

HOBBING IN NEW STANDARDS

FHC 80 / FHC 180 Flexible Hobbing Center



 **FELSMAT**®

FHC 80 / FHC 180 Flexible Hobbing Center

Top efficiency in facts:

- ▶ Shorter main processing times due to higher stock removal rates.
- ▶ Minimum idle times: chip-to-chip time < 1 second by loading/unloading simultaneously to the main processing.
- ▶ Parallel to main processing time push-roll-deburring with fettling wheel or elimination of the resulting burr at the flank with the second dressing cut.
- ▶ Lasting lowest costs per piece and longer tool life.
- ▶ Finish cutting in final quality by a dressing cut.
- ▶ Compact Single Box Machine with 6 sqm footprint to allow for easy relocation
- ▶ Easy retooling with outstanding accessibility and ergonomic tool and chucking changeover < 10 minutes.
- ▶ More than doubled life cycle time by two spindles with lower drive-away and slow-down accelerations.
- ▶ Comfortable easy operation with intelligent technology software.

Cutting edge machine technology:

Base of machine

- ▶ Maximum rigidity and optimal damping characteristics with a solid, reclined horizontal base made of concrete with enclosed steel frame.
- ▶ Form-fit mounting surface for work piece spindle and guide rails on high-tensile steel, machined-in-one chucking with high geometric accuracy.
- ▶ Thermo-stable by free chip fall in funnel made of stainless steel with vertical, free of cable drag chain working area, isolated from machine components.

2-Spindle module for more productivity

- ▶ Horizontal swiveling drum, equipped with extremely rigid and high precision linked up axial radial bearings (YRT), which guarantees highest positioning accuracy and rigidity under high dynamic load as well as a fast and precise spindle change from the hob position to the deburring- and load/unloading position.
- ▶ For good automatic control loop dynamics and good synchronisation provision both the rotation engine and highly accurate, totally enclosed, Heidenhain rotation transducers are installed in the two work piece spindles. These are liquid cooled and horizontally installed within the drum cartridge build design.
- ▶ High continuous accuracy.

Cross carriage ZX

- ▶ Slide-gate construction with smallest overhang made of high-strengthened nodular graphite cast iron. The cross carriage ZX with integrated tool index axis has substantial dimensioned linear guides with up to six circular roller units per axis as well as a direct absolute measuring system.

Tangential carriage Y

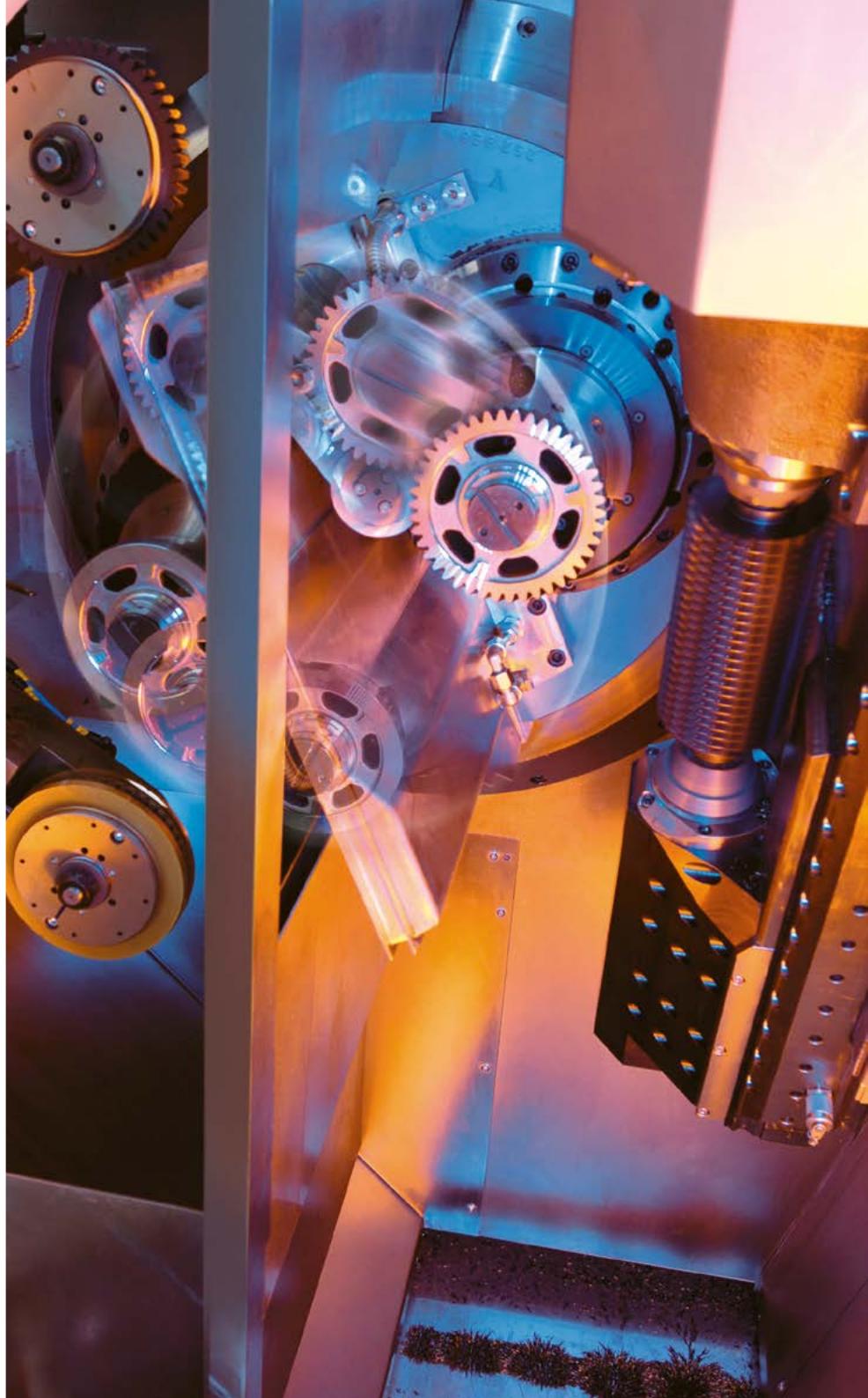
- ▶ The tangential carriage is made of a high-tensile mono block steel with substantial dimensioned guidance base; likewise the counter bearing. In order to obtain an extremely high rigidity during the processing, the complete carriage is additionally captivated hydraulically.

Direct driven hob head

- ▶ The high-speed spindle, which also offers large torques in the lower speed range, ensures sufficient reserves for the introduction of future tool materials.

Fast and easy changeover of the hob head

- ▶ The hob head drives into a vertical changeover position for optimal operator access. Due to the good accessibility and the free use of both hands, the change takes place in < 1 min.



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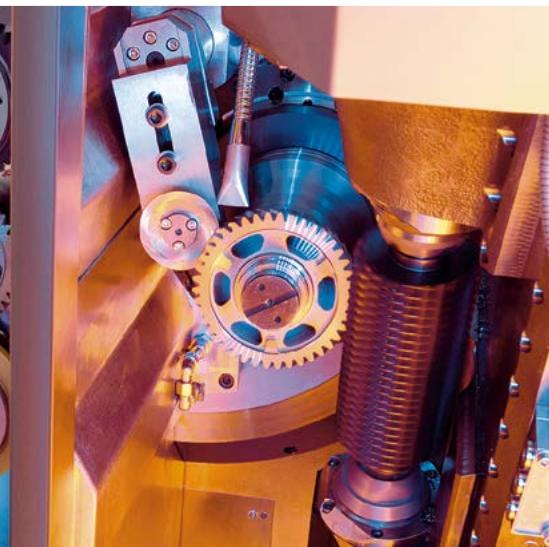
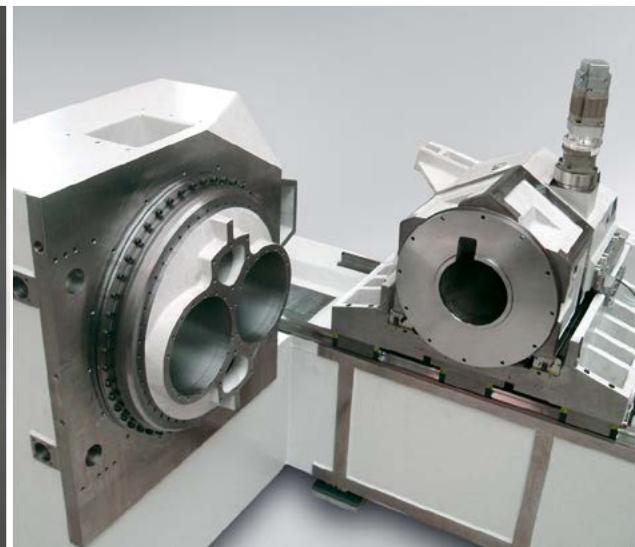
The new dimension in hobbing technology

Highest dynamic efficiency, lower costs per piece, best hobbing quality – the FHC 180 offers new potential in gear hobbing, where nobody expected it – with the smallest footprint and the largest working area.

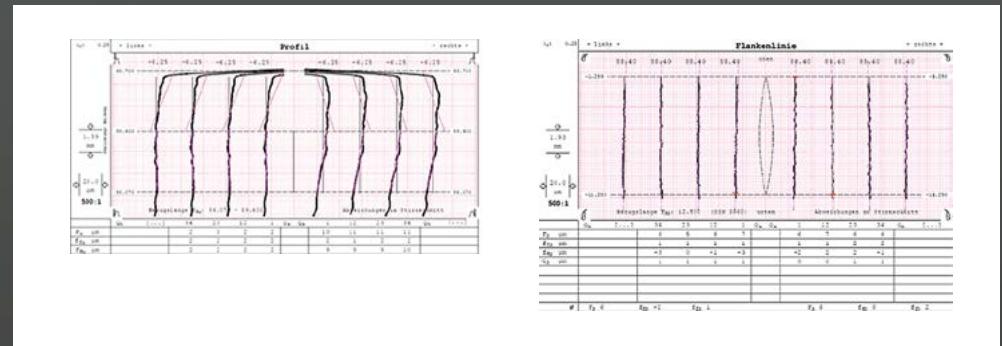
The FHC 180 is a fully-developed machine technique, which is specifically designed for high-speed cutting (HSC process) in passenger car transmission manufacturing.

The hobbing, chamfering and deburring center of Felsomat is designed specifically for an eco-friendly, dry process. The unique 2-spindle-combination enables simultaneous hobbing on one spindle with rolling, deburring and reliable, process-safe work piece loading and unloading on the second spindle. Thereby achieving a chip-to-chip-time of < 1 second.

The dynamic heart of the machine is the idle time free 2-spindle-system which manufactures, due to the dynamically rigid, durable FHC 180, a spur gear in 1-step procedure or for a ready for installation 2-step procedure with highest productivity and highest quality.



| method | hobbing | chamfering/ deburring | chamfering/ deburring/ rolling | hobbing | application | remark |
|--------|------------------------------------|----------------------------------|--------------------------------------|-------------------|---|---|
| 1 | single cut | | | | finish hobbing, shaving, honing or gear grinding | gear teeth sensitive for knicks |
| 2 | roughing and smooth- hobbing | | | | finish hobbing | gear teeth sensitive for knicks |
| 3 | single cut | parallel to machining time | | | shaving, gear grinding | secondary burr in gear flank |
| 4 | single cut | | parallel to machining time | | honing, gear grinding | secondary burr rolled in gear flank |
| 5 | roughing | parallel to machining time | | finish hobbing | finish hobbing, honing, gear grinding | no secondary burr; no rolling required |





Push-roll-deburring parallel to the main processing time

The FHC integrated chamfering and deburring unit consists of two delivery arms for smooth chamfering as well as deburring of the hobbed gear and depending on the respective option, fettling the remaining material at the tooth flanks.

Parallel to the actual hobbing process, the swivel arms with the deburring tools are delivered to the gear and driven by the second work piece spindle. During machining, the deburring wheels remove the burrs at the tooth front edges and produce the desired chamfer. At the same time the secondary burr tools remove the overlaying burrs at the plane surface. When the work piece is machined, it is either moved for the dressing cut again into the work area of the hobbing position or after deburring it is directly unloaded with Felsomat automation and a new turned part is loaded again. The dry deburring process guarantees an absolutely burr-free gear profile and hence it prevents damage of the tools during the tooth profile hardening treatment.

Radial clamping fixture

to center and clamp in the bore by an expanding bush towards a front side plane surface ring (pull-down effect) for stable work pieces with an accordingly large bore.



The control: Siemens 840 D SolutionLine

The applied control and drive technology of the newest generation of Siemens (840 D) enables along with the Felsomat technology software:

- ▶ Comfortable tool organization masks
- ▶ Easy set-up programming
- ▶ Enhanced help functions for intuitive diagnosis
- ▶ Part programming

Radial-axial clamping device

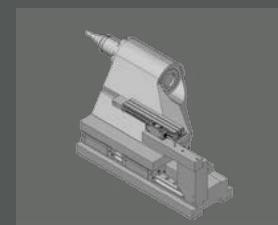
with fine centering actuated by a spring washer set, hurrying ahead for the true radial running accuracy by radial expanding bush in the work piece bore.



Separated from it the actual clamping is realized over a clamping bell axially on the front surface (close to the root circle of the gear) directly across from the plane face for less form-stable work pieces or work pieces with smaller drilling diameter. The clamping bell is put on automatically by the work piece, change over with a bayonet fixing and activated hydraulically, coaxially exact in the center of the spindle with a pulling arbor of the hydraulic force clamping unit. With this stable separate centering and axial clamping can be done without a complex counter-holder for gears.

Tailstock (FHC 80)

With a tension rod for an extremely closed force loop. Distortions, misalignments or helix angle deviations are reliably prevented, the coaxial clamping is guaranteed. The tailstock can also be used to support slim, long work pieces or clamping devices. With small bore diameters or an unfavorable ratio of the bore vs. outside diameter the tailstock increases the axial clamping force. Operated servo-hydraulically with a linear measuring scale to precisely monitor the pressure force and stroke.



All security-relevant functions are monitored by Safety Integrated.

Options:

- ▶ Total Production Maintenance (TPM)
- ▶ Machine Data Acquisition (MDA)
- ▶ Remote diagnosis via modem or network

With that functions as remote support and automatic error notification per SMS or e-mail are available.

GMC – intelligent combination and automation

For the complete green machining of gears

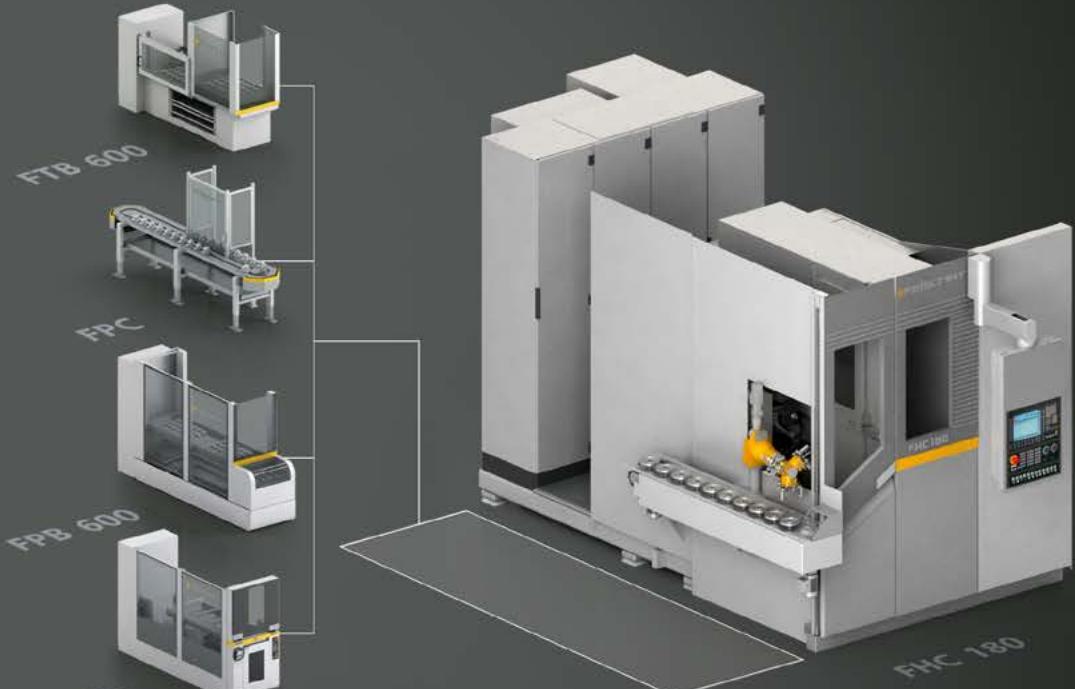
The Gear Manufacturing Cell GMC, is the high-performance technology platform for the complete process chain of gear manufacturing from the blank to the finished gear, all in a standard cell. The green machining cell consists of the Flexible Hobbing Center FHC 180, the Flexible Automation Module FAM, and, depending on the scope of the green machining process, a scalable Flexible Turning Center FTC 180 – the high performance turning module for dry machining.

For the multitude of different work pieces, the batch size and the internal work piece handling, various work piece storage systems and universal work piece grippers are available from our standard automation modules.

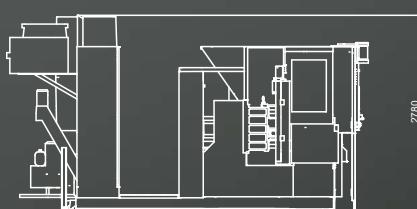
Technical Data

| Work piece | | | |
|---|--------------------|-----------|-----------|
| Outside diameter max. | [mm] | 80 | 180 |
| Module max. | [mm] | 2 | 4 |
| Tool | | | |
| Cutter diameter min./max. | [mm] | max. 70 | 50 – 100 |
| Total length of cutter min./max. | [mm] | 240 – 276 | 200 – 310 |
| Usable hob length max. | [mm] | 190 | 224 |
| Cylindrical hob clamping interface | [mm] | 22 | 32 |
| Short taper counter support size | [mm] | 25 | 25 |
| Machine | | | |
| Hobbing spindle drive power | [kW] | 8,8 | 23 |
| Hobbing spindle speed range min./max. | [1/min] | 7,500 | 5,500 |
| Work piece spindle drive power | [kW] | 0,5 | 15 |
| Work piece spindle speed range min./max. | [1/min] | 700 | 620 |
| Axial stroke max. (Z-axis) | [mm] | 200 | 250 |
| Radial stroke max. (X-axis) | [mm] | 80 | 110 |
| Center distance hob cutter and work piece min./max. | [mm] | 33 – 113 | 52 – 162 |
| Swiveling range of the hobbing head (A-axis) | [°] | +/- 35 | +/- 35 |
| Tangential stroke max. (Y-axis) | [mm] | 170 | 200 |
| Maximum feed and rapid speed | axial [m/min] | 30 | 40 |
| | radial [m/min] | 30 | 40 |
| | tangential [m/min] | 15 | 18 |
| Controller | Siemens 840 D | | |
| Power | | | |
| Total connected power of the basic machine approx. | [kW] | 30 | 42 |
| Weight | | | |
| Weight of the basic machine approx. | [kg] | 10,000 | 12,000 |
| Installation surface | | | |
| Basic machine (without chip container) approx. | [m] | 1.8 x 3.9 | 2.1 x 4.0 |

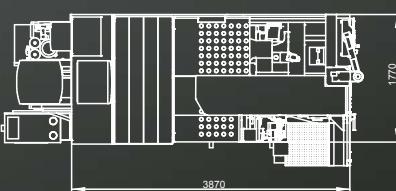
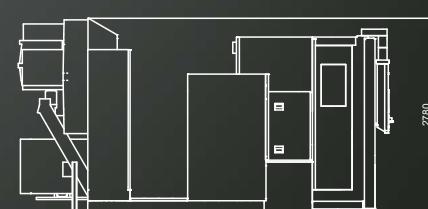
The specified dimensions and machine performance data may vary depending on the gear geometry parameters and material grade.



FHC 80



FHC 180



Flexline: highest efficiency, cost-effectiveness and quality

The Future of Gear Manufacturing

Machines, tooling and automation, including integrated quality assurance for every individual process: REISHAUSER and FELSMAT are redefining the integration of gear manufacturing technologies.

The task

Combining all process technologies into one complete system. Every process step is integrated into the seamless, continuous-flow production process, thereby streamlining the production line and drastically reducing throughput time and work in process.



The result

A highly efficient integrated production system, consisting of interchangeable technology modules and automation components. This results in lowest cost per part and maximum return on investment, without compromising process reliability or quality.



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GROUP

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