

# Methods

## Methods MB 650U 5-Axis Simultaneous Performance Machining Center



### Designed for productivity and efficiency

Methods Brand 5-Axis Bridge Type Machining Center are made to Methods design and engineering standards by Litz Hitech Corp., a reputable, well-established, quality machine tool builder and are fully backed by Methods industry-leading technical service and parts support. Methods Machining Centers are affordable, mid-range, best-in-class products providing durability, accuracy and long term reliability.

# Key Design Features

Machine structure features  
21 precision hand  
scraped joints

Powerful 25 hp direct drive  
hollow shaft spindle motor  
w/1000 psi CTS prep

48 Tool ATC with fast 2.5  
sec. Tool-to-Tool time

15,000 rpm Big Plus/  
CAT40 Spindle with Oil-Air  
Lubrication

Durable B/C Type Tilt  
Rotary Table

Auto grease lubrication  
system for all axes

Machine design qualified  
using FEA (Finite Element  
Analysis) techniques to  
provide superior machining  
performance. All castings  
are MEEHANITE certified

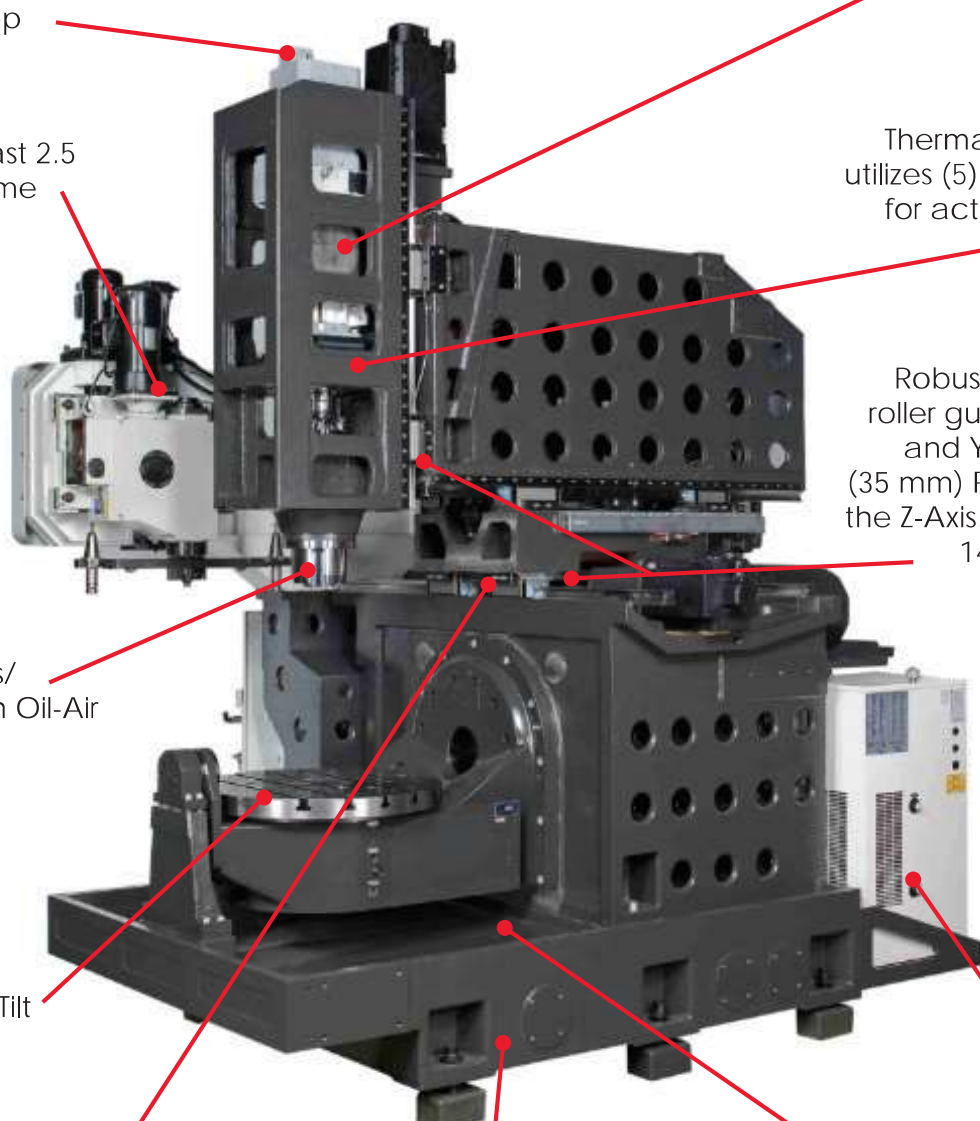
Chiller cooled spindle  
motor plate minimizes  
heat migration

Thermal compensation  
utilizes (5) thermo-couples  
for actual temperature  
feedback

Robust 1.771" (45 mm)  
roller guideways in the X  
and Y-Axis and 1.377"  
(35 mm) Roller guideways  
the Z-Axis. All axes feature  
1417 ipm (36 mm)  
rapid rate.

Spindle/Head  
Cooling System

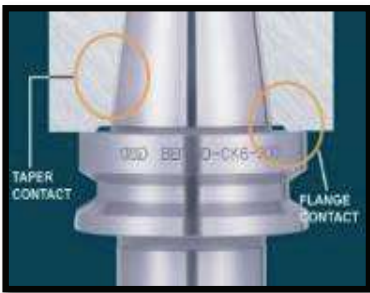
Includes chip conveyor,  
coolant wash down,  
and coolant flush gun



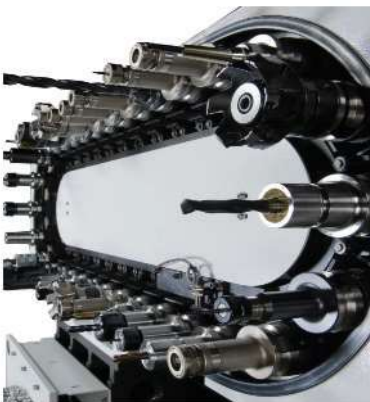


**FANUC is the Industry Benchmark for Quality and Reliability.** We are not FANUC compatible, we are FANUC. The High Performance FANUC 31iMB5 Control with 15" TFT Screen Includes 2 gb Data Server, Manual Guide i, AICC II, 1 mb of NC memory, .4 ms BPT, 600 Block Look Ahead, Collision Detection (Built in 3D Interference Check), Fast Package III w/ TPC, Ethernet 100 mbps, USB, PCMCIA, and RS232C providing the highest level of performance and processing power required for complex 5-Axis machining. This package is well suited for industries such as medical, mold, aerospace, automotive and job shops.

**15,000 rpm Big Plus/CAT40 Taper Spindle** with oil-air lubrication and spindle chiller provides power, speed, stiffness, required for the most adverse machining applications while providing long spindle life, thermal stability and overall machining accuracy.



**Powerful Direct Drive 25 hp (30 min & 15 min), Hollow Shaft Spindle Motor** allows machining of tough-to-machine materials with fine surface finishes and the ability to add Coolant Through Spindle (CTS) easily. A standard spindle chiller and cooled spindle-motor-plate minimizes heat migration from the spindle motor and spindle, to the headframe for added thermal stability.



**BIG-PLUS Dual Contact Spindle** provides a stiffer interface between both the spindle surface and tool holder flange surface, & spindle taper and tool holder taper. This design provides higher rigidity, stiffness, longer tool life, and improved accuracy when performing high-speed and difficult to machine applications when compared to traditional 40 Taper Tooling. Tool retention force is a Superior 2,205 lbf (1000 kgf).

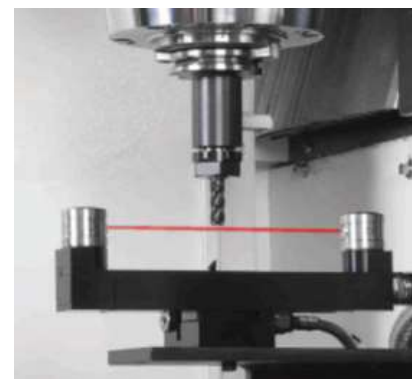
**Large Capacity 48 Tool Automatic Tool Changer** with Auto Door provides tooling capacity for jobs that require it, or multiple jobs to be prepped, and/or redundant tools. The auto door keeps chips and coolant out of the tool storage area minimizing potential chip and coolant ingress.



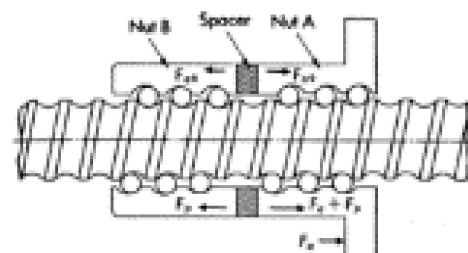
**The Cam Type ATC Provides Fast, Reliable 2.5 sec. Tool-to-Tool Time.** This design incorporates an Inverter type cam-box-motor for easy ATC recovery in the event of a mishap. The tool change arm is designed for low inertia (not adding additional or excessive weight) allowing precise positioning and long lone service life.

# Features & Benefits

**Standard BLUM NT-A2 Laser Tool Measurement System** with high-quality laser optics and intelligent electronics ensure high reliability and precision, allows non-contact measurement of all tool types, shapes, and cutting materials, provides highly dynamic measurement of all tool parameters, recognizes changes in geometry such as tool wear and breakage, allows the measurement of micro-tools and very small cutting edge geometries, provides reliable compensation for any potential thermal drift and/or runout errors, reduces non-productive time and allows for automated operation.



**Fixed, Pre-Tensioned 1.570" (40 mm) Double-Nut Ball-Screws** are featured in the X, Y & Z Axes. This design minimizes thermal growth, enhances rigidity, stability, and precision of the machine. The X, Y, & Z Axes feature a fast 1417 ipm (36 mm) rapid rate reducing non-cutting time.



**Robust LR Type Roller Guideways** in the X, Y & Z Axes allows fast, accurate machining required for adverse 5-Axis components. The X & Y-Axis feature 1.771" (45mm) roller guideways and 1.377" (35 mm) roller guideways the Z-Axis. Cylindrical type rollers provide greater contact area and vibration-damping characteristics that improve rigidity, cutting performance, surface finish and longer overall service life when compared to LM Ball Type Guideways.



**Rugged 19,400 lb (8,800 kg) Bridge Type Construction** designed for fast, accurate, complex 5-Axis simultaneous machining. The B/C type tilt-rotary table is designed specifically for demanding full 5-Axis applications. The B/C tables servo driven worm and worm gear design provides high rigidity, accuracy, long life and reduced machine maintenance cost. B/C-Axis also feature a full circle hydraulic brake system ensuring high rigidity in fixed heavy cutting operations. All components are qualified by Finite Element Analysis ensuring the highest precision, stability and production efficiencies. Castings are all MEEHANITE certificated.

**Durable B/C Type Tilt Rotary Table** is anchored to a robust one piece base casting and features  $-50^{\circ} \sim +110^{\circ}$  of rotation, 661 lb (300 kg) table load capacity, incorporates a servo driven worm wheel design with 25 rpm rapid speeds, 10 arc sec. positioning and 5 arc sec. repeatability with standard Heidenhain rotary scales in both the B & C-Axis. This proven design allows the fast, accurate machining of complex 5-Axis components.







## Machine Structure Features 21 Precision Hand Scraped Joints

for increased structural rigidity, maximum stiffness, and optimum cutting performance. Proper hand scraping techniques improve the overall machine geometry, and minimizes the amount of electronic compensation required on the machine. For example, ball-screw bearing housings can be aligned to closer tolerances, improving all axes laser interferometry results and minimizing required electronic compensation. Proper scraping improves all axes straightness, squareness and tram, also limiting the effects of roll, pitch and yaw.

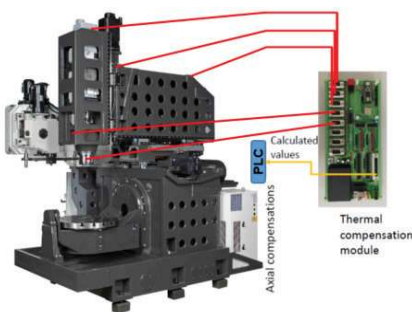


## World Class Heidenhain Scales (encoders) Featured in All Axes.

Heidenhain LC 195F Series linear scales are mounted in X/Y/Z Axes and Heidenhain rotary scales in the B & C-Axis allowing for the most demanding machining accuracies. Linear and rotary scales are a fully closed-loop system that measures the direct position of the moving element in each axis improving the overall machine precision, while also minimizing the thermal effects of the ballscrews, worm-drives, or any other machine component where scales are utilized.

## Thermal Compensation Utilizes (5) Thermo-Couples for actual

temperature feedback. The temperature data is then processed through proprietary software to accurately compensate for thermal growth, greatly minimizing the impact of overall thermal movement. Thermal compensation combined with spindle chiller, chilled motor plate, oil-air lubrication, and fixed, pre-tensioned double-nut ball-screws proved a thermally stable machine, minimizing human intervention (adjusting offsets, etc.) during production.



## Standard Kinematics Calibration Hardware and Software includes

a calibration ball, TCP software, and the BLUM TC60 probe system for setting/calibrating precise tool center point. Using the standard hardware and TCP software precise calibration of all 5-Axis of the machining center can be achieved to the highest level of precision possible. Calibration is also performed to identify and eliminate potential errors in the machine following collision or any other errors. These standard features allows the user to calibrate and/or check the status of all machine geometries of the axes and perform calibration yourself as necessary saving an expensive service call.

# Features & Benefits

**Rigid Swivel-Pendent Mounted Control** provides ease of operation with the ability to be moved to either main guard door and can be adjusted in height for superior ergonomics. The remote MPG hand-wheel allows for easy workpiece set-up.

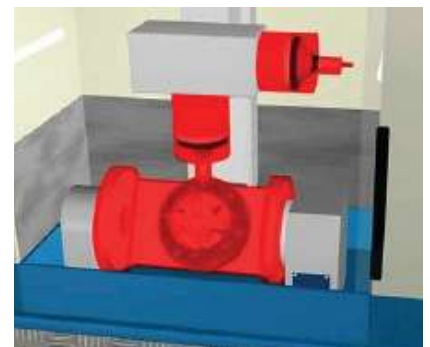
**Efficient Chip and Coolant Management** featuring Spindle Coolant Ring (4-ports on the spindle face) Spindle Flushing (3-adjustable ports right side of spindle) Spindle Air Blast (2-lock lines right side of spindle) Coolant Wash Down System (base chip wash-down), Coolant Wash-down Gun, and Hinge Type Chip Conveyor with 41.34" (1050 mm) drop height provides efficient chip and coolant evacuation and management.

**Large Dual Main Access Doors Provide Easy Access** to the work area and allows the implementation of automation, pallet changers, robots with optional factory installed auto doors.

**Bellows Type Roof Top Cover Ensures Chip and Coolant Containment** and can also be easily unlatched and manually moved back on a track when loading heavy parts on the table with an overhead crane.

**The 3D Interference Check Function** is an advanced anti-collision function. The function is implemented directly into the CNC and has an extremely rapid interference check in real time. The success in avoiding collisions is almost 100% - even when setting up or in manual mode. This function is particularly recommended for 5-Axis machines, or more complex machines.

**A Potential Collision** can be checked by detecting the interference between components and parts such as tooling, work-pieces and table in three dimensional space, in real time. This function helps to prevent an expensive workpiece from being damaged. This function is also useful in manual operation, for example, for protection against malfunction during setup. Thus, the time required for setup can be reduced.



## Standard Features

- FANUC 31IMB5 Simultaneous 5-Axis Control with 15" Color TFT
- Includes 2 gb Data Server, Manual Guide I, AICC II, 1 MB of NC memory, .4 ms Block Processing Time, 600 Block Look Ahead, Collision Detection (Built in 3D Interference Check), Fast Package III w/TCP, Ethernet 100 mbps, USB, PCMCIA & RS232C
- 15,000 rpm, Air / Oil Lubricated, Direct Drive Spindle with Big Plus/CAT40 Taper
- 25 hp Hollow Shaft Spindle Motor w/1000 psi (70 bar) CTS Prep (does not include pump)
- Spindle Chiller, Spindle Air Dryer, Spindle Motor Plate Cooling, Spindle Air Dryer and Thermal Compensation
- Robust Bridge Type Construction with 1.771" (45 mm) Roller Guide Ways in the X/Y-Axes and 1.377" (35 mm) in the Z-Axis
- X/Y/Z Travel at 24.4" x 20.4" x 18.1" (620 mm x 520 mm x 460 mm)
- X/Y/Z Rapid Travel at 1417/1417/1417 in/min (36/36/36 m/min)
- Fixed pre-tensioned 1.57" (40 mm) double-nut ball-screws in the X/Y/Z-Axes
- Heidenhain Linear Scales in the X/Y/Z Axes
- Tilting B-Axis with -50 ~ +110 Degrees Rotation
- C-Axis with 360 Degree Rotation and 650 mm Table Diameter
- Heidenhain Rotary Scales in the B & C-Axis
- Table Center Point Calibration Ball, Kinematic Software and Spindle Probe
- Full Circular Hydraulic Brake System for Rigid B & C-Axis Clamping
- 48 Tool Dual Swing Arm ATC w/2.5 second Too-to-Tool time
- Laser Tool Length Measurement System
- Automatic Grease Lubrication System
- Coolant System with Spindle Coolant Nozzles (4), Spindle Coolant Ring Nozzles (4), Chip Wash Down, and Coolant Flush Gun
- Remote Manual Pulse Generator (MPG) hand-wheel
- Full enclosure with bellow type roof that includes a Manual-Retractable Top Door allowing overhead part loading using a crane, or hoist
- Dust Tight Electrical Cabinet with Heat Exchanger
- Spindle air blast nozzles (2)
- Chain/Hinge Chip Conveyor 41.3" (1050 mm) Drop-off Ht., Speed - 55 ipm (1400 mm/min)
- Bright Interior Work Lights
- 3 Color Signal Light
- Air gun
- Tool kit
- Methods Safety Spec (CE Mark Modified)
- 2-Year Machine and Control Warranty

## Options

- Heidenhain TNC 640 Control Unit\*
- High Pressure Coolant (up to 1000 psi)
- CT to BT Arm
- Oil/Coolant Separator
- Filter Mist Collector
- Electrical Cabinet Air Conditioner\*
- Transformer
- Rotary Window\*

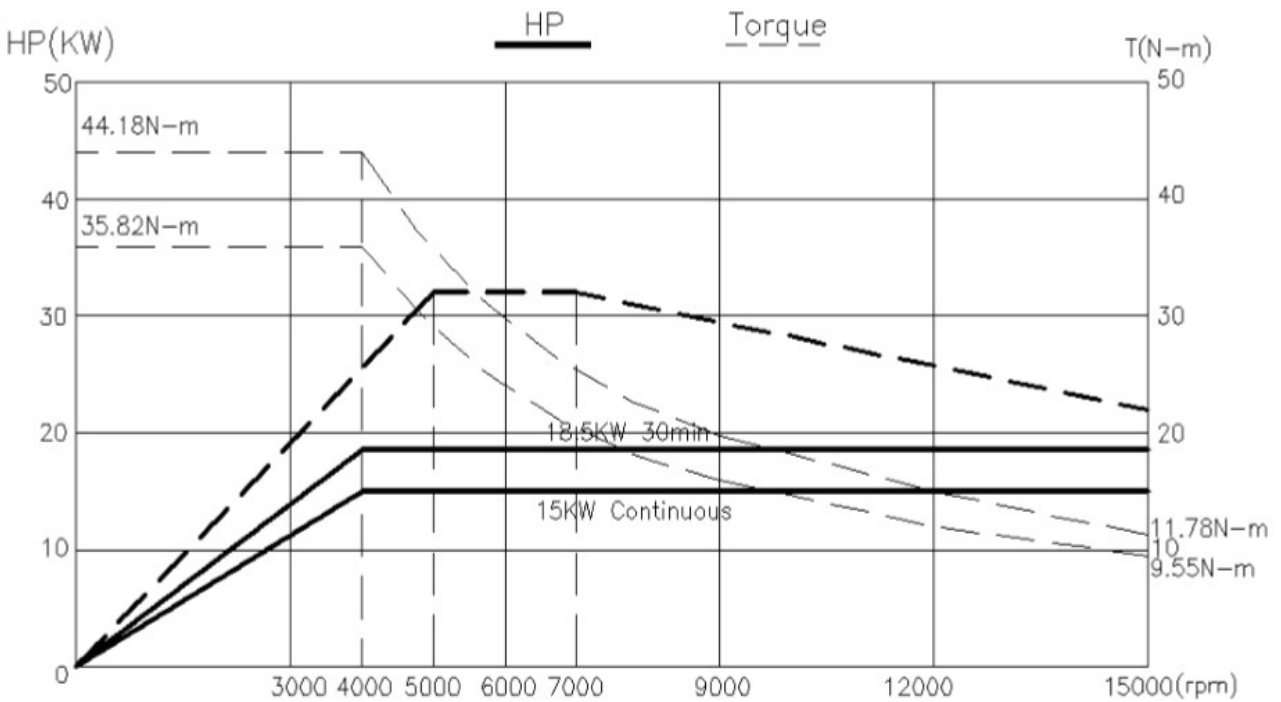
# Specifications

FEATURES	UNIT	MB 650U
<b>X/Y-Axis Roller Guideways</b>		
X/Y-Axis Travel	in (mm)	X - 24.4 (620) Y - 20.47 (520)
X/Y-Axis Rapid Traverse	in/min (m/min)	1,417 (36)
X/Y-Axis Max Cutting Speed	in/min (m/min)	787 (20)
X/Y-Axis LR Type Roller Guideways	in (mm)	1.771 (45)
Y/Y-Axis Distance Between Guideways	in (mm)	X - 27.36 (695) Y - 13.86 (352)
X/Y-Axis Motor	FANUC	a22i
X/Y-Axis Power	hp (kw)	5.4 (4)
X/Y-Axis Ball Screw Class	-	C3
X/Y-Axis Ball Screw Diameter	in (mm)	1.57 (40)
<b>Z-Axis Roller Guideways</b>		
Z-Axis Travel	in (mm)	18.1 (460)
Z-Axis Rapid Traverse	in/min (m/min)	1417 (36)
Z-Axis Max Cutting Speed	in/min (m/min)	787 (20)
Z-Axis LR Type Roller Guideways	in (mm)	1.378 (35)
Z-Axis Distance Between Roller Guideways	in (mm)	11.42 (290)
Z-Axis Motor	FANUC	a22Bi
Z-Axis Power	hp (kw)	5.4 (4)
Z-Axis Ball Screw Class	-	C3
Z-Axis Ball Screw Diameter	in (mm)	1.57 (40)
X/Y/Z Axes Lubrication	-	Auto Grease
<b>Spindle</b>		
Spindle Speed	rpm	15,000
Spindle Type	Dual Contact	BIG-PLUS CAT 40 Taper
Spindle Power	hp (kW) Cont. hp (kW) 30 min hp (kW) 15 min	20 (15) 25 (18.5) 25 (18.5)
Spindle Torque	ft-lb (nm) Cont. ft-lb (nm) 30 min ft-lb (nm) 15 min	70.4 (95.5) 86.9 (117.8) 106 (143.7)
Spindle Base Speed	rpm cont. / rpm 15 min	1,500 / 1,230
Spindle Lube	-	Oil / Air
Spindle Cooling	-	Chiller
Spindle Bearings	-	70mm Ceramic Angular (6)
<b>Automatic Tool Changer (Random/Bi-Directional)</b>		
Tool Changer for Big Plus/CAT40 Tool Holders	-	Dual Swing Arm Type
Maximum Number of Tools	-	48
Pull Stud	-	DIN CAT40 A Type
Maximum Tool Weight	lbs (kg)	15.4 (7)
Maximum Tool Length	in (mm)	9.84 (250)
<b>Specifications subject to change without notice</b>		

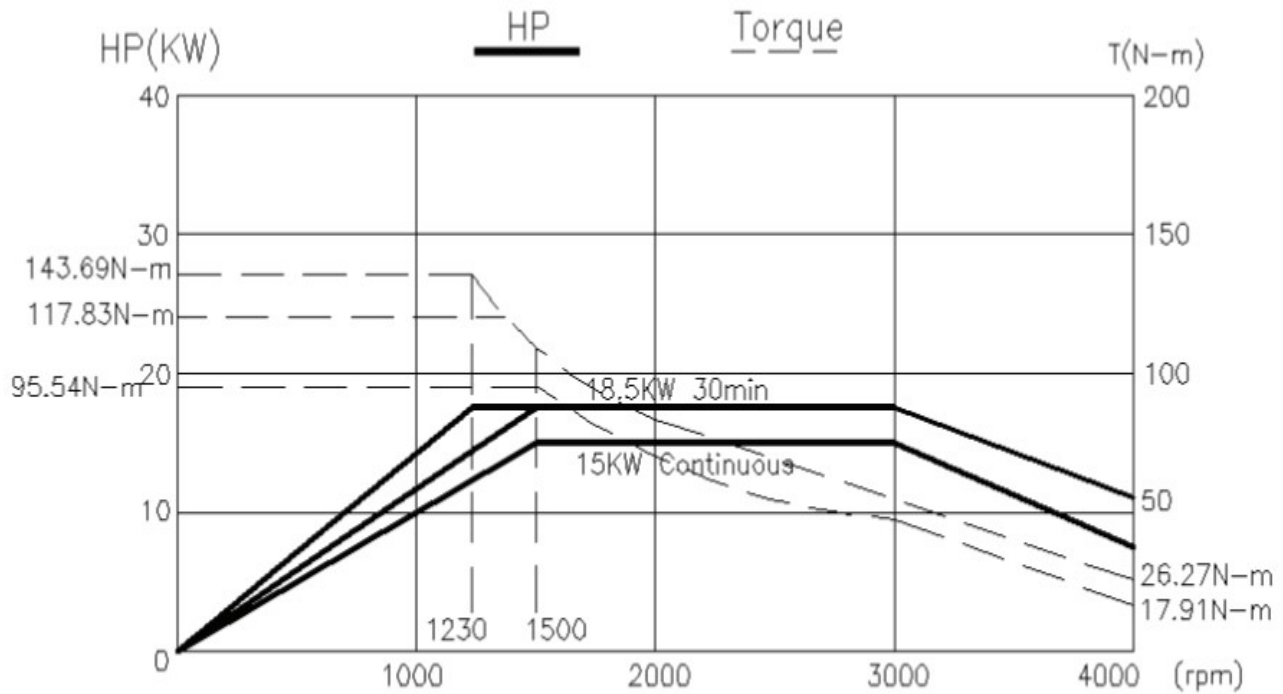


FEATURES	UNIT	MB 650U
<b>Automatic Tool Changer (Continued)</b>		
Maximum Tool Diameter	in (mm)	3 (76)
<b>Maximum Tool Diameter - No Adjacent Tool</b>	in (mm)	5 (127)
Tool Changing Time - Tool-to-Tool	sec	2.5
Tool Holder	-	Big Plus / CAT40
Tool Clamp Force	lbf (kgf)	2,205 lbf +/- 220 lbf (1000 kgf +/- 100 kgf)
<b>Tilt Rotary Table</b>		
Table Dimensions (Diameter)	in (mm)	25.59 (650)
Spindle Nose to Table Surface	in (mm)	5.9 ~ 24 (150 ~ 610)
Table Surface to Floor	in (mm)	29.4 ± .2 (764 ± 5)
T-Slot Width	in (mm)	.708 (18)
Number Of T-Slots	qty	5
Distance between T-Slots	in (mm)	3.937 (100)
Maximum Load	lbs (kg)	661 (300)
<b>B-Axis Tilting</b>		
Tilting Angle	°	-50 ~ +110
Minimum Table Increment	°	.001
Maximum Torque	ft-lb (nm)	11,506 (15,600)
Maximum Clamp Force	psi (kg/cm <sup>2</sup> )	3,741 (263)
B-Axis Power	hp (kw)	12 (9)
Maximum Rotation Speed	rpm	25
<b>C-Axis Rotary</b>		
Rotation Angle	°	360
Maximum Torque	ft-lb (nm)	1,549 (2,100)
Maximum Clamp Force	psi (kg/cm <sup>2</sup> )	2,404 (169)
C-Axis Power	hp (kw)	4 (3)
Maximum Rotation Speed	rpm	25
<b>Dimensions / Weight / Capacities / Power</b>		
Floor Space with Chip Conveyor	in (mm)	146.8 x 119.4 (3,729 x 3,032)
Machine Weight	lbs (kg)	19,400 (8,800)
Maximum Machine Height	in (mm)	130.3 (3,310)
Coolant Tank Capacity	gal (l)	68.7 (260)
Coolant Motor (60 hz)	hp (kw)	1.3 (1)
Coolant Flow (Nozzle)	gpm (l/m)	16 (30)
Coolant Pressure (Nozzle)	psi (kg/cm <sup>2</sup> )	17 (1.2)
Machine Power Capacity	kva / amp	25 / 75
Machine Voltage & Phase	volts / phase	220 / 3
<b>Specifications subject to change without notice</b>		

# Spindle Power & Torque Diagrams



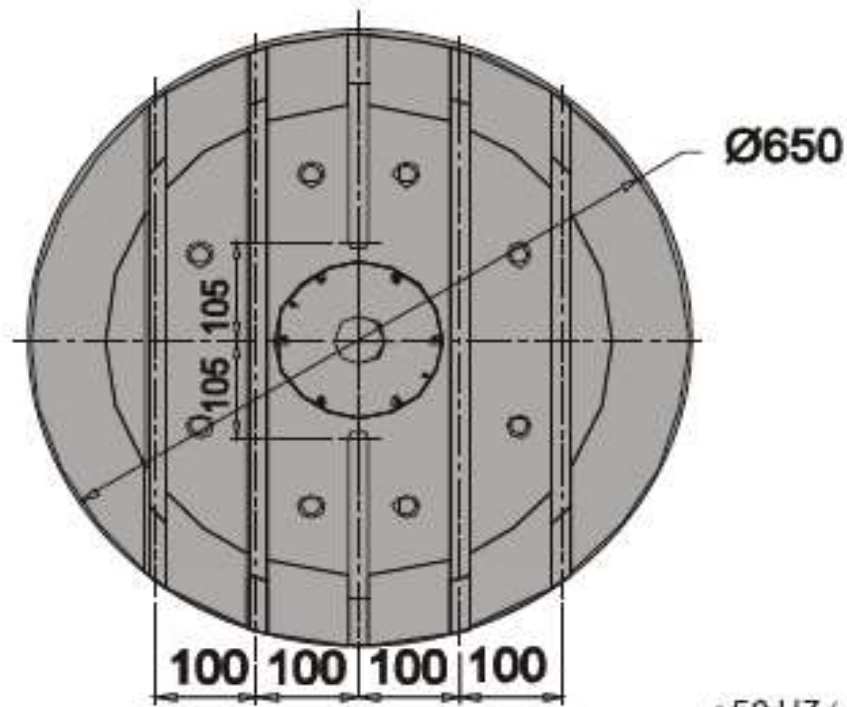
∝L8/15000i(High-speed winding output)  
MB-650U Spindle Power-Torque Chart



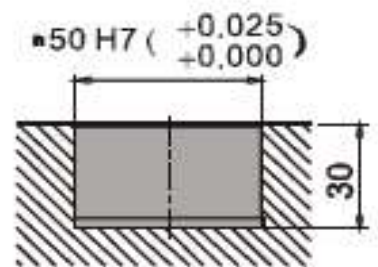
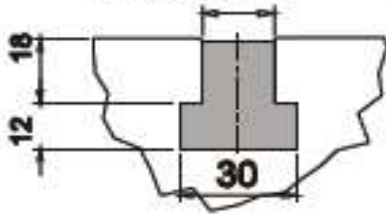
∝L8/15000i(Low-speed winding output)  
MB-650U Spindle Power-Torque Chart

# Table Diagram

Dim. shown in mm



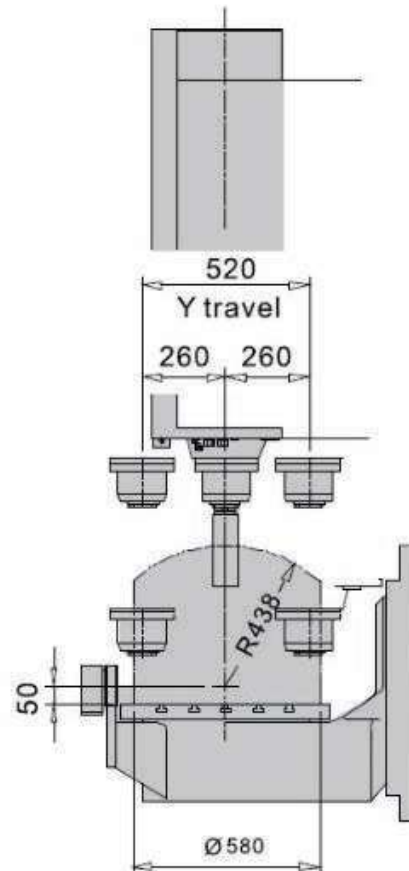
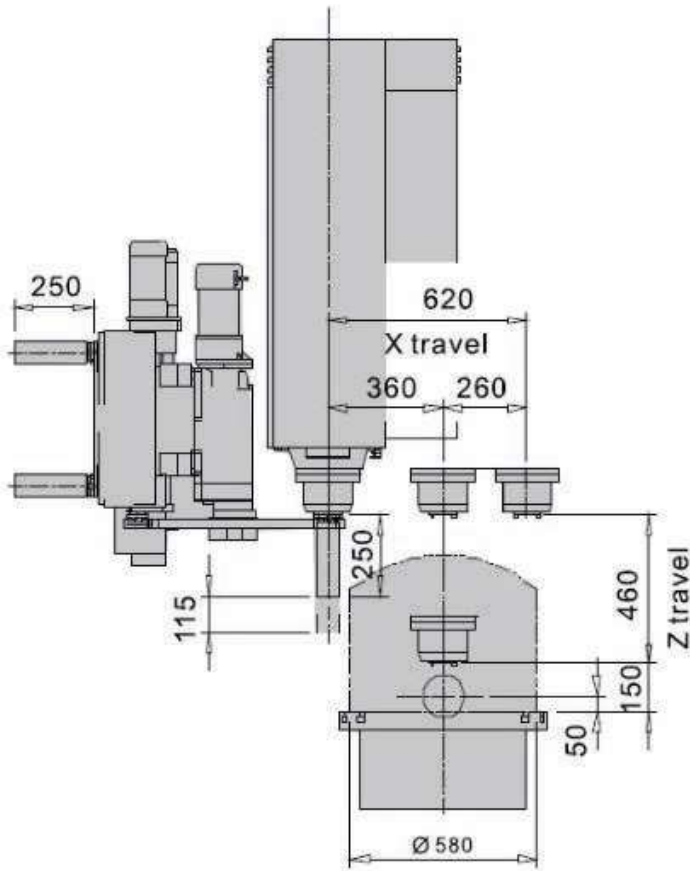
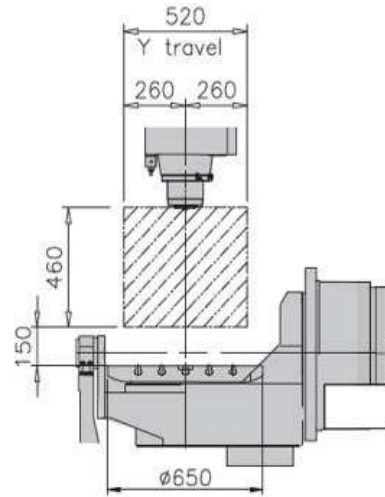
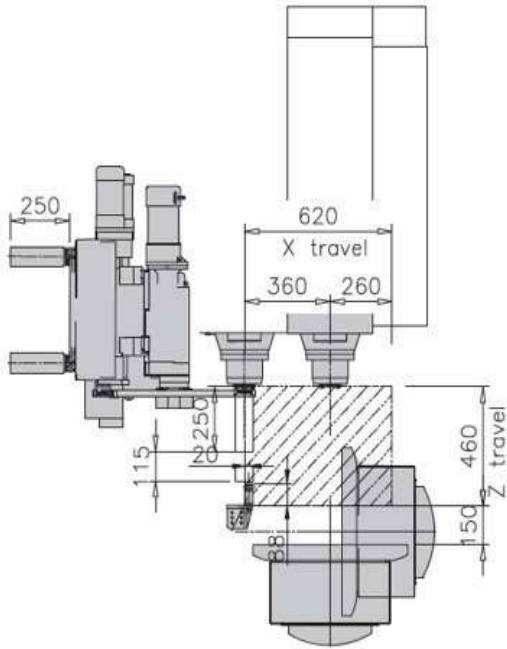
18 H7(  $\begin{matrix} +0.018 \\ +0.000 \end{matrix}$  ) / H11(  $\begin{matrix} +0.110 \\ +0.000 \end{matrix}$  )



Center Hole B-B

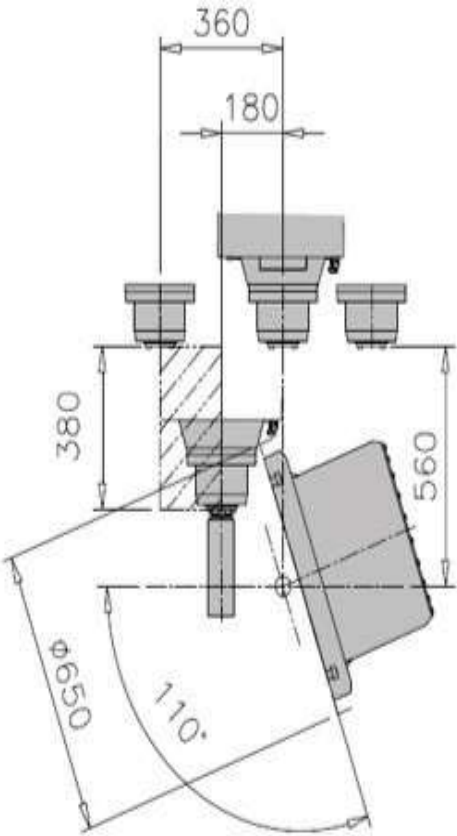
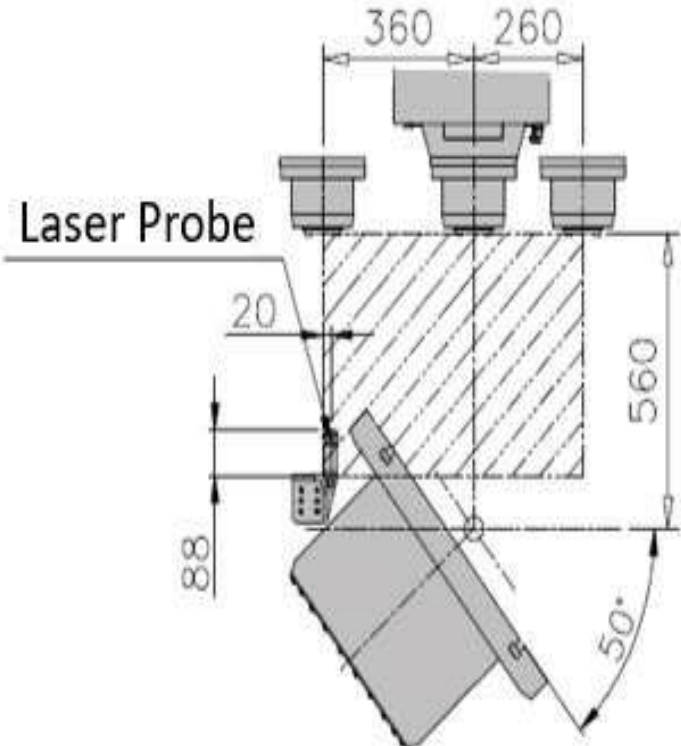
# Work Envelope / Cutting Area

Dim. shown in mm





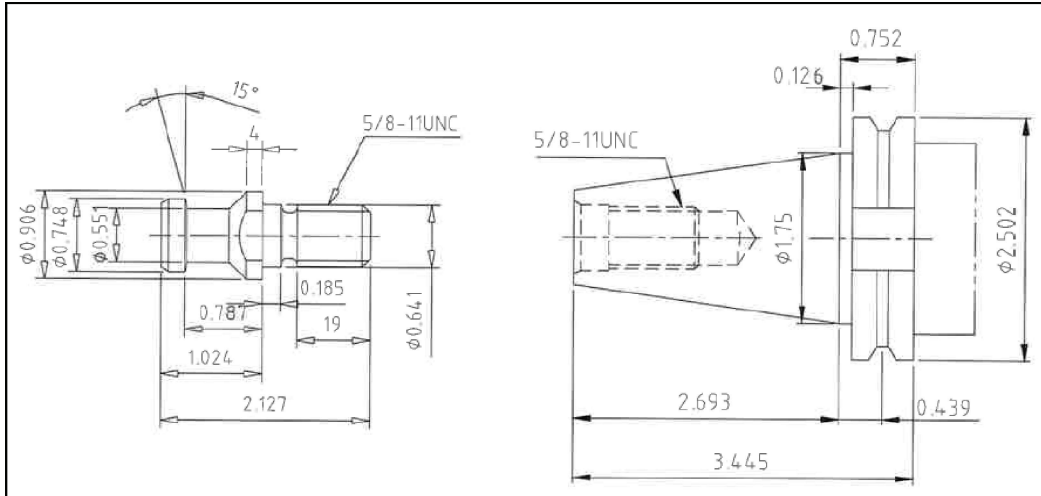
Dim. shown in mm



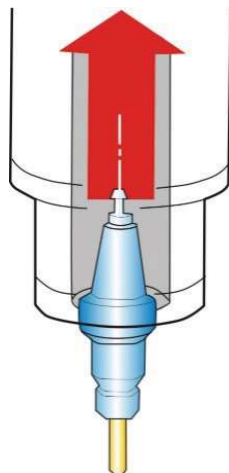
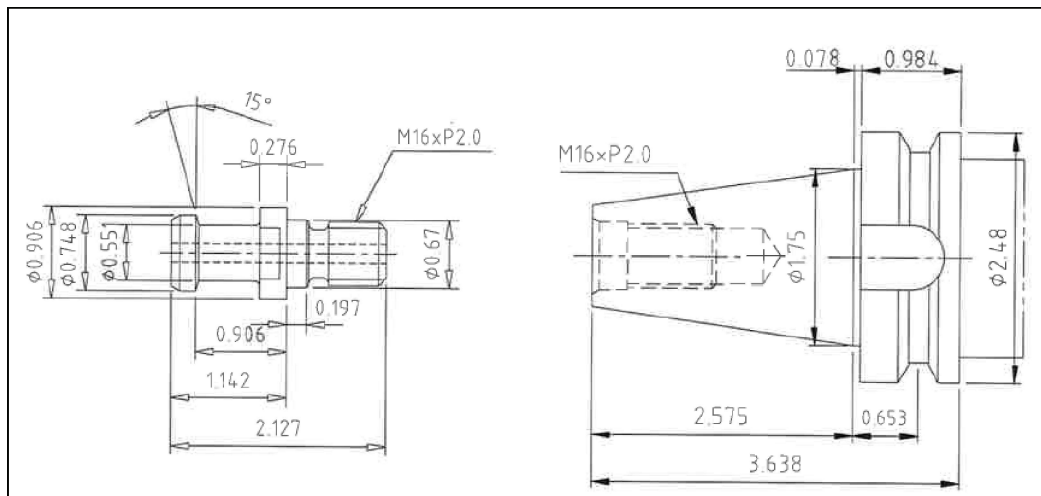
# Tooling Diagram

Dim. shown in mm

## Big Plus CAT40 Tooling



## Big Plus BBT40 Tooling



## Tool Clamp Force

2,205 lbf +/- 220 lbf  
(1,000 kgf +/- 100 kgf)

## In Compliance with Quality Assurance Procedures and Standards

- Strict quality standards require that all manufacturing and inspection equipment is calibrated, monitored and controlled using recognized and traceable systems and methods

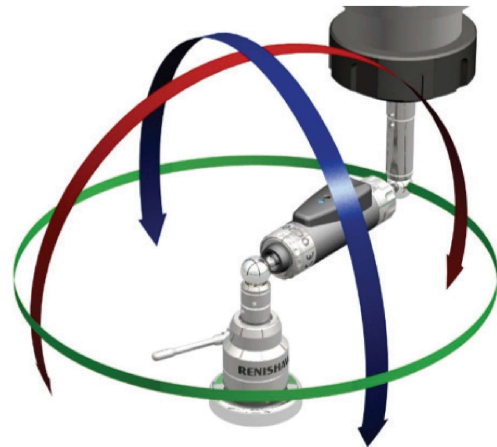
## All MB 650U Machines are fully Lasered and Ballbared

- Laser interferometer and Ballbar measurement systems assess, monitors and can help to improve the static and dynamic performance of the machine
- Ballbar testing provides an important, rapid check of a CNC machine tools positioning performance accuracy as it relates to circularity and circular deviation positioning accuracy. This test is recognized by international standards such as ISO 230-4 and ANSI/ASME B5.54

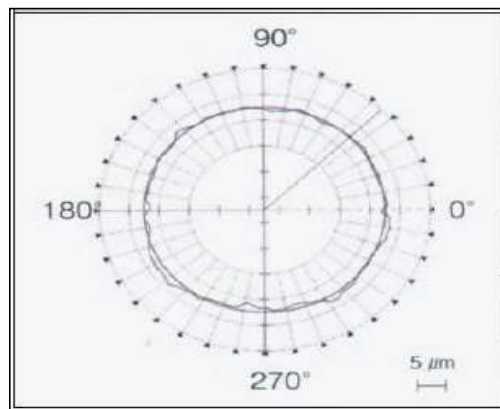
### Laser Interferometer



### Ballbar



**A Dynamic High-Accuracy, High Performance 5-Axis Simultaneous Cutting Test** is performed on each MB 650U machine according to the NAS979 standard ensuring that every machine meets and/or exceeds strict performance and quality specifications. Roundness Value Tested .0003" (8 $\mu$ ).



Cutting conditions:	
Cutting Object (JIS)	A7075 (alu. Alloy)
Tool	Ultra-hard End-mill Tool - $\varnothing$ 40mm (double- edge Tool)
Spindle Speed	2000 rpm
Milling Speed	2000 mm/min
Workpiece Dimensions	$\varnothing$ 216mm x $\varnothing$ 250mm x 63.5mm (H)

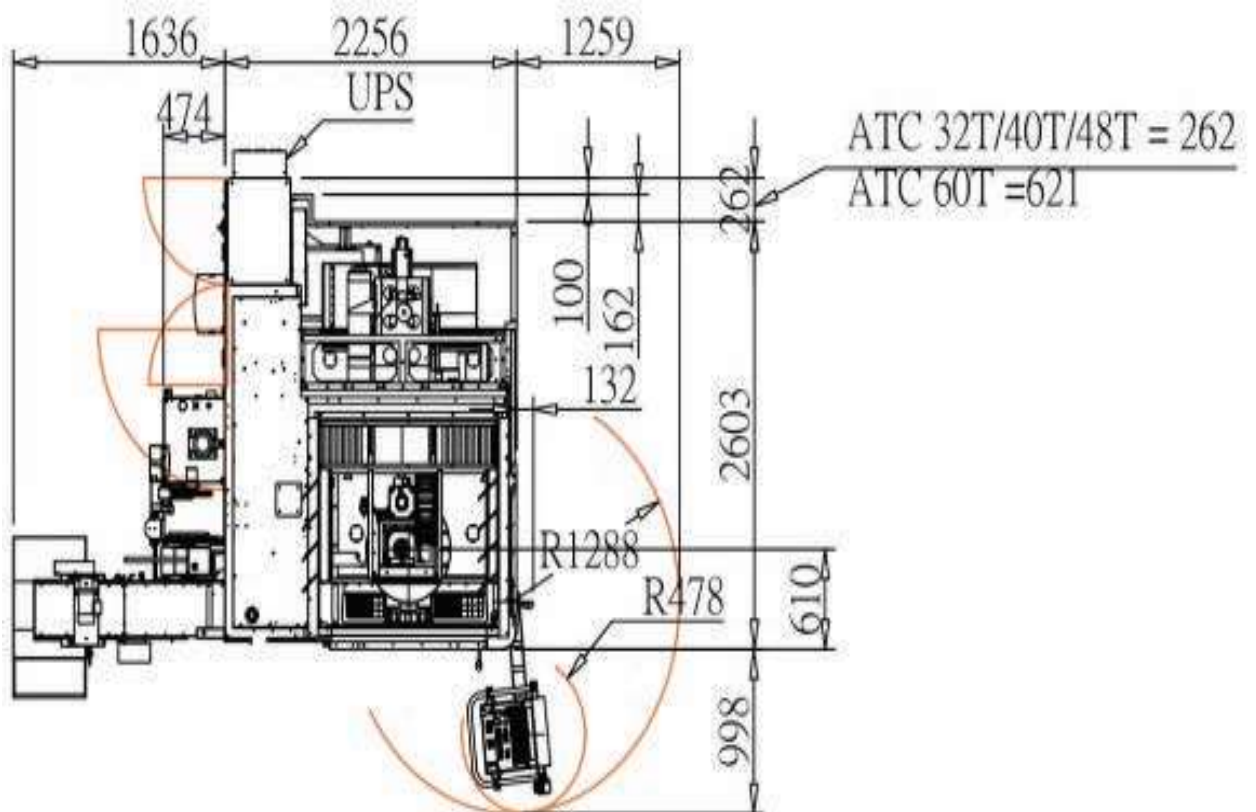
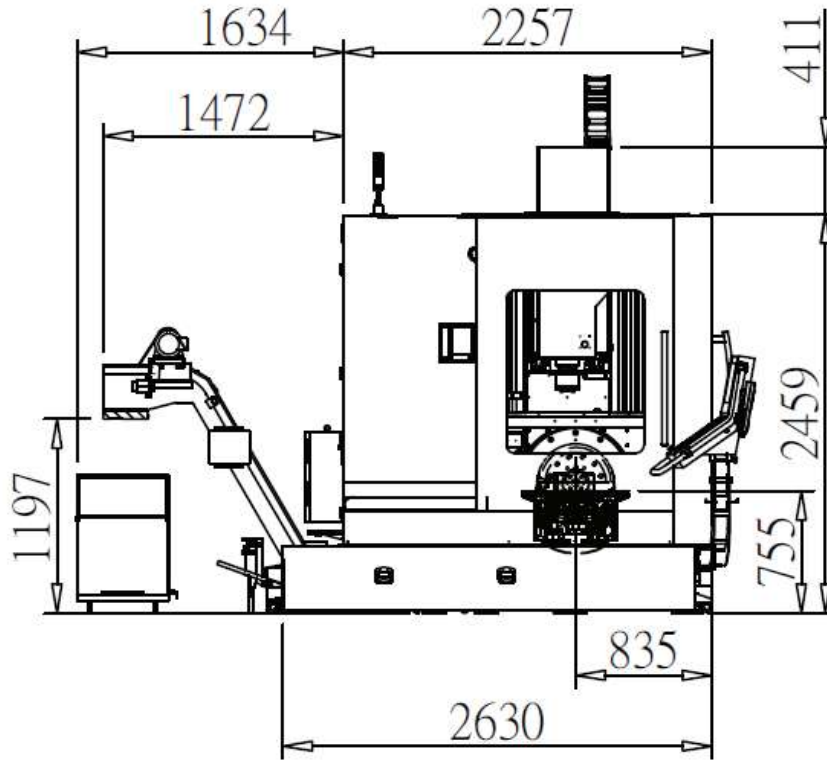
# FANUC Control Specifications

- Simultaneously controlled axis 5
- Fast Package III w/TCP
- HRV 3 control
- 2GB Data server
- Manual Guide i
- AICC II
- 600 block look ahead
- 3D Interference Check
- .4ms Block Processing Time
- 1Mbyte program storage
- 200 tool offsets
- 1000 registered part programs
- Inch/Metric conversation
- Machine lock
- Mirror image
- Rigid tapping
- Single direction position
- Exact stop mode
- Exact stop
- Tapping mode
- Cutting mode
- Dwell
- Linear interpolation
- Circular interpolation
- Helical interpolation
- Skip Function
- High Speed Skip Function
- Reference point return
- Feed per minute
- 2nd reference point return
- Feedrate override
- Jog override
- Program No. Search
- Sequence No. Search
- Dry run
- Jog feed
- Manual reference return
- Optional block skip
- Program number
- Sequence number
- Absolute/incremental programming
- Plane selection
- Automatic coordinate setting
- Coordinate setting
- Manual absolute on and off
- Custom macro B
- Programmable data input
- Circular interpolation by program
- Automatic corner deceleration
- Scaling
- Coordinate system rotation
- Canned cycles for drilling
- Tool compensation pairs
- Tool offset memory C
- Tool length compensation
- Cutter compensation C
- Tool life management
- Backlash compensation for each rapid traverse
- Stored pitch error compensation
- Tool length measurement
- Ethernet 100Mbps, USB, RS232C, PCMCIA
- Current position display
- Program display
- Self-diagnosis function
- Parameter setting display
- Run hour/part cont display
- Actual Cutting feed rate display
- Operator monitor Screen
- Spindle setting screen
- Spindle information screen
- Machine alarm diagnosis
- Alarm history display
- Operator history display
- Graphic function
- Ethernet & Memory card interface
- 15" TFT color display
- Additional of custom macro variables common
- Sub program call
- Extended part program editing
- Additional work piece coordinate
- Auto power off



# MB 650U Dimensional Drawings

Dim. shown in mm



# MB 650U Dimensional Drawings

Dim. shown in mm

