MicroStar
Finishing – Grinding – Honing

In Cooperation with

3-in-One
Honing meets Finishing
Thielenhaus and Gehring – An all-round solution!

Three processes on one machine

In order to offer an innovative solution for the machining of pinion gears to our customers, we have jointly developed the new MicroStar 285. Generating customer value – investment, cycle time and quality – is the center of our effort. The outcome is one single rotary transfer machine which ideally interconnects finishing, grinding and honing.

The MicroStar F-G-H is a high precision machine tool for carrying out several high precision 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 workpiece all subsequent operations like finishing, gaging, bore grinding, and honing are carried out with the workpiece clamped in one chuck. This is the unique feature of the 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 workpiece quality due to machine precision eliminating errors caused by multiple clamping
- Shortest cycle times through simultaneous processes
- Affordable automation due to handling single workpieces and eliminating the need of bundling

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**Process Chain e.g. pinion gear**

- Station 1: loading and unloading
- Station 2: flat finishing; generating a reference face
- Station 3: flip over
- Station 4: bore grinding
- Station 5: rough honing
- Station 6: bore gaging
- Station 7: finish honing
- Station 8: flat finishing side 2

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In Cooperation with
Station 1
Loading and unloading
At this station the workpieces 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 workpieces and not on bundles.

Station 2
Flat finishing – Generating a reference surface
In order to achieve the highest specifications regarding parallelism and perpendicularity of the bore towards the faces of the workpiece one face is microfinished, thus generating a reference face for the subsequent operations.

The tools applied are cup wheels being positioned offset to the workpiece. Tilting a tool axis generates flat, concave, or convex surfaces.

The high surface contact between workpiece and tool and the low cutting speeds, as compared to grinding, both result in pure metallurgical surfaces featuring high positive residual compressive stress.

The patented MicroSens system controls the feed of the axes producing a loss-free machining force, so that the tools, optimized for the specific workpiece regarding grain, binding, and hardness, will function optimally and consistently. At the same time this system is used for first cut detection.
After generating a reference surface the workpiece is flipped over by 180° and clamped into the same chuck onto this defined face. This procedure eliminates the influence of chucking errors. The workpiece 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 qualities regarding machine precision.

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 with fresh tools.

The grinding process is based on oscillation grinding at cutting speeds suitable also for CBN or diamond tools.
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 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. Thereby a high stock removal rate in minimal time is achieved during the machining of the work piece.

Station 5
Rough honing

Rough honing station

Tool for honing operation
The bore diameter is determined via an air gaging unit. An air gage 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.

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 gaging systems.
The final finishing process generates the final size of the workpiece. 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 0-50µm (sharp edged free of burrs)
- Tape finishing operations
- MicroSens force-controlled broaching of a center bore
- Pre, post, and in-process gauging
- Tape finishing operations

Station 8
Flat finishing side 2

Flat finishing side 2
**Worldwide Presence**

With our presence on three continents and a total of seven subsidiaries, we are very well-positioned and primed for the increasing globalization of the world economy.

Our representatives worldwide stand competently by your side and are your direct contacts in the market.

We are on the spot for you and provide the ideal solution for all honing applications.