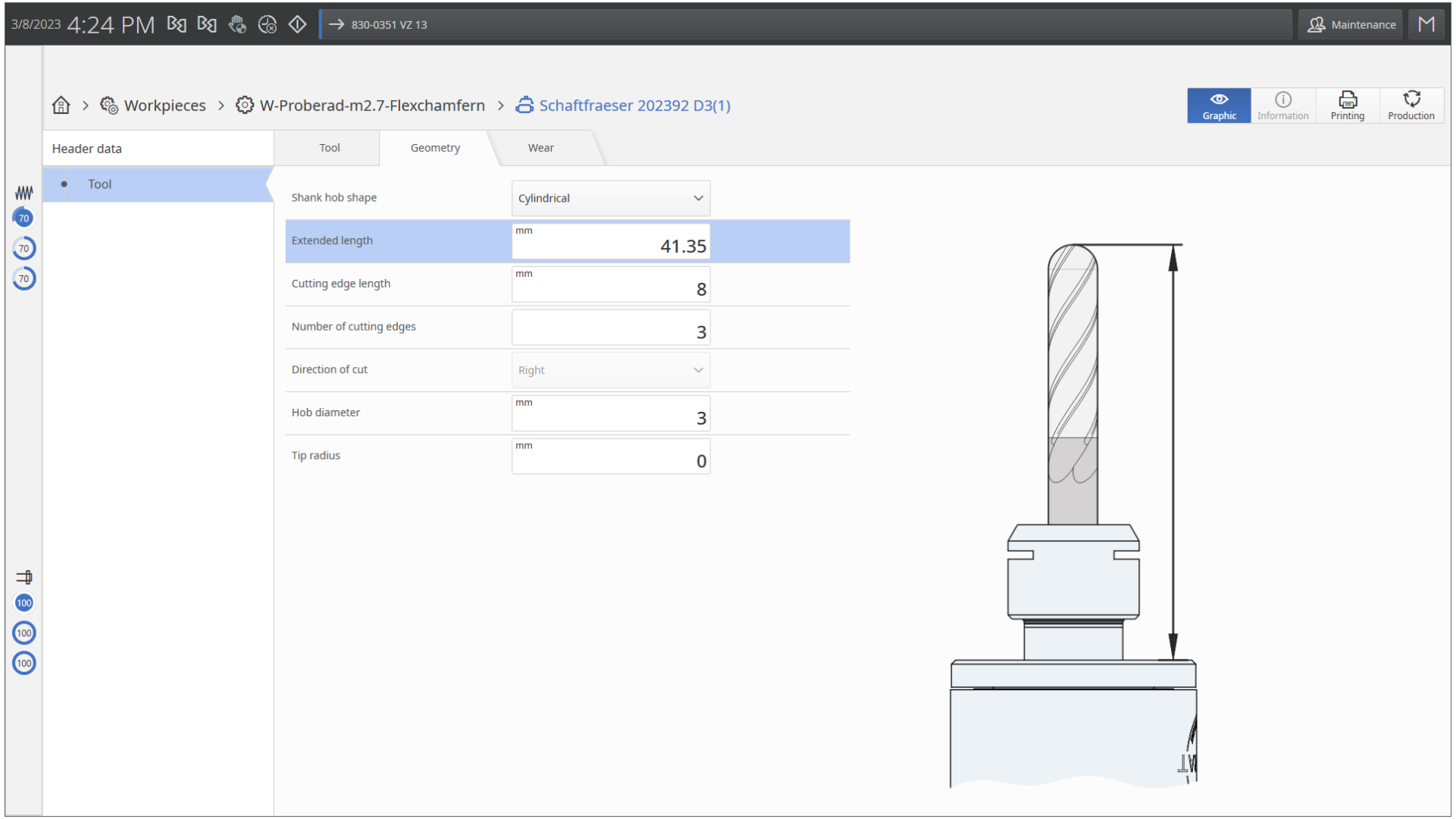
LH GearTec – Dedicated HMI for FlexChamfer (tool data)



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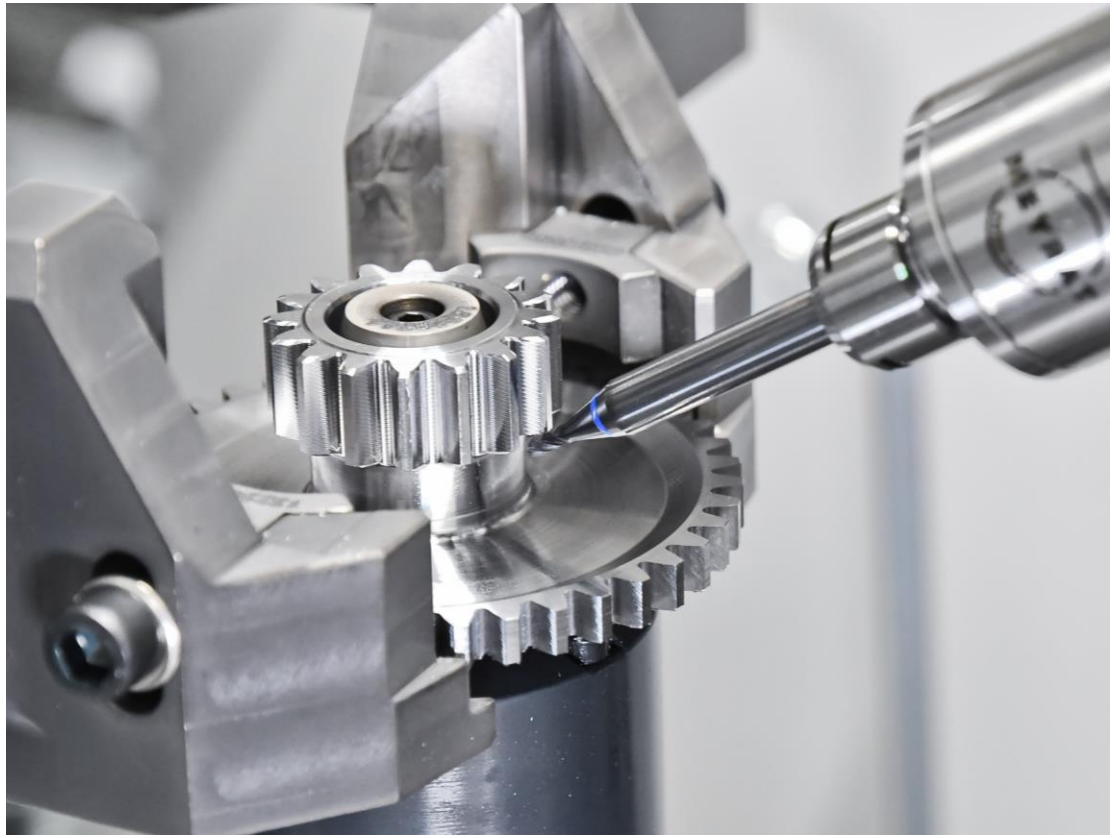
FlexChamfer - Summary



- Flexible solution especially for external gears with interference contours or internal gears
- Consistent chamfer width from tip to the root
- Time parallel chamfering for hobbing, shaping or skiving
- Generation of variable chamfer shapes with CNC technology
- Use of standard end mills (stock tools)

Workpieces leave the machine burr-free with a defined chamfer. This is unique!

HMI & Software

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LHStation & LHMobile

New Liebherr Panel

LHStation

- **Flexible mount** for cabinet integration or installation on an external bracket
(depending on machine type)

- 8 **freely configurable buttons or key-switches** for custom-extensions

- **Context-sensitive display** of PLC/NC keys and machine/program states

- Portable **handheld terminal** as a **standard** component

LHMobile

- New GUI surface LHGearTec

- 24“ **Touch Monitor**

- 2 **USB Ports** for flexible data Import Export

- **Reduced tactile switches** (NC-Start/Stop, hand wheel) for fast access

- **Tactile numeric block** for fast input of tool und workpiece data

- **Cable-based transmission** for maximized safety

LHStation & LHMobile

New Liebherr Panel

LHStation

LHMobile

- Standardized
  Operation Mode Switch
  (EKS) with RFID chips for fast mode selection and user authentication

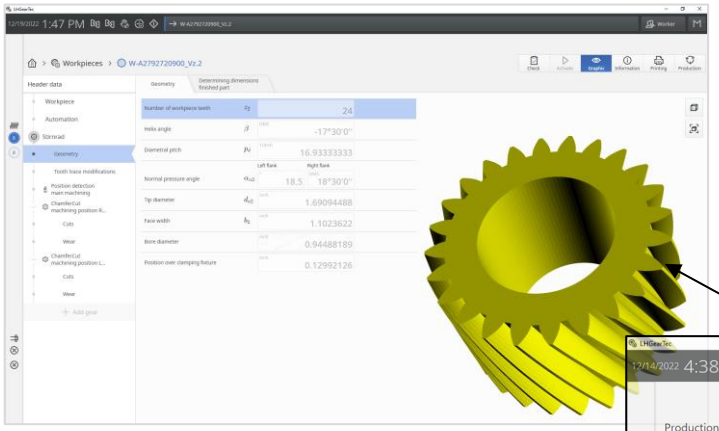
LHStation & LHMobile

New Liebherr Panel

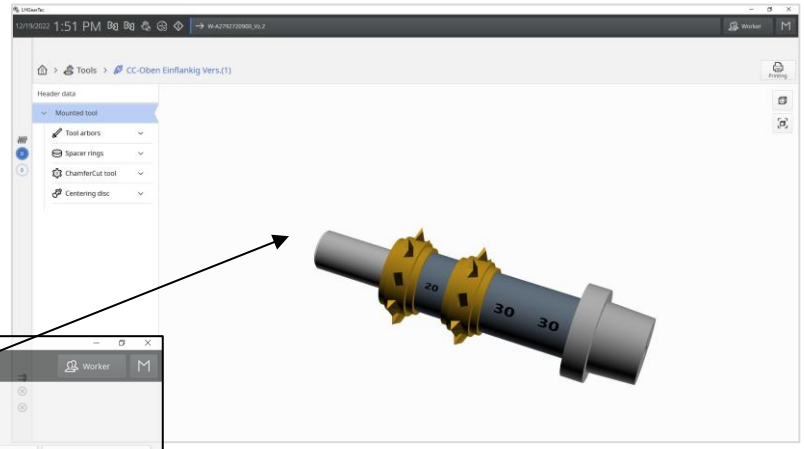
LC 280 DC

LGG 280

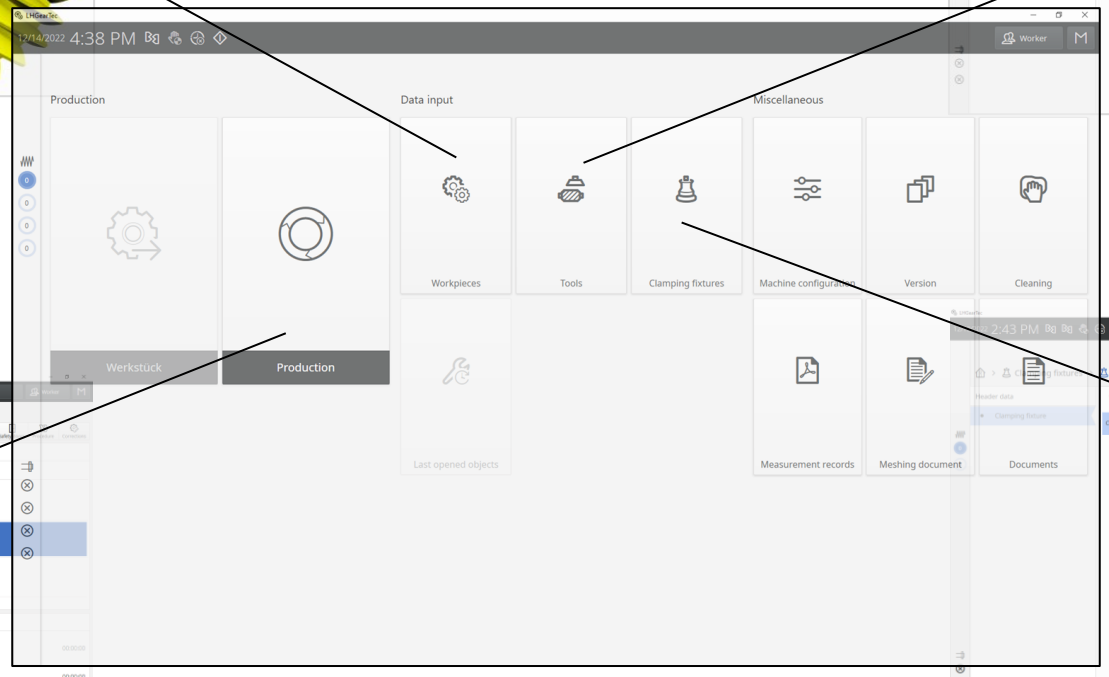
LD 180 / 280 C with LHGearTec HMI



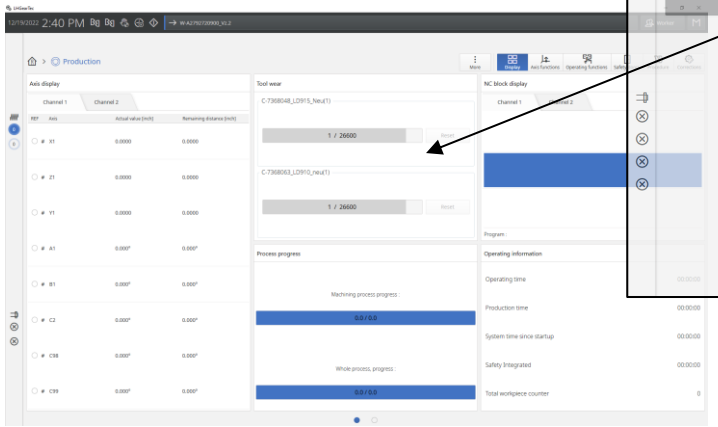
– Parametric workpiece data input



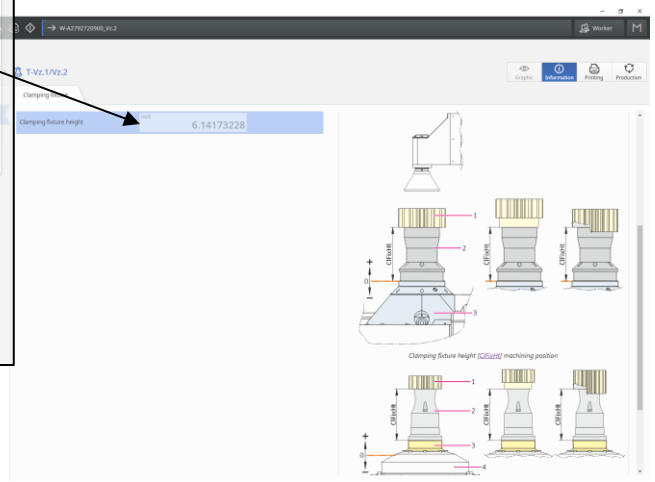
– Parametric tool definition



– Production view



– Fixture definition



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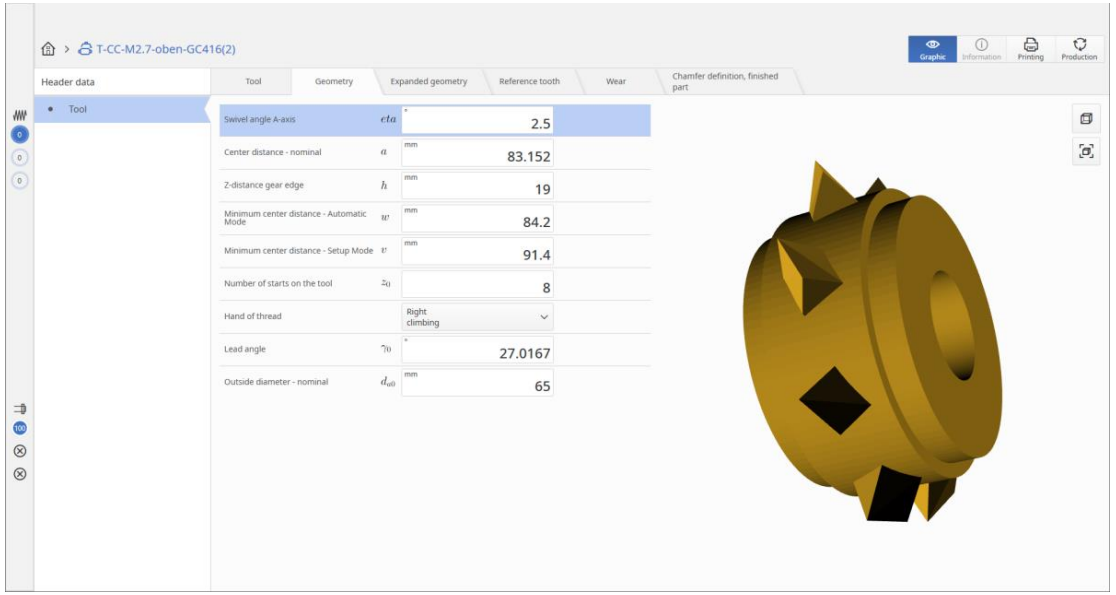
User Interface (from Liebherr)

HMI



For an easy machine setup, Liebherr provides a **special software** designed to apply FETTE ChamferCut tools.

The main features are:

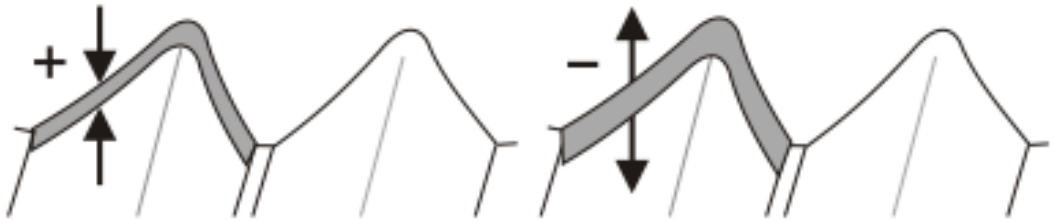
- input data identical to FETTE setup chart
- automatic loading of the setup sheet (XML file)
- graphical support
- automatic chamfer correction based on measured width
- self-correcting setup data after resharpening

Adjustment Possibilities - Basics

Chamfer size

X1-correction Chamfer [T]

Correction of chamfer size. With a positive correction value, chamfer gets smaller, with a negative bigger.

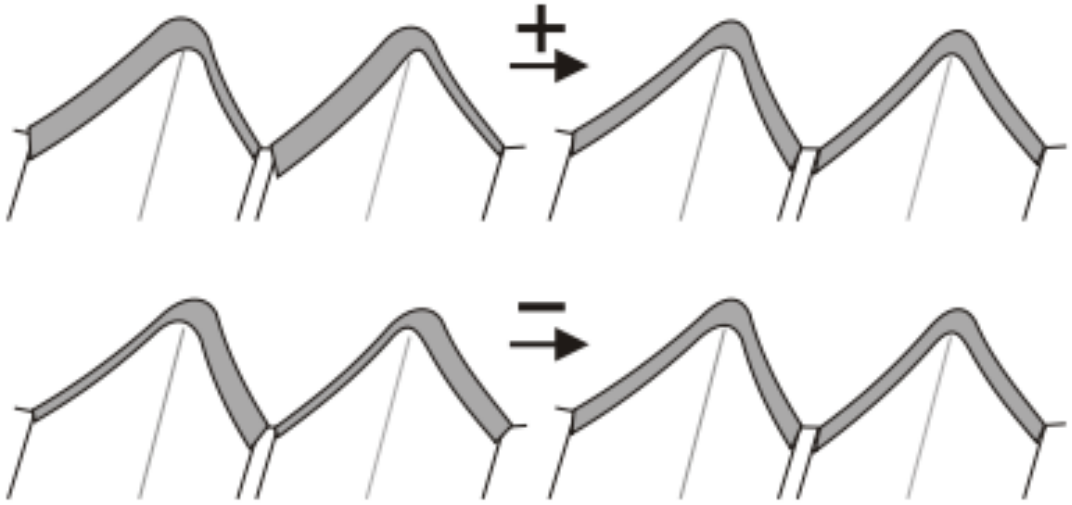


Chamfer symmetry

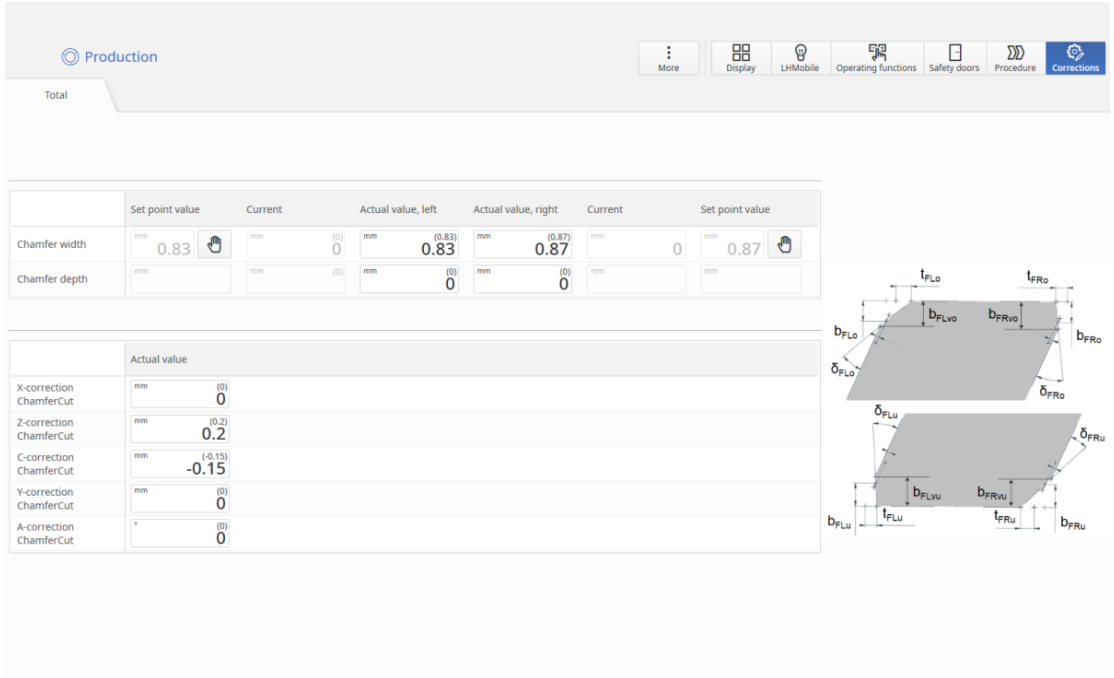
C2-Correction Chamfer [O]

Correction of chamfer symmetry (same width of left and right flank). With a positive correction value, chamfer width shifts to the right, with a negative value to the left side.

Corrections of the C2-axis are required after corrections on the A1-axis.



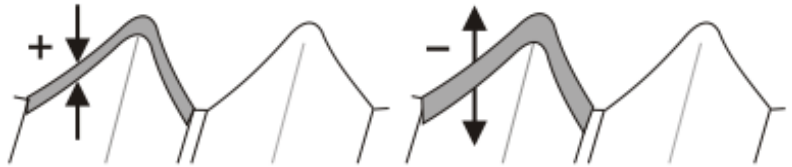
Automatic Chamfer Correction



Chamfer width

Z1-correction Chamfer [T]

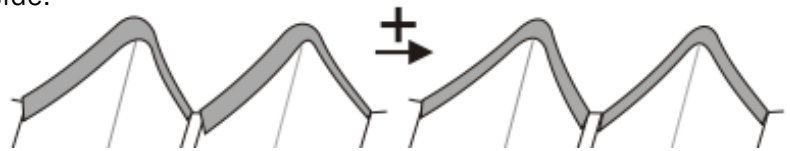
Correction of chamfer size. With a positive correction value, chamfer gets smaller, with a negative bigger.



Chamfer symmetry

C2-correction Chamfer [T]

Correction of chamfer symmetry (same width of left and right flank). With a positive correction value, chamfer width shifts to the right, with a negative value to the left side.



chamfer corrections based on the measured chamfer width

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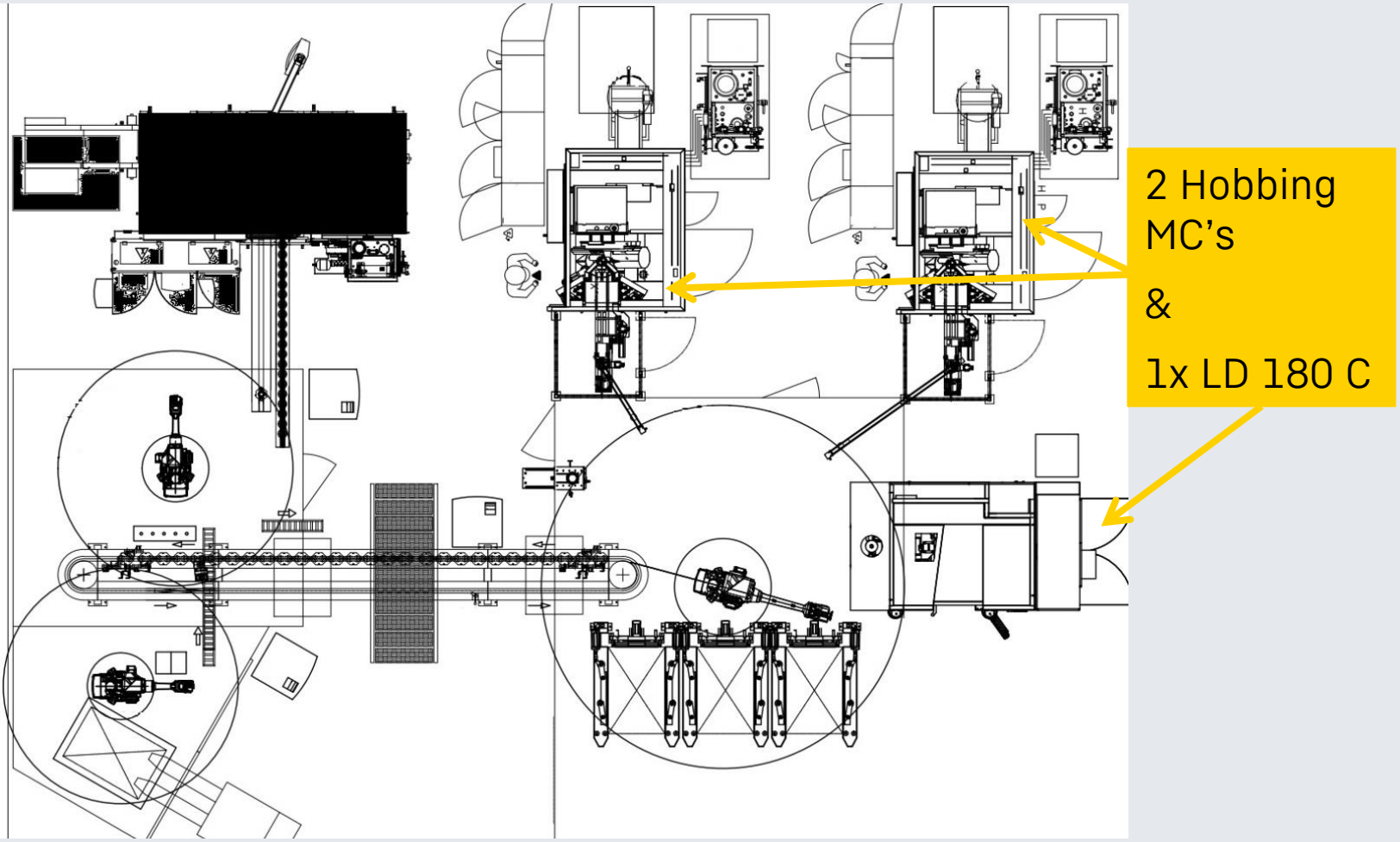
Layout of a Customer Solution



- already in use by an automotive manufacturer
- some more solutions are possible by automations from Liebherr

Customer Solution: Integration in existing production environment

Integration of the ChamferCut solution in a cell layout

Layout of a Customer Solution

Integration of the ChamferCut solution in a cell layout

Layout of a Customer Solution

Layout of a Customer Solution

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08
Automation

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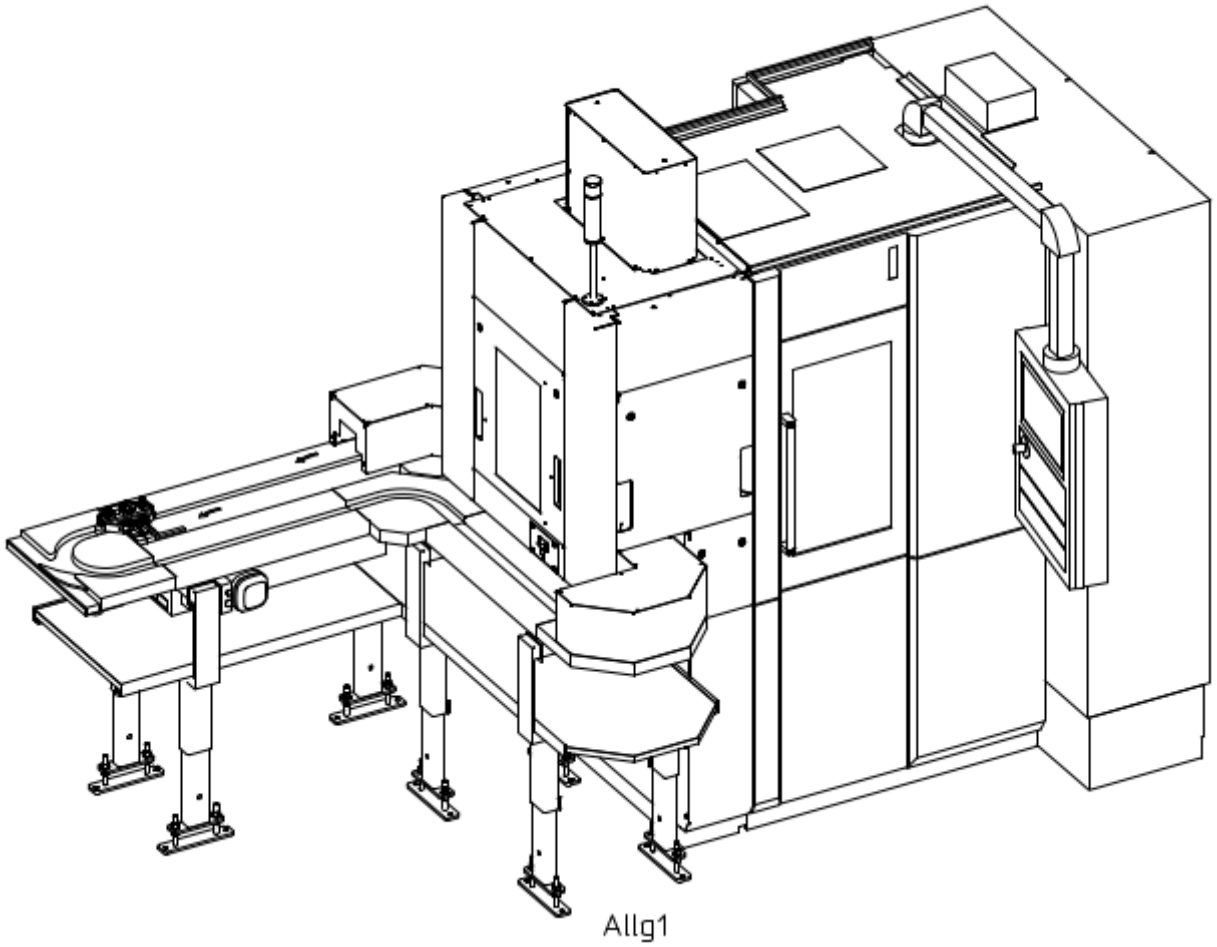
Automation solutions for LD 180 / 280 C

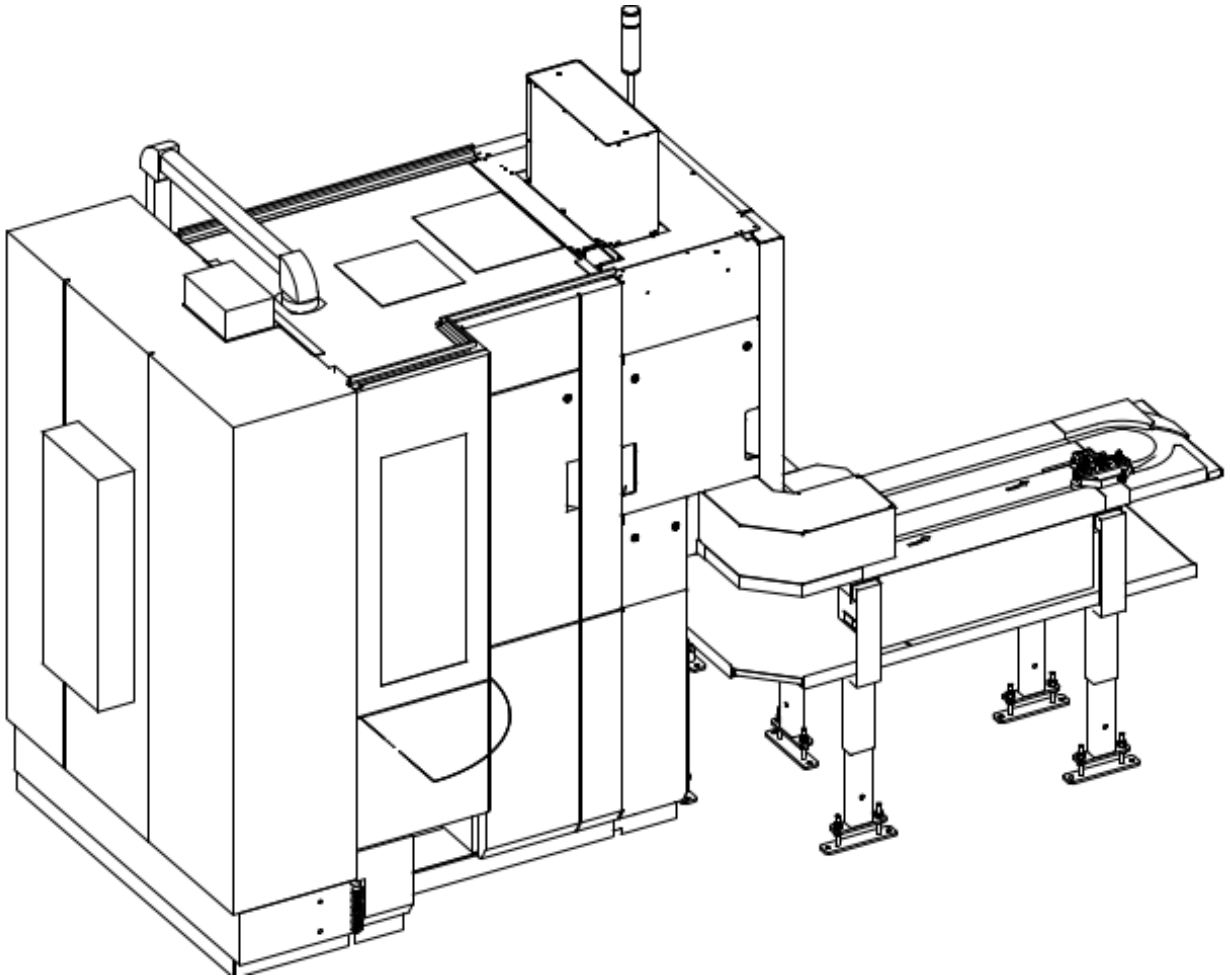
LD in combination with a conveyor

LD in combination with a robot solution (direct loading on machine table)

Automation solutions for LD 180 / 280 C

LD 180/280 C with external conveyor solution





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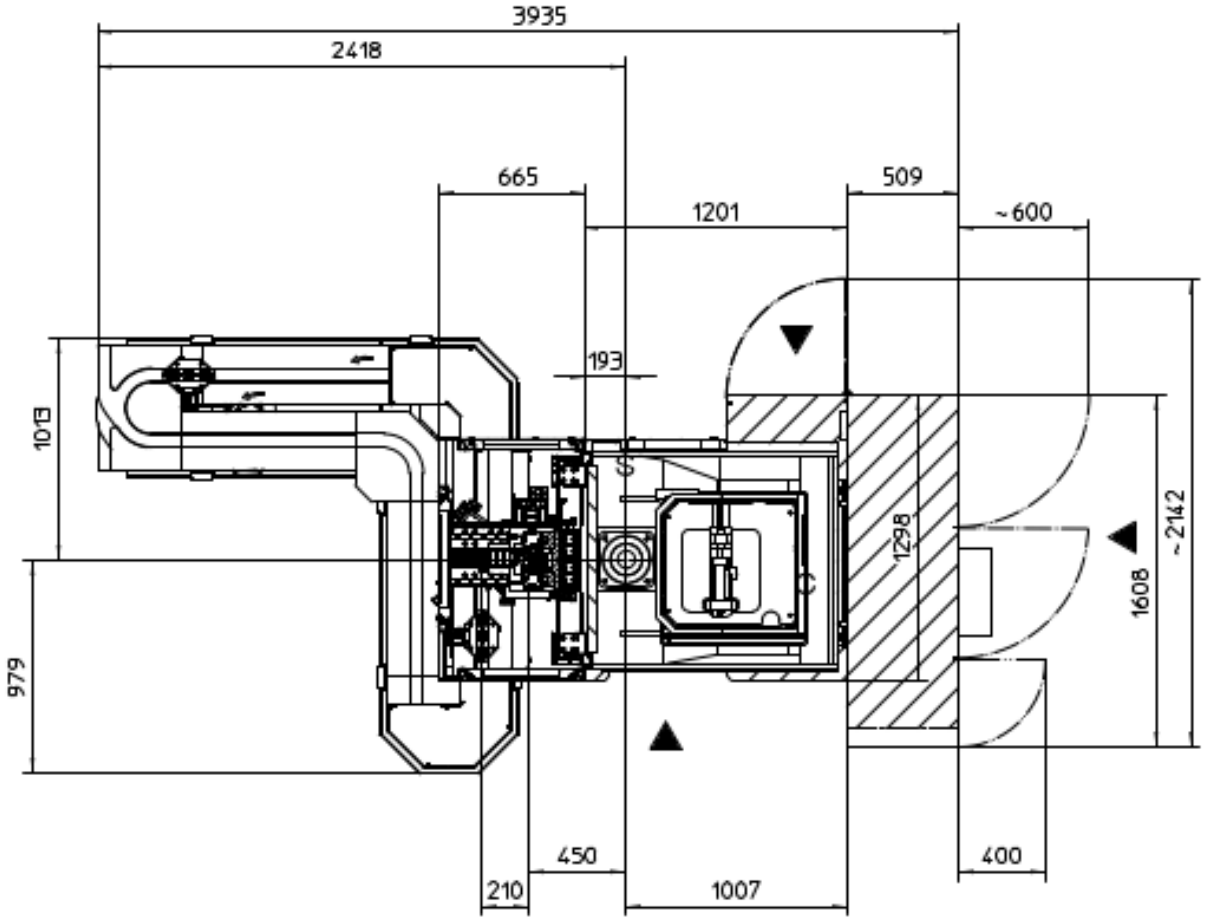
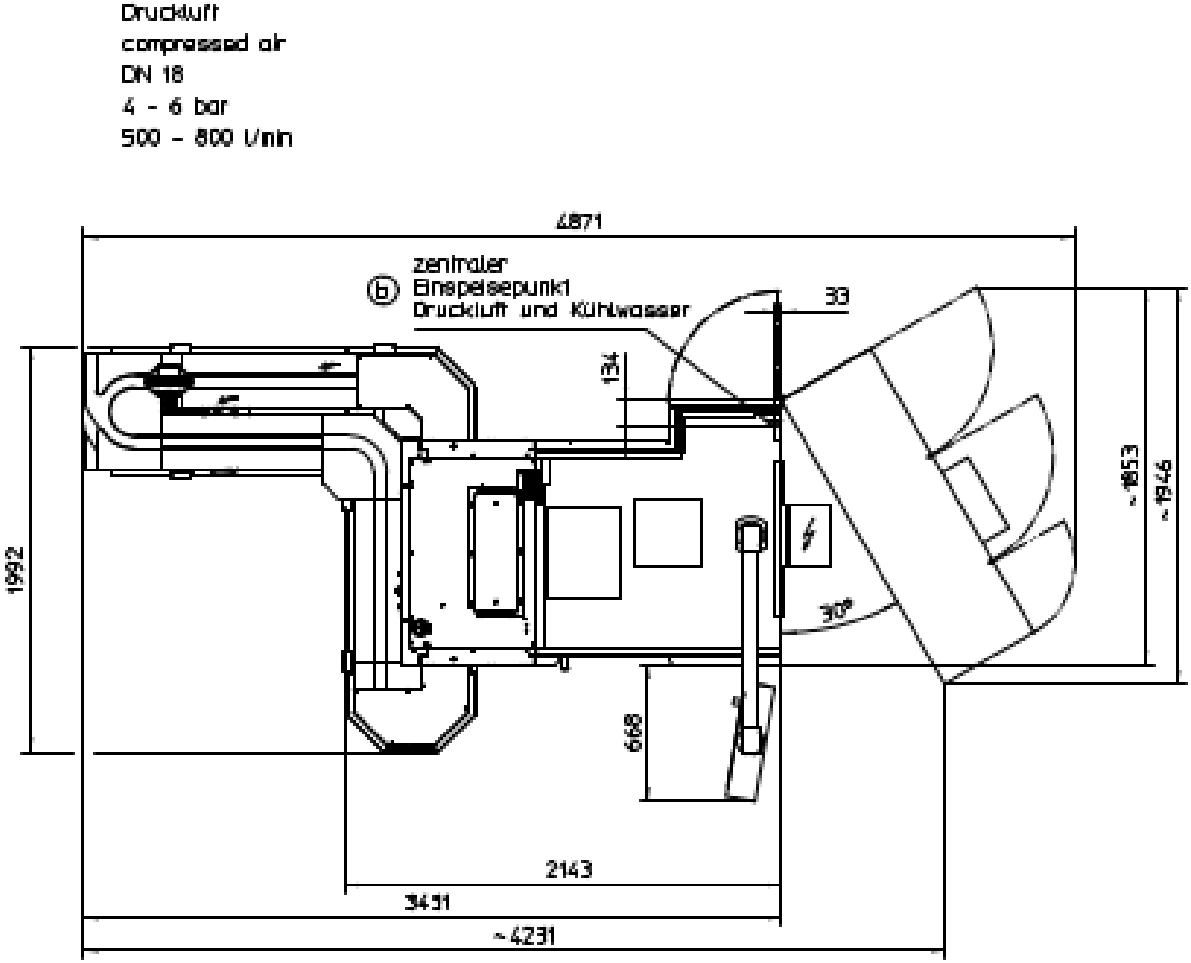
LD 180/280 C with external conveyor solution





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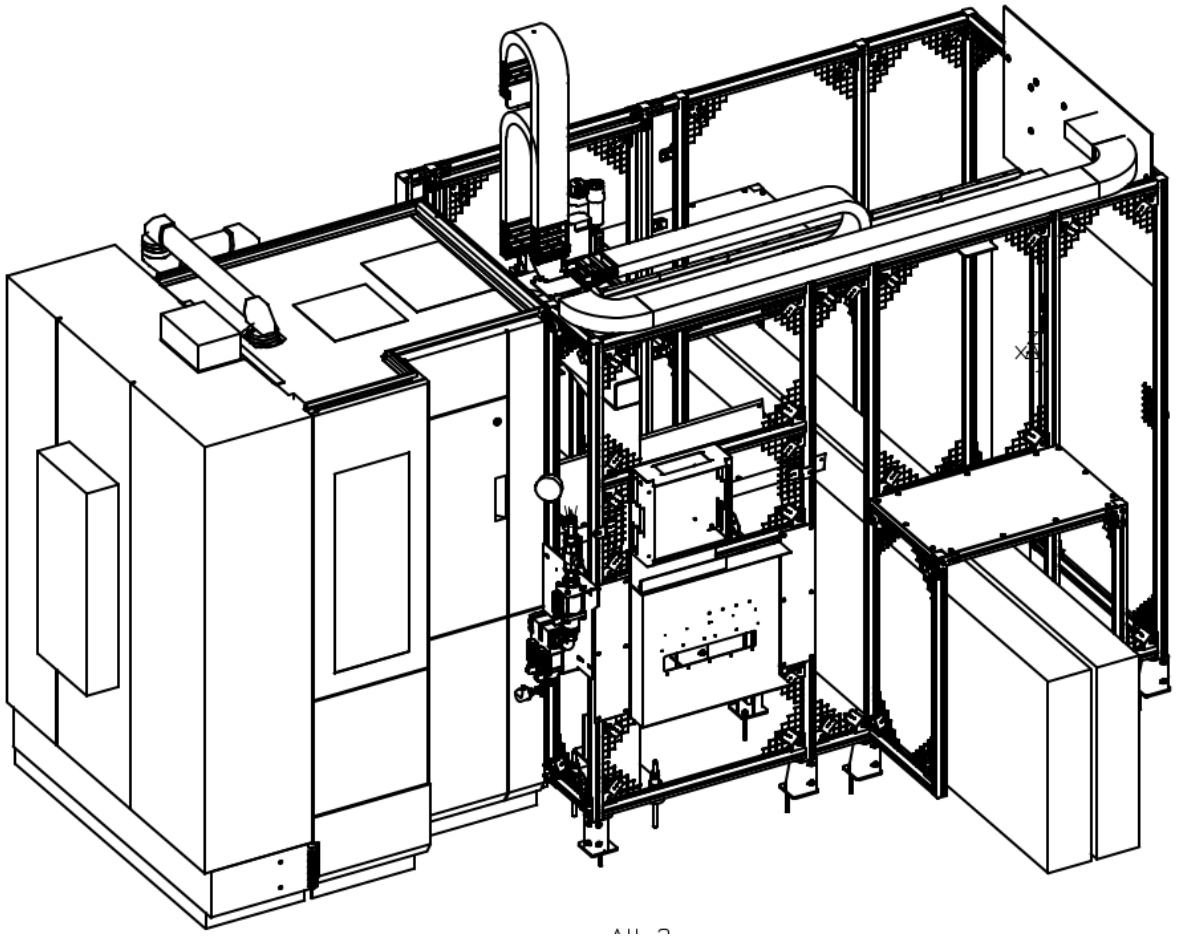
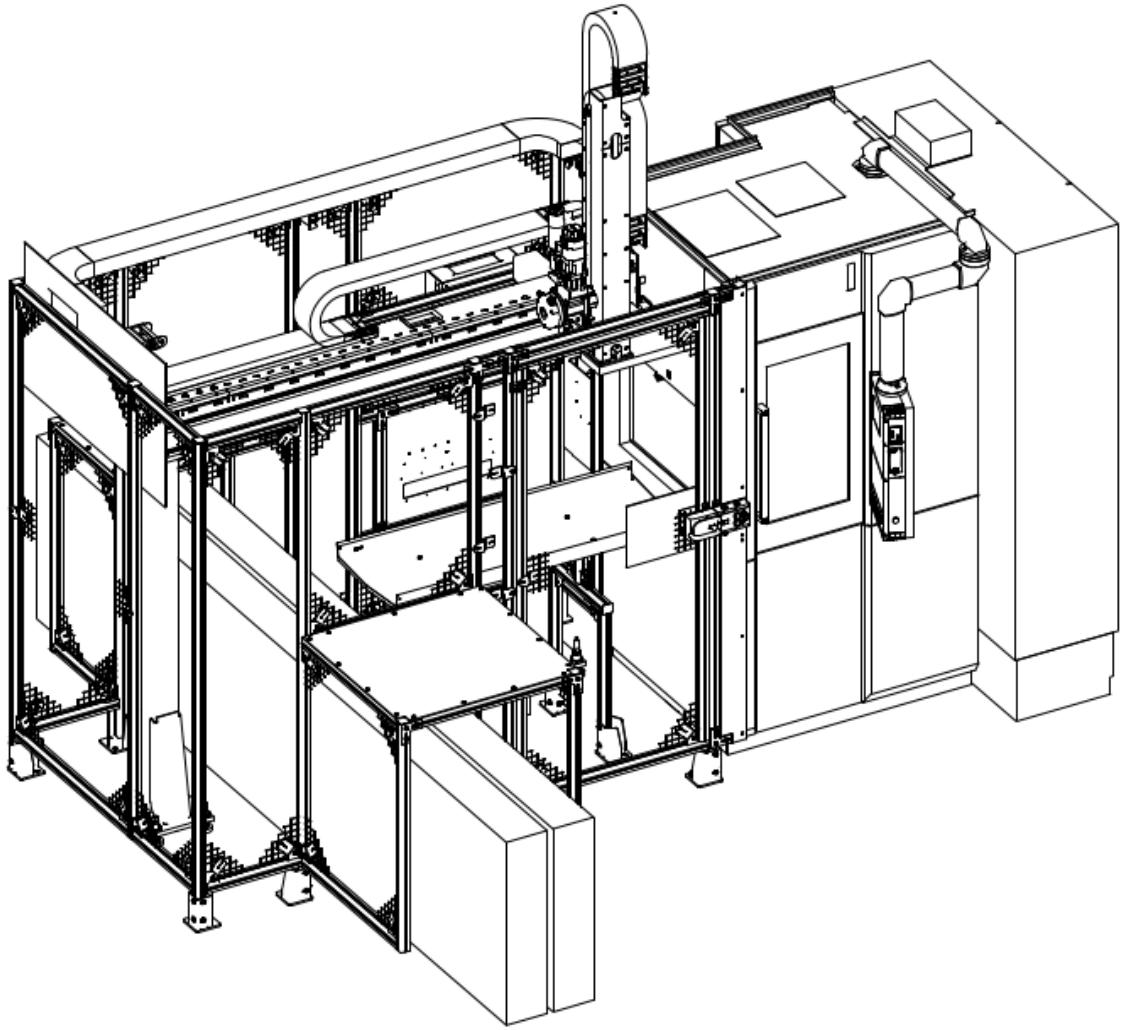
LD 180/280 C with pick & place unit



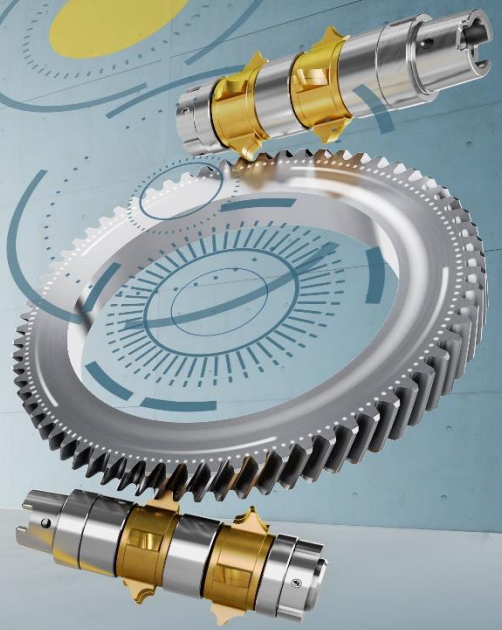


LD180 / 280 C

LD 180 / 280 C

- higher performance (cycle time) & excellent chamfer-form (shape)
- high efficiency due to minimal tool costs per piece
- considerable small machine footprint
- fast, intelligent, flexible automation solution
- 10 years technology experience & successful customer application
- hook ready machine
- Liebherr product range:
  - Chamfer Cut on the tool-arbor (subsequent chamfering)
  - Chamfer Cut machine integrated (parallel chamfering)
  - Chamfer Cut „stand alone“ (retrofit-solution for actual production)

Thank you.



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