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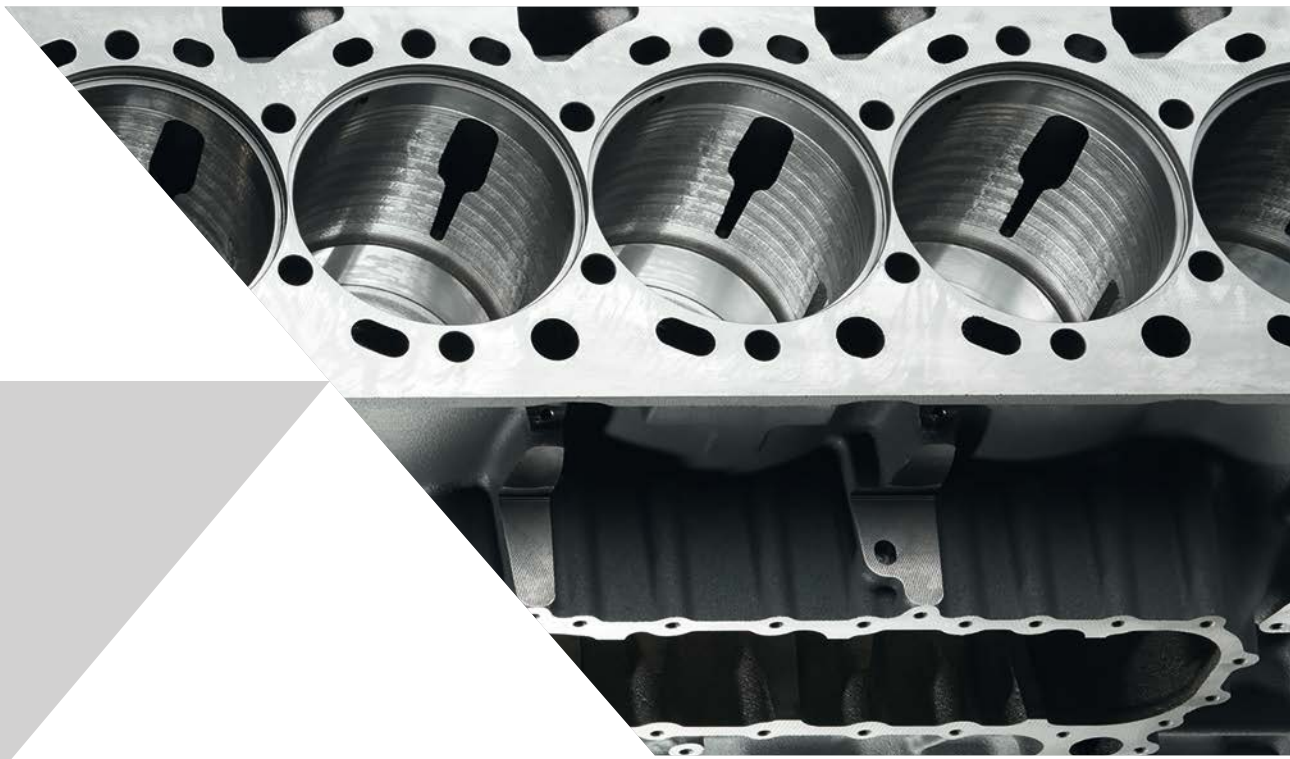
Starrag Group

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HEC Machining Centers

HEC 1000 / HEC 1250 / HEC 1600 / HEC 1800 Athletic

HEC 1000 / HEC 1250 / HEC 1600 / HEC 1800 U5



Modern athletes with a modular structure and flexible application.

The flexible and modular-designed horizontal machining centers HEC 1000 – 1800 Athletic guarantee optimum results in the economic processing of large-sized and heavy workpieces with an edge length of up to 3,300 mm and up to 13,000 kg in all material qualities.

The complete and multi-side machining in one clamping position cuts production and processing times, increases the quality of processing, and reduces the logistics effort.

The model series has four sizes, a wide range of workspindle variants, process-optimized solutions for tool and workpiece handling, and innovative process controls and monitors.

When extended with an NC swivel head, the HEC 1000 – 1800 U5 machining centers are equipped for 5-axis machining and have the best conditions for the machining of form elements in any angular position.

The modular design ensures individual tailor-made customer solutions for single piece, series and bulk series production. The chief areas of application for the machining centers are transportation & industrial components.

They can be used as stand-alone machines, extended with pallet storage, or integrated into flexible manufacturing systems for unattended production.

Customer benefits

- › **Customized version**
Modular construction guarantees customizable manufacturing solutions
- › **Wide range of workspindles**
 - Powerful horizontal spindles, modified in power and speed
 - Horizontal/vertical milling heads for 5-side machining
 - NC quills for low-lying form elements and long travels
 - NC swivel head for all-round machining
(HEC 1000 U5 – 1800 U5)
- › **Reduction of manufacturing and floor-to-floor times**
Assembly-ready complete machining in one clamping
- › **Machining quality to IT 5/6 and high long-term accuracy**
Thermo-symmetrical machine design, FEM optimized main components, use of high-precision functional elements and high accuracy package as an option
- › **Reduction in setup times**
Workpiece setup on separate load-unload station during processing
- › **Decrease in non-productive time**
Highly dynamic tool handling and adjustment axes
- › **Savings on tool and operating costs**
Modern process monitoring and high energy efficiency of the machining centers



Customizable individual solutions from the modular system.

1 Workspindles

▸ Horizontal spindles

- 55 kW, 1,500 Nm, max. 6,000 rpm
- 83 kW, 1,500 Nm, max. 7,500 rpm
- 50 kW, 958 Nm, max. 10,000 rpm
- 50 kW, 958 Nm, max. 12,500 rpm
- with increased power 84 kW, 3,000 Nm, max. 5,000 rpm

▸ Swivel horizontal/vertical milling heads

- 30 kW, 1,088 Nm, max. 6,000 rpm
- 55 kW, 1,042 Nm, max. 7,500 rpm

▸ NC quills

- diameter 125 mm, 55 kW, 2,470 Nm, max. 4,000 rpm, travel 500 mm
- diameter 150 mm, 61.5 kW, 2,150 Nm, max. 5,000 rpm, travel 760 mm

▸ NC swivel heads

(for HEC 1000 U5 - 1800 U5)

- 66 kW, 1,860 Nm, max. 6,000 rpm
- 66 kW, 1,860 Nm, max. 8,000 rpm

2 Tool holders

- Hollow-shaft taper HSK-A100
- Steep taper SK 50 form A and B, BT 50
- BigPlus for steep taper

Machine base

- Vertical travel path Y-axis 1,100 mm to 2,800 mm depending on size and working spindle

4 Machine beds

- Lateral adjustment travels Z-axis 1,850 mm to 2,250 mm depending on size and working spindle

5 Machine tables

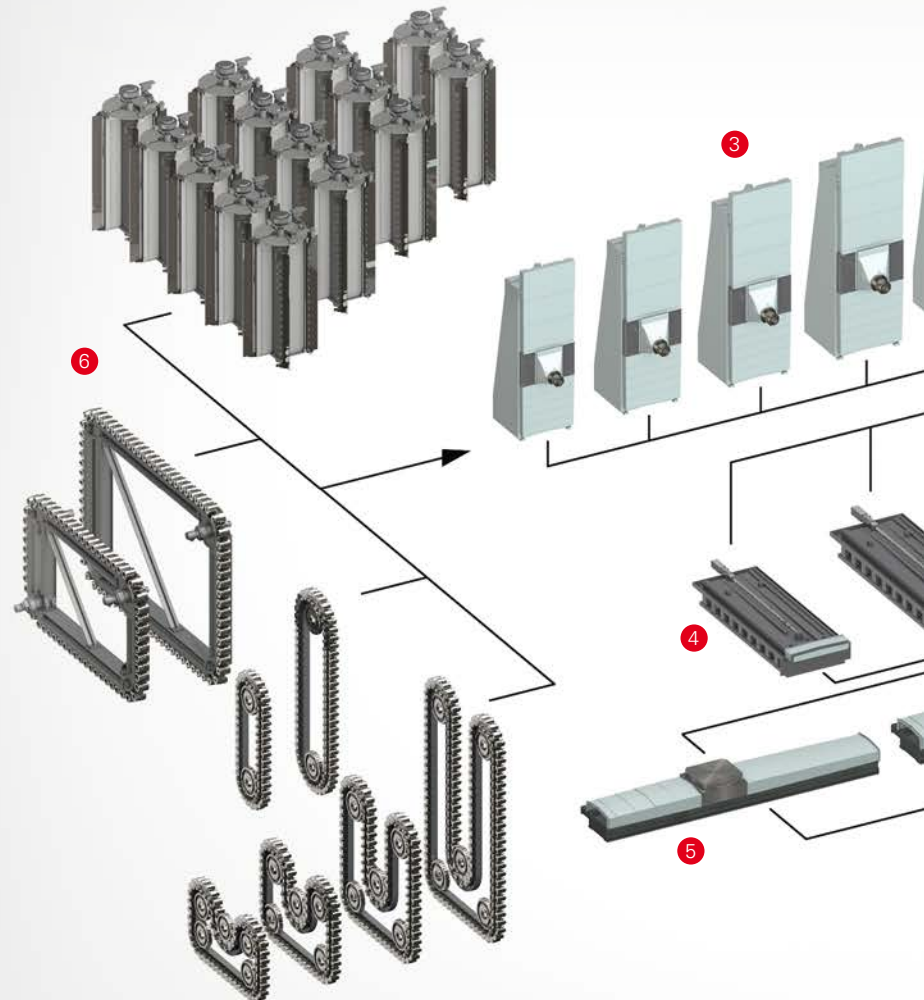
- Longitudinal travels X-axis 1,700 mm to 3,400 mm, depending on size and working spindle

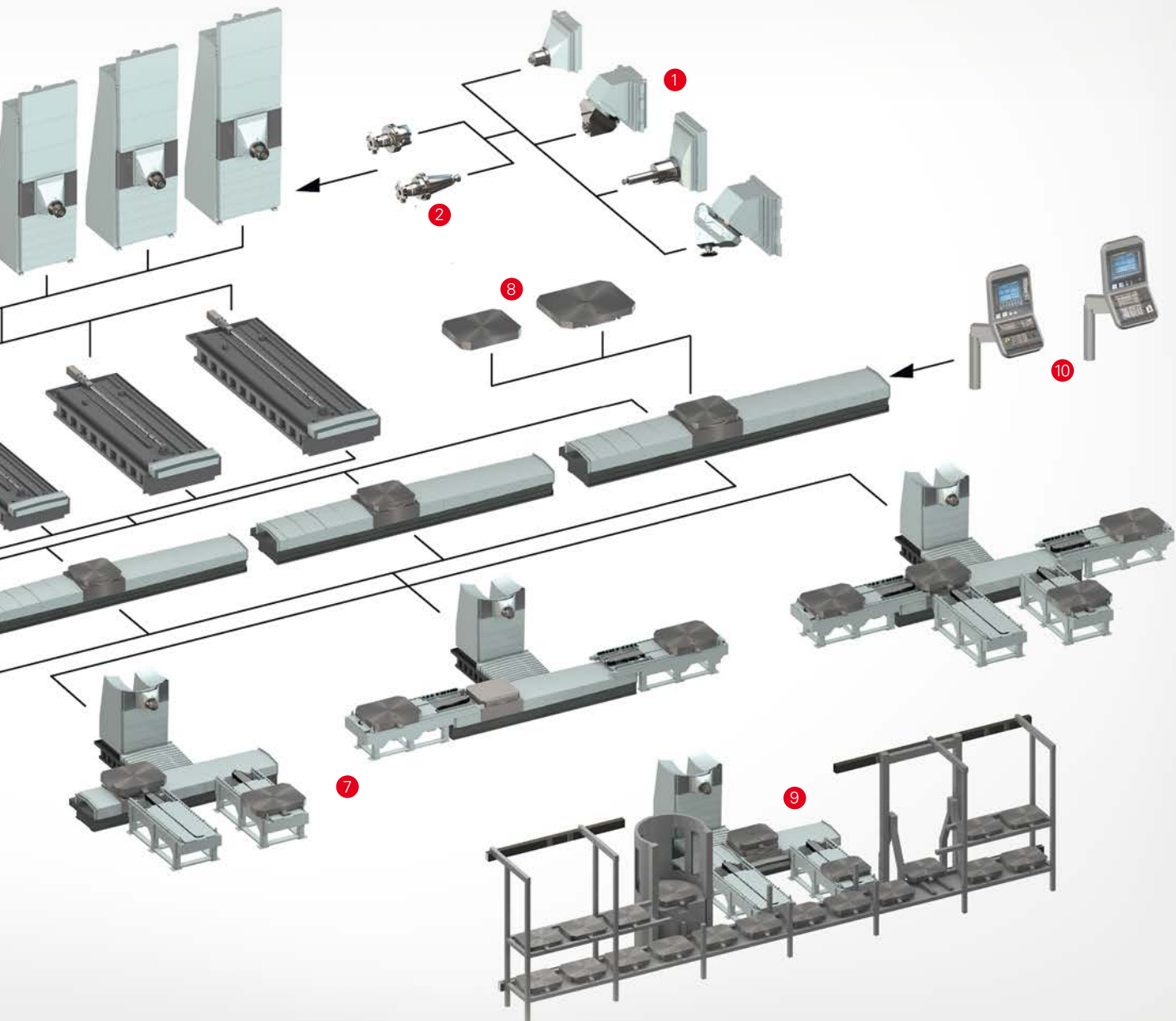
6 Tool magazines

- Chain magazines with 40, 60, 80 and 120 tool pockets
- Tower magazines with 180, 270, 360 and 450 tool pockets

7 Pallet change

- Double changer with pallet feeding from the front
- Double changer with pallet feeding from both sides
- Quadruple changer with pallet feeding from the front or both sides





8 Pallets

- Version with threaded holes or T-slots in the dimensions 1,000 × 800 mm, 1,250 × 1,000 mm, 1,600 × 1,250 mm, 1,800 × 1,250 mm with and without hydraulic clamps for equipment, further pallet dimensions on request

9 Pallet storage

- Linear storage in one or more tiers, with pallet transport trolley, storage and clamping points (number according to choice) and control station

10 CNC controller

- Sinumerik 840 D Solution Line
- Fanuc series 31i

High efficiency with power and precision.

Modern machine concept

- ▶ Compact machine design with movable column in welded steel construction
- ▶ FEM optimized modular components in thermo-symmetrical design
- ▶ Functional groups with a low number of components and signal generators for high reliability and long-term accuracy
- ▶ Central arrangement to reduce maintenance and service work
- ▶ High static and dynamic stability ensures optimum cutting performance and processing quality to IT 5/6
- ▶ Closed frame standards for high rigidity and accuracy
- ▶ Extremely large working areas with optimal travel paths and lifting positions of working spindle
- ▶ Large distances between guideway ensures balanced load and therefore minimal wear
- ▶ Machine bed in granite version with high damping properties (optional)

Performance and accuracy in the machine support

- ▶ Modular frame standards support as a key component for power transmission and machining accuracy
- ▶ The support bears the workspindle components and the AC main motor, which is modifiable in power and speed
- ▶ A two-stage high performance main gearbox with pneumatic circuit and



- oil-circulating lubrication ensures long service life and reliability
- ▶ Hydraulic counterbalancing for support to stabilize and increase accuracy, reduce positioning time and extend tool-life of the ballscrew

High accuracy package (optional)

- ▶ Improvement of positioning uncertainty in the adjustment axes (position uncertainty P[Tp] in all linear axes 0.004 mm, rotary axis 4 arcsec)
- ▶ Thermally insulated and water-cooled machine base
- ▶ Water-cooled main spindle and axis drive motors

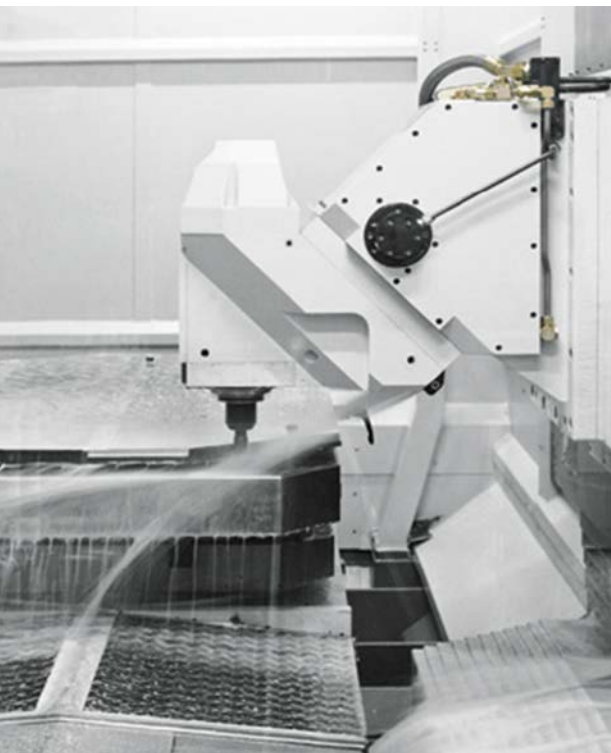
- ▶ Tempered ballscrews
- ▶ Compensation of inaccuracies in the linear and rotary axes
- ▶ Scraping of mounting and contact surfaces

Horizontal working spindle

- ▶ Compact, bend-resistant spindle with high torsional stiffness, modifiable in power up to 84 kW and speed up to 12,000 rpm
- ▶ Material removal rate in steel processing 1,800 cc/min
- ▶ 4-fold precision bearing ensures high accuracy and smooth running

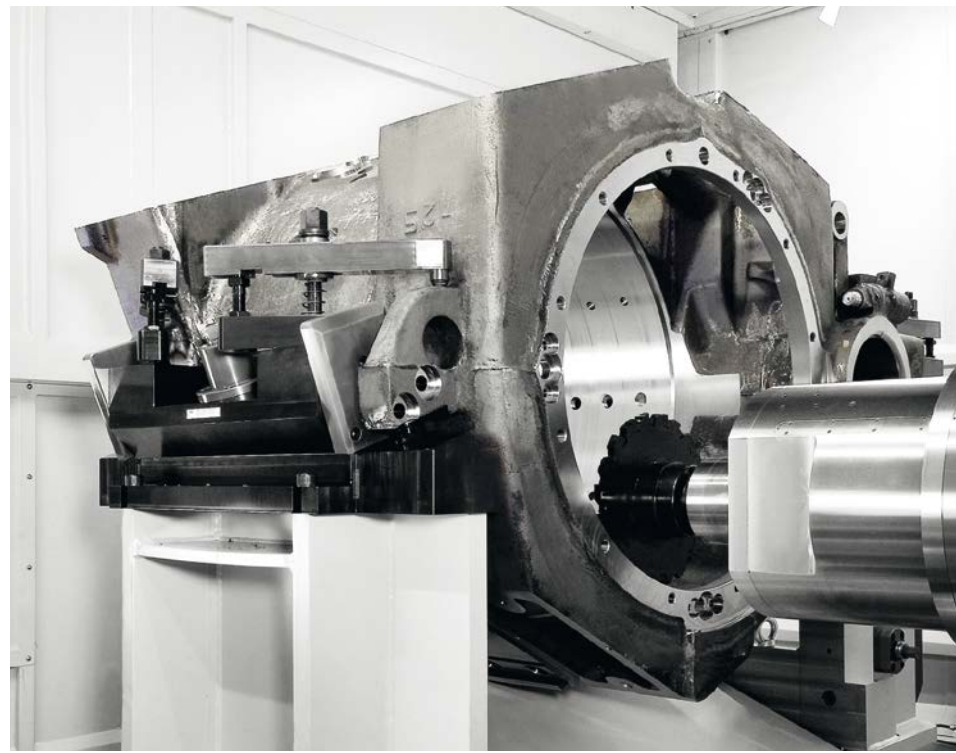


NC quill with stepless adjustment up to 500 mm or 760 mm.



Swivel horizontal/ vertical milling head

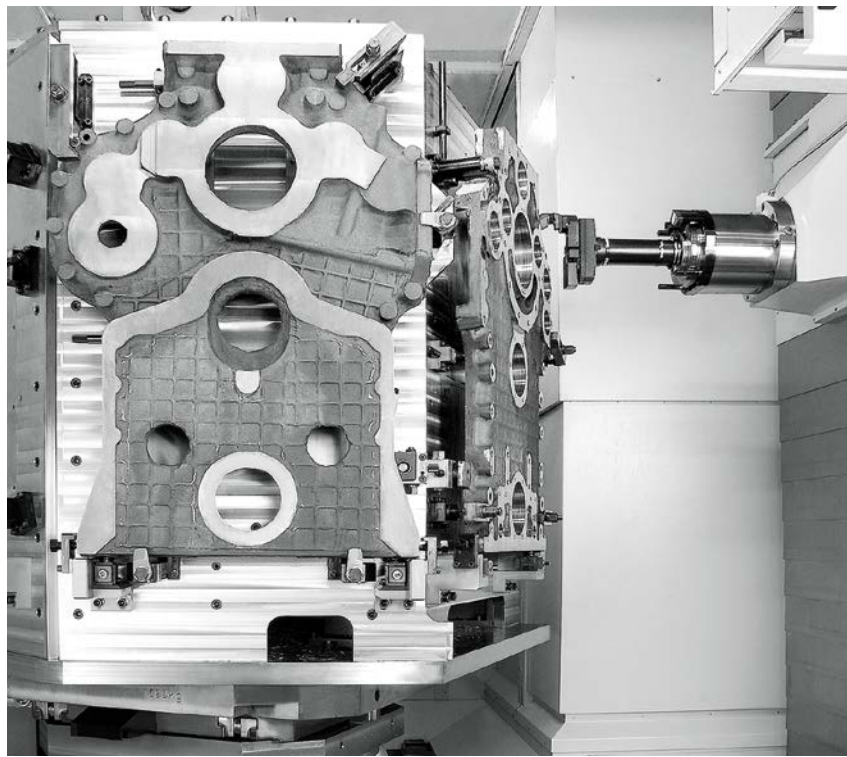
- › 5-side machining in one clamping
- › High rotational accuracy through 5-fold precision bearing
- › Optimal machining with max. 55 kW and up to 7,500 rpm
- › Serrated ring couplings guarantee highly precise swivel position
- › Automatic compensation of axial spindle extension under heat and sag compensation



NC quill

- › Processing low-lying areas and bore holes as well as long travels
- › Compact quill with optional diameter 125 or 150 mm and lift of 500 or 760 mm
- › Time-saving and more accurate alternative to shift drilling by machining with higher cutting parameters and improved process reliability
- › Use of standard tools minimizes tooling costs
- › High running smoothness increases tool life and finish quality

Leading through innovation.



Dynamic feed drives

- ▶ Digital feed drives in all linear axes and the rotary axis
- ▶ High rapid traverse rates up to 60 m/min and short positioning and control times of the feed drives when used with preloaded ballscrews with counter bearing and additional clamping
- ▶ Holding brakes on all axes
- ▶ Absolute direct measuring system with an input resolution 0.001 mm, application of compressed air and additional encapsulation prevent contamination and ensure high measuring accuracy

High-precision subassembly guides

- ▶ Sectional rail roller guides with preloaded and completely sealed guide carriages in all linear axes ensure high machining accuracy and maximum load-bearing capacity
- ▶ Position scattering range of P_{smax} 0.0025 mm, positioning uncertainty $P[Tp]$ 0.004 mm
- ▶ High long-term accuracy through optimal dimensioning of the guide rails

NC rotary table with high precision and high dynamic response

- ▶ NC rotary table for multi-side and complete machining with input resolution 0.001 degrees and absolute direct measuring system
- ▶ High load-bearing capacity of the rotary table, and guarantee of position scattering range of P_{smax} 3" and position uncertainty $P[Tp]$ 4"
- ▶ Hydraulic clamping and application of compressed air into rotary table interior to prevent contamination
- ▶ Table pallets equipped with coupling unit for hydraulic workpiece clamping devices with a pressure of 30 to 240 bar



Process-optimized cutting conditions

- External coolant supply via adjustable nozzles with 50 l/min and through spindle and tool center at max. 70 bar
- Coolant temperature control with temperature compensation
- Rapid swarf removal from workspace with two wide chip conveyors in scraper or link belt design
- Inclined guideway covers for safe chip removal and avoidance of swarf accumulations
- Material-dependent coolant processing via vacuum slot sieve, vacuum rotary filter or fleece compact filter with magnetic drum and oil skimmer
- Emission extraction by suction from work space

User-friendly workpiece handling

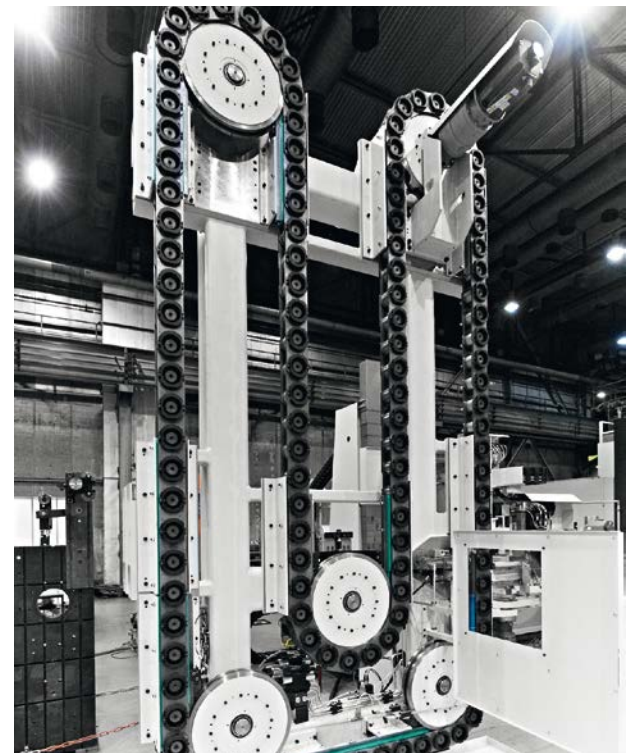
- Workpiece setup on load-unload station parallel to machining reduces setup and non-productive time
- Ergonomically designed load-unload station provides quick and safe access to the workpiece and fixture
- Automatic pallet change, individually adaptable as 2-, 3- and 4-fold changer with pallet feeding from front or side
- Wide selection of hole matrix and T-slot pallets

Workpiece handling – dynamic and flexible.

Tower magazine for max. 450 tools.



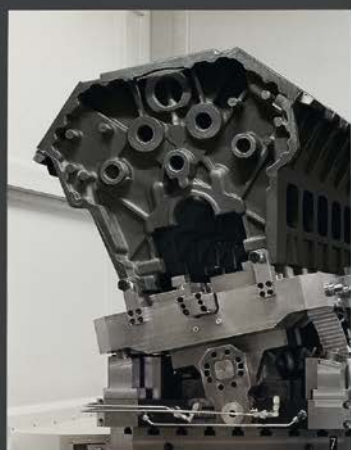
Chain magazine with up to 120 storage places.



Process optimized tool handling

- ▶ Chain magazine with 40, 60, 80 or 120 tool pockets for tools with max. diameter 325 mm (T-type tool up to 500 mm diameter), length up to 800 mm and max. individual weight 35 kg
- ▶ Short chip-to-chip time during automatic tool change through highly dynamic drive units for the movements of the magazine chain and the dual gripper.
- ▶ Tower magazine for increased tool requirements with either 180, 270, 360 and 450 tool pockets for tools up to 340 mm in diameter (T-type tools up to 950 mm) and single mass up to 50 kg for the automatic substitution of auxiliary equipment
- ▶ Advantages of the tower magazine
 - Small installation area with highest tool density
 - Tool loading parallel to machining reduces setup times
 - Quick tool changing
 - Increased functional and operational safety through visual tool monitoring and second screen display on tower magazine





- Ease of use through manual access to all tools
- Automatic tool management with chip coding and extensive installation tools

Highly safe and comfortable operation

- Swivel-type operator panel with good visibility in the work area
- Complex noise-insulated work space guard with safety glass
- Protection systems and ergonomically shaped control points in accordance with EC directives

- Swivel shower in work space with 200 l/min and flushing gun on load-unload station for workpiece cleaning
- Low maintenance due to long-term greasing of the workspindle and central oil lubrication of profile rail guides and ballscrews

Innovative process control and monitoring

- CNC Sinumerik 840 D Solution Line or, alternatively, Fanuc Series 31i, each with integrated PLC and digital drive technology

- Modular service and diagnostics system SAM to monitor the machine functions, fault diagnosis, planning and maintenance, data collection and statistics
- Laser tool breakage monitoring in the work space, speed monitoring for the tools, monitoring by tool-life or workpiece count, capacity utilization monitoring of main drive, tool identification, 3D probe and CMC monitoring system for collision detection and damage limitation

Top-class energy efficiency.



Drive system

- ▶ Energy recovery when axes are braking
- ▶ Use of servo drives with a very high level of efficiency
- ▶ Energy use according to demand with small baseload

Hydraulic with accumulator charging circuit

- ▶ An accumulator charging circuit is the most efficient strategy to supply hydraulic energy
- ▶ Pressure-free oil circulation reduces base load and energy requirements and improves the oil quality
- ▶ Minimum dimensioning of the hydraulic unit to minimize the base load losses
- ▶ Only minimal heating of the hydraulic oil
- ▶ Use of low-leakage valves
- ▶ Energy-neutral counterweight balancing for the spindle slide rest

Coolant high-pressure circuit

- ▶ Automatic shutdown of the pump motor
- ▶ Pressures and pump outputs can be adapted to the particular machining task
- ▶ Use of variable pressure reducing valves
- ▶ Speed-controlled pump motor (optional)



Compressed air

- ▶ Automatic shutdown of compressed air
- ▶ Use of high quality pneumatic systems
- ▶ Full functionality guaranteed even at low system pressure of 5 bar

Cooling systems

- ▶ Cooling systems operate in an intermittent mode with low switching frequency
- ▶ Interface for central cooling-water connection and thus further energy saving effects

Sleep mode

- ▶ Automatic machine shutdown during production breaks configurable as standard

Warm-up program

- ▶ Supports resumption of production without delay

Optimized mechanical system

- ▶ Use of low-friction roller-bearing guides in all linear axes

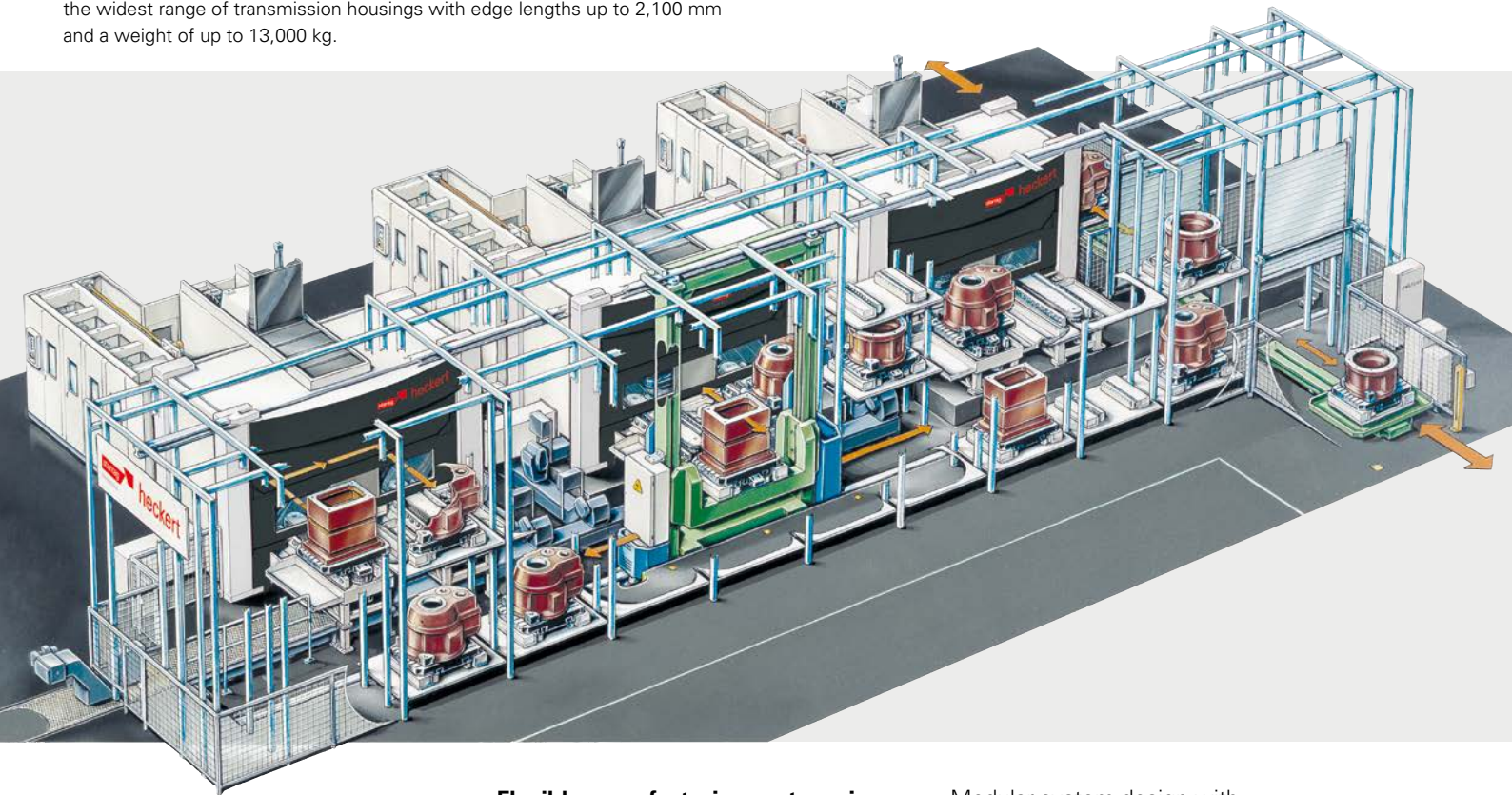
5-axis machining with NC swivel head on HEC 1000 U5 – 1800 U5.



- Expansion of HEC 1000 – 1800 Athletic machining centers to process form elements at any spatial position within the swivel angle $\pm 180^\circ$
- Highly precise complete machining of complicated workpiece shapes in milling, drilling and threading processes
- High effective material removal rate through powerful AC main motor with 2-stage transmission (66 kW, 1,860 Nm) with oil-circulating lubrication
- Compact, bend and torsion-resistant workspindle with quadruple storage and oil-air lubrication ensures smooth running and long-term accuracy
- Electronic spindle straightening fixture and hydraulic clamping of the NC head for stable, reliable and precise positioning
- Clamping via a Belleville spring package with hydraulic release
- The spindle taper and internal coolant supply of the tools are blown out with compressed air during the tool change for cleaning
- Automatic compensation of heat-induced axial extension of the spindle for high positioning accuracy (position uncertainty P 6")
- Direct drive torque motor (0.9 s for 180°) ensures highly dynamic swivel movement of the head
- Stepless speed range up to 8,000 rpm, choice of different tool holders (HSK-A100, SK 50, BigPlus) and attachment of additional equipment
- Optimum work space conditions through ideal lifting positions for the workspindle via pallet center
- Use of tools up to 800 mm in length for long travel boring operations as a time-saving and quality alternative to shift drilling

Flexible manufacturing systems – know-how and expertise.

Flexible manufacturing system FMS 1600 for the complete machining of the widest range of transmission housings with edge lengths up to 2,100 mm and a weight of up to 13,000 kg.



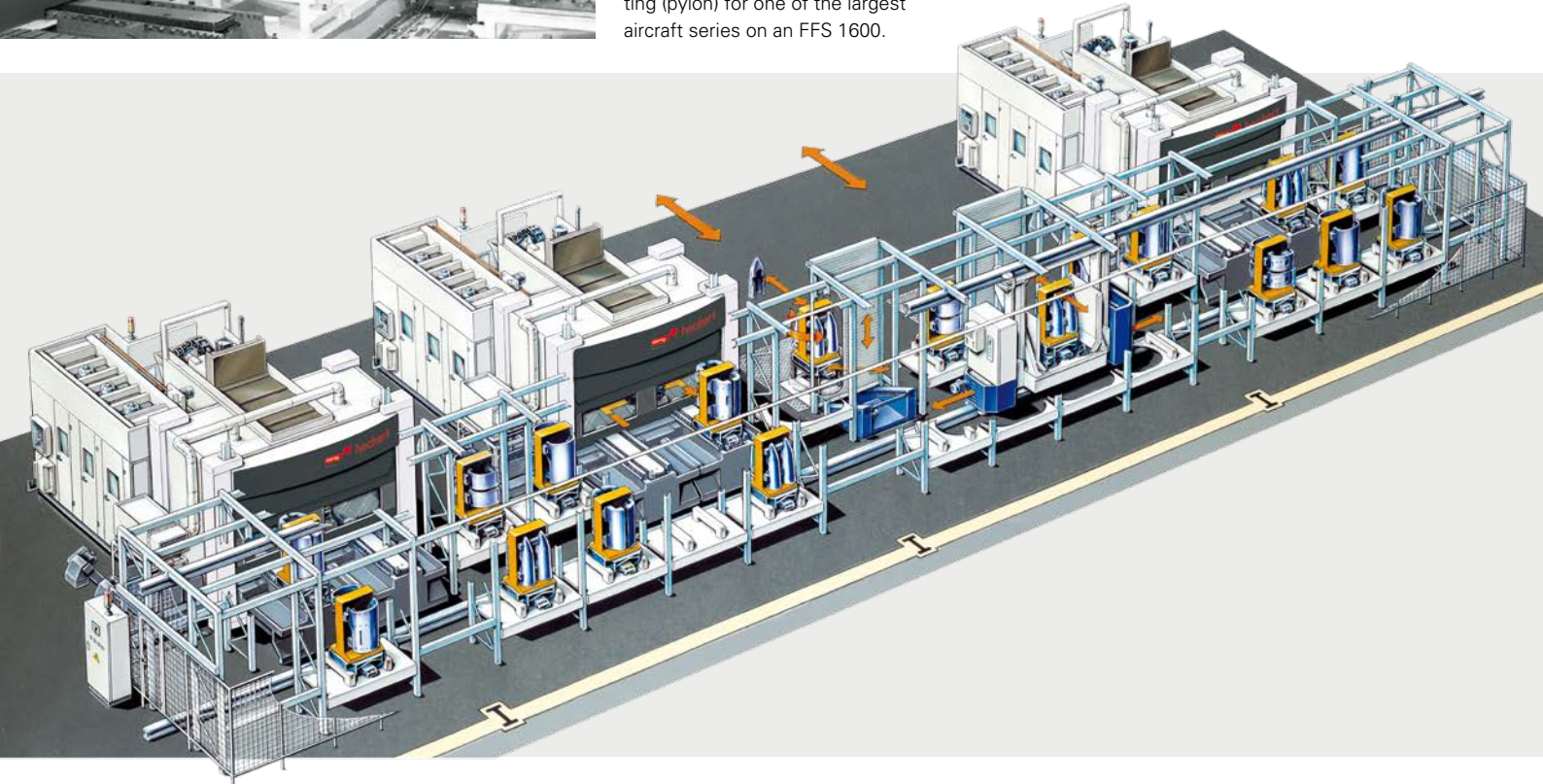
Flexible manufacturing systems in multi-shift operation with unmanned production

- Expansion into flexible manufacturing systems with appropriate HEC 1000 – 1800 interfaces for automatic workpiece, tool and information flow
- Linear pallet storage with tool pockets in one or more tiers for workpiece handling and storage processes
- Modular system design with load-unload stations for setup of workpiece and fixture and insertion into the fully automatic system, storage and retrieval unit for automatic pallet transfer between load-unload station, storage and machining center and with control station
- Integration of mounting stations, measuring and testing equipment and wash stations



Flexible manufacturing system for machining large gears for wind turbines.

Machining of over 400 structural components of the engine mounting (pylon) for one of the largest aircraft series on an FFS 1600.



Customer benefits

- Complete machining on flexible manufacturing systems in batch sizes from 1 to bulk series reduces unit costs, cuts tool and rework costs and minimizes the measuring and test operations
- Minimal re-equipping costs when the production changes
- Production in line with actual requirements with low quantities of circulating material
- Multi-shift operation with unmanned production
- Assembly-ready production with high processing quality and series-proven long-term accuracy

Implementation of turnkey projects

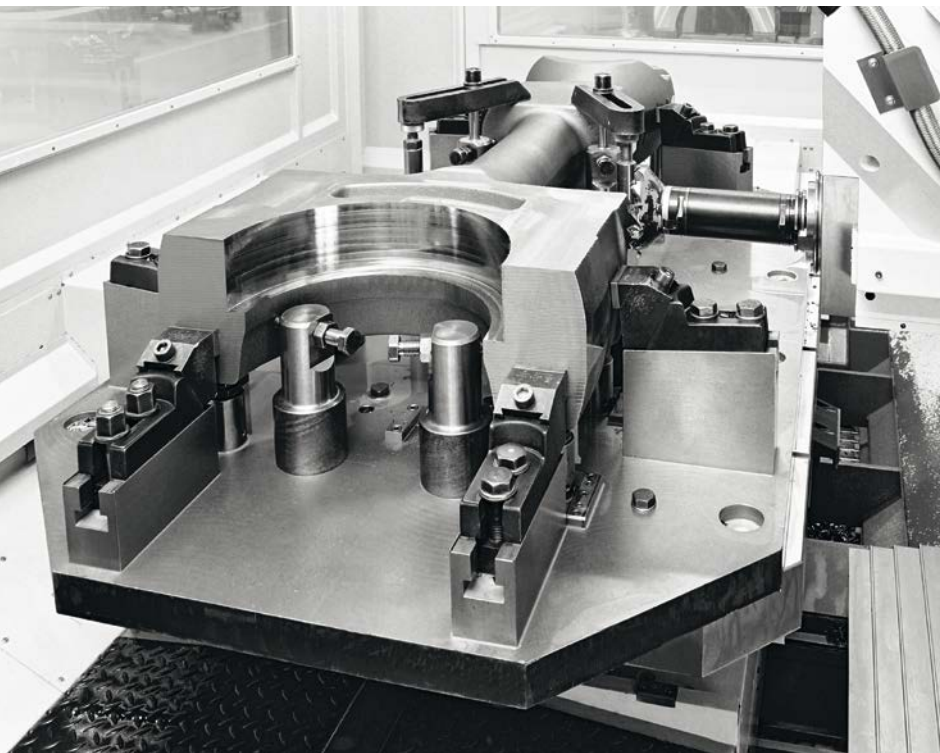
- General contractor with complete turnkey solutions:
 - Engineering
 - Overall project planning
 - Processing technology and NC programs
 - Supplying of all system subassemblies (machining centers, clamping technology, tools and additional modules for systems engineering)
 - Training and qualification
 - Installation and commissioning
 - Production support
 - Service and maintenance

After-sales service

- Worldwide service presence 7 days/week, 24 hours/day
- Assembly, installation and commissioning
- Preventive maintenance contracts
- Spare parts supply
- Implementation and retrofitting of machining centers
- Maintenance and service training
- Phone service
- Remote diagnostics via modem

Applications.

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Piston rods for marine propulsion and power plants.



- ▶ Heavy-duty cutting of die-forged high-alloyed chromium-nickel steel piston rods for marine propulsion and power plants
- ▶ 5-side machining on HEC 1250 Athletic with swivel horizontal/vertical milling heads
- ▶ Quadruple pallet changer with frontal and side pallet feed
- ▶ Precision boring of crankshaft bearing holes (0.02 mm roundness, 0.01 mm straightness) with drill rod diameter 500 mm

- ▶ Flexible machining of stator housings for electric motors used in locomotive construction on a HEC 1250 Athletic
- ▶ Processing with outsized T-type tools from tower magazine for diameter 910 H9 at 400 mm length



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Stator housing for electric motors.

Finish machining with T-type tool diameter 600 mm.



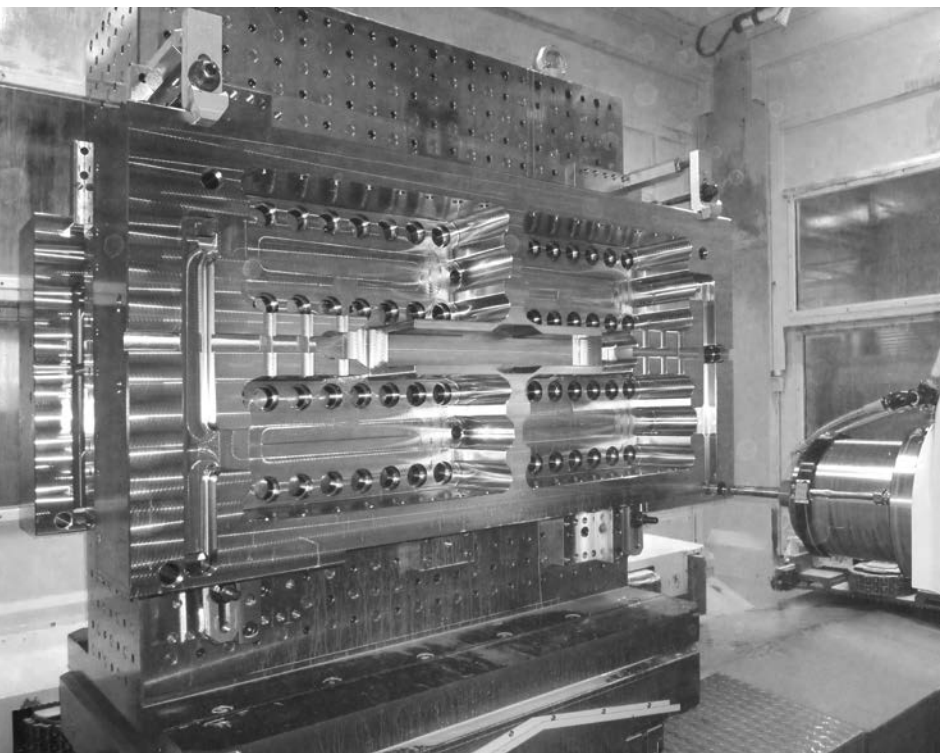
- › Processing planetary wheel supports for wind turbine gearboxes on two HEC 1600 P Athletic
- › Time-saving alternative to manufacturing on vertical lathe
- › Series-proven long-term accuracy (positional accuracy 0.04 mm, surface quality Ra 1.6 μm)
- › Complete machining in one clamping, among others with T-type tool diameter 600 mm, drill rod 735 mm in length and right-angle drilling head

Fine machining of bore axis to fit H7.



- › Highly flexible complete machining of various plate washers for compaction equipment roller drums on an HEC 1600 P Athletic
- › Reduction of manufacturing times compared to machining on boring mills
- › NC quill ensures vibration-free machining of low-lying areas and bore holes, thus replacing expensive special tools

Complete machining of mold plates with a tolerance between the plates of ≤ 0.01 mm.



- ▶ Use of 3 HEC 1250 Athletics for the fully automated complete machining of master form plates made of chromium-molybdenum steel for injection molds for the production of PET bottles
- ▶ Time-saving alternative to machining on jig boring machine and jig grinder
- ▶ Workpiece setup on three load-unload stations parallel to machining
- ▶ Use in 3-shift operation with an unmanned production shift

Machining of heavy and large castings up to 2,000 mm.

- ▶ High precision machining of large parts weighing up to 5,000 kg on a HEC 1250 P Athletic horizontal machining center with quill
- ▶ Series-proven long-term accuracy to IT 5 and high material removal rate in heavy-duty cutting



Technical data.

Values in brackets = options

	HEC 1000 H	HEC 1000 H/V	HEC 1000 P 125
Workspindle version	Horizontal	(Horizontal/vertical)	(NC quill)
NC rotary table			
Clamping area hole matrix DIN 55201	mm	1,000 × 800	1,000 × 800
Max. load	kg	4,000	4,000
Max. speed	rpm	10	10
Resolution	degree	0.001	0.001
Workpiece swing diameter	mm	1,700/1,900	1,700/1,900
Automatic pallet change			
Number of loadable pallets		2	2
Max. pallet change time	s	40	40
Traverse values			
Linear travel X	mm	1,700	1,700
Vertical travel Y	mm	1,250 (1,600)	1,150 (1,450)
Traverse travel Z	mm	1,850	1,850
Quill travel	mm		500
Workspindle	AC motor	AC motor	AC motor
Drive power 100% c.d.f.	kW	29	29
Drive power 25% c.d.f.	kW	55	30/ 60% c.d.f.
Torque 100% c.d.f.	Nm	936	985
Torque 25% c.d.f.	Nm	1,500	1,088/ 60% c.d.f.
Speed range, stepless	rpm	20...6,000	20...6,000
Tool-holder	Hollow-shaft taper HSK-A100 (steep taper DIN 69871-AD 50 and B 50, BT, BigPlus)		
Diameter in front bearing	mm	100	170
Quill diameter	mm		125
(Workspindle)	AC motor	AC motor	
Drive power 100% c.d.f.	kW	44	29
Drive power 25% c.d.f.	kW	84	55
Torque 100% c.d.f.	Nm	1,650	718
Torque 25% c.d.f.	Nm	3,000	1,042
Speed range, stepless	rpm	20...5,000	20...7,500
(Workspindle)	AC-Motor		
Drive power 100% c.d.f.	kW	44/29/29	
Drive power 25% c.d.f.	kW	83/50/50	
Torque 100% c.d.f.	Nm	1,500/958/958	
Torque 25% c.d.f.	Nm	1,500/958/958	
Max. speed	rpm	7,500/10,000/12,500	
Tool changer			
Chain magazine			
Number of tool pockets		40 (60/80/120)	40 (60/80/120)
Max. tool diameter	mm	325	325
Max. T-type tool diameter	mm	500	500
Max. tool length	mm	800	600
Max. tool weight	kg	35	35
Chip-to-chip time / tools up to 15 kg	s	12	12
(Tower magazine)			
Number of tool pockets		180/270/360/450	180/270/360/450
Max. tool diameter	mm	340	340
Max. T-type tool diameter	mm	950	950
Max. tool length	mm	450/800	450/600
Total weight of all tools per tower	kg	900	900
Traversing rates			
Feed range, stepless	mm/min	1...45,000	1...45,000
Max. feed force	kN	20	20
Rapid traverse rate X/Y/Z	m/min	45 (60/60/60)	45 (60/45/60)
Coolant supply system			
Supply through spindle center			
Flow rate	l/min	20	20
Pressure on pressure relief valve	bar	15 (70)	15 (70)
Coolant through nozzles			
Flow rate	l/min	50	50
Pump pressure	bar	5	5
Coolant reservoir	l	1,500	1,500
Machine accuracy			
Linear axes X/Y/Z			
Positioning uncertainty P [TP]	mm	0.006 (0.004)	0.006 (0.004)
Position scattering range P _{smax}	mm	0.004 (0.0025)	0.004 (0.0025)
NC rotary table			
Positioning uncertainty P [TP]	arcsec	6 (4)	6 (4)
Position scattering range P _{smax}	arcsec	4 (3)	4 (3)
CNC control	Sinumerik 840 D solution Line (Fanuc Series 31i)		
(Pallet linear magazine)			
NC transport trolley	rail-borne, with cross-conveying and lifting device		
Load/unload station	rotating and indexing by 4 × 90°		
Magazine locations, variant	variable in one or more tiers		
Dimensions and weight			
Length × width × height	m	10.25 × 7.4 × 4.5	10.25 × 7.4 × 4.5
Weight	kg	35,400	35,400

Technical data.

	HEC 1250 H	HEC 1250 H/V	HEC 1250 P 125	HEC 1250 P 150
Workspindle version	Horizontal	(Horizontal/vertical)	(NC quill)	(NC quill)
NC rotary table				
Clamping area hole matrix DIN 55201	mm	1,000 × 1,250	1,000 × 1,250	1,000 × 1,250
Max. load	kg	5,000	5,000	5,000
Max. speed	rpm	10	10	10
Resolution	degree	0.001	0.001	0.001
Workpiece swing diameter	mm	2,200/2,400	2,200/2,400	2,200/2,400
Automatic pallet change				
Number of loadable pallets		2	2	
Max. pallet change time	s	47	47	47
Traverse values				
Linear travel X	mm	2,200	2,200	2,200
Vertical travel Y	mm	1,600	1,450	1,500
Traverse travel Z	mm	1,850	1,850	1,850
Quill travel	mm		500	760
Workspindle	AC motor	AC motor	AC motor	AC motor
Drive power 100% c.d.f.	kW	29	29	41
Drive power 25% c.d.f.	kW	55	30/ 60% c.d.f.	61,5/ 40% c.d.f.
Torque 100% c.d.f.	Nm	936	985	1,500
Torque 25% c.d.f.	Nm	1,500	1,088/ 60% c.d.f.	2,150/ 40% c.d.f.
Speed range, stepless	rpm	20...6,000	20...6,000	20...4,000
Tool-holder		Hollow-shaft taper HSK-A100 (steep taper DIN 69871-AD 50 and B 50, BT, BigPlus)		
Diameter in front bearing	mm	100	110	170
Quill diameter	mm			125
(Workspindle)	AC motor	AC motor		
Drive power 100% c.d.f.	kW	44	29	
Drive power 25% c.d.f.	kW	84	55	
Torque 100% c.d.f.	Nm	1,650	718	
Torque 25% c.d.f.	Nm	3,000	1,042	
Speed range, stepless	rpm	20...5,000	20...7,500	
(Workspindle)	AC-Motor			
Drive power 100% c.d.f.	kW	44/29/29		
Drive power 25% c.d.f.	kW	83/50/50		
Torque 100% c.d.f.	Nm	1,500/958/958		
Torque 25% c.d.f.	Nm	1,500/958/958		
Max. speed	rpm	7,500/10,000/12,500		
Tool changer				
Chain magazine				
Number of tool pockets		40 (60/80/120)	40 (60/80/120)	40 (60/80/120)
Max. tool diameter	mm	325	325	325
Max. T-type tool diameter	mm	500	500	500
Max. tool length	mm	800	600	800
Max. tool weight	kg	35	35	35
Chip-to-chip time / tools up to 15 kg	s	12	12	12
(Tower magazine)				
Number of tool pockets		180/270/360/450	180/270/360/450	180/270/360/450
Max. tool diameter	mm	340	340	340
Max. T-type tool diameter	mm	950	950	950
Max. tool length	mm	450/800	450/600	450/800
Total weight of all tools per tower	kg	900	900	900
Traversing rates				
Feed range, stepless	mm/min	1...45,000	1...45,000	1...45,000
Max. feed force	kN	20	20	20
Rapid traverse rate X/Y/Z	m/min	45 (60/60/60)	45 (60/45/60)	45 (60/45/60)
Coolant supply system				
Supply through spindle center				
Flow rate	l/min	20	20	20
Pressure on pressure relief valve	bar	15 (70)	15 (70)	15 (70)
Coolant through nozzles				
Flow rate	l/min	50	50	50
Pump pressure	bar	5	5	5
Coolant reservoir	l	1,500	1,500	1,500
Machine accuracy				
Linear axes X/Y/Z				
Positioning uncertainty P [TP]	mm	0.006 (0.004)	0.006 (0.004)	0.006 (0.004)
Position scattering range P _{max}	mm	0.004 (0.0025)	0.004 (0.0025)	0.004 (0.0025)
NC rotary table				
Positioning uncertainty P [TP]	arcsec	6 (4)	6 (4)	6 (4)
Position scattering range P _{max}	arcsec	4 (3)	4 (3)	4 (3)
CNC control		Sinumerik 840 D solution Line (Fanuc Series 31i)		
(Pallet linear magazine)				
NC transport trolley		crail-borne, with cross-conveying and lifting device		
Load/unload station		rotating and indexing by 4 × 90°		
Magazine locations, variant		variable in one or more tiers		
Dimensions and weight				
Length × width × height	m	10.9 × 8.85 × 5.35	10.9 × 8.85 × 5.35	10.9 × 8.85 × 5.35
Weight	kg	41,700	41,700	41,700

Values in brackets = options

	HEC 1600 H	HEC 1600 H/V	HEC 1600 P 125	HEC 1600 P 150
Workspindle version	Horizontal	(Horizontal/vertical)	(NC quill)	(NC quill)
NC rotary table				
Clamping area hole matrix DIN 55201 mm	1,600 × 1,250	1,600 × 1,250	1,600 × 1,250	1,600 × 1,250
Max. load kg	8,000 (13,000)	8,000 (13,000)	8,000 (13,000)	8,000 (13,000)
Max. speed rpm	8	8	8	8
Resolution degree	0.001	0.001	0.001	0.001
Workpiece swing diameter mm	2,800/3,000	2,800/3,000	2,800/3,000	2,800/3,000
Automatic pallet change				
Number of loadable pallets	2	2	2	
Max. pallet change time s	60	60	60	60
Traverse values				
Linear travel X mm	2,800	2,800	2,800	2,800
Vertical travel Y mm	2,000	1,850	1,900	2,100
Traverse travel Z mm	2,100	2,100	2,100	2,100
Quill travel mm			500	760
Workspindle	AC motor	AC motor	AC motor	AC motor
Drive power 100% c.d.f. kW	29	29	29	41
Drive power 25% c.d.f. kW	55	30/ 60% c.d.f.	55	61,5 /40% c.d.f.
Torque 100% c.d.f. Nm	936	985	1,300	1,500
Torque 25% c.d.f. Nm	1500	1,088/ 60% c.d.f.	2,470	2,150/ 40% c.d.f.
Speed range, stepless rpm	20...6,000	20...6,000	20...4,000	20...5,000
Tool-holder		Hollow-shaft taper HSK-A100 (steep taper)	DIN 69871-AD 50 and B 50, BT, BigPlus)	
Diameter in front bearing mm	100	110	170	200
Quill diameter mm			125	150
(Workspindle)	AC motor	AC motor		
Drive power 100% c.d.f. kW	44	29		
Drive power 25% c.d.f. kW	84	55		
Torque 100% c.d.f. Nm	1,650	718		
Torque 25% c.d.f. Nm	3,000	1042		
Speed range, stepless rpm	20...5,000	20...7,500		
(Workspindle)	AC-Motor			
Drive power 100% c.d.f. kW	44/29/29			
Drive power 25% c.d.f. kW	83/50/50			
Torque 100% c.d.f. Nm	1,500/958/958			
Torque 25% c.d.f. Nm	1,500/958/958			
Max. speed rpm	7,500/10,000/12,500			
Tool changer				
Chain magazine				
Number of tool pockets	40 (60/80/120)	40 (60/80/120)	40 (60/80/120)	40 (60/80/120)
Max. tool diameter mm	325	325	325	325
Max. T-type tool diameter mm	500	500	500	500
Max. tool length mm	800	600	800	800
Max. tool weight kg	35	35	35	35
Chip-to-chip time / tools up to 15 kg s	14	14	14	14
(Tower magazine)				
Number of tool pockets	180/270/360/450	180/270/360/450	180/270/360/450	180/270/360/450
Max. tool diameter mm	340	340	340	340
Max. T-type tool diameter mm	950	950	950	950
Max. tool length mm	450/800	450/600	450/800	450/800
Total weight of all tools per tower kg	900	900	900	900
Traversing rates				
Feed range, stepless mm/min	1...40,000	1...40,000	1...40,000	1...40,000
Max. feed force kN	20	20	20	20
Rapid traverse rate X/Y/Z m/min	40	40	40	40
Coolant supply system				
Supply through spindle center				
Flow rate l/min	20	20	20	20
Pressure on pressure relief valve bar	15 (70)	15 (70)	15 (70)	15 (70)
Coolant through nozzles				
Flow rate l/min	50	50	50	50
Pump pressure bar	5	5	5	5
Coolant reservoir l	1,500	1,500	1,500	1,500
Machine accuracy				
Linear axes X/Y/Z				
Positioning uncertainty P [TP] mm	0.006 (0.004)	0.006 (0.004)	0.006 (0.004)	0.006 (0.004)
Position scattering range P _{max} mm	0.004 (0.0025)	0.004 (0.0025)	0.004 (0.0025)	0.004 (0.0025)
NC rotary table				
Positioning uncertainty P [TP] arcsec	6 (4)	6 (4)	6 (4)	6 (4)
Position scattering range P _{max} arcsec	4 (3)	4 (3)	4 (3)	4 (3)
CNC control		Sinumerik 840 D solution Line (Fanuc Series 31i)		
(Pallet linear magazine)		rail-borne, with cross-conveying and lifting device		
NC transport trolley		rotating and indexing by 4 × 90°		
Load/unload station		variable in one or more tiers		
Magazine locations, variant				
Dimensions and weight				
Length × width × height m	12.6 × 9.7 × 5.73	12.6 × 9.7 × 5.73	12.6 × 9.7 × 5.73	12.6 × 9.7 × 5.73
Weight kg	65,000	65,000	65,000	65,000

Technical data.

	HEC 1800 H	HEC 1800 H/V	HEC 1800 P 125	HEC 1800 P 150
Workspindle version	Horizontal	(Horizontal/vertical)	(NC quill)	(NC quill)
NC rotary table				
Clamping area hole matrix DIN 55201	mm	1,800 × 1,250	1,800 × 1,250	1,800 × 1,250
Max. load	kg	13,000	13,000	13,000
Max. speed	rpm	8	8	8
Resolution	degree	0.001	0.001	0.001
Workpiece swing diameter	mm	3,300	3,300	3,300
Automatic pallet change				
Number of loadable pallets		2	2	2
Max. pallet change time	s	120	120	120
Traverse values				
Linear travel X	mm	3,400	3,400	3,400
Vertical travel Y	mm	2,800	2,650	2,700
Traverse travel Z	mm	2,250	2,250	2,250
Quill travel	mm		500	760
Workspindle	AC motor	AC motor	AC motor	AC motor
Drive power 100% c.d.f.	kW	29	29	41
Drive power 25% c.d.f.	kW	55	30/60% c.d.f.	61,5 /40% c.d.f.
Torque 100% c.d.f.	Nm	936	985	1,500
Torque 25% c.d.f.	Nm	1,500	1,088/60% c.d.f.	2,150/ 40% c.d.f.
Speed range, stepless	rpm	20...6,000	20...6,000	20...4,000
Tool-holder		Hollow-shaft taper HSK-A100 (steep taper DIN 69871-AD 50 and B 50, BT, BigPlus)		
Diameter in front bearing	mm	100	110	170
Quill diameter	mm			125
(Workspindle)	AC motor	AC motor		
Drive power 100% c.d.f.	kW	44	29	
Drive power 25% c.d.f.	kW	84	55	
Torque 100% c.d.f.	Nm	1,650	718	
Torque 25% c.d.f.	Nm	3,000	1,024	
Speed range, stepless	rpm	20...5,000	20...7,500	
(Workspindle)	AC motor			
Drive power 100% c.d.f.	kW	44/29/29		
Drive power 25% c.d.f.	kW	83/50/50		
Torque 100% c.d.f.	Nm	1,500/958/958		
Torque 25% c.d.f.	Nm	1,500/958/958		
Max. speed	rpm	7,500/10,000/12,500		
Tool changer				
Chain magazine				
Number of tool pockets		40 (60/80/120)	40 (60/80/120)	40 (60/80/120)
Max. tool diameter	mm	325	325	325
Max. T-type tool diameter	mm	500	500	500
Max. tool length	mm	800	600	800
Max. tool weight	kg	35	35	35
Chip-to-chip time / tools up to 15 kg	s	18	18	18
(Tower magazine)				
Number of tool pockets		180/270/360/450	180/270/360/450	180/270/360/450
Max. tool diameter	mm	340	340	340
Max. T-type tool diameter	mm	950	950	950
Max. tool length	mm	450/800	450/600	450/800
Total weight of all tools per tower	kg	900	900	900
Traversing rates				
Feed range, stepless	mm/min	1...35,000/40,000/40,000	1...35,000/40,000/40,000	1...35,000/40,000/40,000
Max. feed force	kN	20	20	20
Rapid traverse rate X/Y/Z	m/min	35/40/40	35/40/40	35/40/40
Coolant supply system				
Supply through spindle center				
Flow rate	l/min	20	20	20
Pressure on pressure relief valve	bar	15 (70)	15 (70)	15 (70)
Coolant through nozzles				
Flow rate	l/min	50	50	50
Pump pressure	bar	5	5	5
Coolant reservoir	l	1,500	1,500	1,500
Machine accuracy				
Linear axes X/Y/Z				
Positioning uncertainty P [TP]	mm	0.006 (0.004)	0.006 (0.004)	0.006 (0.004)
Position scattering range P _{max}	mm	0.004 (0.0025)	0.004 (0.0025)	0.004 (0.0025)
NC rotary table				
Positioning uncertainty P [TP]	arcsec	6 (4)	6 (4)	6 (4)
Position scattering range P _{max}	arcsec	4 (3)	4 (3)	4 (3)
CNC control		Sinumerik 840 D solution Line (Fanuc Series 31i)		
(Pallet linear magazine)		rail-borne, with cross-conveying and lifting device rotating and indexing by 4 × 90° variable in one or more tiers		
Dimensions and weight				
Length × width × height	m	12.97 × 11.07 × 5.95	12.97 × 11.07 × 5.95	12.97 × 11.07 × 5.95
Weight	kg	80,000	80,000	80,000

Values in brackets = options

	HEC 1000 U5	HEC 1250 U5	HEC 1600 U5	HEC 1800 U5
Workspindle version	NC swivel head	NC swivel head	NC swivel head	NC swivel head
NC rotary table				
Clamping area hole matrix DIN 55201	mm 1,000 × 800	1,250 × 1,000	1,600 × 1,250	1,800 × 1,250
Max. load	kg 4,000	5,000	8,000 (13,000)	1,3000
Max. speed	rpm 10	10	8	8
Resolution	degree 0.001	0.001	0.001	0.001
Workpiece swing diameter	mm 1,700/1,900	2,200/2,400	2,800/3,000	3,300
Automatic pallet change				
Number of loadable pallets	2	2	2	2
Max. pallet change time	s 40	47	60	120
Traverse values				
Linear travel X	mm 1,700	2,200	2,800	3,400
Vertical travel Y	mm 1,100	1,450	1,800	2,600
Traverse travel Z	mm 2,100	2,100	2,100	2,250
Support with NC swivel head	AC motor	AC motor	AC motor	AC motor
Drive power 100% c.d.f.	kW 46 (44)	46 (44)	46 (44)	46 (44)
Drive power 40% c.d.f.	kW 66 (66)	66 (66)	66 (66)	66 (66)
Torque 100% c.d.f.	Nm 1,024 (1,024)	1,024 (1,024)	1,024 (1,024)	1,024 (1,024)
Torque 40% c.d.f.	Nm 1,860 (1,860)	1,860 (1,860)	1,860 (1,860)	1,860 (1,860)
Speed range, stepless	rpm 20...6,000 (8,000)	20...6,000 (8,000)	20...6,000 (8,000)	20...6,000 (8,000)
Tool-holder	Hollow-shaft taper HSK-A100 (steep taper DIN 69871-AD 50 , BigPlus)			
Diameter in front bearing	mm 110	110	110	110
Swivel angle	degree ± 180	± 180	± 180	± 180
Swivel time through 180°	s 0,9	0,9	0,9	0,9
Tool changer				
Chain magazine				
Number of tool pockets	40 (60/80/120)	40 (60/80/120)	40 (60/80/120)	40 (60/80/120)
Max. tool diameter	mm 325	325	325	325
Max. T-type tool diameter	mm 500	500	500	500
Max. tool length	mm 800	600	800	800
Max. tool weight	kg 35	35	35	35
Chip-to-chip time / tools up to 15 kg	s 12	12	14	18
(Tower magazine)				
Number of tool pockets	180/270/360/450	180/270/360/450	180/270/360/450	180/270/360/450
Max. tool diameter	mm 340	340	340	340
Max. T-type tool diameter	mm 950	950	950	950
Max. tool length	mm 450/800	450/600	450/800	450/800
Max. tool weight	kg 35 (50)	35 (50)	35 (50)	35 (50)
Total weight of all tools per tower	kg 900	900	900	900
Traversing rates				
Feed range, stepless X/Y/Z	mm/min 1...45,000	1...45,000	1...40,000	1...35,000/40,000/40,000
Max. feed force	kN 20	20	20	20
Rapid traverse rate X/Y/Z	m/min 45	45	40	35/40/40
Coolant supply system				
Supply through spindle center				
Flow rate	l/min 20	20	20	20
Pressure on pressure relief valve	bar 15 (70)	15 (70)	15 (70)	15 (70)
Coolant through nozzles				
Flow rate	l/min 50	50	50	50
Pump pressure	bar 5	5	5	5
Coolant reservoir	l 1,500	1,500	1,500	1,500
Machine accuracy				
Linear axes X/Y/Z				
Positioning uncertainty P [TP]	mm 0.006	0.006	0.006	0.006
Position scattering range P _{smax}	mm 0.004	0.004	0.004	0.004
NC rotary table				
Positioning uncertainty P [TP]	arcsec 6 (4)	6 (4)	6 (4)	6 (4)
Position scattering range P _{smax}	arcsec 4 (3)	4 (3)	4 (3)	4 (3)
Pivot axis C				
Positioning uncertainty P [TP]	arcsec 6	6	6	6
Position scattering range P _{smax}	arcsec 4	4	4	4
CNC control	Sinumerik 840 D solution Line (Fanuc Series 31i)			
(Pallet linear magazine)				
NC transport trolley	rail-borne, with cross-conveying and lifting device			
Load/unload station	rotating and indexing by 4 × 90°			
Magazine locations, variant	variable in one or more tiers			
Dimensions and weight				
Length × width × height	m 10,42 × 7,4 × 4,41	11,74 × 8,85 × 5,26	12,72 × 11,16 × 5,64	13,6 × 11,6 × 6,3
Weight	kg 37,400	43,700	67,000	82,000



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