



Starrag Group

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DBF Machining Centers
DBF 630/800



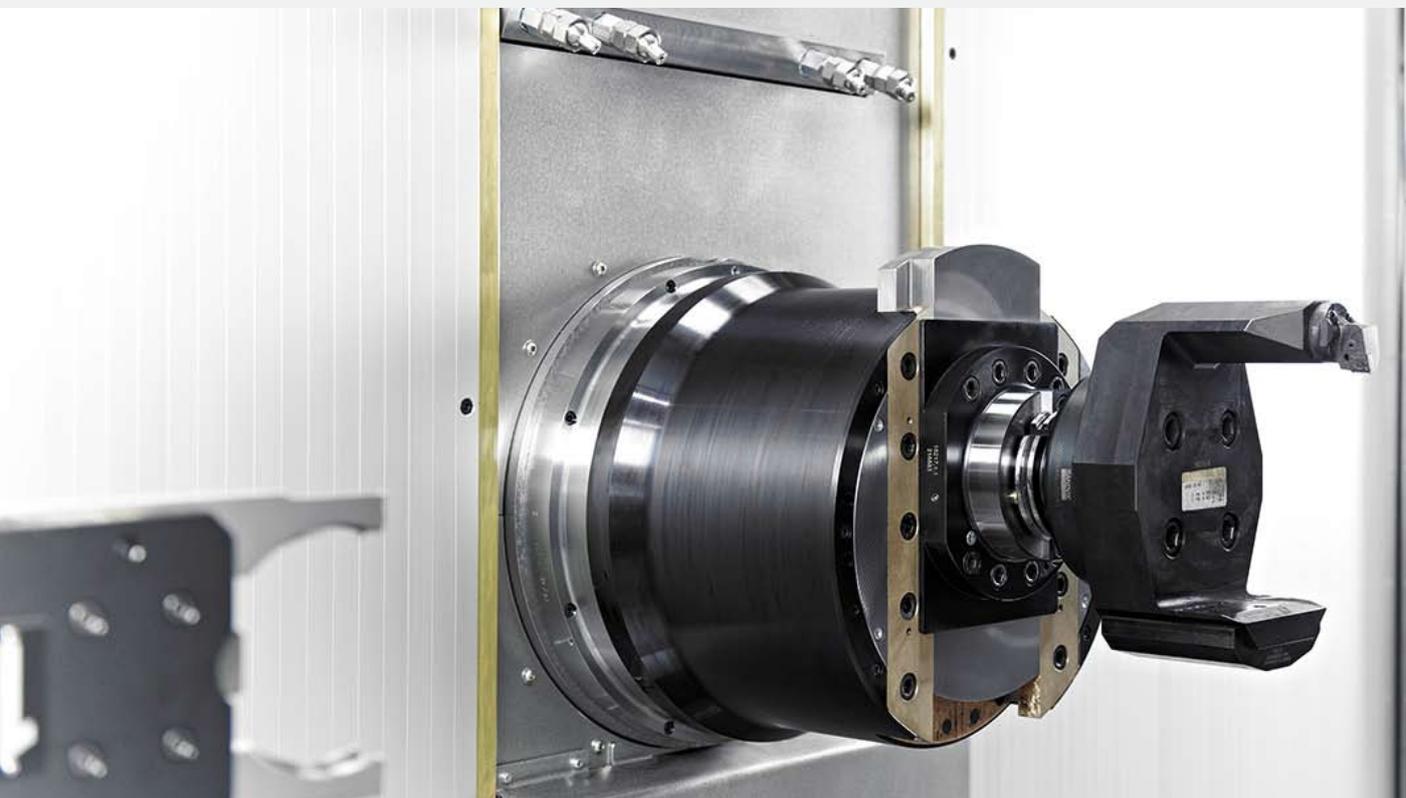
Turning/drilling/milling

The Horizontal Machining Centers HEC 500 / 630 / 800 Athletic can be used as all-round machining centers in a versatile and highly efficient manner.

A further increase in flexibility and efficiency was realized thanks to the development of the machining centers DBF 630 and DBF 800 on the basis of the Athletic series.

Thanks to the integrated DBF spindle head, the complex production in the processes turning, drilling and milling can be realized in one single workspace.

The goal of complete machining in one clamping set-up on one machine is optimally reached thanks to the Horizontal Machining Centers DBF 630 and DBF 800.



Application

- Complex turning, drilling and milling of housing-shaped and prismatic work pieces with an interference diameter of up to 1,400 mm in one clamping operation
- Cutting of different work pieces in light metal, cast and steel design from batch size 1 to mass production
- Comprehensive turning operations:
 - external turning
 - face turning
 - internal face turning
 internal plain turning and relieving
- Use in the fields of aerospace, transport, industry and energy

Technological benefits

- Reduction of production and processing times: complete machining in the processes turning, drilling and milling
- High procedural integration: combination of the technologies of single machines in one workspace
- Reduction of non-productive times: high dynamics in the adjustment axes and in tool and work piece handling
- Precision with long-term accuracy: production with true running and axial run-out accuracy of 5 – 6 μm

- Reduction of the tooling times: clamping and unclamping of the tools during primary processing time at the clamping station
- Personalized production solutions: optimal realization of special customer requirements thanks to modular machine design
- Minimization of the maintenance and operating costs: comprehensive dispositioning facilities and monitoring devices for the entire system and high energy efficiency of the machining centers

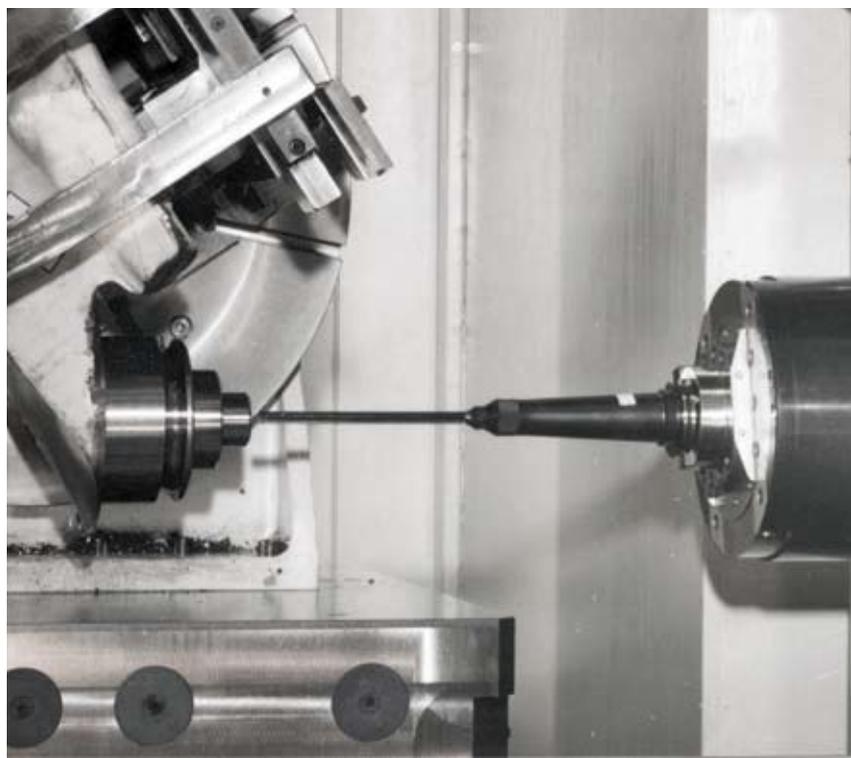


Advance through innovation

Turning



Drilling



Thermal machine stability

FEM-optimized main subassemblies with thermo-symmetric design for high static and dynamic stiffness

Short installation times and low assembly costs

Compact design for complete transport and installation with low requirements for foundation work

High machining and long-term accuracy

Use of high-precision subassemblies such as profiled rail guides in the linear axes, ball screw drives with counter bearing, hydraulic weight

compensation for vertical support adjustment, absolute, direct position measuring systems and angle measuring systems.

Optimal conditions for dry machining

Safe and quick chip removal by means of a wide chip conveyor and vertical guide plates to avoid chip clusters in the workspace.

Complete machining by means of turning/drilling/milling

DBF spindle head, consisting of a face plate with integrated spindle and CNC-controlled radial facing slide for turning, drilling and milling

High process reliability

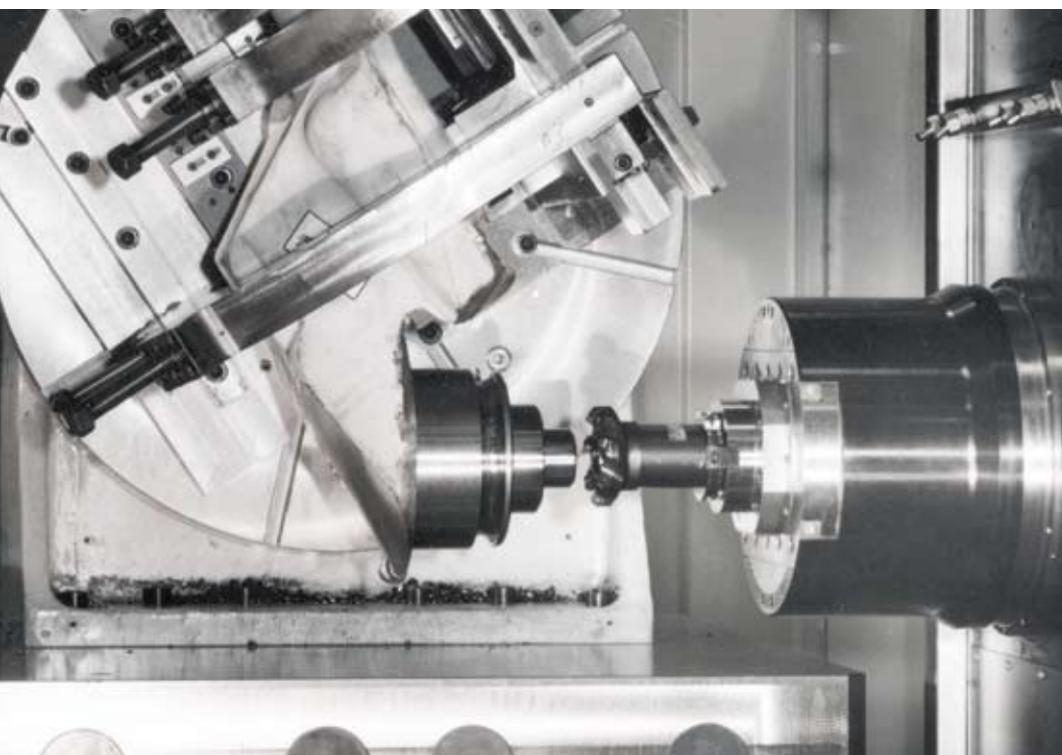
Work pieces in gantry design with guideways, ball screw drives and measuring systems, not being influenced by chips and coolant

Precise multi-side machining

NC rotary table with max. 70/60 rpm, input resolution 0.001 degrees, max. positioning scatter band P_{smax} 3", max. reversal error U_{max} 2"

Reduction of tooling times

Clamping and unclamping of work pieces during primary processing time at a separate clamping station.

 Milling

User-friendly work piece handling

- Turnable clamping station with 4 × 90 degrees of indexing
- Coupling unit for hydraulic clamping devices (6 channels, 30 – 240 bar)
- Hydraulic lifting/pivoting changer for automatic pallet change

Reduction of non-productive times

- High dynamics during tool and work piece handling and in the adjustment axes
- Hydraulic tool double-arm gripper and arrangement parallel to the spindle of the tools inside the magazine

Most modern process control and monitoring

- CNC control Sinumerik 840 D solution Line or Fanuc Series 31 i each with integrated PLC and digital propulsion technology
- Monitoring of life and number of pieces
- Tool identification
- Tool break-down checking during primary processing time
- Tool-specific capacity utilization monitoring of the work spindle drive and the rotary table drive resp.
- Speed monitoring of the tools
- Optical measuring probe
- ARTIS tool and process monitoring

Innovative tool handling

- Chain magazine with 60, 80 or 120 storage places for tools with diameters of up to 325 mm and a length of up to 700 mm (turning operation: Ø 500 mm, width 200 mm)
- Tower magazine for max. 320 tools with a diameter of up to 250 mm and a length of up to 700 mm (turning operation: Ø 500 mm, width 200 mm)
- Tool change in the tower magazine during primary processing time

Low maintenance and operating costs

- Modular service and diagnostic system SAM to improve the machine uptime, fast error diagnosis, data collection and statistics
- Brankamp-CMS Monitoring System for collision detection

Expansion into Flexible Manufacturing Systems

Linear storage unit for pallets with stacking crane, 6 storage places (DBF 800) and 10 storage places (DBF 630) for machine pallets, a loading and unloading station and master control (the storage places and clamping stations are optionally expandable)

Power / precision / efficiency



Thermo-symmetric machine design

The machining centers have a cross-bed design with optimized main subassemblies. This compact design with integration of hydraulic and pneumatic subassemblies into the basic machine ensures complete transport, installation with low requirements for foundation work and thus short installation and commissioning periods.

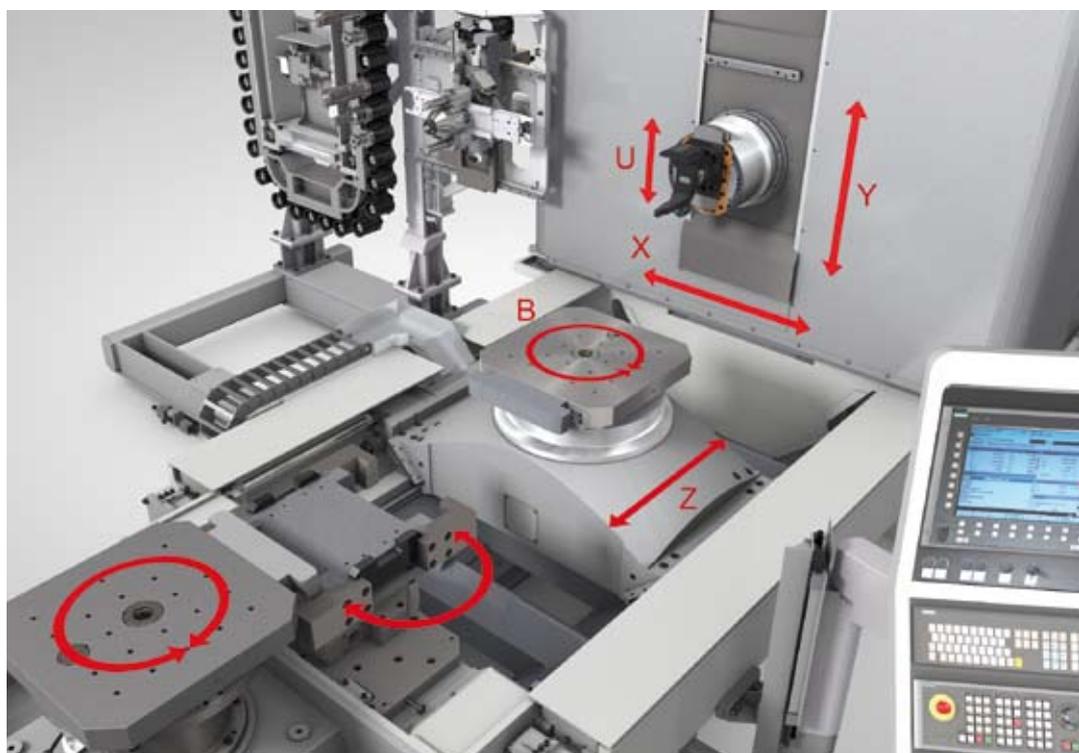
As a requirement for the high pallet loading mass of up to 2,500 kg and the dynamics of the adjustment axes, the work piece side of the centers is realized in gantry design with two feed drives. Guideways, ball screw drives and measuring systems cannot be influenced by chips and coolant in order to increase process reliability and process accuracy.

A hydraulic weight compensation for the vertical axis increases precision during machining extends the service life and increases dynamics.

High-precision functional groups

Long-term tested subassemblies such as profiled rail guides with prestressed sealed guiding carriages in all linear axes and low-backlash digital AC-feed drives with ball screw drives and counter bearing ensure high adjustment and acceleration values, work piece accuracy of class IT 5 and long-term accuracy.

Positioning and angle measuring is realized by means of absolute, direct measuring systems with protected housing and supplied with compressed air.



A high positioning accuracy of the NC rotary table is ensured thanks to hydraulic clamping of the table and by means of compressed air application onto the table's internal space in order to avoid contamination.

Flexible and time-saving tool handling

In the standard version, tool storage is realized in the chain magazine with 60, 80 or 120 places for tools with a diameter of up to 325 mm and a length of up to 700 mm. For requirements for higher tool amounts, the machining centers can be optionally equipped with tower magazines for max. 320 tools. The tower magazines distinguish

themselves by their low space requirement at highest tool density, the reduction of tooling times thanks to tool change during primary processing time and a high user comfort.

The hydraulically functioning double-arm gripper, the arrangement parallel to the spindle of the tool inside the magazine and an optimized changing procedure ensure shortest chip-to-chip times.

Tool identification, tool break-down checking and monitoring of the tool-specific speeds are a part of the modern tool management.

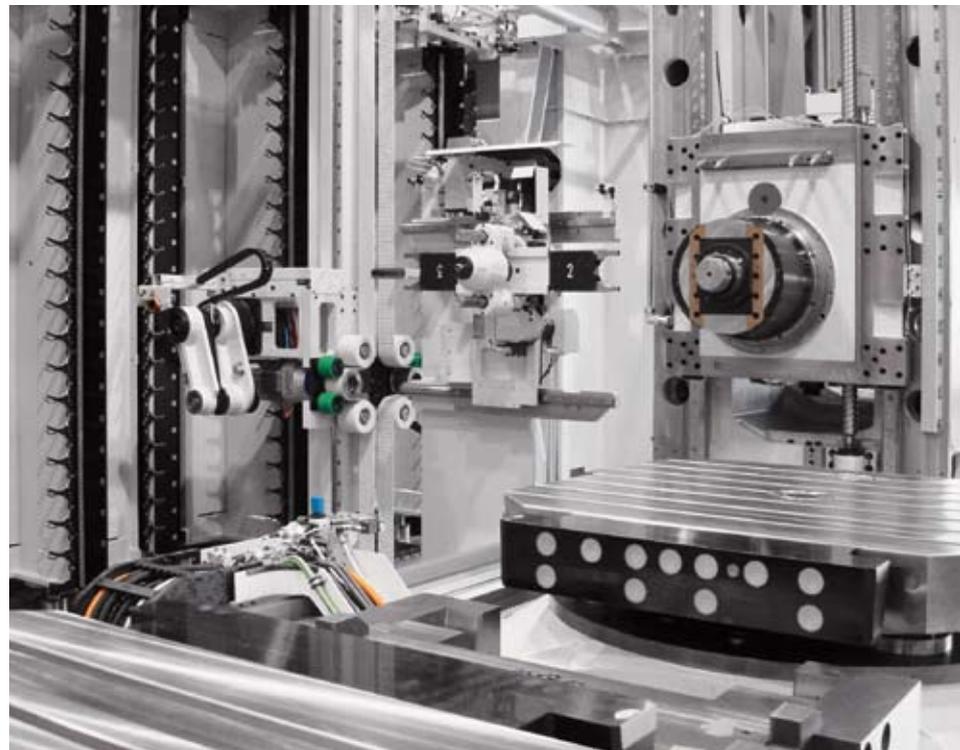
Chain magazine for tools with a diameter of up to 325 mm and a length of up to 700 m



Comfortable tool handling

The tools are clamped, re-clamped and unclamped at the clamping station during primary processing time. The clamping station, which is turnable and indexable by 4×90 degrees facilitates tooling on the fixture and on the work piece. The square-shaped or rectangular work piece pallets which are adapted to their respective tasks can be delivered in the dimensions 630×630 mm to $1,000 \times 800$ mm with tapped holes and T-grooves. For hydraulic clamping devices, the table pallets can be upgraded with a coupling unit for hydraulic clamping systems of 30 – 240 bar. A hydraulic lifting/pivoting device changes from the

Machine design with tower magazine



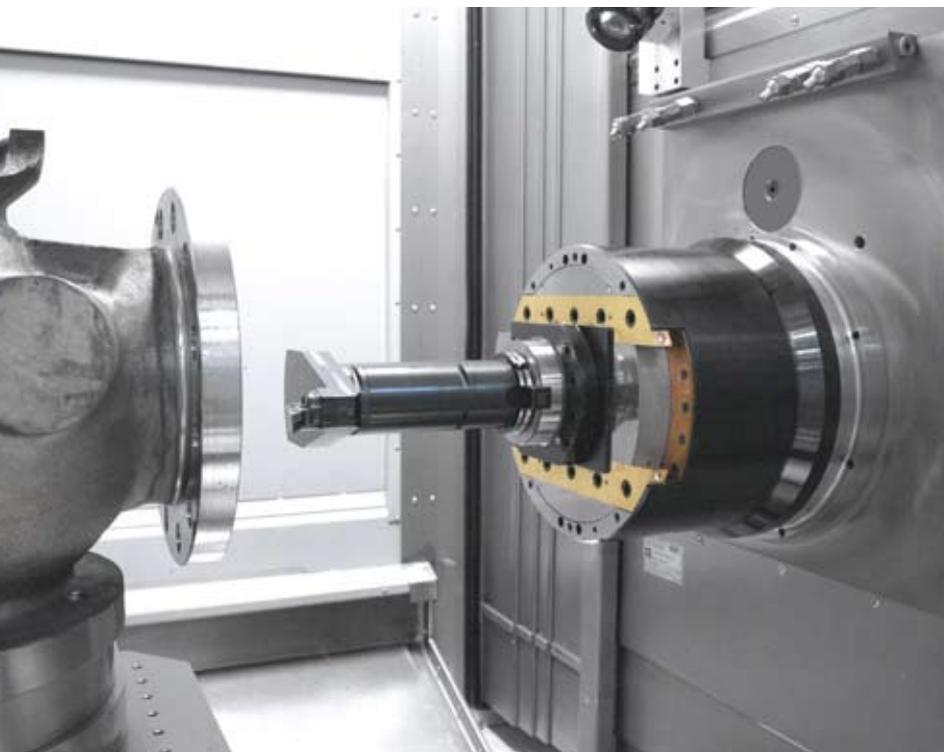
clamping station to the workspace quickly and automatically. In order to increase the flexibility and to ensure unattended production, the machining centers equipped with pallet linear storage unit are expandable.

Optimal cutting conditions

The machining centers provide ideal conditions for wet and dry machining. For wet machining, the coolant is supplied via the spindle and tool center at a pressure of max. 70 bar or at 50 l/min via nozzles. Depending on the cutting material, the coolant unit can be optionally equipped with vacuum slotted screen, fleece gravity filter or rotary vacuum filter. Temperature stabilization

for the coolant is additionally available. The chips are discharged out of the workspace quickly and safely via the wide chip conveyor in scraper or link conveyor design, which is arranged centrally underneath the machine bed. Vertically arranged guide plates in the workspace prevent the formation of chip clusters and thus create good conditions for dry machining. In order to further improve the working and operating quality, the machining centers can be complemented by a splash shower for cleaning the work pieces, by a workspace and cover rinsing device, emission suction and a fire protection package for machining magnesium alloys.

Internal and face turning work at the valve housing



External and face turning work at steering pivot pins of a truck



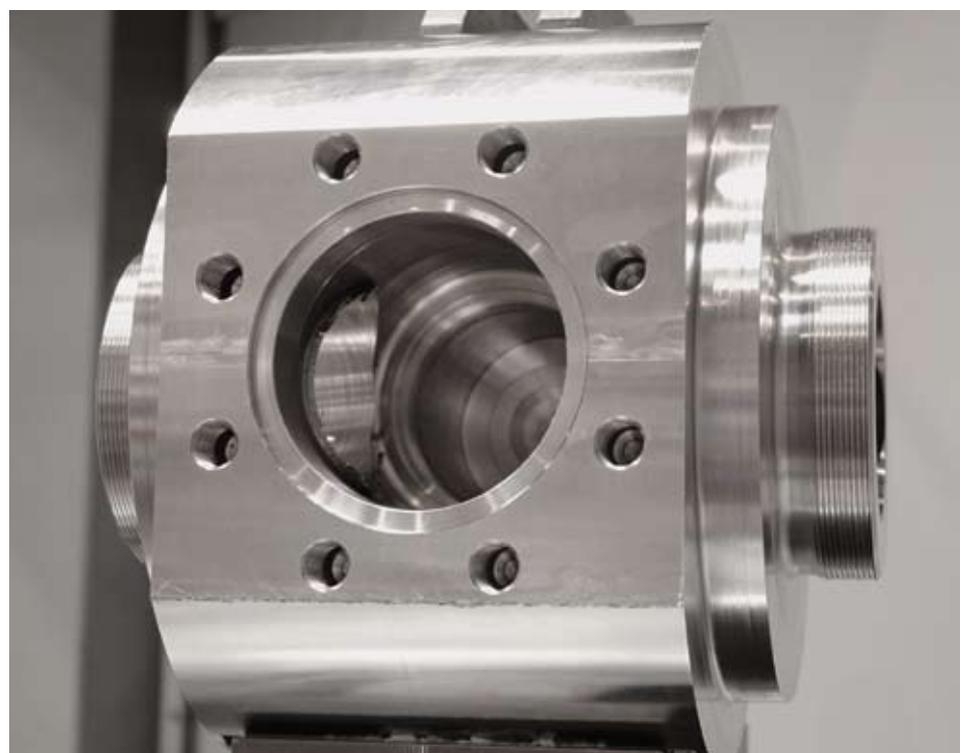
Turning, drilling and milling by means of DBF spindle head

The DBF head ensures complete machining in the processes turning, drilling and milling on one machining center in the fit quality IT 5 with high surface quality. The spindle head consists of a face plate with integrated work spindle and a CNC-controlled radial facing slide. For turning on a fixed work piece, the rotating lathe tool can be radially adjusted by ± 35 mm. A leveling compound integrated into the head compensates the imbalance and thus ensures an axial run-out and true running accuracy of 5 – 6 μm . For drilling and milling applications, the work spindle is arranged in central position. The high drive power of

max. 45 kW and the max. torque of 1,700 Nm ensure drilling into solid materials with a diameter of up to 100 mm. Besides external, internal and face turning, conical and contour turning are also possible thanks to the full-value NC axis of the radial facing slide. The coolant supply through the spindle center provides all turning, drilling and milling tools.

The DBF spindle head ensures high procedural integration for each clamping operation. The complete machining on only one machine and the omission of re-clamping work increase the work piece accuracy and reduce the production and processing time.

Technology examples



Duty profile

- Flexible production and complex unit parts in a great variety of versions with milling, drilling and turning of solid material X6 CrNiMoTi 17-12-2
- Increased requirements for accuracy and surface quality, in particular when machining the seal seats.
- Required machine accuracy according to VDI/DGQ 3441: Position uncertainty $P < 0.015$ mm, Positioning scatter band $P_{\text{medium}} < 0.006$ mm
- Reduction of the number of machine tools and clamping operations
- Reduction of production and processing times

Solution

- Use of the Horizontal Machining Center DBF 800 with the specification:
 - DBF spindle head (45 kW/1,700 Nm/ max. 3,500 rpm)
 - Tool tower magazine with 320 storage places
 - Pallet linear storage unit with 6 pallet places
- Production technology
 - Complex production in one single clamping operation
 - Milling with face-milling cutter $\varnothing 125$ mm, HSC-milling cutter $\varnothing 125$ mm with a feed rate of 5 000 mm/min and insert endmill $\varnothing 50$ mm
 - Solid drilling $\varnothing 70$ mm
 - Turning with turning tool $\varnothing 89$ mm and external turning tool $\varnothing 300$ mm

Customer benefits

- Reduction of the production time by 77 % thanks to ready-for-assembly complete machining in one clamping set-up
- Reduction of processing times by 95 % thanks to production on one single Machining Center DBF 800.
- Minimization of non-productive times thanks to high dynamics during automatic tool exchange
- Unattended production thanks to pallet storage system and high tool storage capacity
- Machine accuracy ($P = 0.008$ mm/ $P_{\text{medium}} = 0.002$ mm) ensures high work piece precision



Duty profile

- Complete production of valve housings in a great variety of designs for gas turbines for the construction of power stations.
- Ready-for-assembly machining of the valves made of high-alloyed steel casting for high pressures and temperatures
- Use of high-speed spindles and angular milling heads
- Production processes turning, drilling and milling with a precision of class IT 5

Solution

- Production on Horizontal Machining Center DBF 800 with
 - DBF spindle head (45 kW/1,700 Nm/ max. 3,500 rpm)
 - Chain magazine for max. 80 tools up to Ø 325 mm and a length of up to 700 mm
 - Telescopic torque support for the use of additional units (high-speed spindle/angular milling heads)

Customer benefits

- Complete machining in one clamping set-up
- Reduction of production and processing times
- High flexibility during machining of the valve housings in great variety of versions
- Reduction of the non-productive times thanks to high dynamics during tool and work piece handling

Technical Data

Values in brackets = option

	DBF 630		DBF 800	
Design work spindle	Horizontal		Horizontal	
Design table	NC rotary table		NC rotary table	
Clamping surface/perf. pallet DIN 55201	mm	630 × 630 (800 × 630)	800 × 800 (1,000 × 800)	
Max. load	kg	1,500	2,000 (2,500)	
Max. rotational speed	rpm	70	60	
Input and display resolution	degree	0.001	0.001	
Interference diameter	mm	1,250	1,400	
Automatic pallet change				
Number of changeable pallets basic machine		2	2	
Max. pallet changing time	s	14	18	
Adjustment ranges				
Longitudinal adjustment X	mm	1,070	1,320	
Vertical adjustment support Y	mm	870	1,070	
Cross adjustment table Z	mm	1,200	1,300	
Radial adjustment lathe tool U	mm	± 35	± 35	
Work spindle/DBF spindle				
Drive power 100 % c.d.f.	kW	45	45	
Torque 100 % c.d.f.	Nm	1,700	1,700	
Speed rang, turning	rpm	50...1,200	50...1,200	
Max. speed, drilling/milling	rpm	3,500	3,500	
Tool holder		HSK-A 100 (SK 50 Form B/BT)	HSK-A 100 (SK 50 Form B/BT)	
Tool change				
Magazine design		Chain (Tower)	Chain (Tower)	
Magazine storage places		60 (80/120) (180/240/320)	60(80/120) (180/240/320)	
Max. tool diameter	mm	325 (250)	325 (250)	
Max. tool length	mm	700 (450/700)	700 (450/700)	
Max. tool mass	kg	35 (35)	35 (35)	
Max. tool dimensions, turning				
Diameter/width	mm	500/200 (500/200)	500/200 (500/200)	
Max. tool mass, turning	kg	25 (25)	25 (25)	
Chip-to-chip time VDI 2852	s	8 (8)	8 (8)	
Movement speed				
Feed range X/Y/Z, stepless	mm/min	1...40,000/40,000/60,000	1...40,000/40,000/60,000	
Fast motion X/Y/Z	m/min	40/40/60	40/40/60	
Feed force X/Y/Z 60% c.d.f.	kN	22/18/22	22/18/22	
Coolant device				
Supply via nozzles				
Output	l/min	50	50	
Pressure	bar	2	2	
Supply through spindle center				
Output	l/min	30	30	
Pressure		15 (50/70)	15 (50/70)	
Machine accuracy VDI/DGQ 3441				
Linear axes X/Y/Z				
Max. position uncertainty P[Tp]	mm	0.006	0.006	
Max. positioning scatter band P _{smax}	mm	0.004	0.004	
Max. reversal error U _{max}	mm	0.003	0.003	
NC rotary table				
Max. position uncertainty P[Tp]	sec	6 (4)	6 (4)	
Max. positioning scatter band P _{smax}	sec	4 (3)	4 (3)	
Max. reversal error U _{max}	sec	3 (2)	3 (2)	
U-axis				
Max. position uncertainty P[Tp]	mm	0.015	0.015	
Position scatter band P _{smax}	mm	0.007	0.007	
Dimensions and weights				
Length × width × height	m	8.10 × 5.35 × 4.15	8.50 × 5.50 × 4.15	
Weight	kg	28,200	32,000	
CNC control	Sinumerik 840 D solution Line (Fanuc 31 i)		Sinumerik 840 D solution Line (Fanuc 31 i)	



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