

mitsubishi

5-AXIS

SIMULTANEOUS CONTROL
MACHINING CENTER SERIES



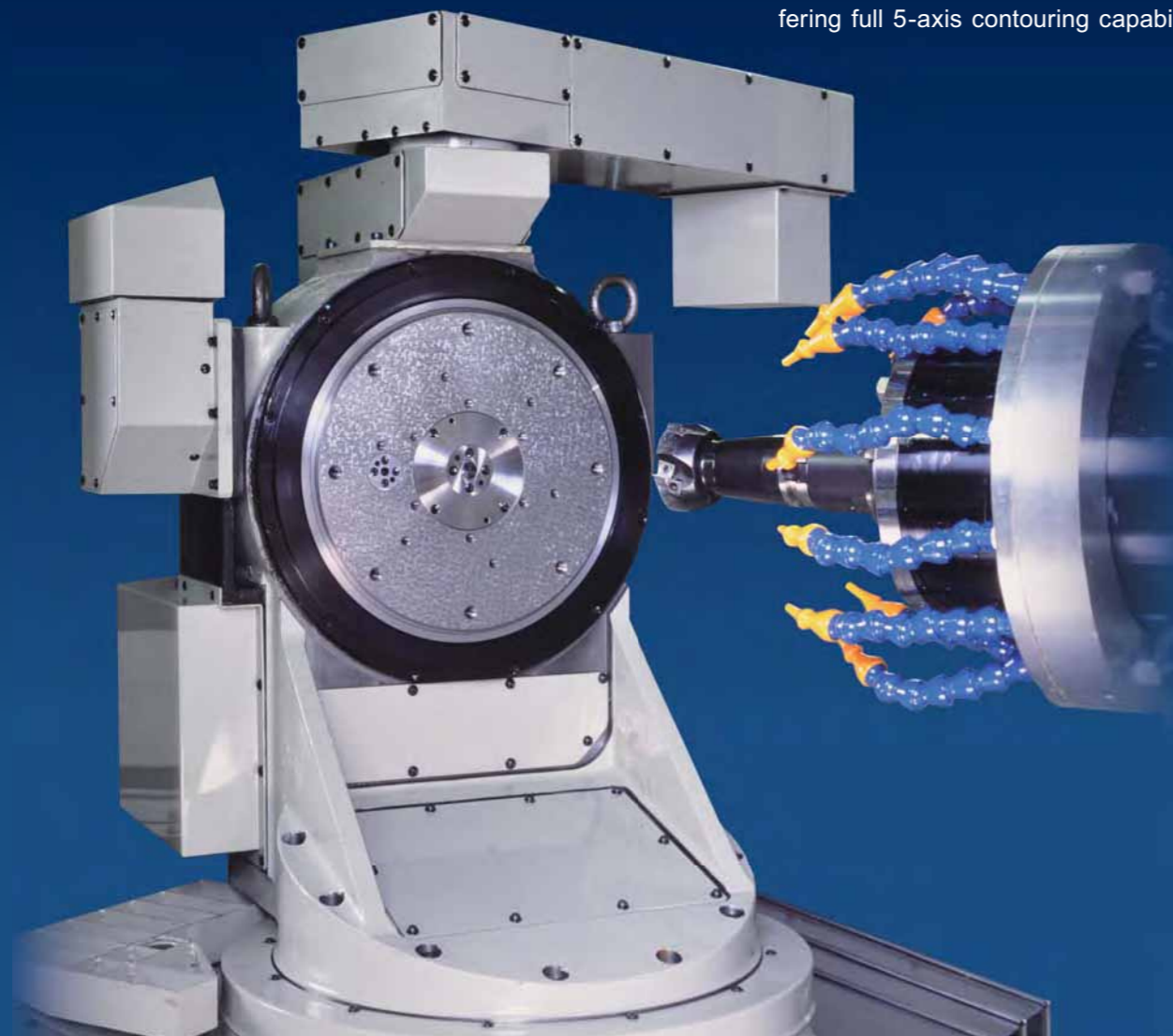


Mitsui Seiki is the leader in developing complex machined components specifically for global original equipment manufacturers, top tier suppliers, and contract shops.

Mitsui Seiki is the leader in developing 5-axis machining centers for specifically for global original equipment manufacturers, top tier suppliers, and contract shops.

Mitsui Seiki's strategy for the development of 5-axis machining centers is based on market-leading technical advancements addressing specific customers' needs and a long history of applying engineered solutions. In the 1970s, we developed one of the first "table on table" (C-axis table mounted on the B-axis rotary table) machines, offering full 5-axis contouring capabilities for

aircraft engine components. In 1986, we unveiled the HS5A-5X trunnion type horizontal machining center. Today, we lead globally in 5-axis machine tool product diversity for the most demanding, high accuracy applications. This brochure outlines these machines and several of the applications, which attests to the accuracy, efficiency, and acceptance of these products globally.

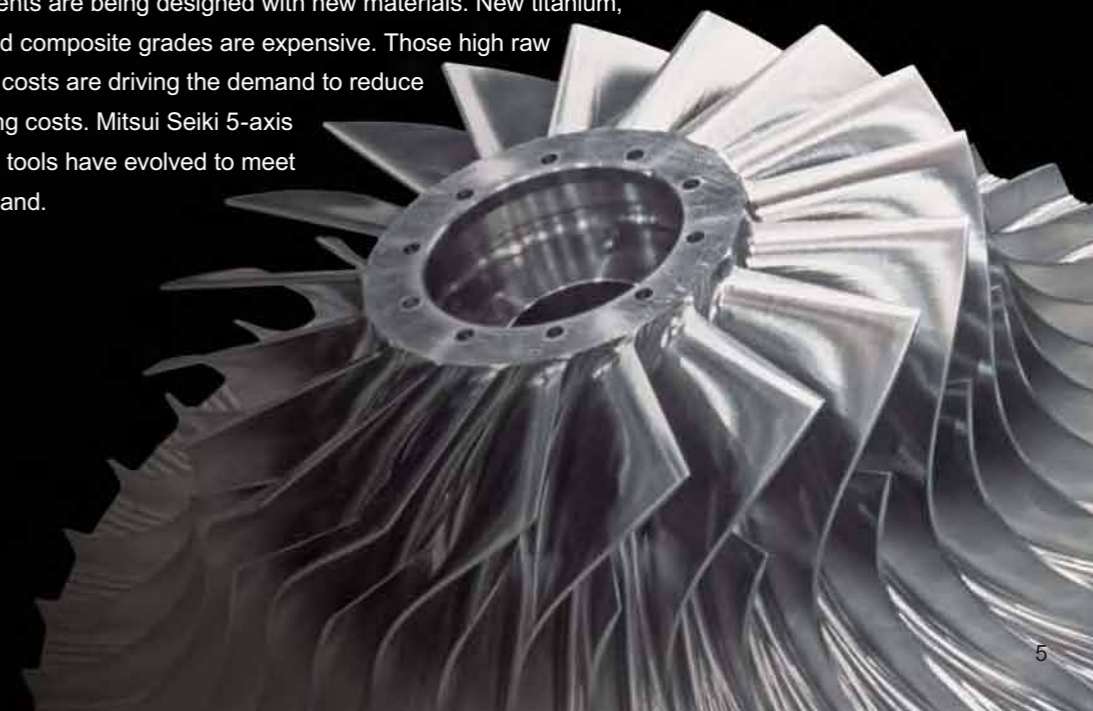




Aerospace parts manufacturing

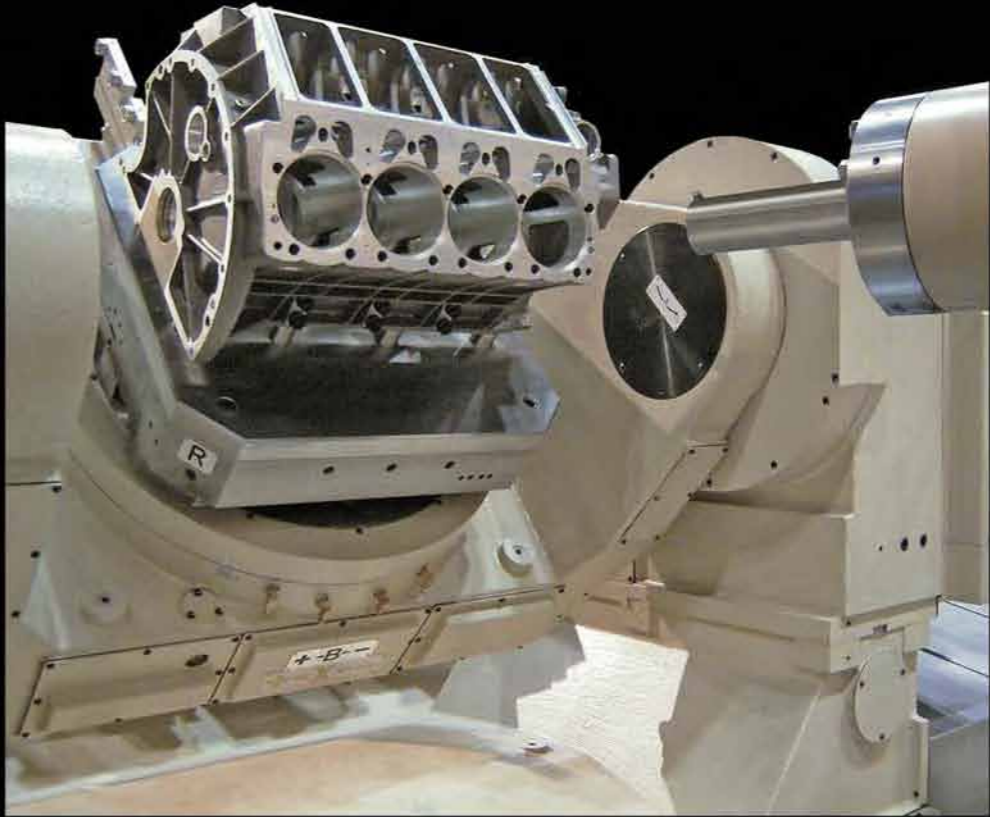
Complex part geometries and long cycle times are best processed with efficient 5-axis machining centers.

Jet engine components including impellers, blisks, and blades are continually being redesigned with new materials and geometries. Continual machine tool development and applications expertise are essential for cost reduction and improved engine performance for these parts. Manifolds, aircraft frame components, landing gear, and related structural aircraft components are being designed with new materials. New titanium, steel, and composite grades are expensive. Those high raw material costs are driving the demand to reduce machining costs. Mitsui Seiki 5-axis machine tools have evolved to meet this demand.





AUTOMOBILE & MOTORSPORTS



Automotive parts manufacturing

Angular 5-axis positioning for faces, bores and related high accuracy volumetric positional features reduces steps in the manufacturing process.



For example, the extreme performance required from race car engines rely on constant immediate design changes and the relationship of feature accuracies to each other. This volumetric accuracy is best achieved when the part handling from one process to another is reduced. Additionally, 5-axis machines are ideal for prototype part development for testing and for the features that require jig boring tolerances. Mitsui Seiki 5-axis machining centers are the optimum solution for these applications.





POWER GENERATION

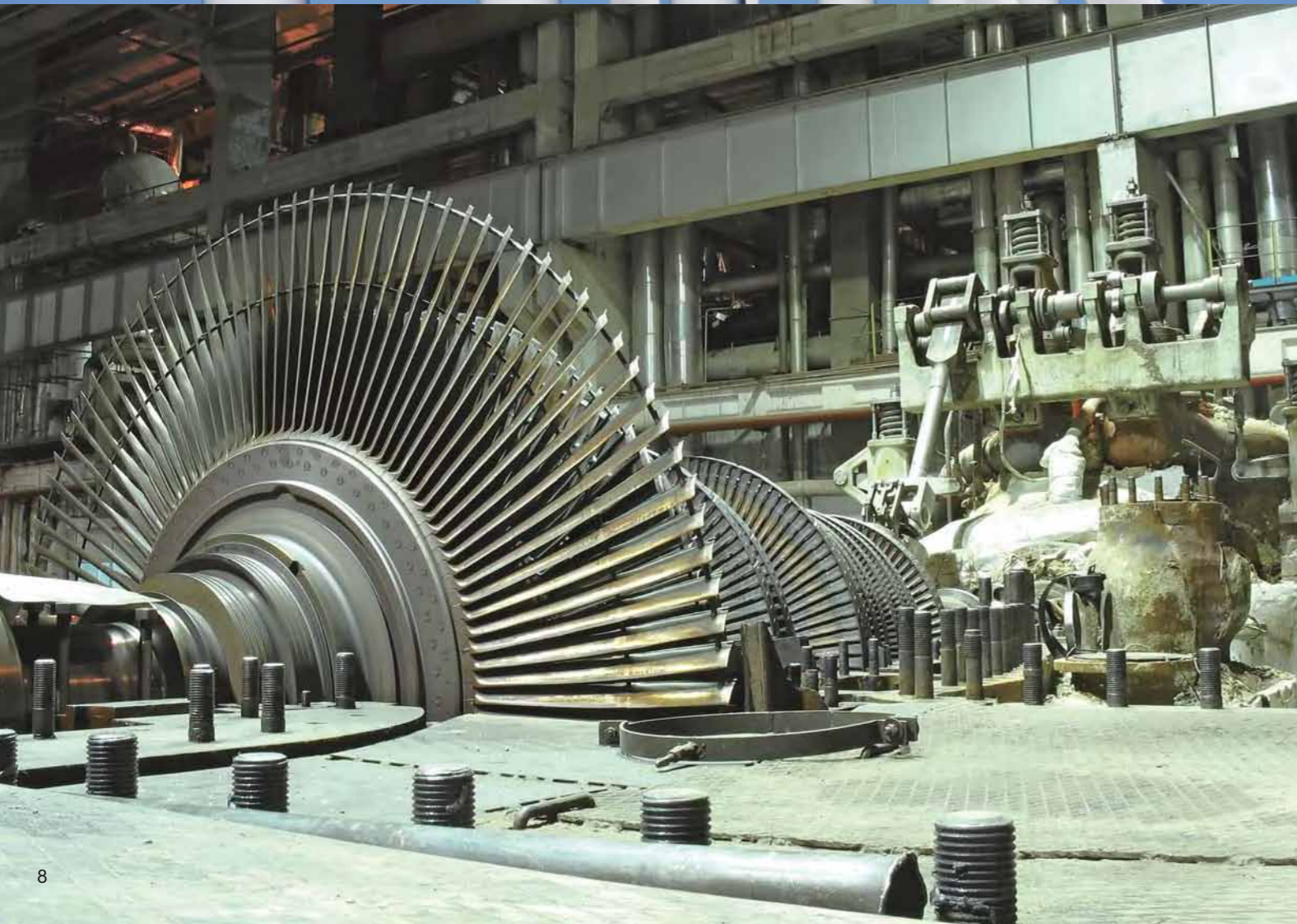


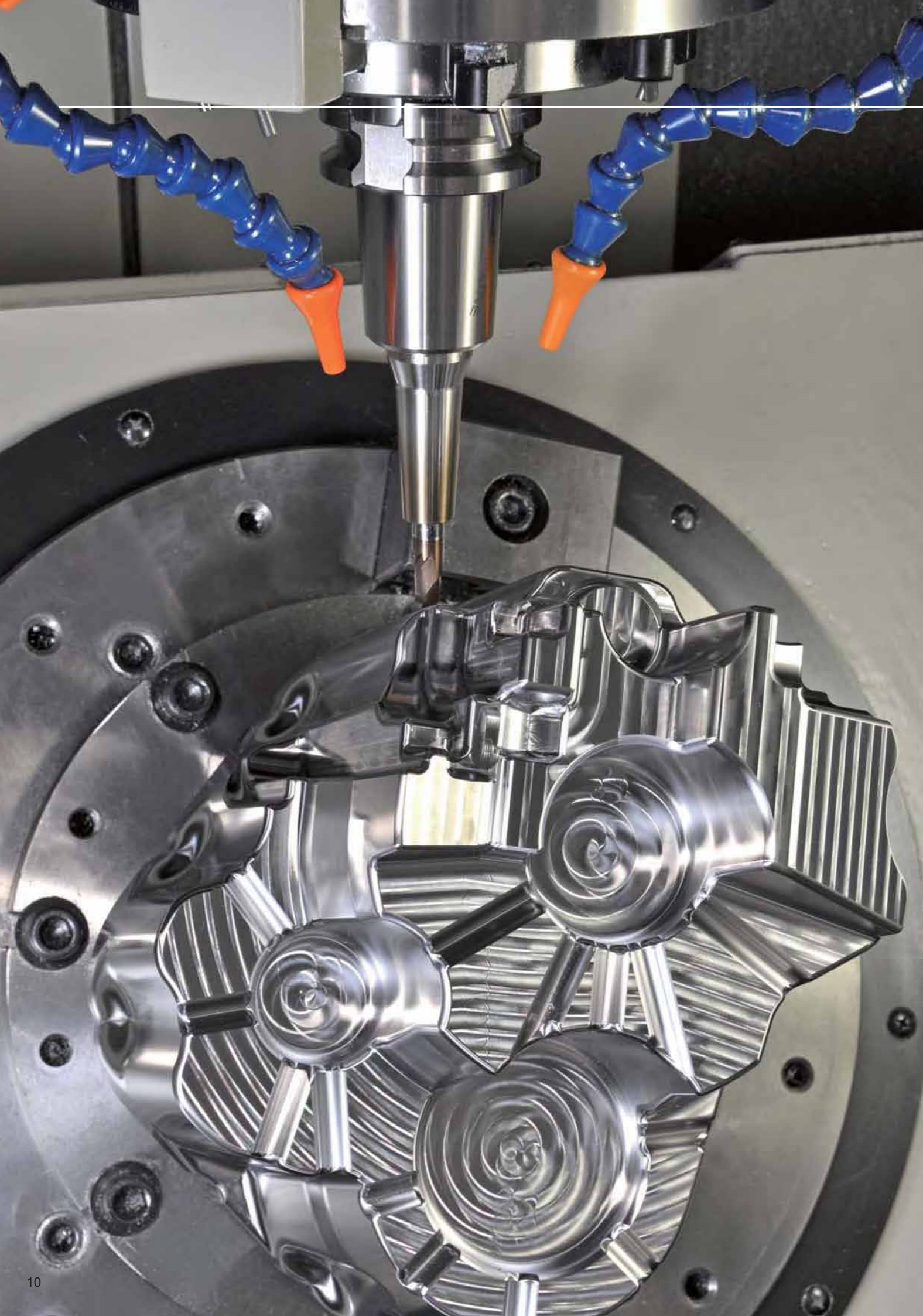
Power generation parts manufacturing

Hard material machining, high volumetric accuracy,
and high precision contouring requirements match perfectly
to our 5-axis machining centers.

■

Wind power generation relies on ultra precise, multi featured gear boxes. The gas turbine blades, blings, and flades made of hard exotic materials require rigid 5-axis contouring capabilities as do the gears and related drive train components. These types of applications are best suited for our 5-axis machine tools.

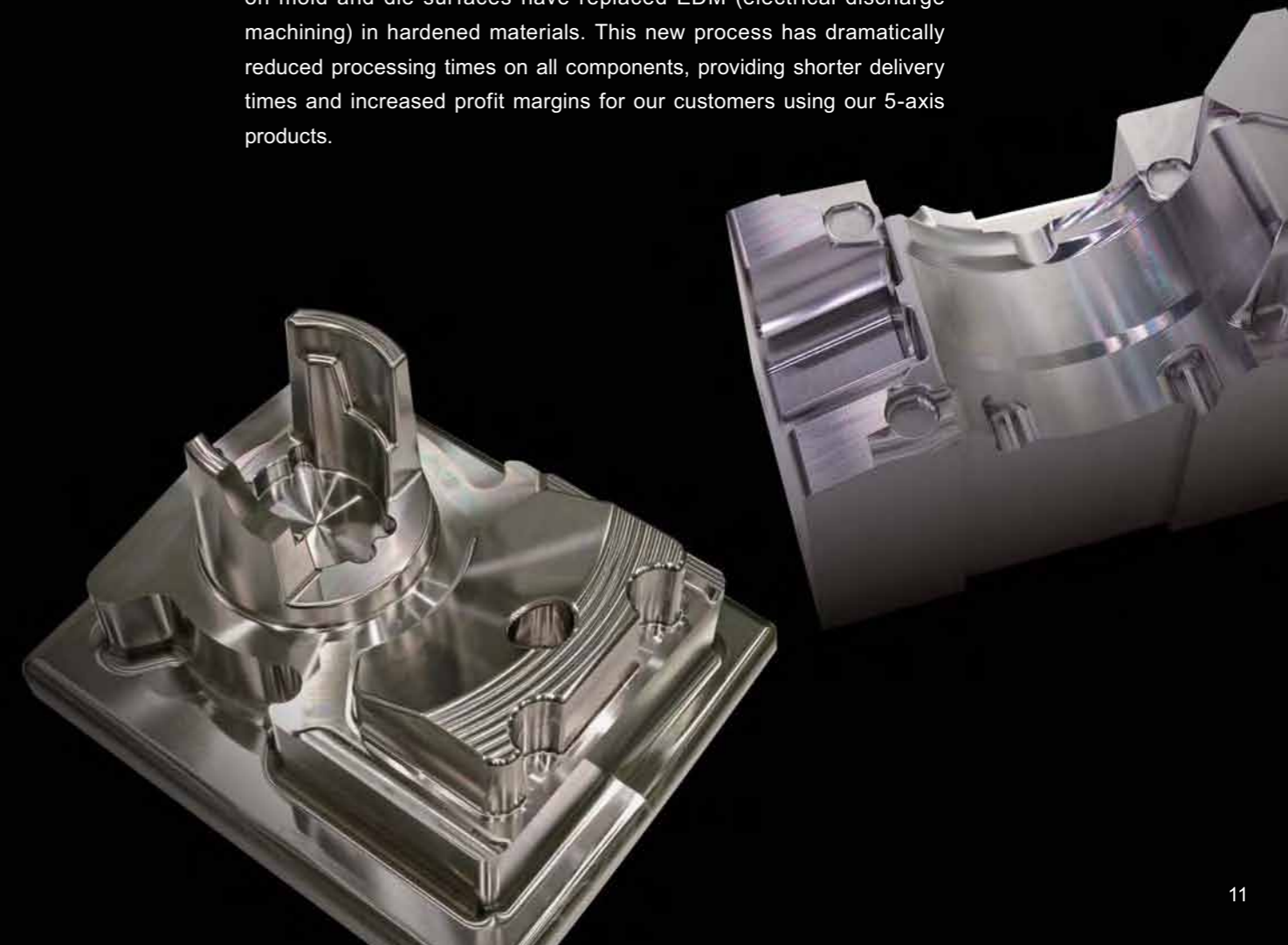


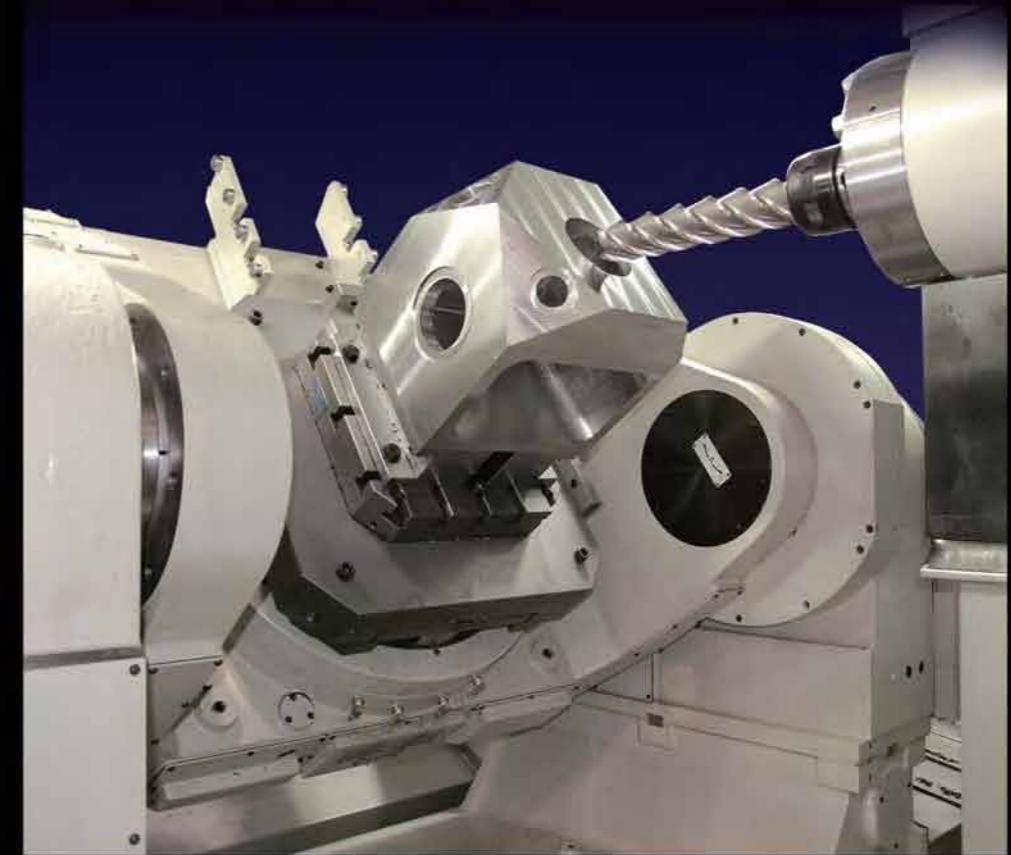


Die and Mold manufacturing

High quality surface finishes, superior form accuracy, and reduced cycle times are the result when parts are processed on Mitsui Seiki 5-axis machines.

■
Ultra high speed spindles coupled with optimal tangential tool positioning on mold and die surfaces have replaced EDM (electrical discharge machining) in hardened materials. This new process has dramatically reduced processing times on all components, providing shorter delivery times and increased profit margins for our customers using our 5-axis products.

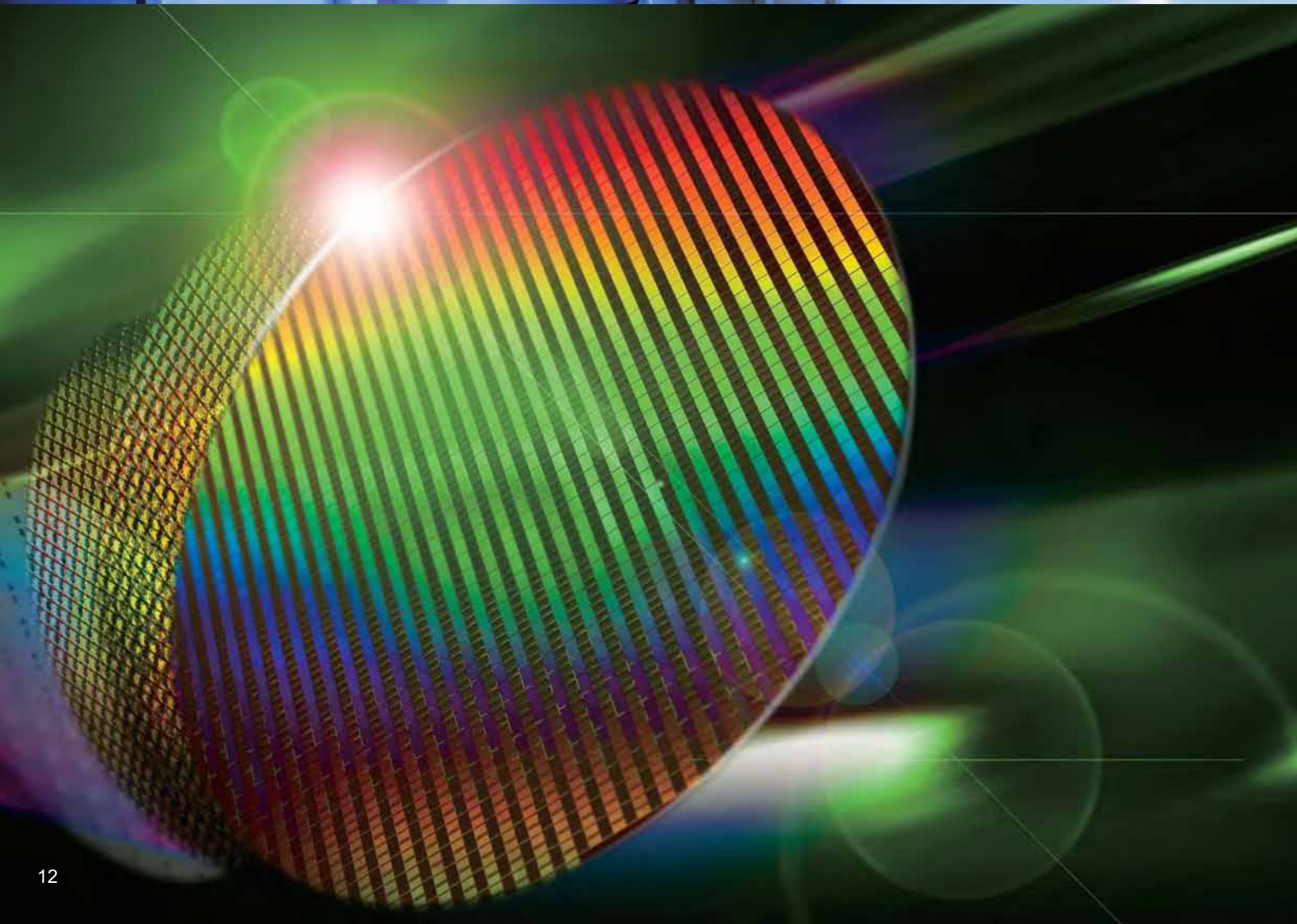




Semiconductor parts manufacturing

**Superior surface finishes
and highly precise flat surfaces are required.**

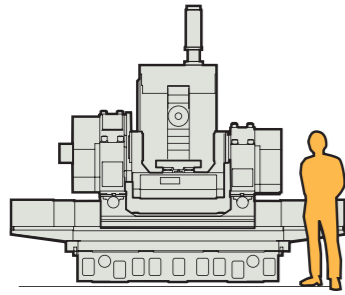
■
Semiconductor processing chambers or transfer chambers require multifaced machining and low RMS surface finish values directly off the machine tool. Additionally, ultraprecise flatness tolerances on surfaces are critical. Mitsui Seiki hand-scraped machine tools with superior straightness of axis travel are ideal for semiconductor work.



Four Versatile Solutions for Your Complex Part Machining

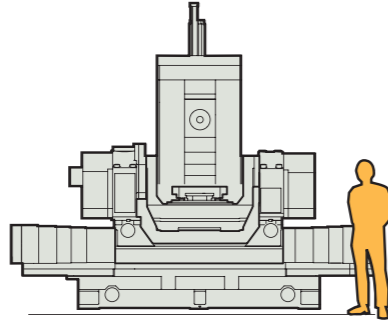
Trunnion Type (Horizontal Machining Center)

HU50A-5X



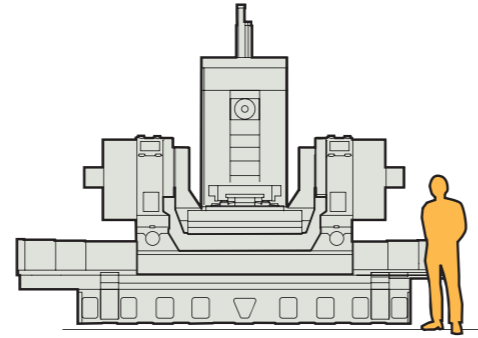
STROKE X:720mm Y:850mm Z:850mm
B:360° A:+5~-95°
PALLET SIZE 500mm×500mm

HU63A-5X



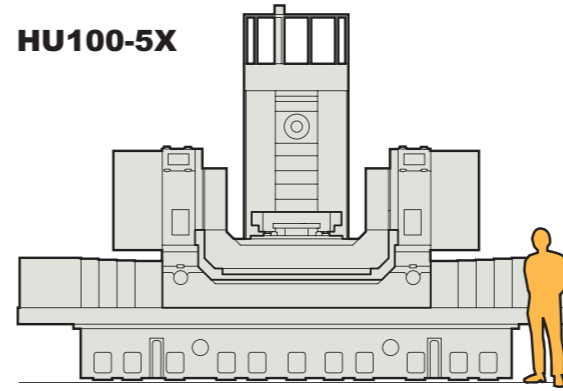
STROKE X:900mm Y:900mm Z:900mm
B:360° A:+5~-95°
PALLET SIZE 630mm×630mm

HU80A-5X



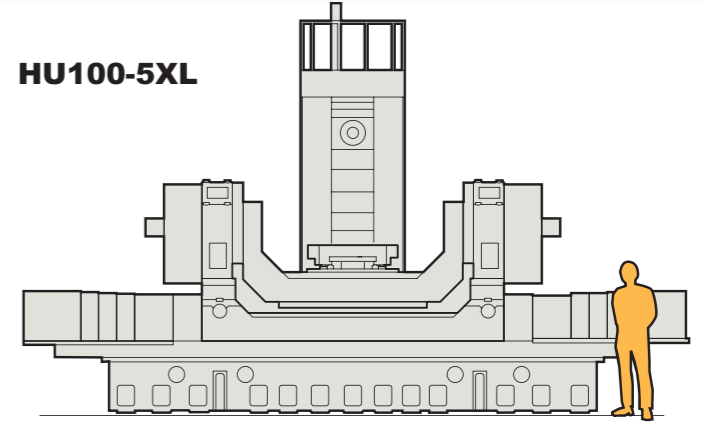
STROKE X:1200mm Y:1000mm Z:1050mm
B:360° A:+5~-95°
PALLET SIZE 800mm×800mm

HU100-5X



STROKE X:1500mm Y:1200mm Z:1200mm
B:360° A:+5~-95°
PALLET SIZE 1000mm×1000mm

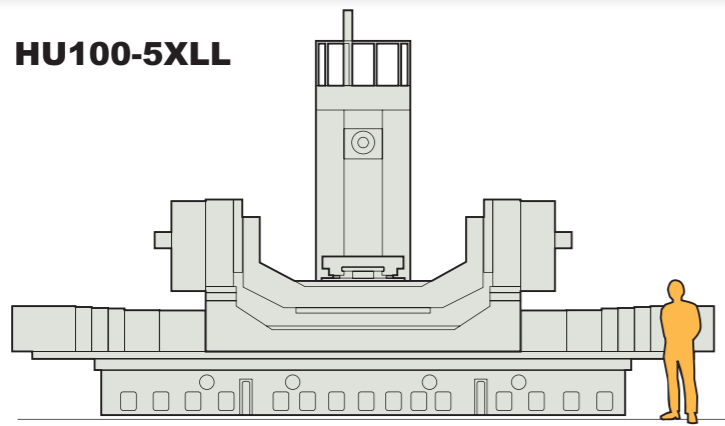
HU100-5XL



STROKE X:2000mm Y:1500mm Z:1400mm
B:360° A:+5~-95°
PALLET SIZE 1000mm×1000mm

Trunnion Type (Horizontal Machining Center)

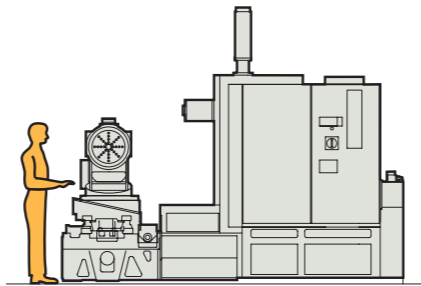
HU100-5XLL



STROKE X:2500mm Y:1750mm Z:1400mm
B:360° A:+5~-95°
PALLET SIZE 1000mm×1000mm

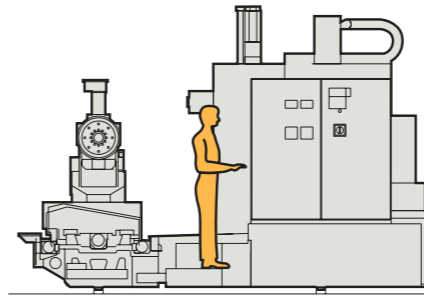
Table on Table Type (Horizontal Machining Center)

HU50-T



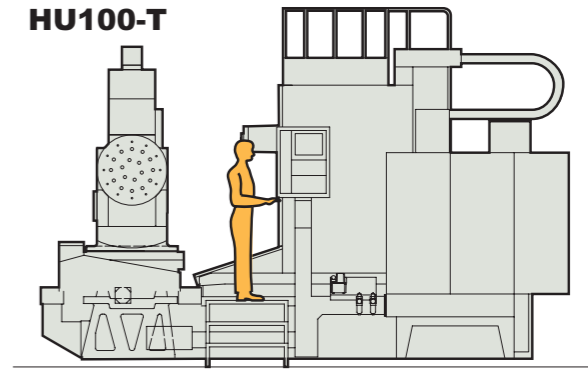
STROKE X:770mm Y:700mm Z:650mm
B:-90~+180° C:360°
PALLET SIZE φ360mm

HU63-T



STROKE X:900mm Y:800mm Z:800mm
B:-90~+180° C:360°
TABLE SIZE φ360mm

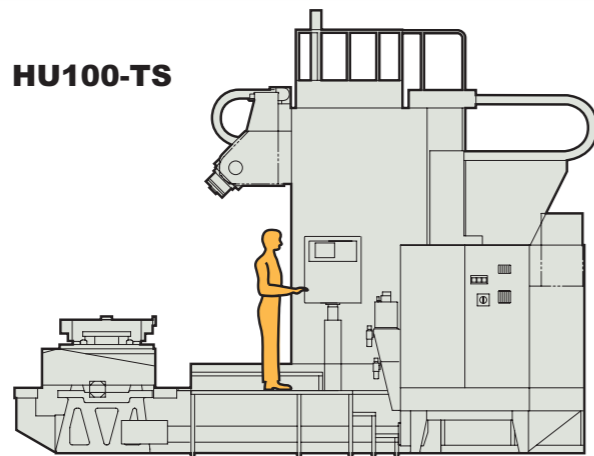
HU100-T



STROKE X:1300mm Y:1000mm Z:1000mm
B:-90~+180° C:360°
PALLET SIZE φ600mm

Tilt Spindle Type (Horizontal Machining Center)

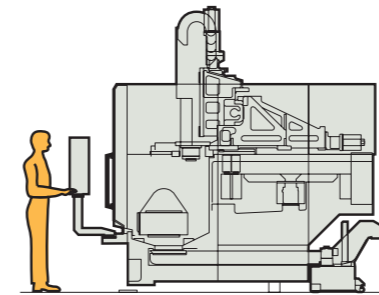
HU100-TS



STROKE X:1300mm Y:1500mm Z:1400mm
B:360° C:-30~+120°
PALLET SIZE 1000mm×1000mm

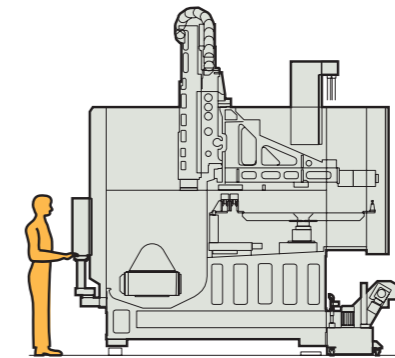
Trunnion Type (Vertical Machining Center)

Vertex550-5X



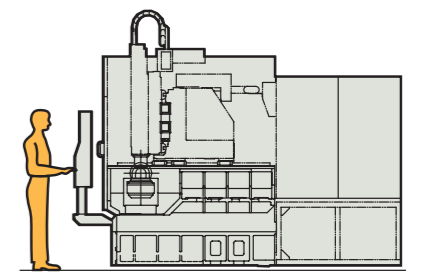
STROKE X:550mm Y:600mm Z:500mm
C:360° A:+15~-105°
TABLE SIZE φ400mm

Vertex750-5X



STROKE X:750mm Y:800mm Z:700mm
C:360° A:+15~-105°
TABLE SIZE φ500mm

VL30-5X



STROKE X:200mm Y:300mm Z:200mm
C:360° A:+40~-110°
TABLE SIZE φ180mm

Fundamental Machine Structure Designed to Support High Accuracy and High Productivity.

Mitsui Seiki 5-axis machining centers have evolved from a long history of Jig Boring manufacturing methods, such as hand-scraping and hand-fitting machine tool components in a tightly temperature controlled assembly environment. This fortunate foundation and the company's myriad advanced technical developments have contributed to Mitsui Seiki's "best in class" 5-axis machines.

The most critical and difficult aspect of 5-axis machine tool construction is the fitting of the rotary and tilting table assembly. To assure low table wobble tolerances and that the intersecting planes of A and B axes are accurately aligned, Mitsui Seiki conducts all component manufacturing and assembly in-house at our world class assembly facility.



Design based on FEA (Finite Element Analysis)



Scraping area



Final adjustment stage in search for accuracy



Adjustment & inspection area

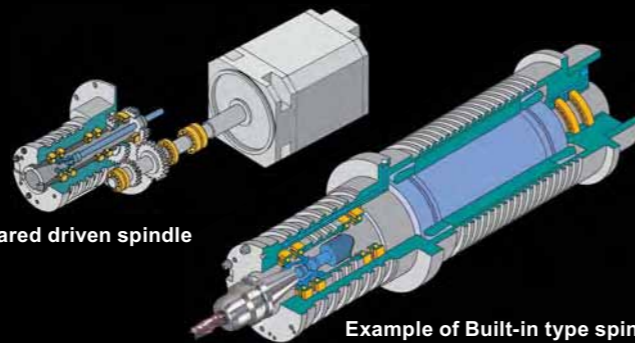


Versatile Spindles: Speed, Stiffness, Reliability



Ultra High Torque and High Power, HSK-A100 Spindle

Mitsui Seiki designs and manufactures a wide range of spindles to machine all types of materials. We can accommodate high rotational speeds for aluminum and other non ferrous materials or high torque geared spindles for the world's toughest materials.



Example of Geared driven spindle

Example of Built-in type spindle

Machining Center Spindle Specification Chart

Machine	Item	Integral motor						Integral motor			Gear drive		
		HSK			BT			BT			BT		
		E40	E32	E25	#40			#50			#50		
Spindle RPM	25000	30000	50000	8000	12000	15000	20000	25000	10000	12000	15000	4500	6000
	HU50A-5X HU50-T	-	-	-	-	-	18.5/15 28.6/14	-	-	**30/25 420/239	-	-	-
	HU63A-5X HU63-T HU80A-5X	-	-	-	-	-	-	-	-	**30/25 420/239	-	2-shift 18.5/1.5 26/22	3-shift 601/487 1081/915
	HU100-T HU100-5X HU100-5XL HU100-5XLL	-	-	-	-	-	-	-	-	**30/25 420/239	-	3-shift 18.5/1.5 26/22	3-shift 37/30 1277/1036 3331/2701
	HU100-TS	-	-	-	-	-	**18.5/15 28.6/14	22/18.5 167/95.4	-	-	-	-	-
	Vertex550-5X Vertex750-5X	-	-	-	-	*7.5/5.5 98/44	**18.5/15 28.6/14	-	-	-	-	-	-
	VL30-5X	3.7/1.5 3.53/1.43	4.1/1.5 1.31/0.72	5.5/1.5 1.31/0.72	-	-	-	-	-	-	-	-	-

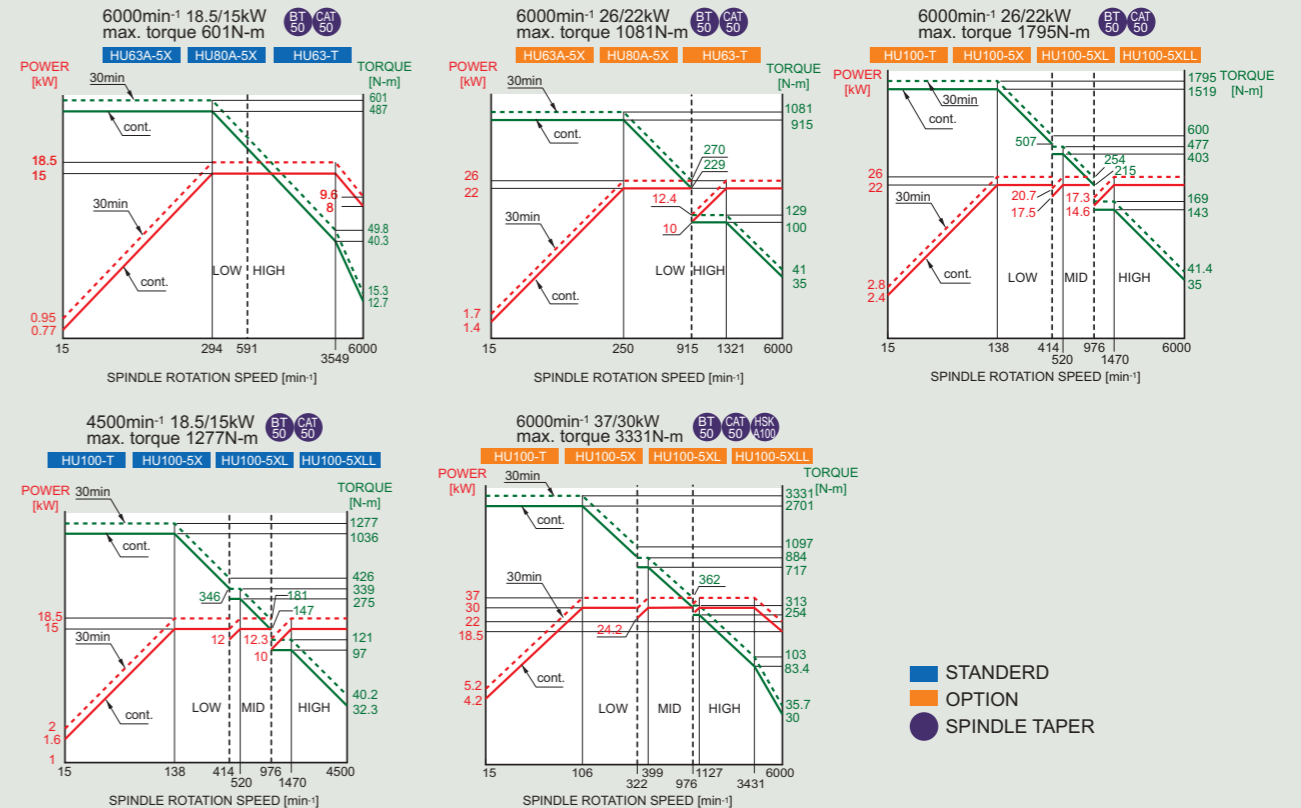
Upper: Power (kw 30min/continuous)

Lower: Torque (Nm 30min/continuous *1min/continuous **25%ED/continuous)

Blue=Standard Orange=Option

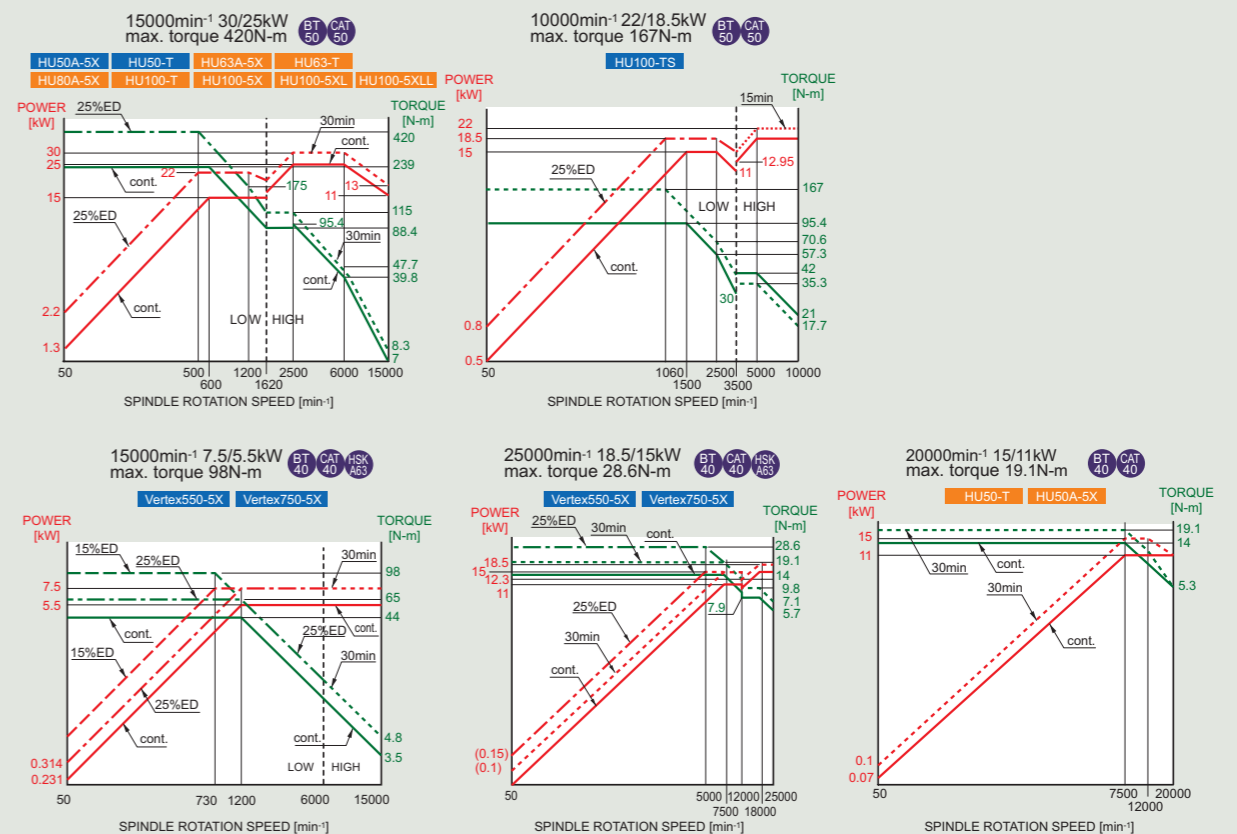
"-"=Off the subject

Gear Drive Type Spindle



Blue=STANDERD
Orange=OPTION
Blue circle=SPINDLE TAPER

Built-In Type Spindle



Trunnion type (Horizontal Machining Center)



HU50A-5X



HU63A-5X



HU80A-5X



HU100-5X



HU100-5XL



HU100-5XLL



Specifications

Item		Unit	HU50A-5X	HU63A-5X	HU80A-5X	HU100-5X	HU100-5XL	HU100-5XLL	
Stroke	X-axis	mm	720	900	1200	1300	2000	2500	
	Y-axis	mm	850	900	1000	1200	1500	1750	
	Z-axis	mm	850	900	1050	1200	1400	1400	
	A-axis	°	+5~-95(option:+20~-110)						
	B-axis	°	360						
Table	Pallet size	mm	500×500	630×630	800×800	1000×1000	1000×1000	1000×1000	
	Max. work dia. × height	mm	φ750×700	φ950×900	φ1200×1000	φ1500×1050	φ2000×1200	φ2500×1200	
	Max. permission of weight	kg	650	800	1200	2000	2000	3000	
Spindle	Taper		ISO 7/24 taper No.50						
	Spindle rotation speed	min ⁻¹	50~12000	50~6000			15~4500		
	Spindle motor power (30min/cont.)	kW	30/25	18.5/15			18.5/15		
Rapid feed rate	X, Y, Z-axis	m/min	X:24 YZ:36	X:12 YZ:24		12	X:10 YZ:12	X:9.5 YZ:12	
	A-axis	min ⁻¹	6			4	2		
	B-axis	min ⁻¹	12	10		6	4		
ATC	Tool storage capacity		60						
	Max. tool length	mm	400	420	450	500			
	Max. tool dia.	with contiguity	φ125						
		without contiguity	φ216						
Max. tool weight	kg	20	25						
APC			2PAC			Option			
Positioning accuracy	X, Y, Z-axis	mm	±0.001		±0.0015	±0.003			
	A-axis	sec.	±6	±8					
	B-axis	sec.	±3			±4			
Machine weight	kg	18000	26000	28000	35000	40000	55000		

Trunnion type (Horizontal Machining Center)

Features

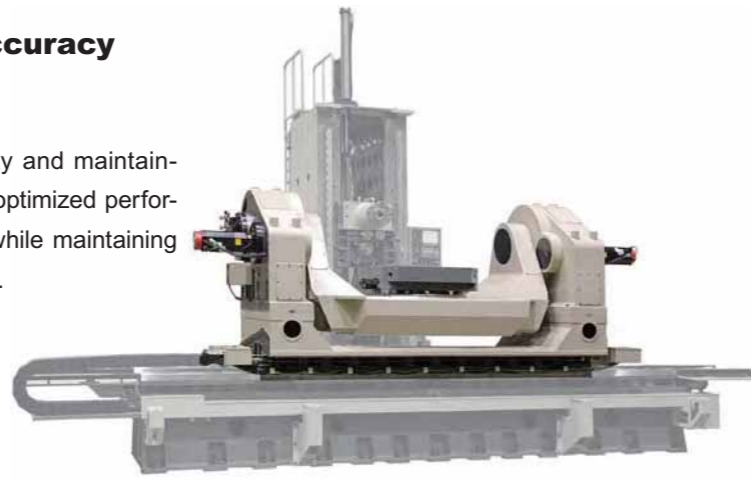
Rigid three point bed design

The triangular rib construction and three-point leveling design provides machine stability, accuracy, and resiliency in both heavy cutting and precision finish machining. Hand-scraping under the tool steel box ways assures that the way-mounted column, saddle and trunnion assemblies are providing the best volumetric accuracies achievable.



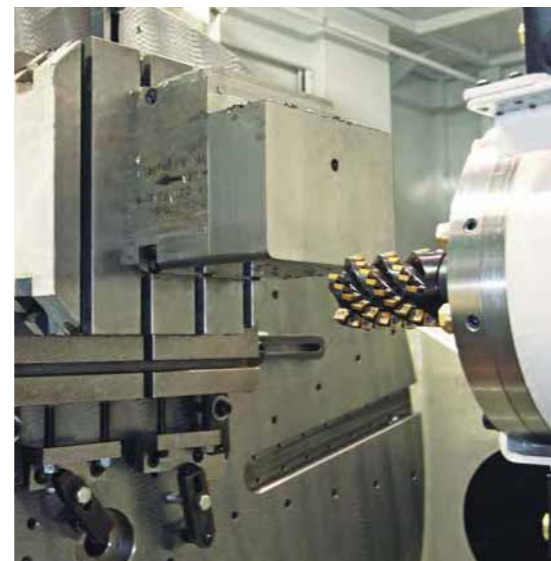
The tilting assemblies provide high accuracy and reliability

The tilting and rotary structure is designed for reliability and maintainability. Mitsui Seiki's experience in trunnion designs has optimized performance for components weighting up to 10 metric tons while maintaining the high precision positioning expected from our products.

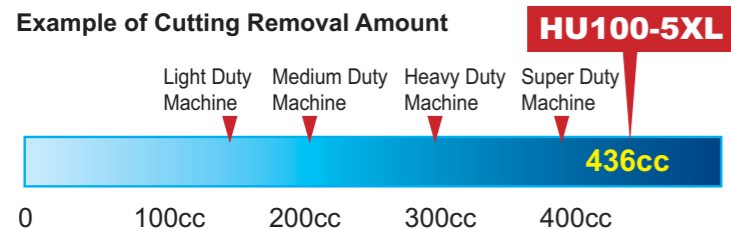


Efficient machining of hard materials

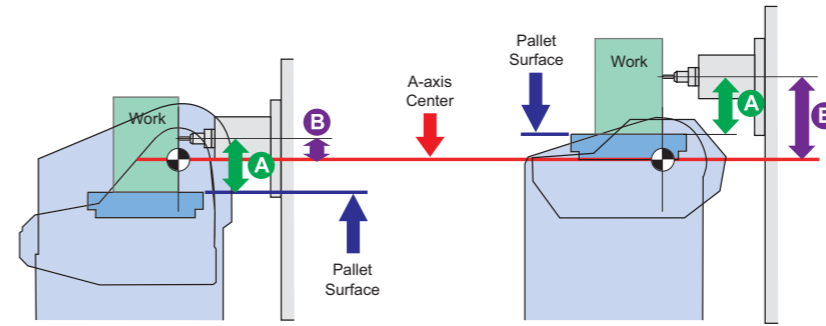
Mitsui Seiki 5-axis machining centers are ideal for hard metal machining. Titanium, inconel, waspaloy, stainless steel and the new special alloy grades being developed are ideally suited for these machines. These 5-axis systems are capable of the highest roughing removal rates available on a horizontal machining center.



Example of Cutting Removal Amount



Rigidity and accuracy are designed into the mechanics of the tilting table assemblies

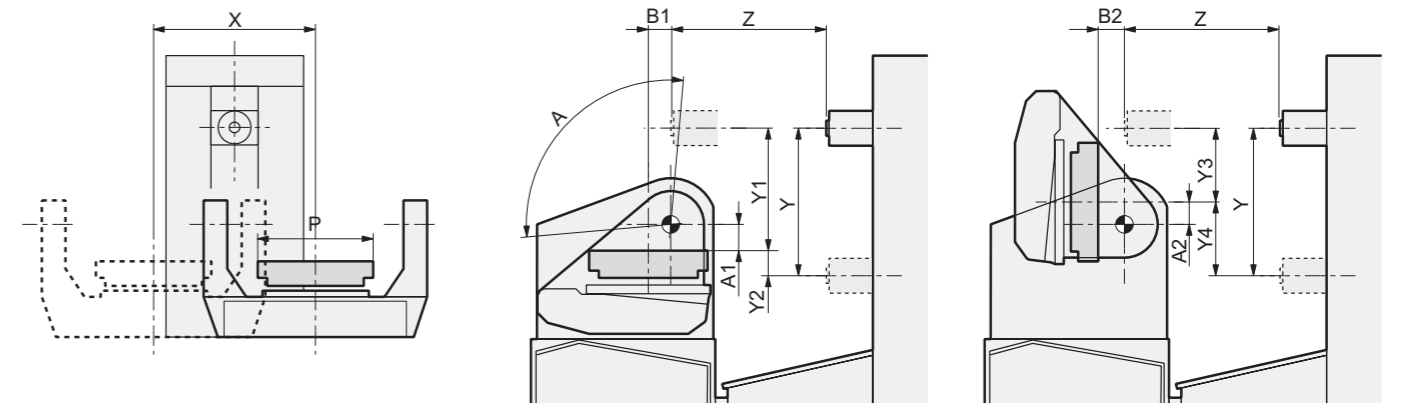


[Type-A]
A axis center is above of pallet surface (Mitsui Seiki)

[Type-B]
A axis center is below of pallet surface

Type A design concentrates the fixtured component around the A-axis center of rotation. This provides less distortion, better rigidity, and higher accuracy because the angular error from A-axis indexing is reduced.

Stroke dimension drawing



Symbol	Unit	HU50A-5X	HU63A-5X	HU80A-5X	HU100-5X	HU100-5XL	HU100-5XLL
P	mm	500	630	800	1000	1000	1000
X	mm	720	900	1200	1300	2000	2500
Y	mm	850	900	1000	1200	1500	1750
Y1	mm	695	800	850	950	1250	1400
Y2	mm	155	100	150	250	250	350
Y3	mm	395	450	500	600	900	1050
Y4	mm	455	450	500	600	600	700
Z	mm	850	900	1050	1200	1400	1400
A	°	+5~-95(option:+20~-110)					
A1	mm	150	175	200	250	250	250
A2	mm	150	175	150	100	100	100
B1	mm	150	150	150	200	200	400
B2	mm	150	150	200	350	350	400

Layout

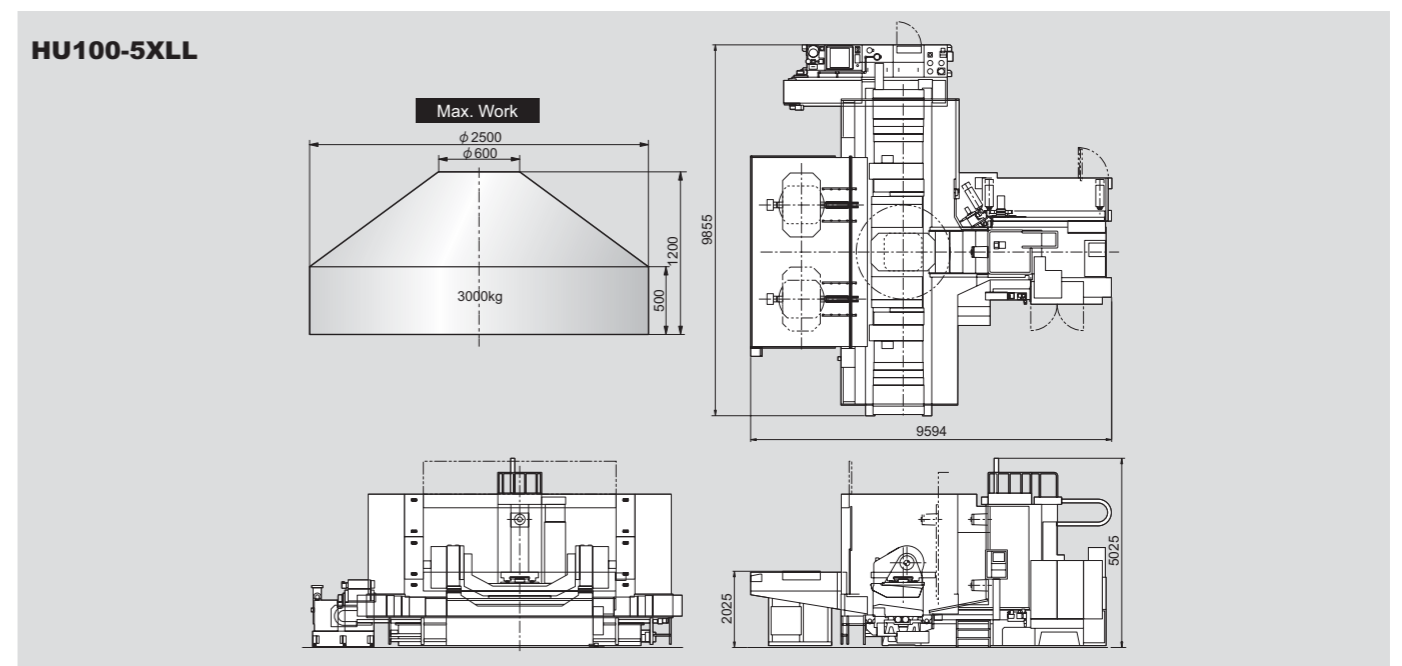
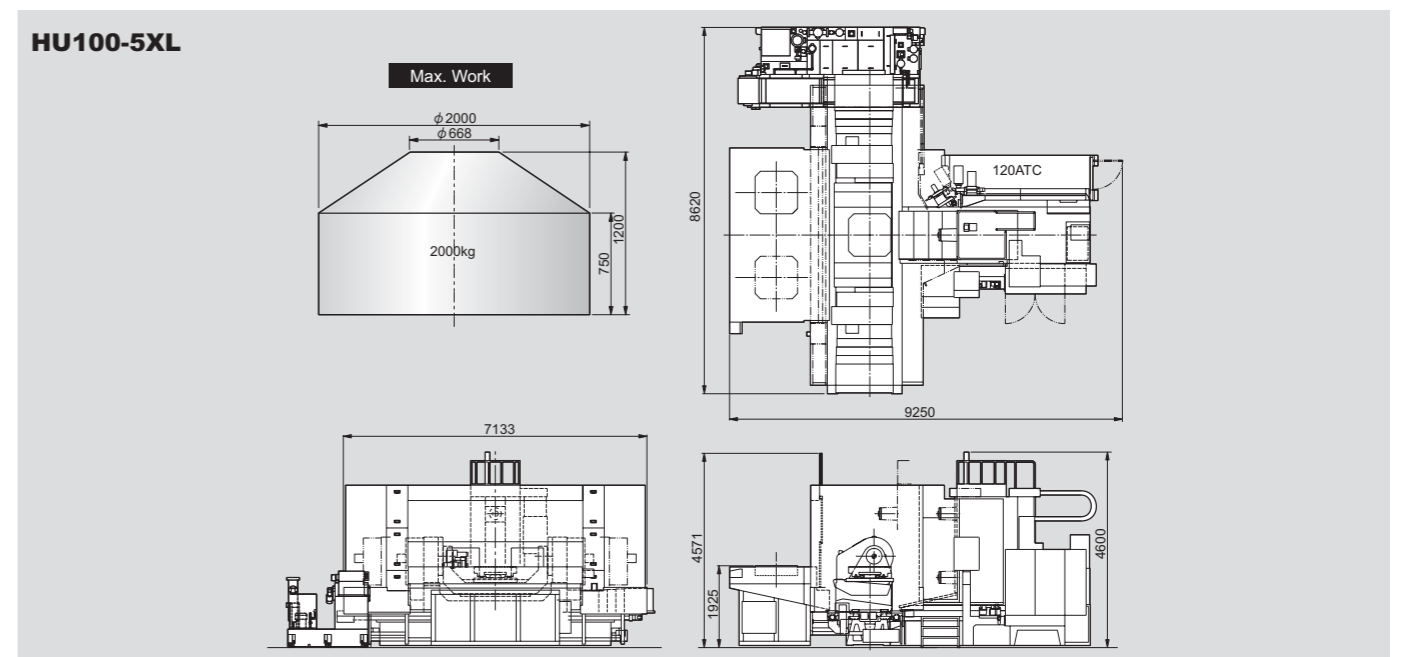
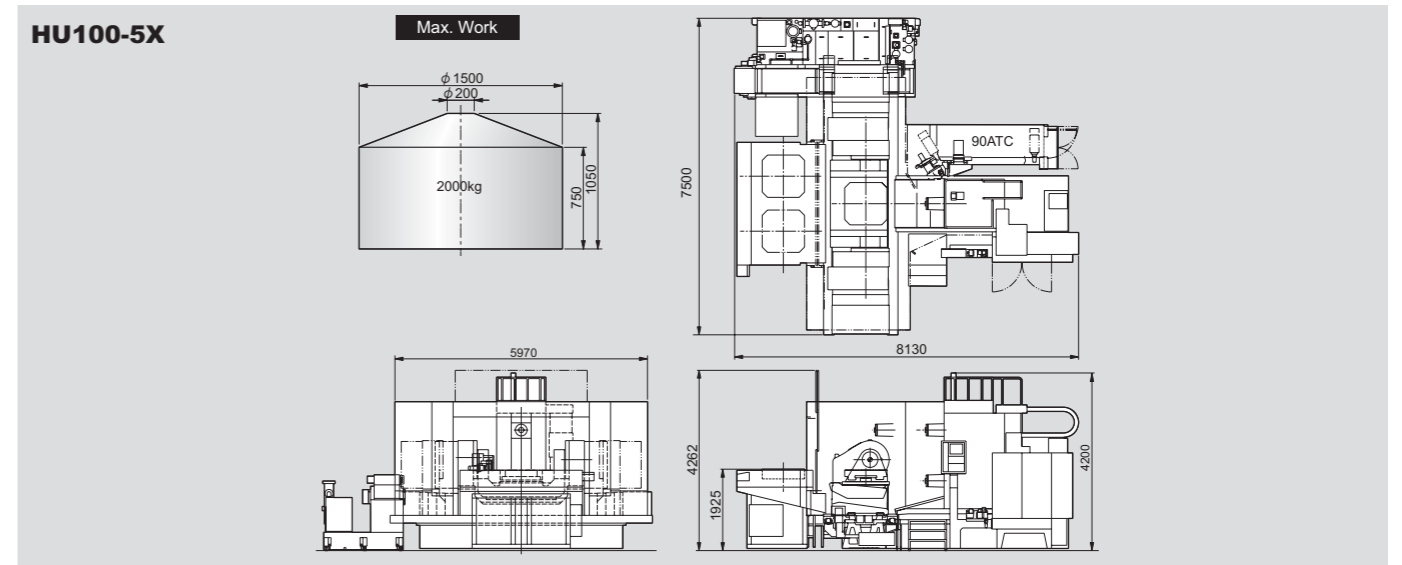
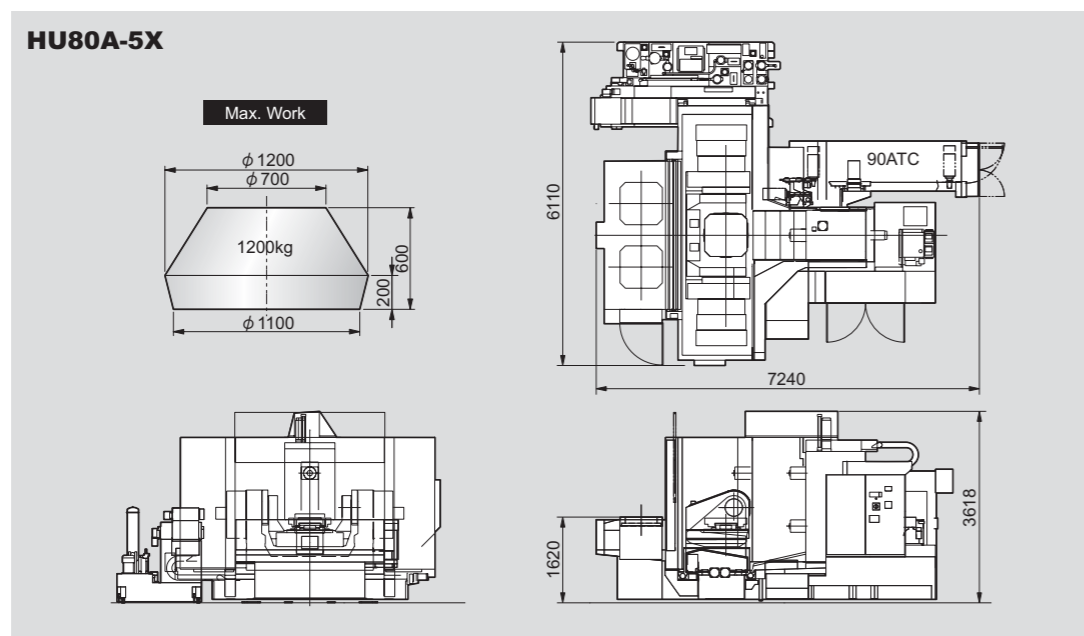
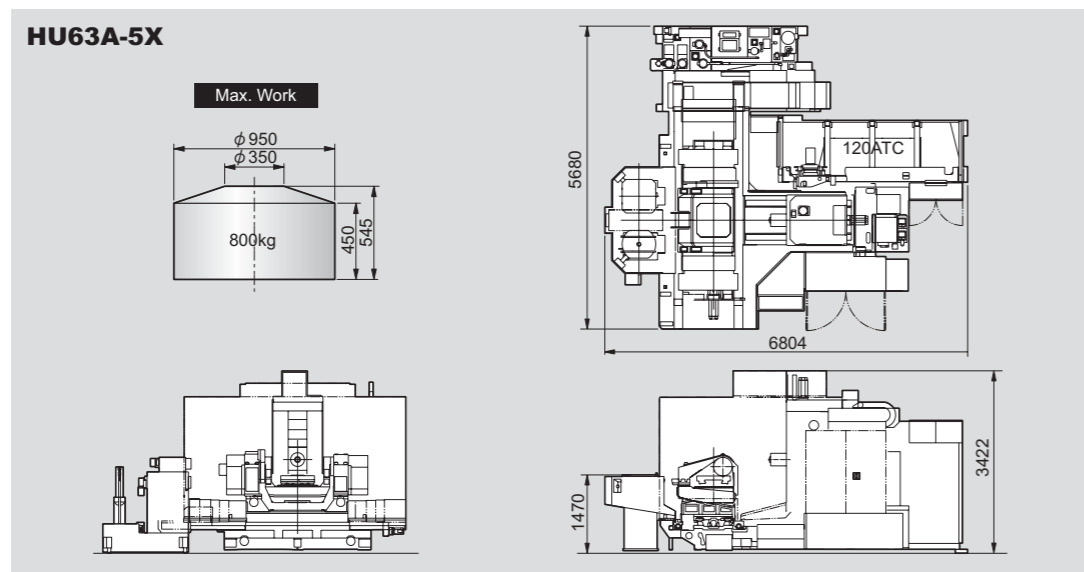
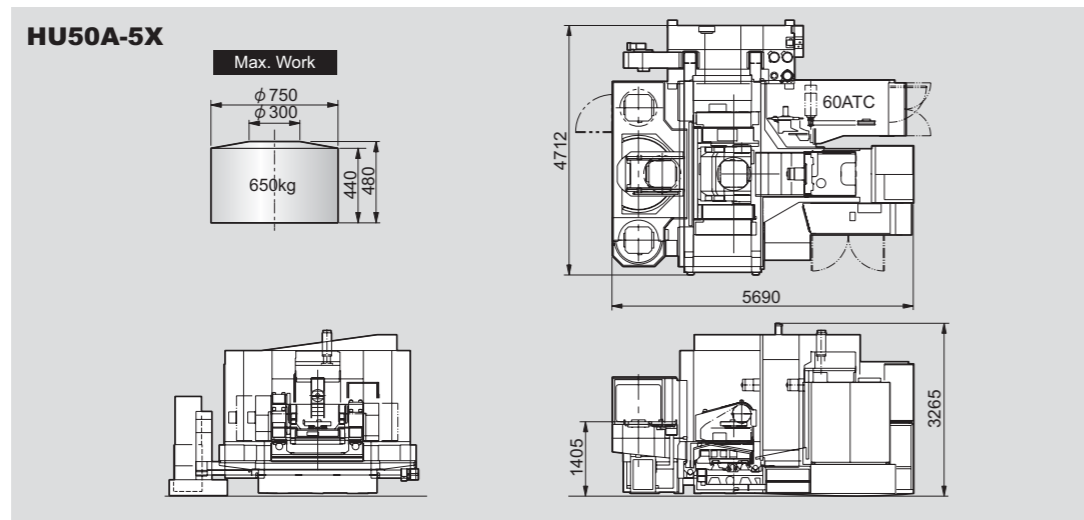


Table on Table Type (Horizontal Machining Center)



HU50-T



HU63-T



HU100-T



Specifications

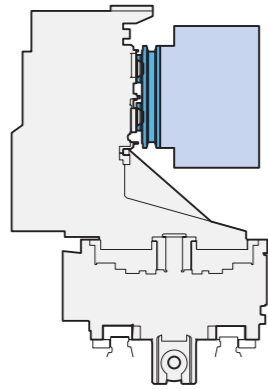
Item		Unit	HU50-T	HU63-T	HU100-T	
Stroke	X-axis	mm	770	900	1300	
	Y-axis	mm	700	800	1000	
	Z-axis	mm	650	800	1000	
	B-axis	°	-90~+180			
	C-axis	°	360			
Table	Table (Pallet) size	mm	φ 360		φ 600	
	Max. work dia. × height	mm	φ 500×350	φ 800×618	φ 1200×700	
	Max. permission of weight	kg	100	300	600	
Spindle	Taper		ISO 7/24 taper No.50			
	Spindle rotation speed	min ⁻¹	50~12000	50~6000	15~4500	
	Spindle motor power (30min/cont.)	kW	30/25	18.5/15	18.5/15	
Rapid feed rate	X, Y, Z-axis	m/min	36	24	15	
	B-axis	min ⁻¹	30	20	10	
	C-axis	min ⁻¹	30	20	10	
ATC	Tool storage capacity		60			
	Max. tool length	mm	400	450	500	
	Max. tool dia.	with contiguity	mm	φ 125		
		without contiguity	mm	φ 216		
	Max. tool weight	kg	20	25		
APC			4APC	Option	×	
Positioning accuracy	X, Y, Z-axis	mm	±0.001		±0.003	
	B-axis	sec.	±3		±4	
	C-axis	sec.	±3		±8	
Machine weight		kg	15000	18000	32000	

Table on table type (Horizontal Machining Center)

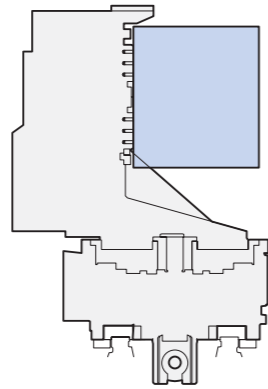
Features

T Series options for special applications

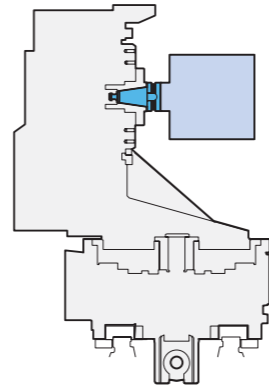
- Automatic pallet changer with a 360mm round pallet
- Automatic work changer with BT50 center mounted holder
- Improved rigidity incorporating B/C axes with three roller bearing assemblies
- Geared drive systems for increased rigidity or direct drive motors for high speed acceleration/ deceleration.



APC type (φ360 pallet)
[HU50-T, HU63-T]

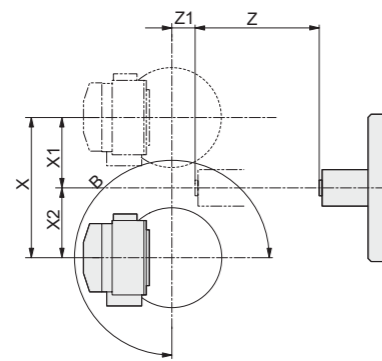


Plane table type
[HU50-T, HU63-T, HU100-T]

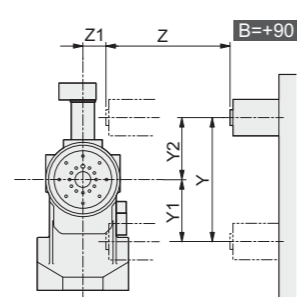
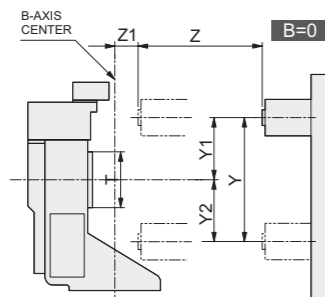


AWC type (BT50 shank)
[HU50-T]

APC cycle

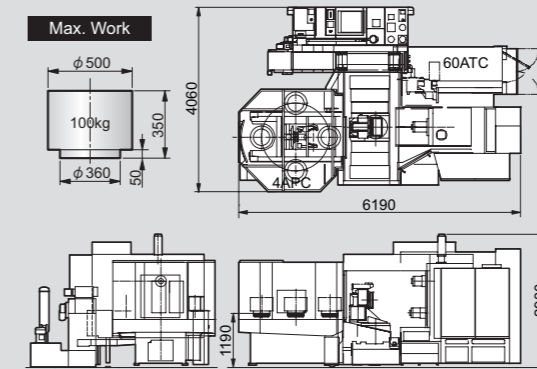


Symbol	Unit	HU50-T	HU63-T	HU100-T
T	mm	φ360	φ360	φ600
X	mm	770	900	1300
X1	mm	410	450	650
X2	mm	360	450	650
Y	mm	700	800	1000
Y1	mm	420	400	530
Y2	mm	280	400	470
Z	mm	650	800	1000
Z1	mm	150	150	200
B	°	-90~+180	-90~+180	-90~+180

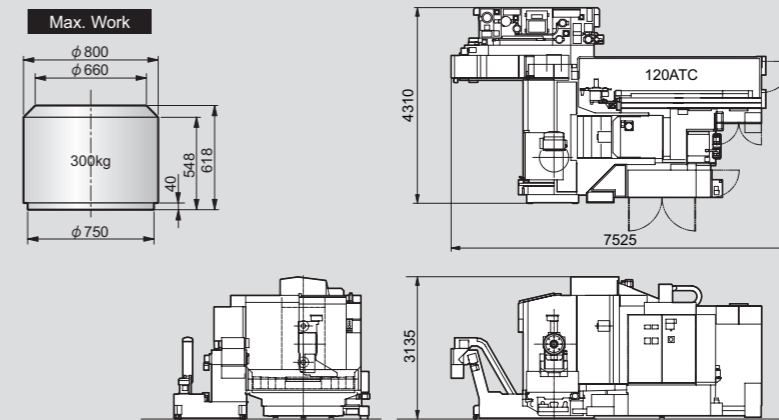


Layout

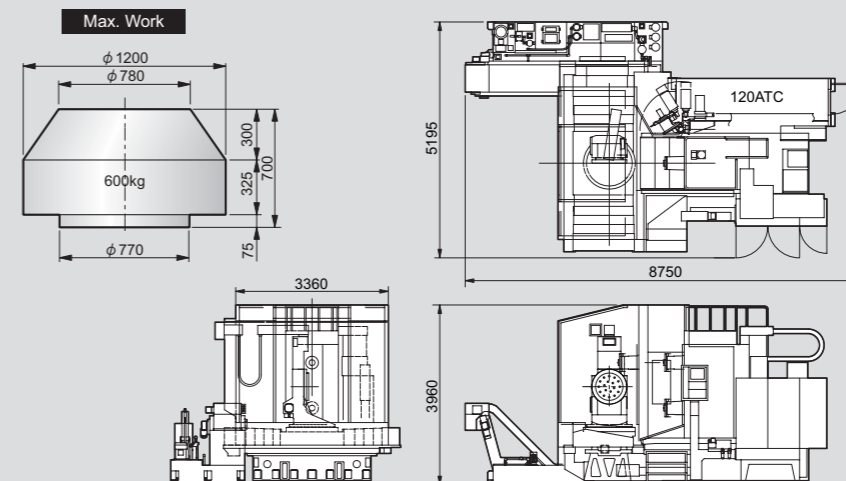
HU50-T



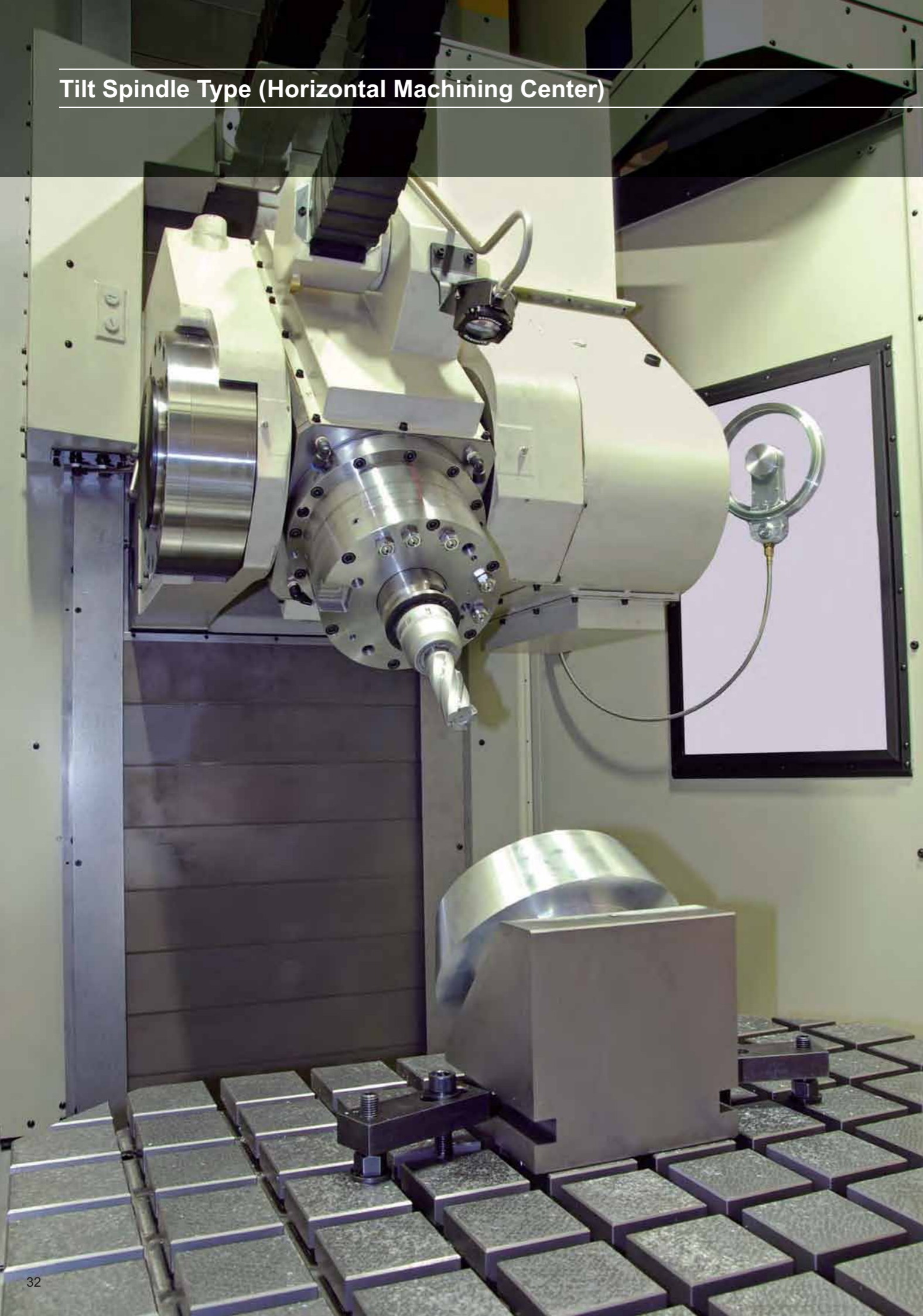
HU63-T



HU100-T



Tilt Spindle Type (Horizontal Machining Center)



HU100-TS



Specifications

Item		Unit	HU100-TS	
Stroke	X-axis	mm	1300	
	Y-axis	mm	1500	
	Z-axis	mm	1400	
	A-axis	°	-30~+120	
	B-axis	°	360	
Table	Table size	mm	1000×1000	
	Max. work dia. height	mm	φ1250×1900	
	Max. permission of weight	kg	3000	
Spindle	Taper		ISO 7/24 taper No.50	
	Spindle rotation speed	min ⁻¹	50~10000	
	Spindle motor power (30min/cont.)	kW	22/18.5	
Rapid feed rate	X, Y, Z-axis	m/min	15	
	A-axis	min ⁻¹	6	
	B-axis	min ⁻¹	10	
ATC	Tool storage capacity		60	
	Max. tool length		mm	500
	Max. tool dia.	with contiguity	mm	φ125
		without contiguity	mm	φ216
Max. tool weight		kg	25	
APC			Option	
Positioning accuracy	X, Y, Z-axis	mm	±0.003	
	A-axis	sec.	±3	
	B-axis	sec.	±3	
Machine weight		kg	31000	

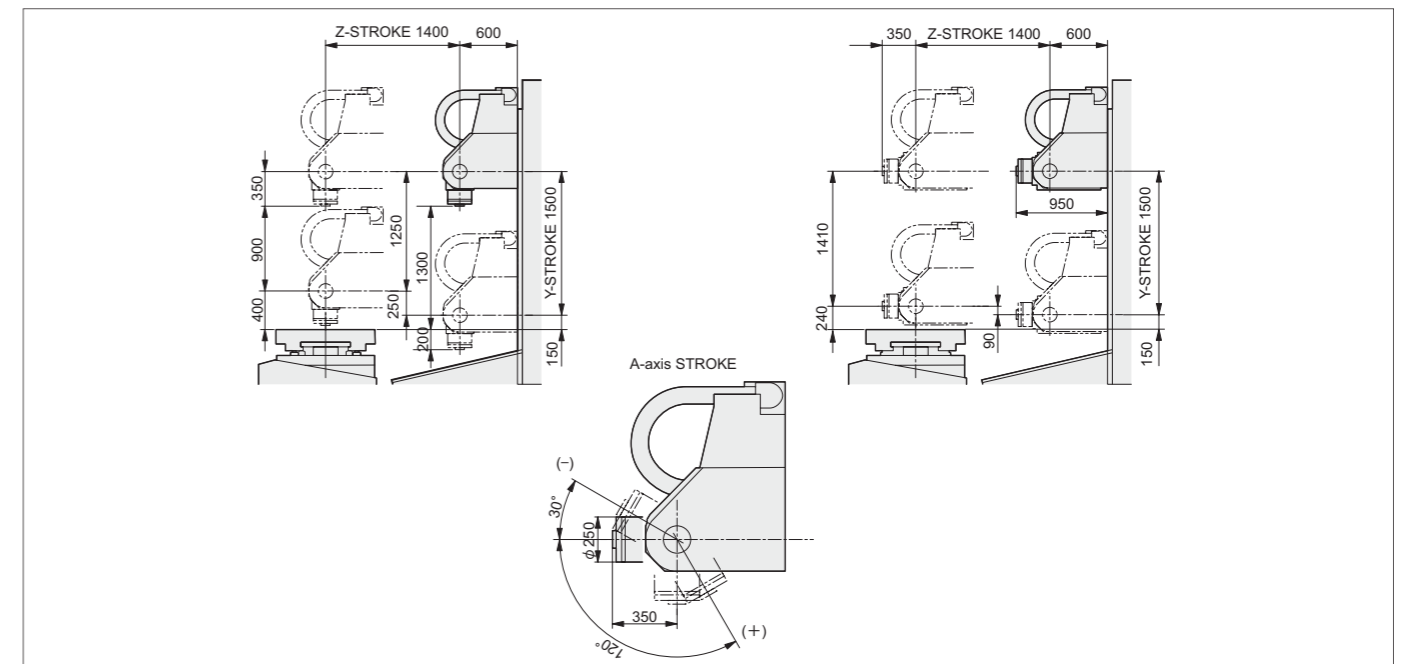
Tilt Spindle Type (Horizontal Machining Center)

Features

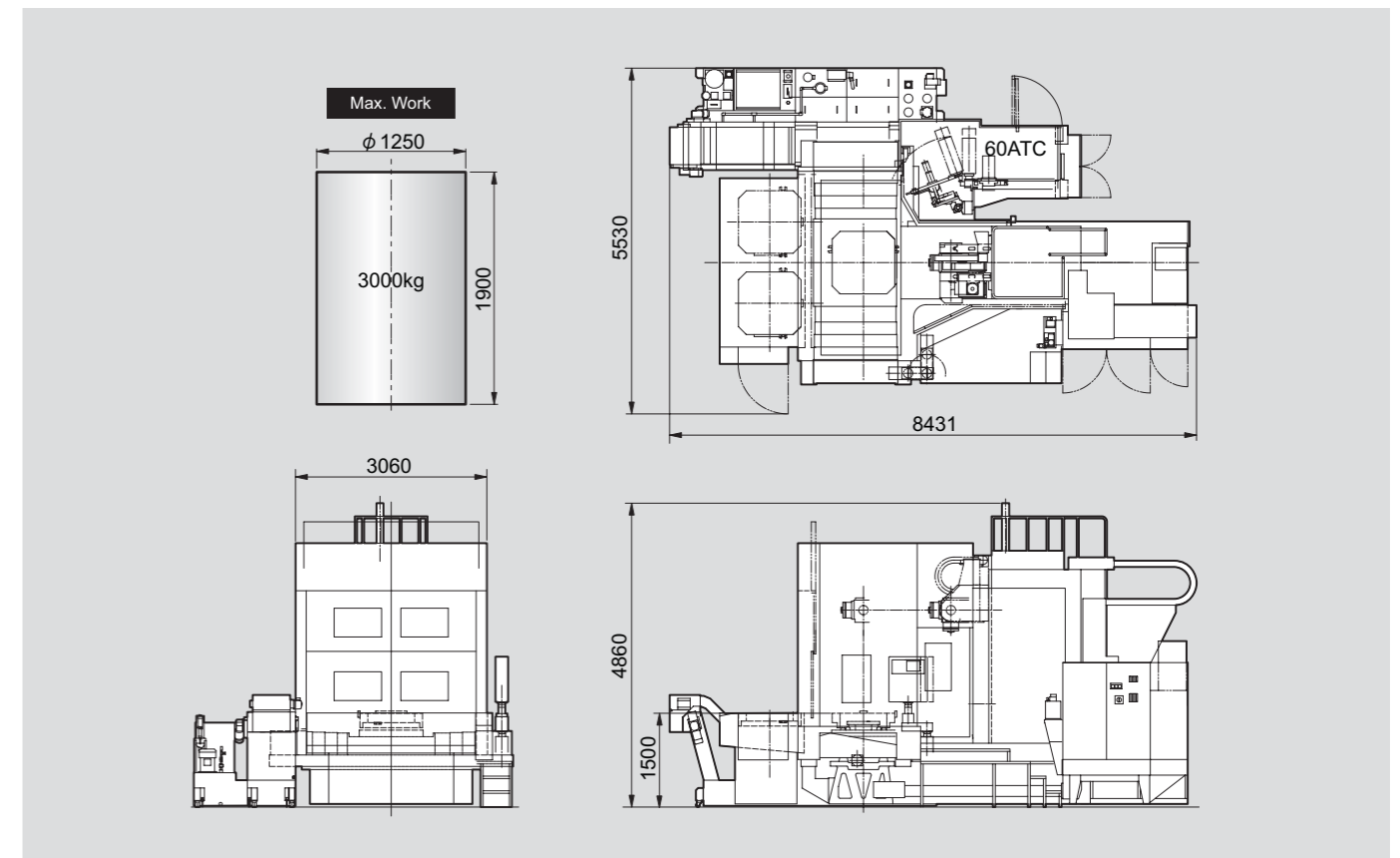
- Tilt spindle head is designed for the rigidity required for hard material machining
- Smooth, zero backlash, B-axis motion for superior 5-axis simultaneous motion control
- 10,000 RPM with BT50 or 25,000 RPM with BT 40 spindles available
- 6,000 RPM with BT50, Heavy duty gear driven spindle is also available

Advantages of the 5-axis tilt spindle design

- Less interference
- Best for large, heavy work pieces
- Machine footprint is smaller than a trunnion style machine
- Accommodates very large diameter workpieces



Layout



Trunnion Type (Vertical Machining Center)



Vertex550-5X



Vertex750-5X



VL30-5X



Specifications

Item		Unit	Vertex550-5X	Vertex750-5X	VL30-5X	
Stroke	X-axis	mm	550	750	200	
	Y-axis	mm	600	800	300	
	Z-axis	mm	500	700	200	
	A-axis	°	+15~105		+40~110	
	C-axis	°	360			
Table	Table size	mm	φ 400	φ 500	φ 180	
	Max. work dia. height	mm	φ 750×525	φ 950×650		
	Max. permission of weight	kg	350	500	20	
Spindle	Taper		ISO 7/24 taper No.40		See below	
	Spindle rotation speed	min ⁻¹	50~25000 or 50~15000			
	Spindle motor power (30min/cont.)	kW	18.5/15 or 7.5/5.5			
Rapid feed rate	X, Y, Z-axis	m/min	48		40	
	A-axis	min ⁻¹	30	20	50	
	C-axis	min ⁻¹	50	40	100	
ATC	Tool storage capacity		40		12	
	Max. tool length	mm	300	350	100(HSK-E25)	
	Max. tool dia.	with contiguity	mm	φ 90		φ 9(HSK-E25)
		without contiguity	mm	φ 125		-
Max. tool weight	kg	10		0.5(HSK-E25)		
Positioning accuracy	X, Y, Z-axis	mm	±0.001			
	A-axis	sec.	± 6			
	C-axis	sec.	± 4			
Machine weight	kg	9500	12500	6500		

VL30-5X SPINDLE Specifications

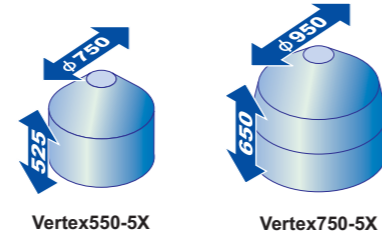
Item		Unit	Type- I	Type- II	Type- III
Spindle	Taper		HSK-E25	HSK-E32	HSK-E40
	Spindle rotation speed	min ⁻¹	500~50000	300~30000	250~25000
	Spindle motor power (30min/cont.)	kW	5.5/1.5	4.0/1.5	3.7/1.5

Trunnion Type (Vertical Machining Center)

Features

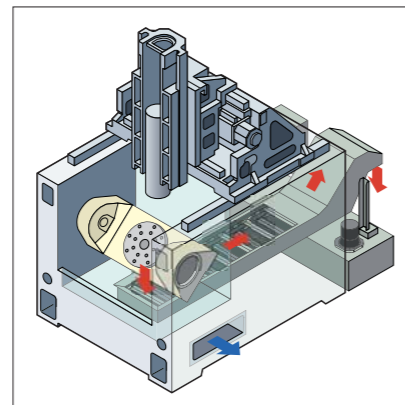
Vertex550-5X/750-5X

- A small footprint with large workpiece capacity
- Ergonomically designed for easy accessibility
- High speed spindle with spindle thermal growth compensation function
- Machine designed for efficient chip evacuation



Floor space and Max. work size to be on

	Floor space		Max. Work size		
	Width	Depth	Diameter	Height	Weight
Vertex550-5X	2m	3m	φ 750mm	525mm	350kg
Vertex750-5X	2.2m	3.5m	φ 950mm	650mm	500kg



Accessing the table surface is very easy and comfortable for the operator because of the stationary table design.

The cutting chips fall directly into the chip conveyor underneath the table and are quickly discharged.

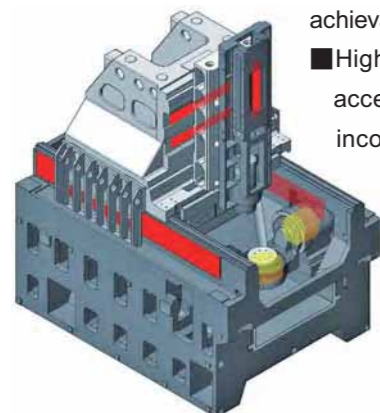


Two spindles are available. A high speed 25,000min⁻¹ spindle or high torque 15,000min⁻¹ spindle

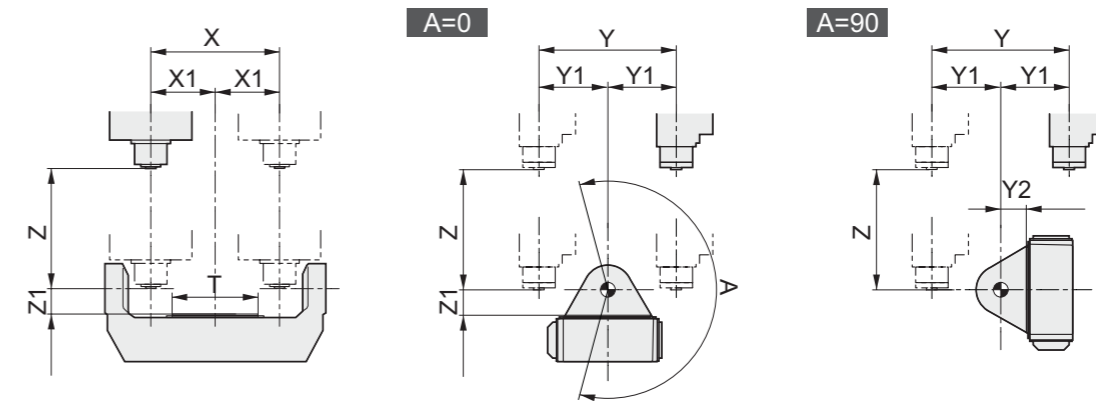
VL30-5X

- Integration of linear motor technology for all axes provides the ultimate high speed and high accuracy machining without backlash or lost motion.
- 40m/min rapid feed rates / cutting feed rates (X,Y,Z) with acceleration/ deceleration at 1 G with 0.1μm numeral control input is achievable.

- High rotational speed and high acceleration is accomplished by incorporating DD (Direct Drive) motor technology on the rotary axis (C-axis) and tilting axis (A-axis)

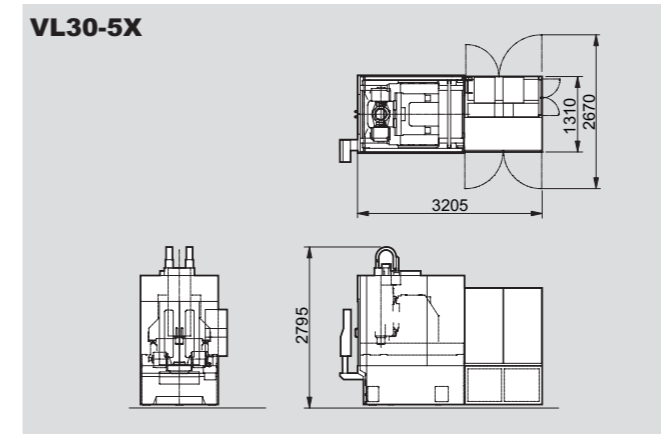
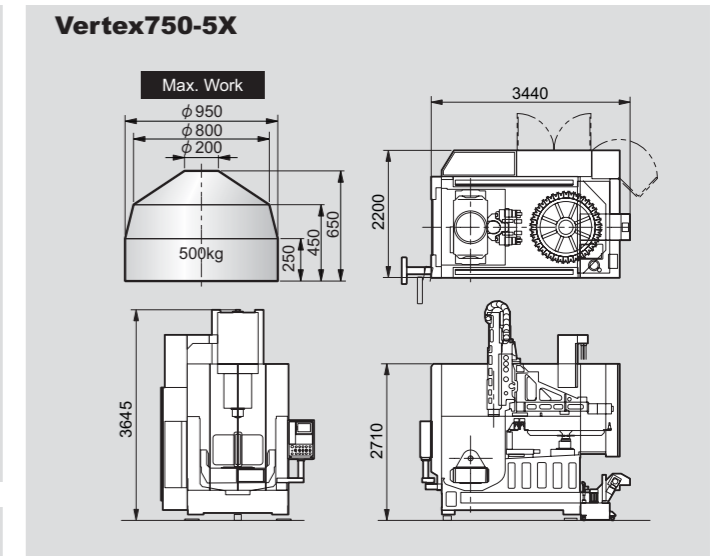
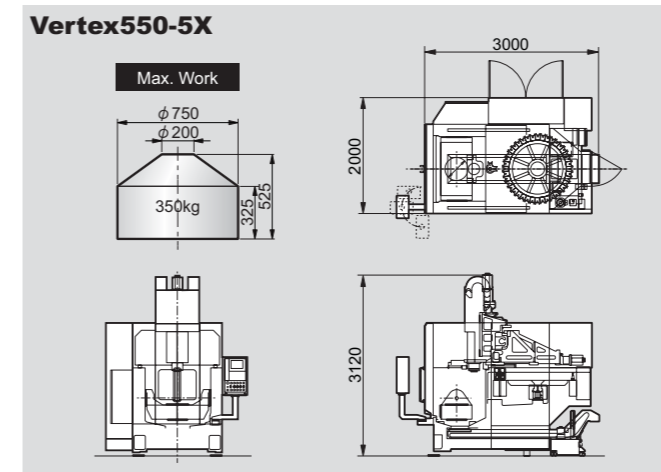


■ Liner Motor
■ D.D. Motor



Symbol	Unit	Vertex550-5X	Vertex750-5X	VL30-5X
T	mm	φ 400	φ 500	φ 180
X	mm	550	750	200
X1	mm	275	375	100
Y	mm	600	800	300
Y1	mm	300	400	150
Y2	mm	100	150	50
Z	mm	500	700	200
Z1	mm	100	150	100
A	°	+15~-105		+40~-110

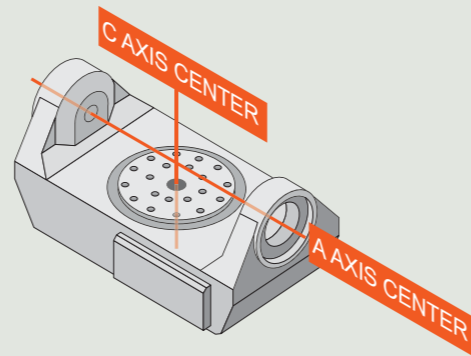
Layout



Tools for supporting 5-axis part processing

Measuring kits for ease of machine tool setup and operations

For high accuracy 5-axis part processing, at times it is necessary to precisely determine a center of the rotating/tilting axes. It is especially important to check before critical finishing features need to be processed on a batch of parts. A dedicated centering gauge, AMCS (Automatic Measurement Correction System), and setup guidance screen are optionally available with the Vertex. By operating the machine in accordance with the instructions on the screen, the center of A-axis or C-axis can be precisely and easily located.



Support Kits



AMCS Touch Probe



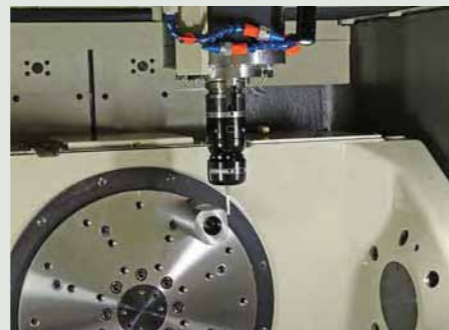
Special centering gauge (2 different types)



Guidance screen



Measurement of C axis rotation center



Measurement of A axis rotation center

Mitsui Seiki 5-axis Dynamic Fixture Offset

In the event the machining part program point of origin (part program zero location) and a datum point of the workpiece are not aligned, this function allows the machine to continuously correct the machining point of origin as the rotating axis moves, by presetting the misalignment scale in the fixture offset. It allows the user to have consistent simultaneous five axis processing with the same part program without reposting, even when a workpiece is misaligned when it is loaded. This function is a Mitsui Seiki exclusive feature.

Calculation macro for A and C axes rotating coordinates

To correct a positional point to the part program zero location as it indexes through a five axes coordinate system, the combined indexing angle changes must be determined. This is very difficult to find. This software is designed to make automatic calculations for this correction by determining the center of the rotating/tilted axes in advance. This feature is ideal when used in conjunction with the measuring assist tools for location of the A and/or C centers of rotation. It helps the user make precise coordinate setup and point-of-origin corrections for the precision workpiece to be processed.

Operation panel pursuit for easy operability

5 axes machining is often required to check the cutting situation by interrupting the operation in the middle of machining process. Many analogue type switches are used on the operation panel in order to make such a interrupting type operation jobs easier. Also since the all operation panel used on the 5 axes machines made by Mitsui Seiki are identical, it is easy to operate the other Mitsui Seiki product machines.







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