Mazak

INTEGREX AG SERIES

Mazak

INTEGREX AG

[Auto Gear]

SERIES

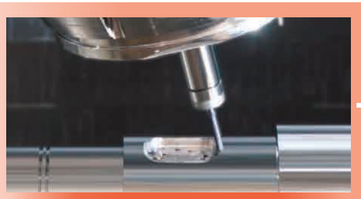
YAMAZAKI MAZAK CORPORATION
1-131 Takeda, Oguchi-cho, Niwa-gun, Aichi-Pref., Japan
TEL: +(81)587-95-1131
www.mazak.com

E

INTEGREX AG series 23.03.0 T 99J685023E0

INTEGREX AG series

The integration of INTEGREX multi-tasking with gear cutting and measurement



5-axis machining

+

Gear machining

+

Gear measurement

- Process integration for high accuracy machining, reduction of in-process time and initial cost
- 3 types of gear machining methods (gear skiving, hobbing and endmilling) can be performed for high-mix, small volume production to large volume production to meet your production requirements
- High speed and high accuracy gear skiving thanks to unique AG control technology
- After gear skiving or hobbing, a touch sensor probes a gear tooth location for in-phase positioning of other machined features
- Gear face scanning is optionally available for the measurement of the gear lead and profile
- Programs for cutting tool paths and measurement can be easily made in a short period of time

Shown with optional equipment

INTEGREX i-500 AG

Shown with optional equipment

INTEGREX i-630V/6 AG

Productivity

Large volume production to high-mix, small volume production

Mass production with specialized tools

Gear Skiving

. Internal gears
. External gears
. Chucking workpieces

Hobbing

. External gears
. Shaft workpieces

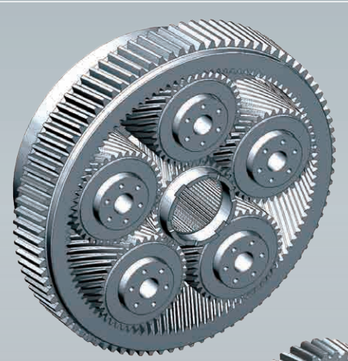
Flexible machining with general-purpose end mill

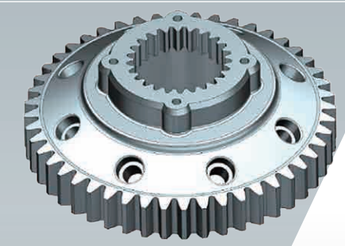
Endmilling

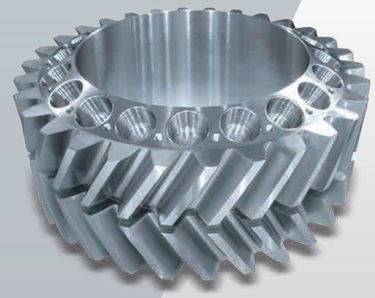
. External gears
. Large workpieces

Flexibility

Example workpieces







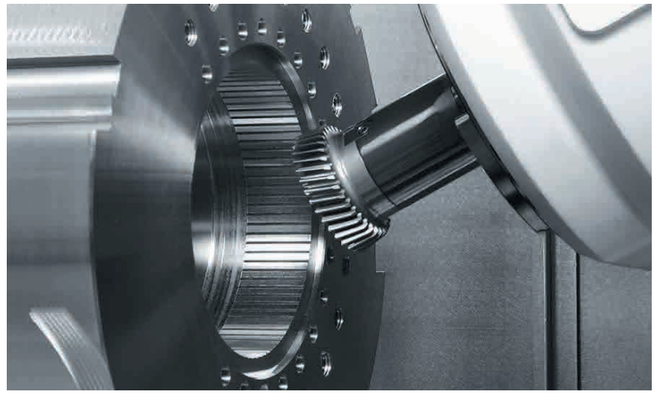
Gear skiving

SMOOTH GEAR SKIVING

Improved productivity thanks to high speed gear skiving

High accuracy gear skiving is realized thanks to unique INTEGREX AG control technology

Rotation of both the main spindle and the milling spindle is synchronized up to the top speed of both spindles to ensure high accuracy gear skiving.

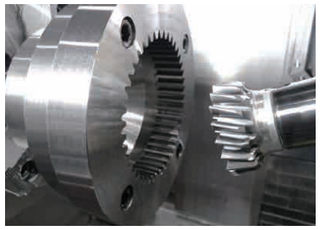


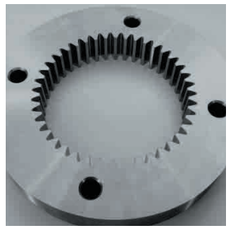
Internal spline cutting applications (INTEGREX i-250H AG)

Internal gears up to module 3 are machined within ISO class 8. In addition, the synchronized control technology incorporated in the INTEGREX i-250H AG enables high-speed, high-efficiency gear skiving of small-diameter workpieces.

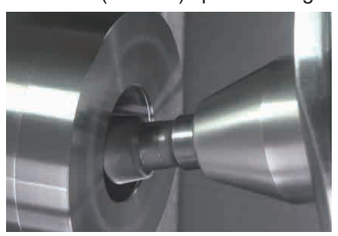
Module 3 Internal Gear Machining Performance

ISO Class7 (AGMA11*)





Module 1 (DP25.4) spline cutting time



INTEGREX AG high speed synchronized control

ISO Class8 (AGMA10*)

48 seconds

(example results)

Module	1 (DP25.4)
Number of gear teeth	44
Pressure angle	30°
Material	C45

INTEGREX AG high speed synchronized control cutting conditions

Tool speed	6525 min^{-1} (rpm)
Workpiece rotation speed	3410 min^{-1} (rpm)
Feedrate (roughing)	0.2 mm/rev (0.0079 IPR) (C-axis)
Feedrate (Finishing)	0.01 mm/rev (0.0004 IPR) (C-axis)
Feed rate(roughing)	1305 mm/min (51 IPM) (0.2 mm per workpiece rotation)
Feed rate (Finish machining)	65 mm/min (3 IPM) (0.1 mm per workpiece rotation)

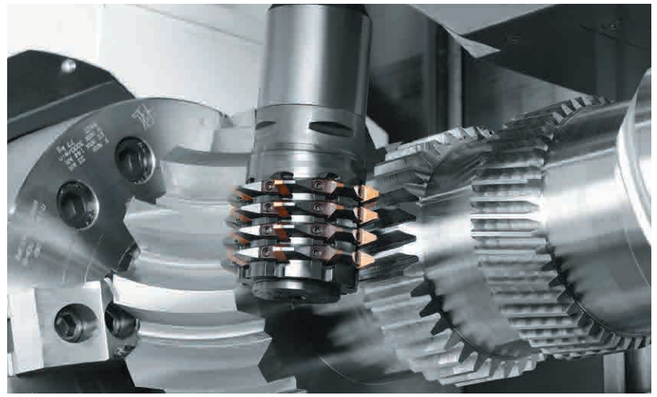
* Approximate equivalent class

Hobbing

SMOOTH GEAR HOBBING

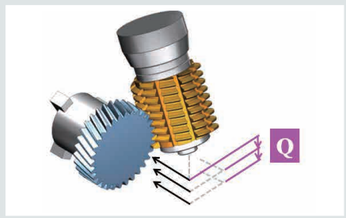
The hob arbor is held on one end by the heavy duty milling spindle providing sufficient rigidity for high accuracy gear hobbing.

With Smooth Gear Hobbing, gear specification data are input to automatically generate the tool path.



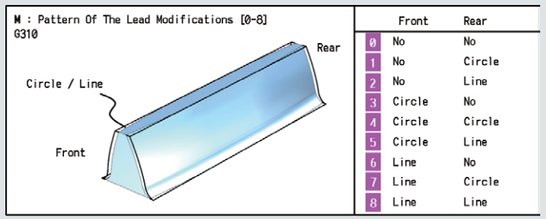
- **Hob shift**

  This function shifts the contact point of the hob and workpiece to extend tool life.



- **Modified gear lead and gear crowning**

  By inputting data for a modified gear lead or gear crowning, the tool path for gear hobbing is automatically generated.



	Front	Rear
0	No	No
1	No	Circle
2	No	Line
3	Circle	No
4	Circle	Circle
5	Circle	Line
6	Line	No
7	Line	Circle
8	Line	Line

Protection of workpiece, tool and spindle

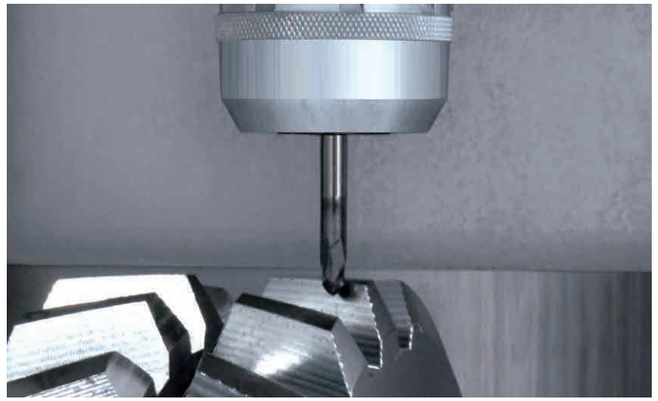
Escape button

The MAZATROL SmoothX and the MAZATROL SmoothAi have an escape button on the operation panel to remove the tool from the workpiece while maintaining synchronized rotation. By using this button during an emergency, the cutter, workpiece and milling spindle are protected.

Endmilling

SMOOTH GEAR MILLING

Using Smooth Gear Milling software, gear teeth can be cut one by one by a standard endmill. Gear specification data, including data for modified gears as well as modified gear lead and modified gear profile, are input to automatically generate the tool path.



Reduced in-process time

During high-mix, small volume production, considerable time is required to prepare tools and fixtures, especially a gear hob. If a gear hob must be ordered, the lead time may be considerable. Since Smooth Gear Milling uses standard endmills instead of a gear hob, this waiting time is eliminated. A wide range of types of gears can be cut by the INTEGREX AG using standard endmills.

Multi-tasking machine

\+

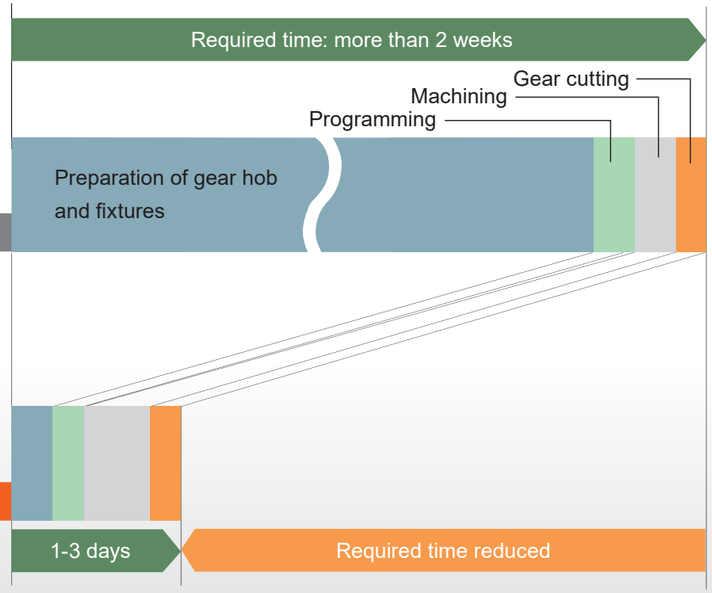
Gear hob

Hobbing on multitasking machine

Hybrid
Multi-tasking machine

Endmill

Endmilling by INTEGREX AG

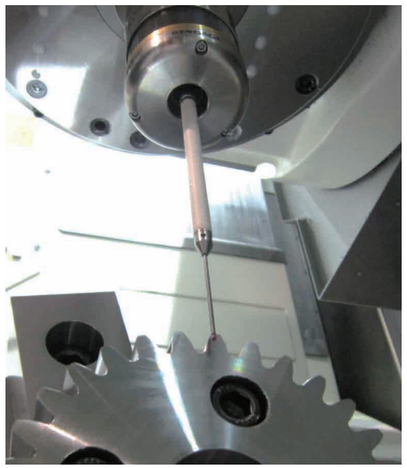


Measurement

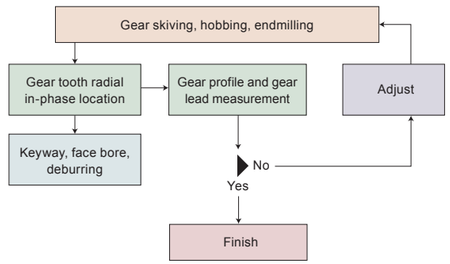
SMOOTH GEAR CHECK

Gear tooth radial in-phase location

After using a new or reground tool, a gear tooth can be probed by a touch sensor to determine the required amount of compensation. This same process can also be used to determine the in-phase positioning of other machined features, such as deburring using a ball endmill or locating a bore on a workpiece face.



Flow chart



Gear profile and gear lead measurement

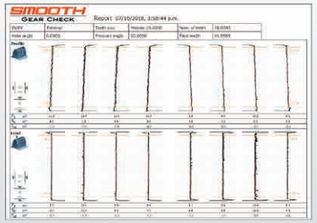
OPTION

The gear profile and gear face are inspected by a scanning probe after machining in the same workpiece setup. Conventionally, gears are machined on special purpose gear cutting machinery and then are transferred to measurement equipment in another location. For large gears, considerable time is required to transfer them to the measurement area, mount them on the measurement equipment and then setup the measurement equipment.
This is eliminated by the optional gear profile and gear lead measurement software.

Gear face measurement by scanning probe

Measurement results are displayed on the MAZATROL SmoothX or the MAZATROL SmoothAi display

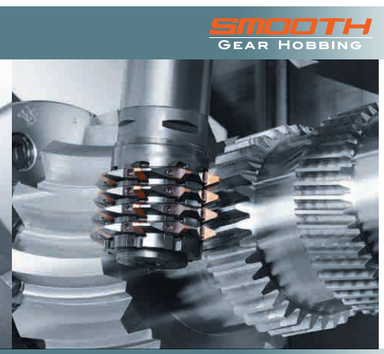
Measurement results shown on the CNC display can be output as a PNG file by pressing a single key.

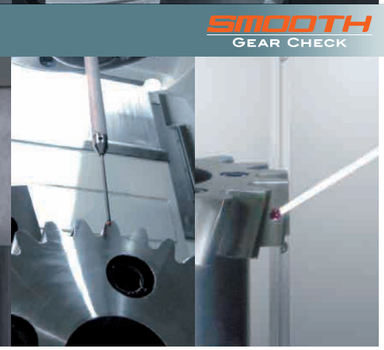


Conversational programming of high accuracy gear cutting and gear measurement

Programs are easily made in a short period of time by just inputting gear data

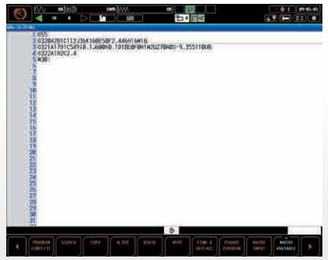
INTEGREX AG software



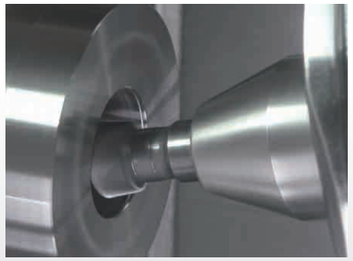


Operation flow

Gear and spline data specifications as well as cutting conditions and measurement data are input using a conversational CNC display.



G code program for cutting and measurement is generated. Gear skiving G code program made by Smooth Gear Skiving shown.



By pushing the cycle start button, gear cutting and measurement are performed.

Gear cutting & measurement

○: Included –: N/A

		External gears		
		Spur gears 	Helical gears 	Involute spline gears 
Gear cutting	SMOOTH GEAR SKIVING	○	○	○
	SMOOTH GEAR HOBBING	○	○	○
	SMOOTH GEAR MILLING	○	○	–
Deburring	SMOOTH GEAR DEBURRING	○	○	–
SMOOTH GEAR CHECK	Gear tooth radial in-phase location	○	○	○
	Gear profile and gear lead measurement OPTION	○	○	○

		Internal gears		
		Spur gears 	Helical gears 	Involute spline gears 
Gear cutting	SMOOTH GEAR SKIVING	○	○	○
	SMOOTH GEAR HOBBING	–	–	–
	SMOOTH GEAR MILLING	–	–	–
Deburring	SMOOTH GEAR DEBURRING	○	○	–
SMOOTH GEAR CHECK	Gear tooth radial in-phase location	○	○	○
	Gear profile and gear lead measurement OPTION	○	–	○

Standard Machine Specifications

INTEGREX i-H AG SERIES

INTEGREX i-450H S AG
Shown with optional equipment

	INTEGREX i-250H AG	INTEGREX i-250H S AG	INTEGREX i-250H ST AG
Universal	1000U·1500U	1000U·1500U	1500U
Max. machining length*1	1011 mm (39.80")·1519 mm (59.80")	1011 mm (39.80")·1519 mm (59.80")	1519 mm (59.80")
Max. machining diameter (upper turret / lower turret)	Φ670 mm (Φ26.38") / -	Φ670 mm (Φ26.38") / -	Φ670 mm (Φ26.38") / Φ420 mm (Φ16.54")
Travel (X / Y / Z / B) (upper turret)	695 mm (27.36") / 300 mm (11.81") / 1077 mm (42.40")· 1585 mm (62.40") / -30° ~ 210°	695 mm (27.36") / 300 mm (11.81") / 1077 mm (42.40")· 1585 mm (62.40") / -30° ~ 210°	695 mm (27.36") / 300 mm (11.81") / 1585 mm (62.40") / -30° ~ 210°
Travel (X2 / Z2) (lower turret)	-	-	220 mm (8.66") / 1539 mm (60.59")
Main spindle (40% ED (30 min. rating))	5000 min^{-1}(rpm), 22 kW (30 HP)	5000 min^{-1}(rpm), 22 kW (30 HP)	5000 min^{-1}(rpm), 22 kW (30 HP)
Second spindle (40% ED (30 min. rating))	-	5000 min^{-1}(rpm), 18.5 kW (25 HP)	5000 min^{-1}(rpm), 18.5 kW (25 HP)
Milling spindle (40% ED (30 min. rating))	12000 min^{-1}(rpm), 24kW (32 HP)	12000 min^{-1}(rpm), 24 kW (32 HP)	12000 min^{-1}(rpm), 24 kW (32 HP)

	INTEGREX i-350H AG	INTEGREX i-350H S AG	INTEGREX i-350H ST AG
Universal	1000U·1500U	1500U	1500U
Max. machining length*1	1011 mm (39.80")·1519 mm (59.80")	1519 mm (59.80")	1519 mm (59.80")
Max. machining diameter (upper turret / lower turret)	Φ670 mm (Φ26.38") / -	Φ670 mm (Φ26.38") / -	Φ670 mm (Φ26.38") / Φ420 mm (Φ16.54")
Travel (X / Y / Z / B) (upper turret)	695 mm (27.36") / 300 mm (11.81") / 1077 mm (42.40")· 1585 mm (62.40") / -30° ~ 210°	695 mm (27.36") / 300 mm (11.81") / 1585 mm (62.40") / -30° ~ 210°	695 mm (27.36") / 300 mm (11.81") / 1585 mm (62.40") / -30° ~ 210°
Travel (X2 / Z2) (lower turret)	-	-	220 mm (8.66") / 1539 mm (60.59")
Main spindle (40% ED (30 min. rating))	4000 min^{-1}(rpm), 30 kW (40 HP)	4000 min^{-1}(rpm), 30 kW (40 HP)	4000 min^{-1}(rpm), 30 kW (40 HP)
Second spindle (40% ED (30 min. rating))	-	4000 min^{-1}(rpm), 26 kW (35 HP)	4000 min^{-1}(rpm), 26 kW (35 HP)
Milling spindle (40% ED (30 min. rating))	12000 min^{-1}(rpm), 24kW (32 HP)	12000 min^{-1}(rpm), 24 kW (32 HP)	12000 min^{-1}(rpm), 24 kW (32 HP)

	INTEGREX i-450H AG	INTEGREX i-450H S AG	INTEGREX i-450H ST AG
Universal	1000U·1500U	1500U	1500U
Max. machining length*1	1011 mm (39.80")·1519 mm (59.80")	1519 mm (59.80")	1519 mm (59.80")
Max. machining diameter (upper turret / lower turret)	Φ670 mm (Φ26.38") / -	Φ670 mm (Φ26.38") / -	Φ670 mm (Φ26.38") / Φ420 mm (Φ16.54")
Travel (X / Y / Z / B) (upper turret)	695 mm (27.36") / 300 mm (11.81") / 1077 mm (42.40")· 1585 mm (62.40") / -30° ~ 210°	695 mm (27.36") / 300 mm (11.81") / 1585 mm (62.40") / -30° ~ 210°	695 mm (27.36") / 300 mm (11.81") / 1585 mm (62.40") / -30° ~ 210°
Travel (X2 / Z2) (lower turret)	-	-	220 mm (8.66") / 1539 mm (60.59")
Main spindle (40% ED (30 min. rating))	3300 min^{-1}(rpm), 37 kW (50 HP)	3300 min^{-1}(rpm), 37 kW (50 HP)	3300 min^{-1}(rpm), 37 kW (50 HP)
Second spindle (40% ED (30 min. rating))	-	4000 min^{-1}(rpm), 26 kW (35 HP)	4000 min^{-1}(rpm), 26 kW (35 HP)
Milling spindle (40% ED (30 min. rating))	12000 min^{-1}(rpm), 24kW (32 HP)	12000 min^{-1}(rpm), 24 kW (32 HP)	12000 min^{-1}(rpm), 24 kW (32 HP)

*1: Depends on chuck specifications

INTEGREX i-500 AG SERIES

INTEGREX i-500 AG
Shown with optional equipment

	INTEGREX i-500 AG	INTEGREX i-500S AG	INTEGREX i-500ST AG
Universal	1500U	1500U	1500U
Max. machining length*1	1529 mm (60.20")	1529 mm (60.20")	1529 mm (60.20")
Max. machining diameter (upper turret / lower turret)	Φ700 mm (Φ27.56") / -	Φ700 mm (Φ27.56") / -	Φ700 mm (Φ27.56") / Φ490 mm (Φ19.29")
Travel (X / Y / Z / B) (upper turret)	845 mm (33.27") / 430 mm (16.93") / 1640 mm (64.57") / -30° ~ 210°	845 mm (33.27") / 430 mm (16.93") / 1640 mm (64.57") / -30° ~ 210°	845 mm (33.27") / 430 mm (16.93") / 1640 mm (64.57") / -30° ~ 210°
Travel (X2 / Z2) (lower turret)	-	-	267 mm / 1373 mm (10.51" / 54.06")
Main spindle (40% ED (30 min. rating))	2500 min^{-1}(rpm), 37 kW (50 HP)	2500 min^{-1}(rpm), 37 kW (50 HP)	2500 min^{-1}(rpm), 37 kW (50 HP)
Second spindle (40% ED (30 min. rating))	-	2500 min^{-1}(rpm), 37 kW (50 HP)	2500 min^{-1}(rpm), 37 kW (50 HP)
Milling spindle (40% ED (30 min. rating))	10000 min^{-1}(rpm), 37kW (50 HP)	10000 min^{-1}(rpm), 37kW (50 HP)	10000 min^{-1}(rpm), 37kW (50 HP)

*1: Depends on chuck specifications

INTEGREX i-V AG SERIES

INTEGREX i-630V/6 AG
Shown with optional equipment

	INTEGREX i-630V/6S AG (Single table)	INTEGREX i-630V/6 AG
Max. machining length*1	Φ1250 mm × 1400 mm (Φ49.21" × 55.12")	Φ1050 mm × 1000 mm (Φ41.34" × 39.37")
Travel (X / Y / Z)	1425 mm (56.10") / 1050 mm (41.34") / 1050 mm (41.34")	1425 mm (56.10") / 1050 mm (41.34") / 1050 mm (41.34")
(B / C)	150° / 360°	150° / 360°
Rapid traverse rate (X-, Y-, Z-axis)	52 m/min (2047 IPM)	52 m/min (2047 IPM)
Turning spindle (cont. rating)	550 min^{-1}(rpm), 37 kW (50 HP)	550 min^{-1}(rpm), 37 kW (50 HP)
Milling spindle (40% ED (30 min. rating))	10000 min^{-1}(rpm), 37 kW (50 HP)	10000 min^{-1}(rpm), 37 kW (50 HP)

*1: Depends on chuck specifications

INTEGREX e-V AG SERIES

INTEGREX e-1250V/8S AG
Shown with optional equipment

	INTEGREX e-1250V/8S AG (Single table)	INTEGREX e-1250V/8 AG	INTEGREX e-1600V/10S AG (Single table)	INTEGREX e-1600V/10 AG
Max. machining length*1	Φ1500 mm × 1600 mm (Φ59.06" × 62.99")	Φ1450 mm × 1600 mm (Φ57.09" × 62.99")	Φ2300 mm × 1684 mm (Φ90.55" × 66.30")	Φ2050 mm × 1600 mm (Φ80.71" × 62.99")
Travel (X / Y / Z)	1875 mm (73.82") / 1250 mm (49.21") / 1345 mm (52.95")	1875 mm (73.82") / 1250 mm (49.21") / 1345 mm (52.95")	2165 mm (85.24") / 1600 mm (62.99") / 1345 mm (52.95")	2315 mm (91.14") / 1600 mm (62.99") / 1345 mm (52.95")
(B / C)	150° / 360°	150° / 360°	150° / 360°	150° / 360°
Rapid traverse rate (X-, Y-, Z-axis)	42 m/min (1654 IPM)	42 m/min (1654 IPM)	42 m/min (1654 IPM)	42 m/min (1654 IPM)
Turning spindle (cont. rating)	500 min^{-1}(rpm), 40 kW (53 HP)	500 min^{-1}(rpm), 40 kW (53 HP)	300 min^{-1}(rpm), 40 kW (53 HP)	300 min^{-1}(rpm), 40 kW (53 HP)
Milling spindle (40% ED (30 min. rating))	10000 min^{-1}(rpm), 37 kW (50 HP)	10000 min^{-1}(rpm), 37 kW (50 HP)	10000 min^{-1}(rpm), 37 kW (50 HP)	10000 min^{-1}(rpm), 37 kW (50 HP)

*1: Depends on chuck specifications