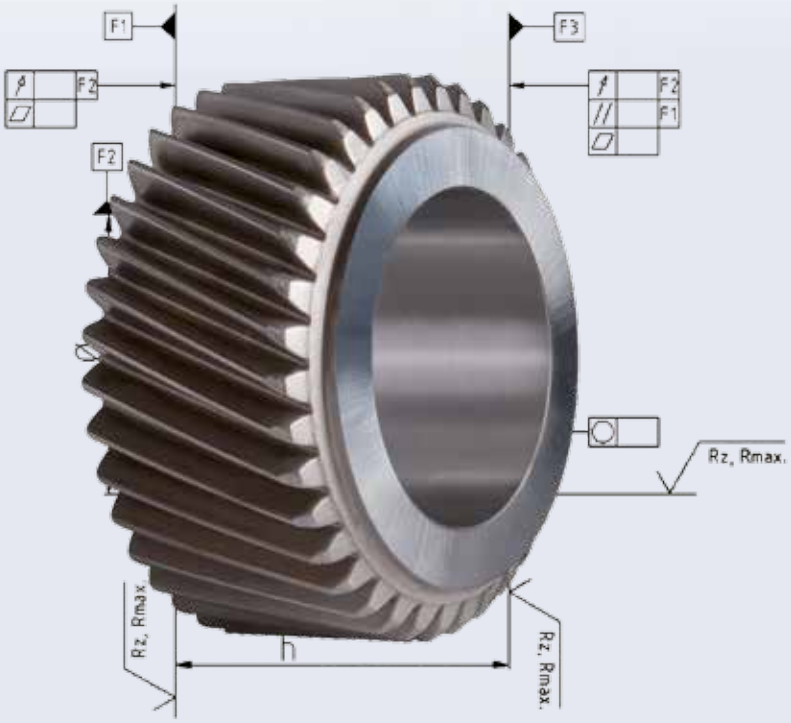
Ra Tpi

THIELENHAUS
MICROFINISH

FINISHING
GRINDING
HONING
in One Chuck



MicroStar F•G•H

Finishing – Grinding – Honing

MicroStar 285 F•G•H

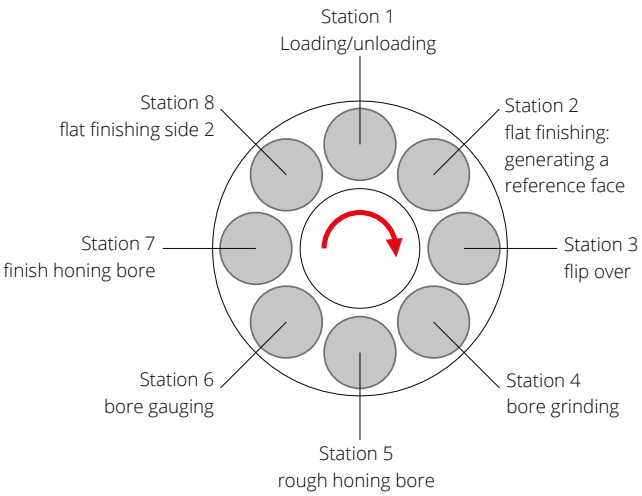
COMBINATION PROCESS FINISHING • GRINDING • HONING

The MicroStar FGH is a high precision machine tool for carrying out several operations in one chuck. This feature eliminates the addition of clamping errors and achieves extremely high qualities over the whole machining process. The machine features an indexing table with eight tool spindles as its base. All tool units are arranged around a central column. After generating a highly precise reference face on one face of the work piece all subsequent operations like finishing, gauging, bore grinding, and honing are carried out with the work piece clamped in one chuck. This is the unique feature of the machine, which was developed according to the motto "three processes – one machine".

YOUR BENEFITS

- **Considerable savings on total investment** through elimination of one or several machines including automation
- **Significantly low footprint** (8 stations on a diameter of 1.4 m)
- **Extremely high work piece quality** due to machine precision eliminating errors caused by multiple clamping
- **Shortest cycle times** through simultaneous processes
- **Affordable automation** due to handling single work pieces and eliminating the need of stack honing

PROCESS CHAIN EXAMPLE GEARWHEEL



STATION 1: LOADING / UNLOADING

At this station the work pieces are loaded and unloaded by handling cells via simple pick & place systems or even manually. The handling of choice depends on the needs of the customer. The automation can be of simple design as the honing process is carried out on single work pieces and not by stack honing.

STATION 2: FLAT FINISHING – GENERATING A REFERENCE FACE

In order to achieve the most demanding specifications regarding parallelism and perpendicularity of the bore towards the faces of the work piece one face is microfinished, thus generating a reference face for the subsequent operations.

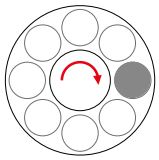
The tools applied are cup wheels, which are offset to the work piece. Through tilting the tool axis, the machine generates flat, concave or convex surfaces.

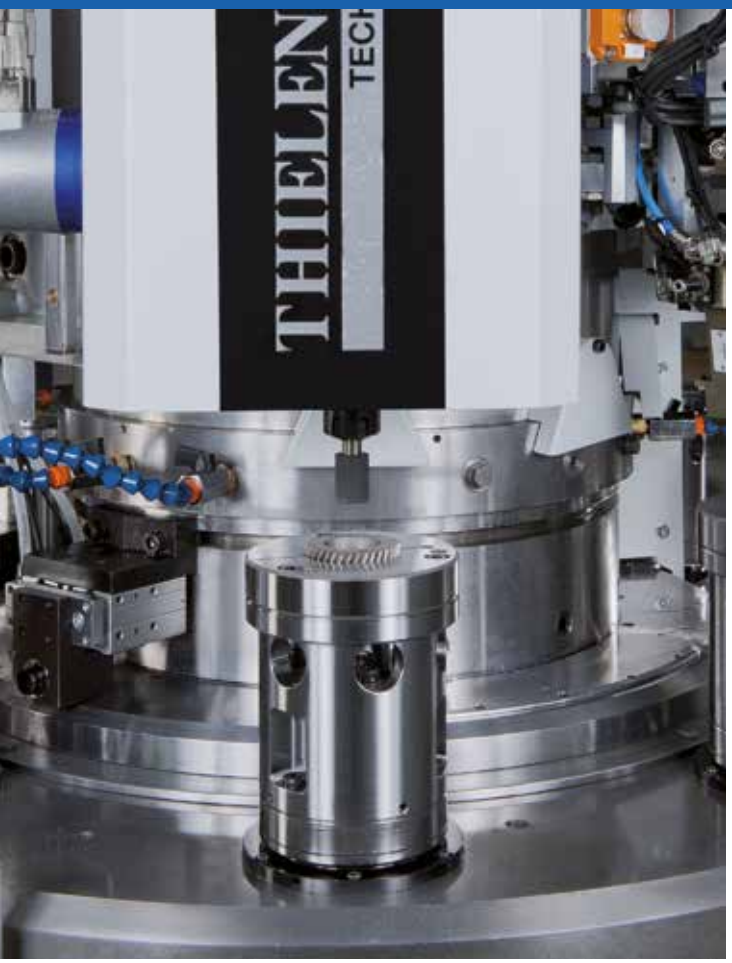
The high surface contact between work piece and tool and the low cutting speeds (as compared to grinding) result in pure metallurgical surfaces featuring high positive residual stress.

The patented MicroSens system controls the feed of the tool axes producing a loss-free machining force. This enables the tools, optimized for the specific work piece with regards to grain, binding, and hardness, to function optimally and consistently. At the same time this system is used for first cut detection.

STATION 3: FLIP OVER

After generating a reference face the work piece is flipped over by 180° and clamped into the same chuck onto this defined face. This procedure eliminates the influence of chucking errors. The work piece remains in this position until all subsequent processes have been carried out. Errors generated by multiple chucking are no longer an issue, thus leading to increased work piece qualities.



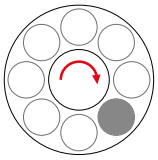


STATION 4: BORE GRINDING

During this operation the varying oversize, originated by tempering, is removed leaving an optimal amount of stock for the next station, so that a constant stock removal can take place.

The grinding station can do both ID and OD grinding. It features a first cut recognition and force control via MicroSens. The optional automatic tool dresser ensures the correct geometry of fresh tools.

The grinding process is based on oscillation grinding at cutting speeds suitable also for CBN or diamond tools.



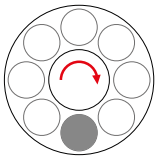
Option:
driven dresser

STATION 5: ROUGH HONING BORE

After the bore is ground, the rough honing process takes place. Here the bore is rough-honed close to the finished bore size using a multiple stone honing tool. This produces the optimized tolerances characteristic of honing, such as roundness, cylindricity and surface finish.

The tool is expanded using an electromechanical feeding system, which continuously monitors the feed rate and the feed force. This ensures that during the machining of the work pieces, very small bore size variations can be achieved leading to a very stable process cycle.

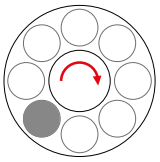
The hone spindle is designed so that in combination with the fixture, high cutting speeds (stroke speeds up to 40 m/min.) can be achieved. This achieves a high stock removal rate in minimal time.



STATION 6: BORE GAUGING

The bore diameter is determined via an air gauging unit. An air gauge mandrel is inserted into the rough honed bore and measures the diameter at multiple levels. In addition the taper of the bore is ascertained by comparing the actual indicated values.

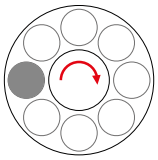
All values are displayed graphically on the operator screen of the hone controls. This allows the machine operator to monitor the honing process at a glance at any time and make corrections as needed. In addition, the determined values are used to control the rough honing process in that, for example, abrasive wear as well as correction of the stroke position are applied automatically to reach optimal bore geometries.



STATION 7: FINISH HONING BORE

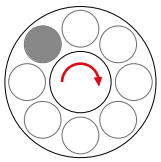
Finish honing enables you to reach the final diameter and the required surface quality. This hone operation also uses multiple stone tools which, through the use of the finest CBN abrasives, produce typical surface structures of predefined quality for honing.

The finish machining of high precision work pieces comes down to the perfect interaction of all the components involved in the hone process: the honing tool, abrasives, fixtures, feeding, and gauging systems.



STATION 8: FLAT FINISHING SIDE 2

The final finishing process generates the final size of the work piece. This can be achieved either by a standard constant stock removal or a tolerance narrowing using tool length compensation by our patented ToolSens or by in-process gauging. Here the tools are again cup wheels. The operation is controlled by MicroSens acting also as a first-cut detection.



OTHER PROCESS COMBINATIONS

- MicroSens force-controlled brush deburring for exact edging within 0 – 50 µm (sharp edged free of burrs)
- MicroSens force-controlled reaming of a center bore
- Tape finishing operations
- Pre-process, post-process and in-process gauging

The Power of Precision.

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