PUMA MX series

Multi-Tasking Turning Center

Doosan Machine Tools

Optimal Solutions for the Future

PUMA MX series

The integration of machining center and turning center gives you unmatched flexibility in a wide variety of part configurations. From simple turning and milling, to complex multi-axis simultaneous machining, all operations can be completed in one machine. Off-center machining with the Y-axis and milling of angled surfaces with the B-axis greatly increases the range of machine applications.

Multi-Tasking Turning Center

Machine Construction

The milling spindle(s) and the lower turret can be coordinated to enable machining at the left or right spindle.

Multi-process capability
Shorter setup times
Optimal cycle distribution
Automated operation support

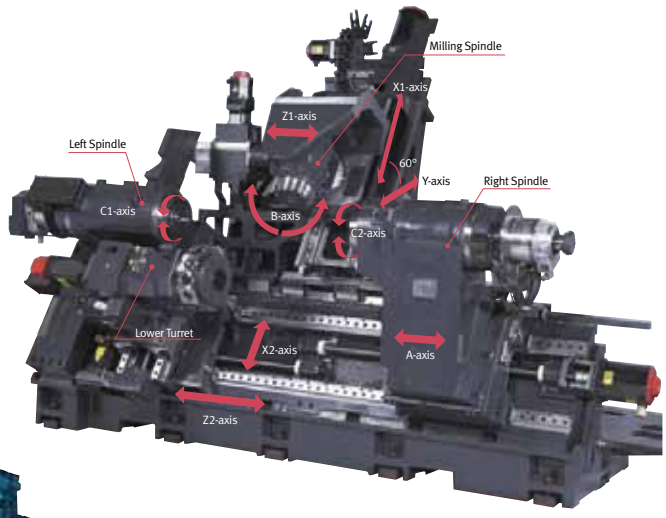
PUMA MX -
maximum economy and productivity

Robust Design PUMA MX2100

Stable base for supporting multi-machining

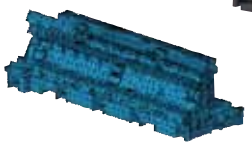
The heavily ribbed torque tube design prevents twisting and deformation. All guideways are wide wrap-around rectangular type for unsurpassed long-term rigidity and accuracy.

	Guideway span
	MX2100
X1-axis	**285 / 315** mm (11.2 / 12.4 inch)
Z1-axis	**540 / 473** mm (21.3 / 18.6 inch)
Y-axis	**435** mm (17.1 inch)



FEM

Finite Element Method (FEM) analysis results in superior machine stability.

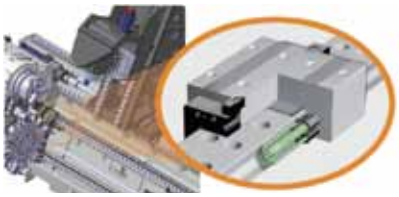


Linear Motion Guide (Roller type)

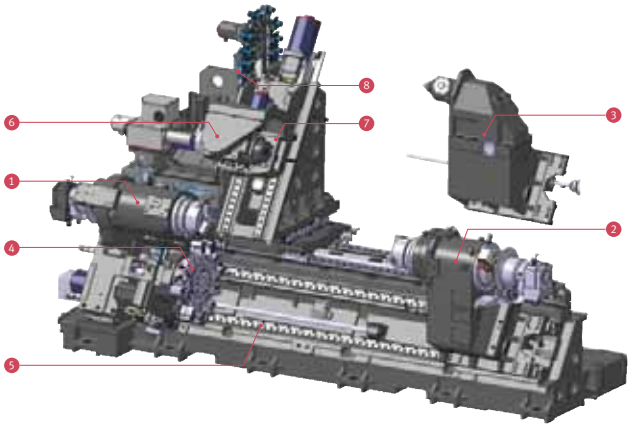
All carriages are mounted on roller-type, linear motion guides to provide high accuracy and rigidity while reducing non-cutting time.

- Zero clearance from preload → High permissible load
- Low friction & wear (LM μ = 0.002~0.003)
- Simple maintenance over the long haul

	Rapid traverse
X1-axis	**36** m/min (1417.3 ipm)
Z1-axis	**36** m/min (1417.3 ipm)
Y-axis	**26** m/min (1023.6 ipm)



LMG (Roller type)



PUMA MX1600

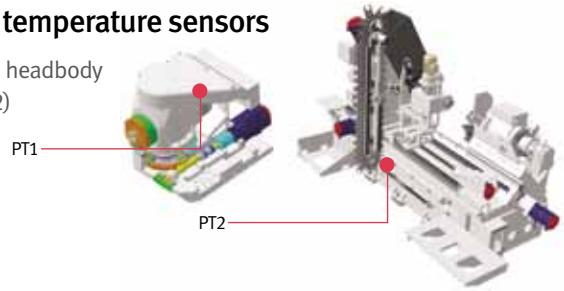
	PUMA MX1600	PUMA MX1600S	PUMA MX1600T	PUMA MX1600ST
1 Left spindle (Mill-turn) : 175mm (6") chuck	●	●	●	●
2 Right spindle (Mill-turn) : 175mm (6") chuck	×	●	×	●
3 Tail stock : Servo driven type	●	×	●	×
4 Lower turret : 16-station 6000 r/min rotary tool	×	×	●	●
5 Roller guide ways for all axes	●	●	●	●
6 Milling spindle : 12000 r/min, Capto C5	●	●	●	●
7 B-axis : Roller gear cam	●	●	●	●
8 ATC & Magazine : 40 ea, Servo driven	●	●	●	●

Thermal compensation system

Milling spindle thermal growth can be compensated for spindle axis direction only. Effectively removes positional deviation of spindle nose due to changing rotational speed.

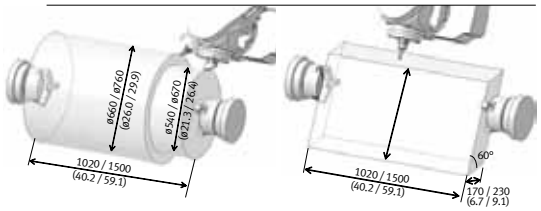
Position of temperature sensors

Milling spindle headbody (PT1), bed (PT2)



Axis Features

Max. working diameter, length (MX 2100 / MX 2600, 3100)



Axis travel

Unit : mm (inch)

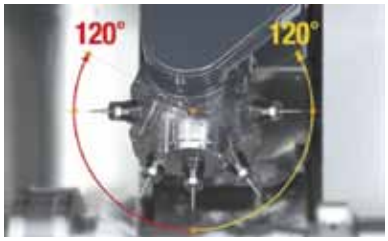
	PUMA MX 2100/2100L	PUMA MX2600/3100	MX1600
X1-axis	565 (22.2)	630 (24.8)	450 (332.1)
X2-axis	187 (7.4)	220 (8.7)	165 (121.8)
Z1-axis	1050/1550 (41.3 / 61.0)	1585 (62.4)	935 (690.0)
Z2-axis	1050/1550 (41.3 / 61.0)	1515 (59.7)	925 (682.7)

Rapid travel

Unit : m/min (ipm)

	PUMA MX2100ST	PUMA MX2600ST	MX1600
X1-axis	36 (1417.3)	36 (1417.3)	36 (1417.3)
X2-axis	24 (944.9)	24 (944.9)	24 (944.9)
Z1-axis	36 (1417.3)	36 (1417.3)	36 (1417.3)
Z2-axis	36 (1417.3)	36 (1417.3)	36 (1417.3)
A-axis	30 (1181.1)	30 (1181.1)	
C-axis	400 (15748.0) r/min	400 (15748.0) r/min	

B-Axis with Virtual Y-Axis



High rigid roller gear cam

B-axis rotating range std.

Precise indexing control of B-axis makes milling jobs on inclined plane possible.

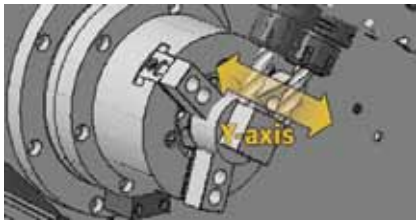
- 5° indexing (by coupling clamp)
- Contouring control in 0.001° increment

B-axis rotation range ± 120°
B-axis indexing time 2 s (90°)

Precision control B-axis movement

The angular position of the B-axis is controlled using precision ground roller gear cam and a highly accurate servo motor.

Virtual Y-axis function



A rigid, double-slide Y-axis construction withstands cutting forces generated during heavy-duty turning and milling.

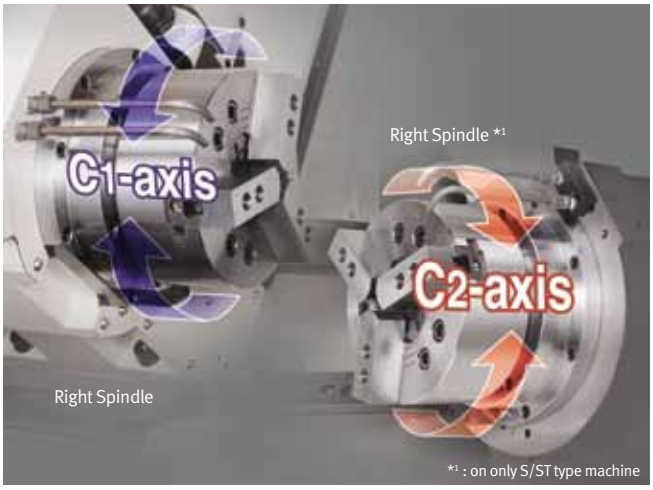
Y-axis stroke 170 mm (6.7 inch) / 230 mm (9.1 inch)
[±85 mm (3.4 inch) / ±115 mm (4.5 inch)]
Y-axis rapid traverse 26 m/min (1023.6 ipm)

Main Spindle

The Perfect Design for Built-in Motor-Driven Spindles.

Main Spindle

Both spindles, left and right, are engineered to minimize the loss of precision through thermal distortion, and to ensure superior performance in applications ranging from heavy-duty cutting at high power and low speed, to fine finishing at high speed.

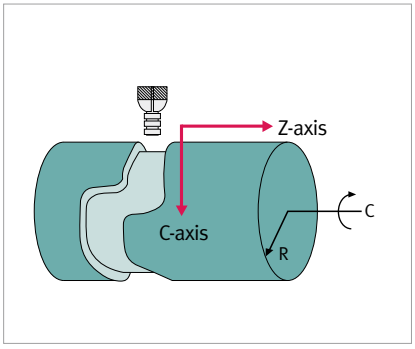


	Max. spindle speed	Motor (30 min)
PUMA MX1600	6000 r/min	15 kW (20.1 Hp)
PUMA MX2100	5000 r/min	22 kW (29.5 Hp)
PUMA MX2600	4000 r/min	26 kW (34.9 Hp)
PUMA MX3100	3000 r/min	30 kW (40.2 Hp)

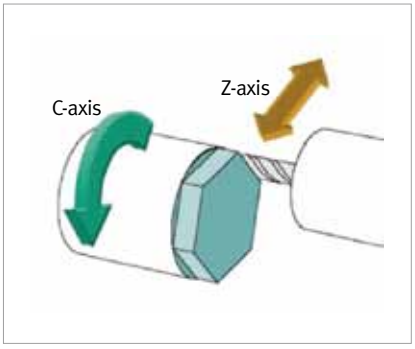
Perfect C-axis control of both spindles

C1, C2-axis index **360°** [in 0.001° increment]

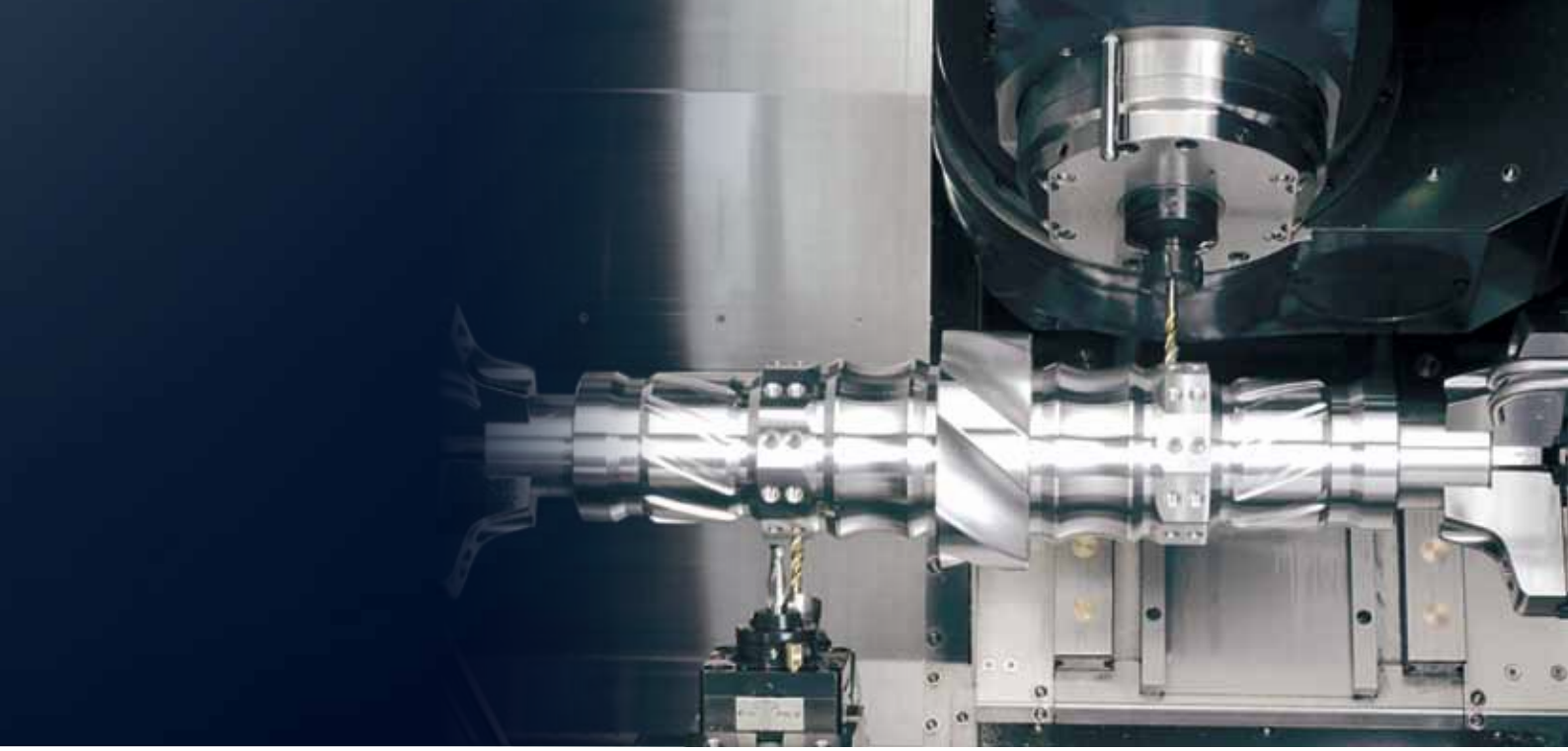
	C1, C2-axis contouring torque
MX1600	208 N·m (153.5 ft·lb)
MX2100S [L/ST/LST]	318 N·m (125.5 ft·lb)
MX2600S/ST	700 N·m (516.6 ft·lb)
MX3100S	1203 N·m (887.8 ft·lb)



C&Z-axis cylindrical interpolation

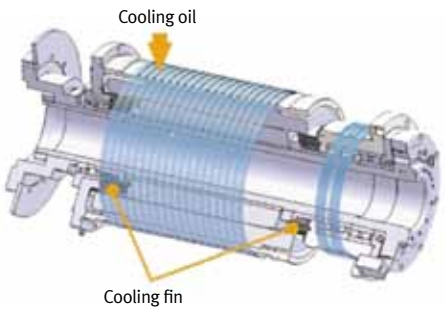


C&X-axis polar interpolation



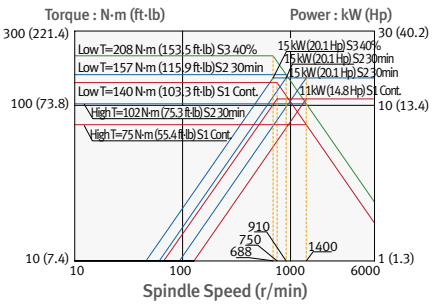
Oil cooling unit for left & right spindles

Both the left and right spindles employ an integral cooling system that circulates coolants through the entire spindle structure. This eliminates thermal distortion in all applications from heavy-duty cutting at high power and low speeds to fine and finish cutting at high speed.



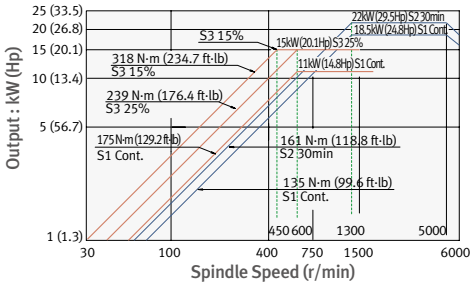
Spindle power-torque diagram

PUMA MX1600



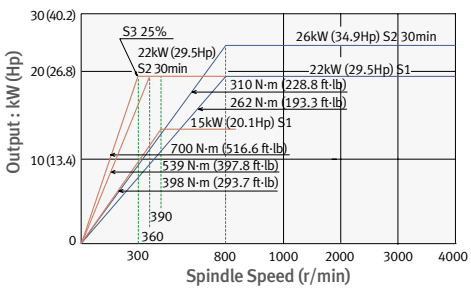
PUMA MX 2100 series (Left & right spindle)

- Spindle motor power : 22 kW (29.5 Hp)
- Max. Spindle speed : 5000 r/min



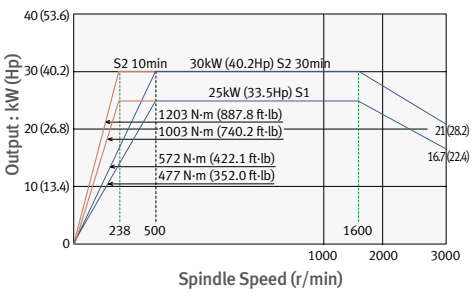
PUMA MX 2600 series (Left & right spindle)

- Spindle motor power : 26 kW (34.9 Hp)
- Max. Spindle speed : 4000 r/min



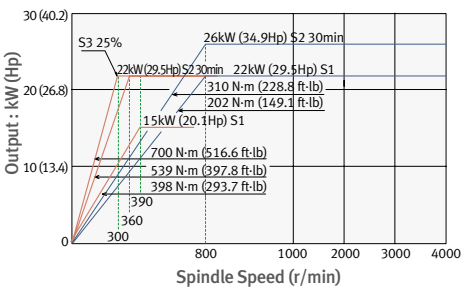
PUMA MX 3100 series (Left spindle)

- Spindle motor power : 30 kW (40.2 Hp)
- Max. Spindle speed : 3000 r/min



PUMA MX 3100 series (Right spindle)

- Spindle motor power : 26 kW (34.9 Hp)
- Max. Spindle speed : 4000 r/min



Milling Spindle

Turning and Milling Perfectly Integrated.

Milling Spindle

Oil-based coolants circulate through the milling spindle, allowing perfect integration of turning and milling applications. An air-gap sensor confirms the clamping status of both tools and parts.

Max. spindle speed **12000** r/min

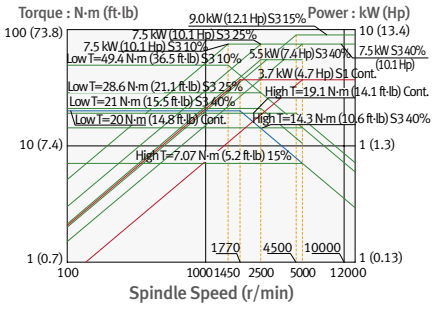
	Motor	Torque
PUMA MX1600	**9** kW (12.1 Hp) [10 min]	**49** N·m (36.2 ft·lb)
PUMA MX2100	**18.5** kW (24.8 Hp) [10 min]	**81** N·m (59.3 ft·lb)
PUMA MX2600/3100	**22** kW (29.5 Hp) [15 min]	**118** N·m (87.1 ft·lb)

Dual Contact Tools (MX 1600 - CAPTO C5, MX2100/2600/3100 - CAPTO C6)

The 360° angular positioning of the milling spindle can accommodate multi insert turning tools that are equipped with two, three, or four inserts.

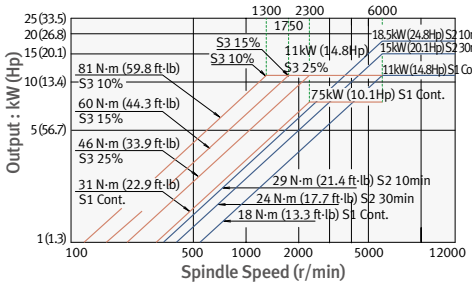
Milling spindle power-torque diagram

PUMA MX1600



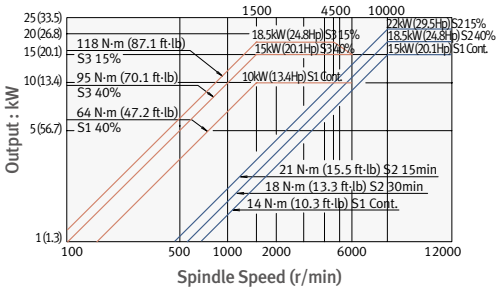
PUMA MX2100 series

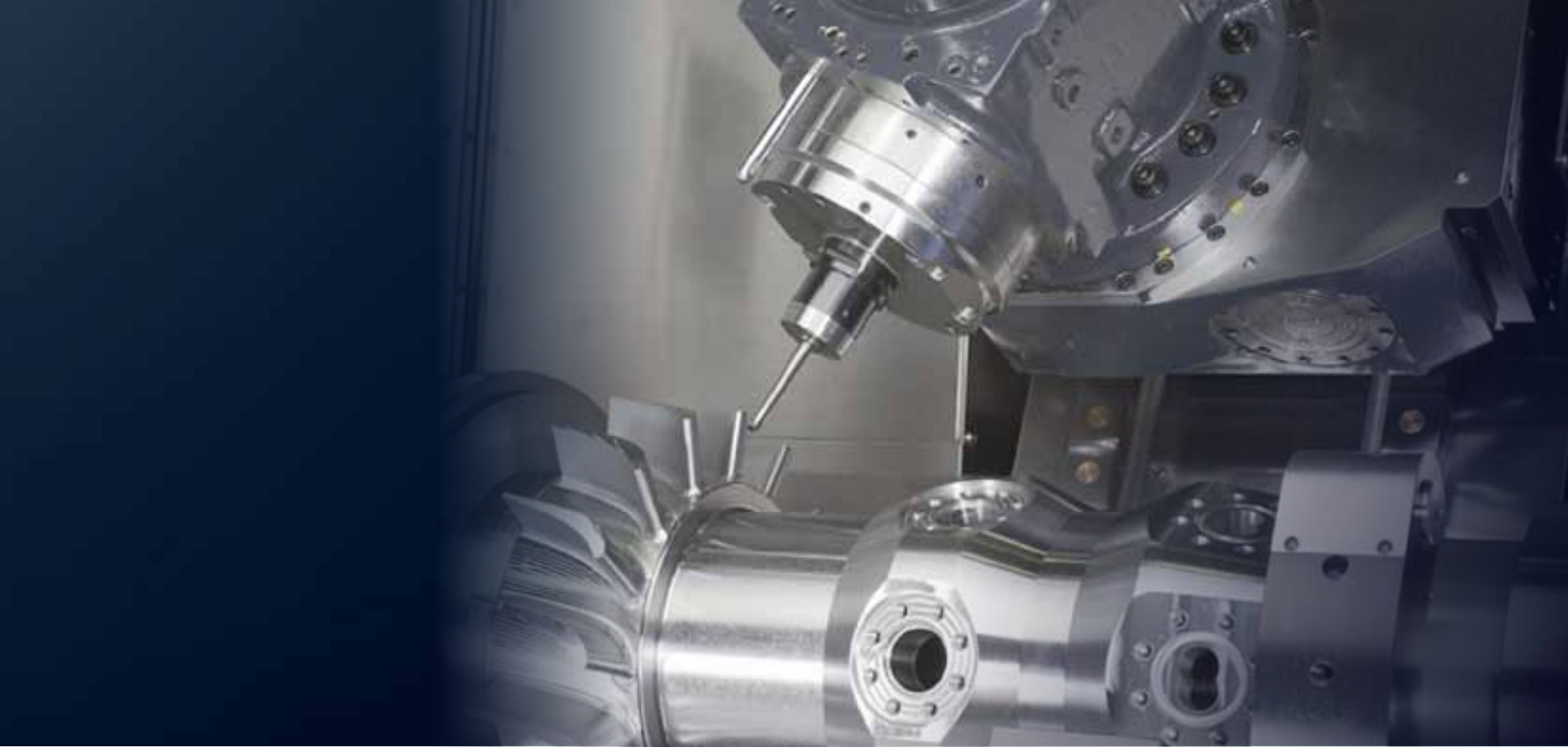
- Spindle motor power : 18.5 kW (24.8 Hp)
- Max. Spindle speed : 12000 r/min



PUMA MX2600/3100 series

- Spindle motor power : 22 kW (29.5 Hp)
- Max. Spindle speed : 12000 r/min





Tool Magazine with ATC

Automatic Tool Changer (ATC)

Advanced mechanisms significantly reduce non-cutting time.

	Tool change time
PUMA MX1600	**2.1** s (T - T - T)
PUMA MX2100	**2.0** s (T - T - T)
PUMA MX2600/3100	**2.0** s (T - T - T)

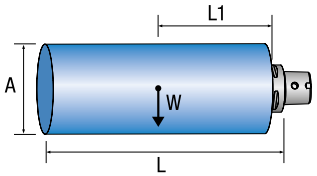
Tool storage capacity

The ATC consists of a servo-driven tool magazine and change arm.

40 ea / **80** ea opt.

Tool Magazine

Maximum tool size

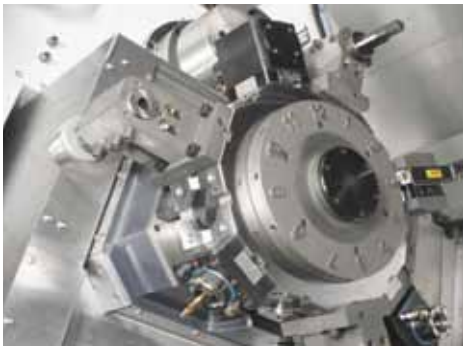


	Max. tool length [L]	Max. tool diameter [A]		Max. tool weight [W]	Max. moment [W x L1]
		Adjacent pots are empty	Continuous		
PUMA MX1600	**200** mm (7.9 inch)	**Ø 95** mm (3.7 inch)	**Ø 70** mm (2.8 inch)	**4** kg (8.8 lb)	**3.9** N·m (2.9 ft·lb)
PUMA MX2100	**300** mm (11.8 inch)	**Ø 120** mm (4.7 inch)	**Ø 90** mm (3.5 inch)	**8** kg (17.6 lb)	**7.54** N·m (5.6 ft·lb)
PUMA MX2600/3100	**400** mm (15.8 inch)	**Ø 130** mm (5.1 inch)	**Ø 90** mm (3.5 inch)	**10** kg (22.0 lb)	**9.81** N·m (7.2 ft·lb)

Lower Turret

Designed for High Accuracy

Lower Turret *1



The 12-station, heavy-duty lower turret features a large-diameter Curvic coupling with heavyduty design for maximum rigidity under tough cutting conditions. Turret rotation, acceleration and deceleration are controlled by a high-torque servo motor. Unclamp and rotation are virtually simultaneous. The fast index response keeps cycle times short.

Index time (1-station swivel) **0.2** s

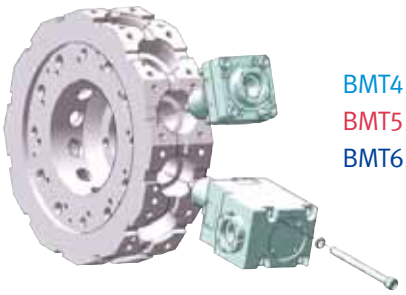
No. of tool station **12** ea (MX2100/2600/3100)

16 ea (MX1600)

*1 : on only T, ST type machine

Radial BMT45P (MX1600), BMT55P (MX2100) and the BMT65P (MX2600)

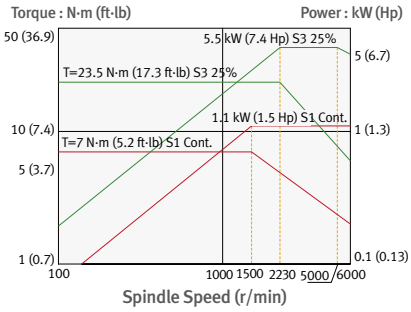
The turret accommodates BMT55P and BMT65P tooling in which the toolholders are mounted directly to the turret's periphery with 4 large bolts. This type of mounting system generates exceptionally high rigidity.



BMT45P (MX1600)
BMT55P (MX2100)
BMT65P (MX2600)

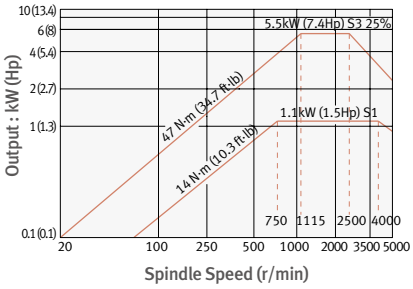
Rotary tool spindle power-torque diagram

PUMA MX1600



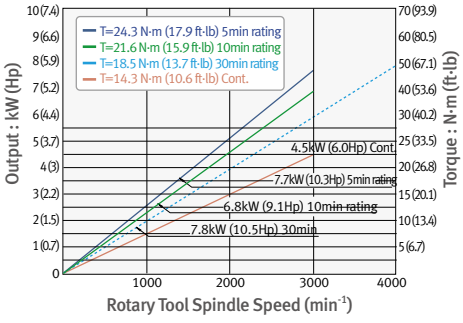
PUMA MX2100 series

- Spindle motor power : 5.5 kW (7.4 Hp)
- Max. Spindle speed : 5000 r/min



PUMA MX2600 series

- Spindle motor power : 7.8 kW (10.5 Hp)
- Max. Spindle speed : 4000 r/min



Servo Driven Tail Stock *1

The tail stock is driven by an AC servo motor and ball screw. Tail stocks thrust force can be controlled and adjusted by using the controls M-code function.

*1 : The servo-driven tail stock with dead center (built in center) is standard on MX2100, 2600/3100 models, but not on those designated as S and ST models.

Programmable tail stock specifications

Model	Unit	MX1600	MX2100	MX2600 / 3100
Bore taper		MT#4	MT#4	MT#5
Travel	mm (inch)	935 (36.8)	1050 (41.3)	1550 (61.0)
Max. thrust force	N (lbs)	3500 (786.8)	7000 (1573.6)	10000 (22480.0)

Machining Capacity

Heavy duty cutting (MX2600) (OD)

Spindle speed r/min	Cutting speed m/min (ipm)	Feedrate m/rev	Cutting depth mm (inch)	Material removal rate cm³/min (in³/min)
910	200 (7874)	0.4	10 (0.4)	800 (315.0)

Milling 1 (MX2600) (Face milling)

Milling Spindle speed r/min	Tool [6Z] mm (inch)	Cutting depth mm (inch)	Feedrate m/rev	Material removal rate cm³/min (in³/min)
1100	Ø80 (3.2)	5 (0.2)	1.0	330 (129.9)

Milling 2 (MX2600) (End milling)

Milling Spindle speed r/min	Tool [6Z] mm (inch)	Cutting depth mm (inch)	Feedrate m/rev	Material removal rate cm³/min (in³/min)
380	Ø25 (1.0)	25 (1.0)	0.5	119 (46.9)

Milling 3 (MX2100) (Drilling)

Milling Spindle speed r/min	Tool [U-drill] mm (inch)	Feedrate m/rev	Material removal rate cm³/min (in³/min)
2000	Ø40 (3.2) [6Z]	0.2	503 (9.7)

- Workpiece material, KS (JIS) : SM45C (S45C), Carbon steel
- The cutting test results indicated above are obtained as an example through real test cutting.
- The results may not be obtained due to differences in cutting and environmental conditions during measurement.

Application of Hybrid Motor Starter (Standard Specifications)

Innovative maintenance-free conditions have been realized compared with conventional motor-driven starters via the application of a hybrid motor starter that allows intellectual switching and simple cabling upon frequent operation of the coolant pump motor.

Hybrid motor starter that allows intellectual motor switching and simple cabling

The hybrid motor starter is capable of starting up the motor faster and more securely than competing motor starters.

Hybrid switching technology, fitted with semiconductors for the supply of power, allows streamlined switching, thereby radically reducing the load on relay contacts and extending the lifecycle of the motor starter tenfold compared with conventional switch gear, and facilitates simple and efficient cabling design at the control and signal levels.

Easy Operation System

Alarm Guidance

User check-up points notice function

Self check-up function (OK / NG)

Status of actuators & sensors of unit

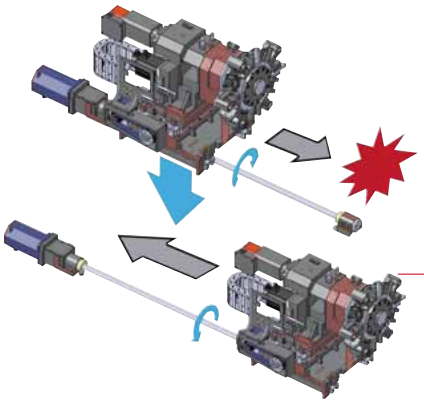
Easy Alarm Check-up & Troubleshooting

Periodic maintenance function

- Avoid Unexpected Downtime
- Optimize the performance
- Increase Efficiently
- Reduce operating costs

Extends the Life of the Tool Machine

Machine - Airbag Function



- It is available on the servo axis (X, Z, B, Y-AXIS).
- This function can not prevent collision but can minimize collision damege.

Machine collision, defection or cutter damage — Caused large load torque

Machine-airbag function

DAMAGE to the machine

Minimize the DAMAGE

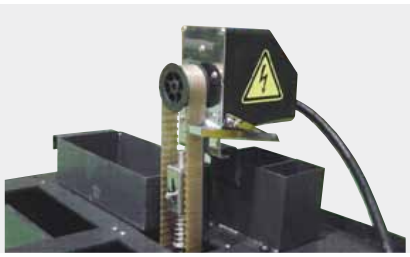
The principle of Machine-airbag Function

1. Higher torque load can be detected than setting vale if machine come into collision.
2. Servo Unit automatically move in the reverse direction instaneously.

Detect the torque data → Machine collision → Instaneous reverse direction moving → Minimize the damage → Protect the machine unit

Various Optional Equipments

Oil mist collector



Oil skimmer

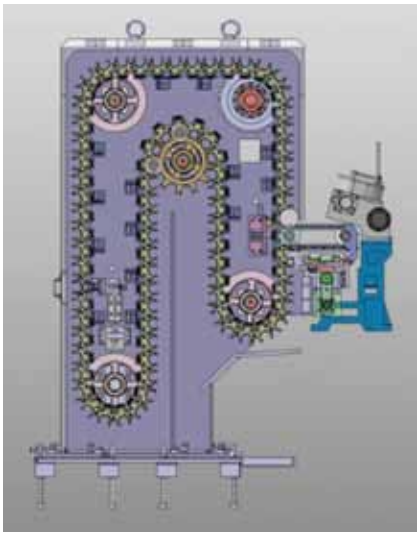
Servo driven steady rest (Automatic type)

Tool setter

Air+Oil mist

Misting device

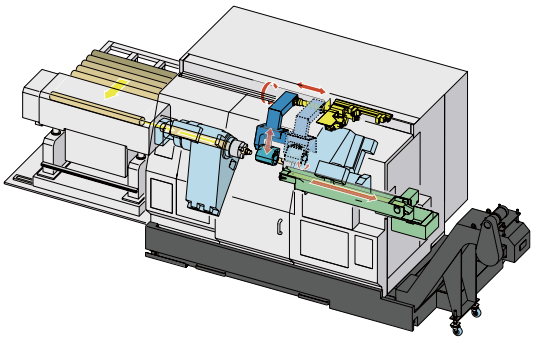
MQL (Minimum quantity lubrication)



Tool magazine 80 tools

Optional Equipments for Automation

- Bar feeder
- Parts unloader & Parts conveyor
- Work ejector



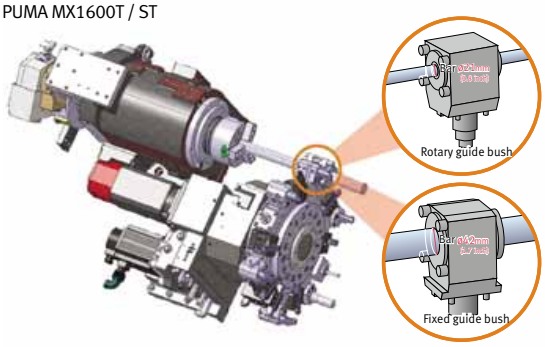
Guide bush* opt.

Combined MX technology with Swiss-turn function for biomedical complex shapes

Rotary guide bush Below 21 mm (0.8 inch)

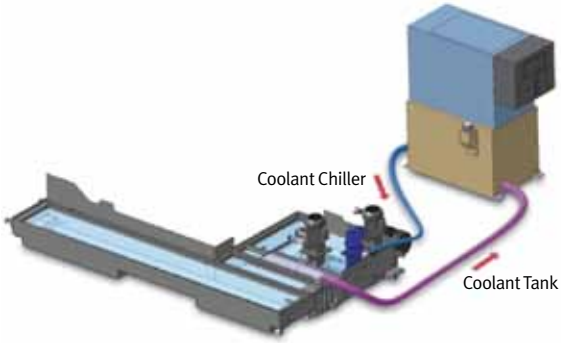
Fixed guide bush Below 22 mm ~ 42 mm (0.9 inch ~ 1.7 inch)

* : PUMA MX1600T / ST



Coolant chiller opt.

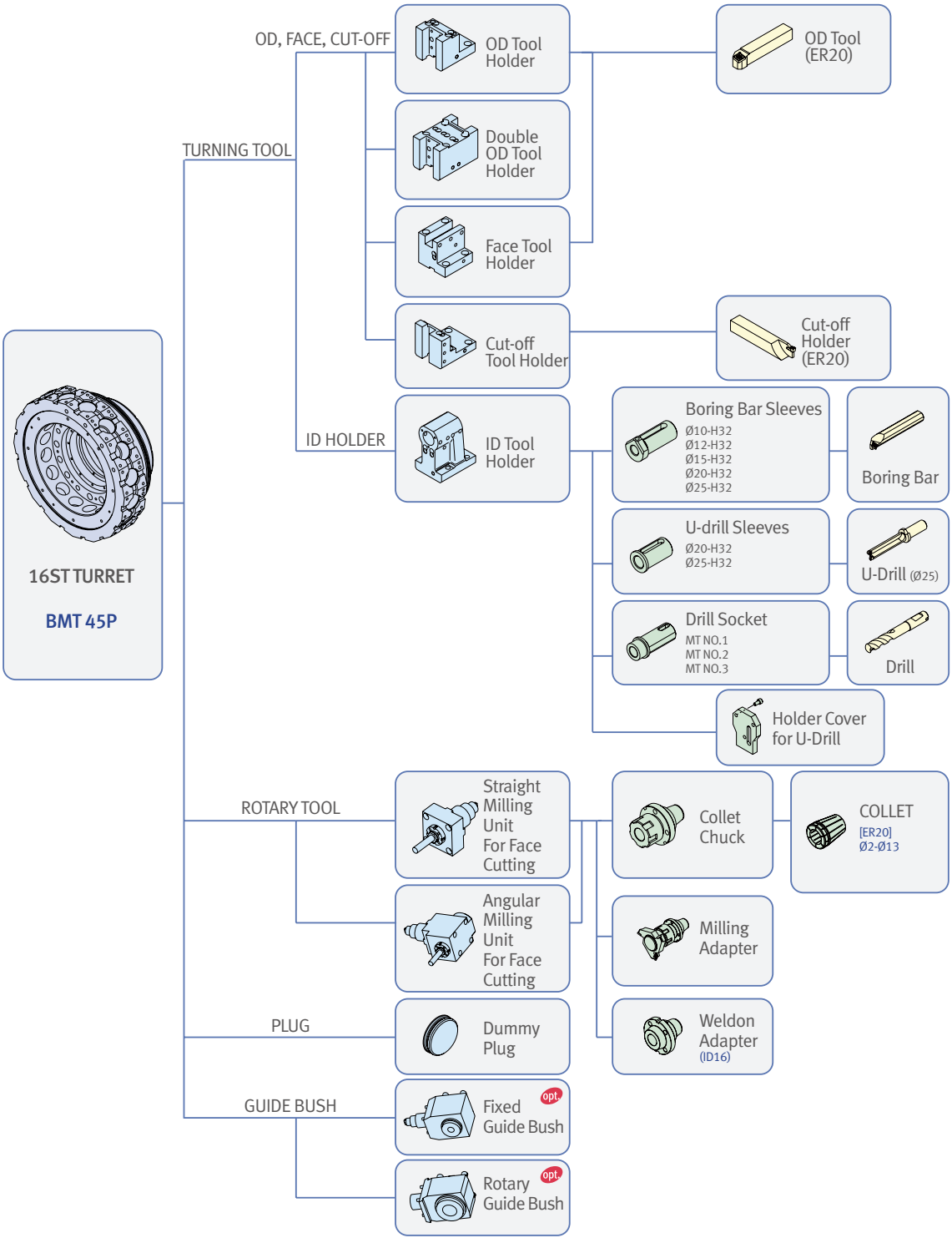
Thermal displacement and dimensional accuracy are greatly influenced by oil temperature in a machine. Coolant Temperature Control unit prevents the coolant from heating. Especially, when using oil-based coolant, the oil temperature can become extremely high.



Tooling System

Unit : mm (inch)

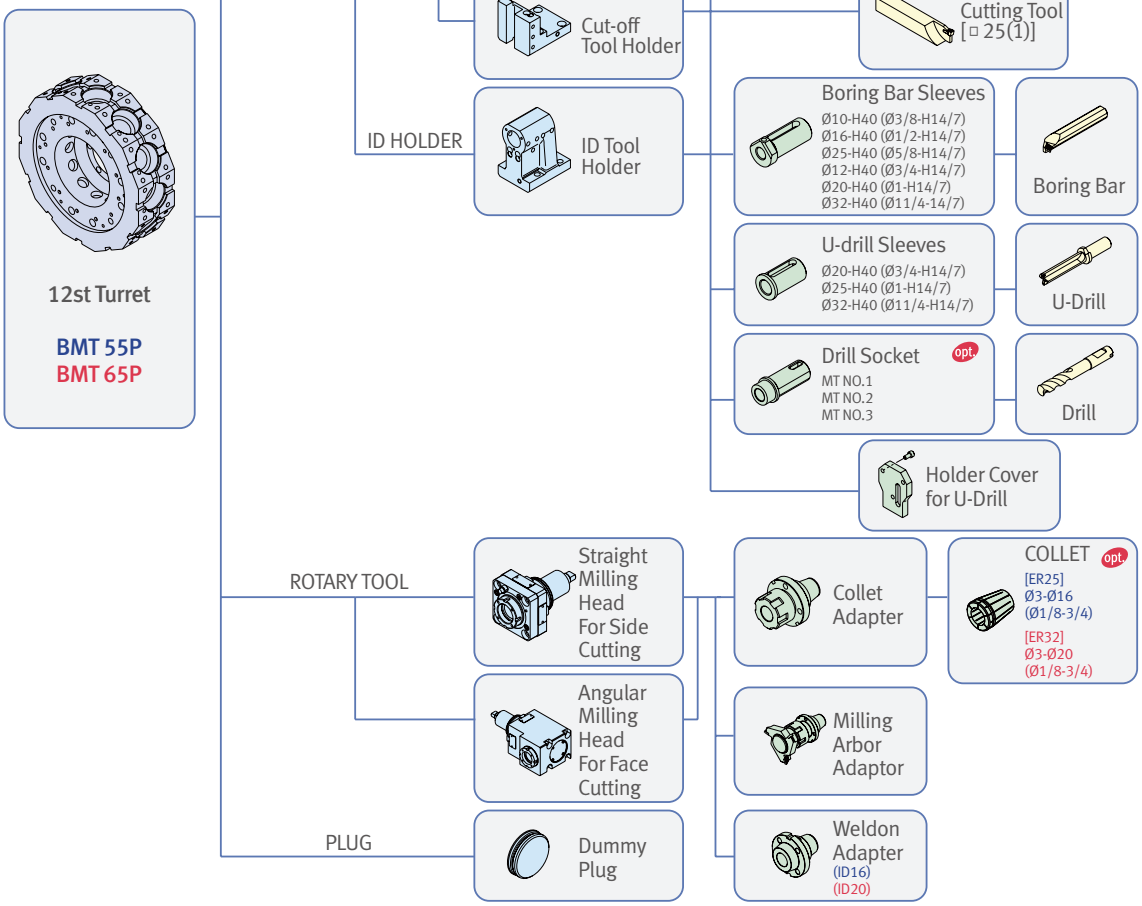
PUMA MX1600



Unit : mm (inch)

PUMA MX2100, PUMA MX2600

- PUMA MX 2100
- PUMA MX 2600



Note) Above tooling system is our recommendation.
Depending on export condition, the standard tooling packed with the machine can be different.

Tooling System

Milling spindle

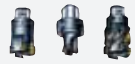
Unit : mm (inch)

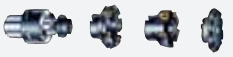
The adapters, in long and short version, make it possible to extend the total length.

Coromant Capto

MX1600: CAPTO C5
MX2100/2600/3100: CAPTO C6

Rotating Tools


CoroMill milling cutters with Coromant Capto coupling


CoroMill milling cutters and adapters


CoroMill modular cutting heads and a variety of shanks

Endmills, shart hole drills and taps with a large number of adapter


Indexable insert drills with Coromant Capto coupling

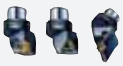

Indexable insert drills and adapters


Boring tools with Coromant Capto coupling

Turning Tools

External machining


45° Coromant Capto cutting units for turning

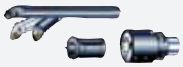

90° Coromant Capto cutting units for turning, threading parting and grooving


Standard shank tools and adapters for turning, threading parting and grooving


Coromant Capto cutting units for turning, threading

Internal machining


Modular tooling system 570-cutting heads for turning, threading, parting and grooving and boring bars in different designs


Boring bars and adapters

Mini-turret


Three tools in one: one position in the magazine containning three standard shank tools.


Multi-function type, suitable for both rotary and fixed tool cutting in milling and lathe


Special tools and engineered products

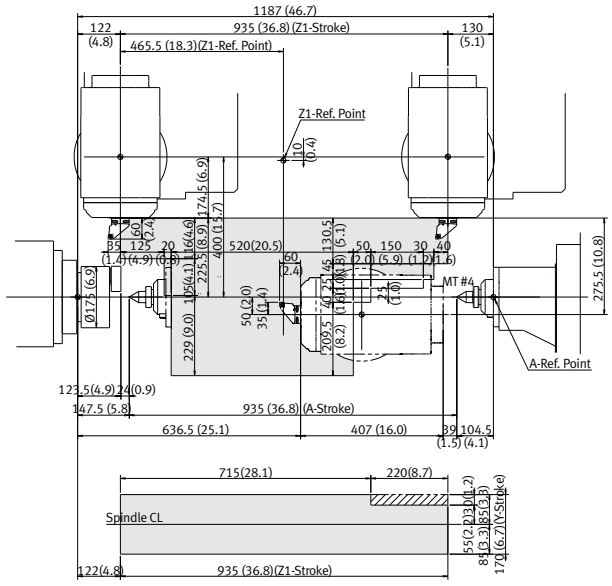

Blanks to be shaped according to your needs

• All holders are not supplied. It is only reference for you.

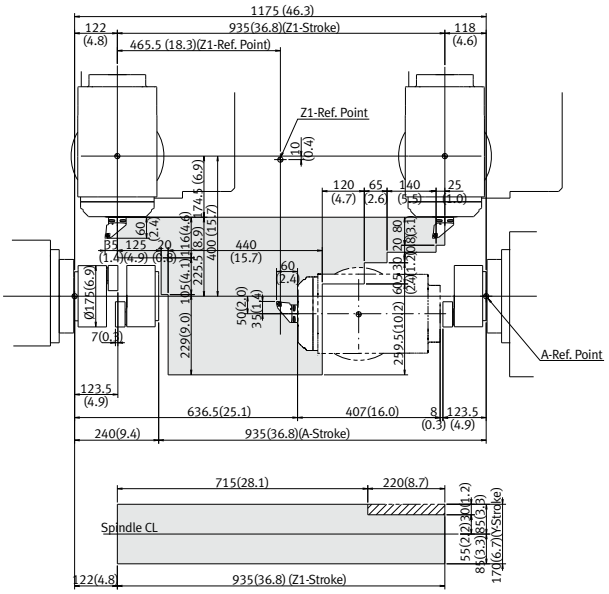
Working Range

Unit : mm (inch)

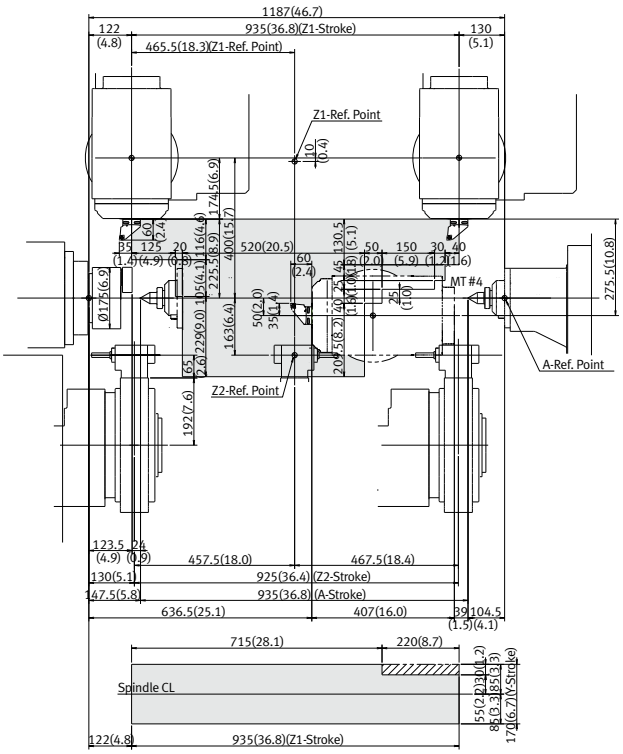
PUMA MX1600



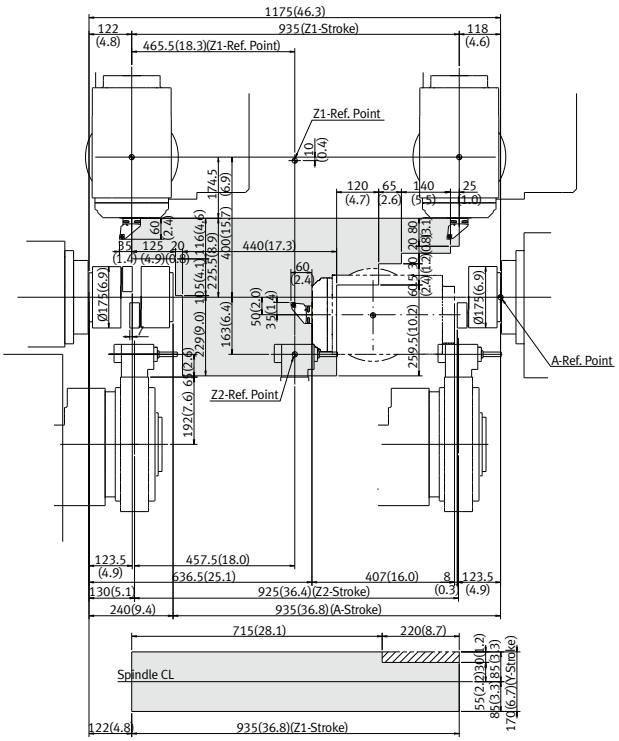
PUMA MX1600S



PUMA MX1600T



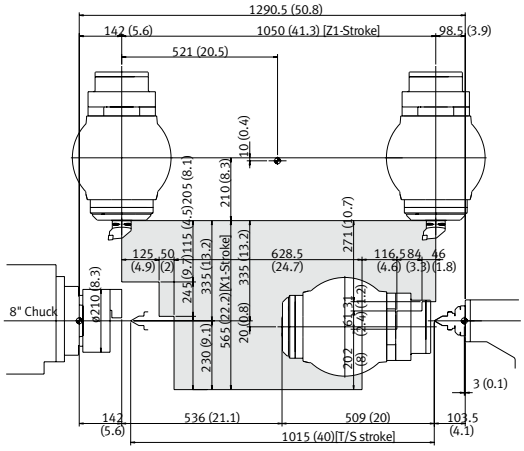
PUMA MX1600ST



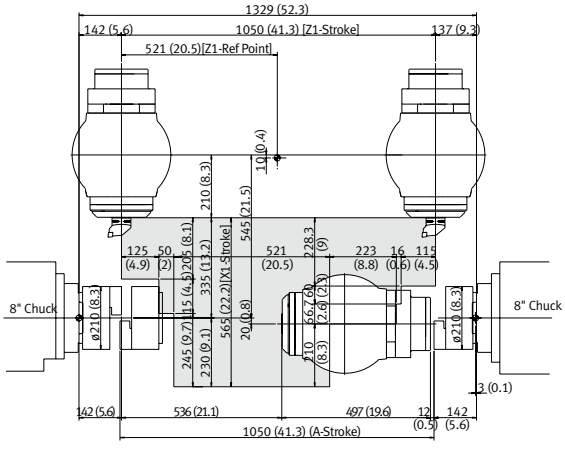
Working Range

Unit : mm (inch)

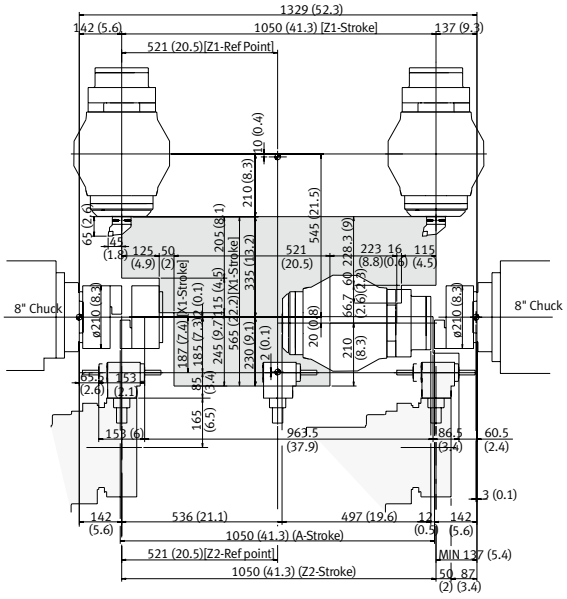
PUMA MX2100



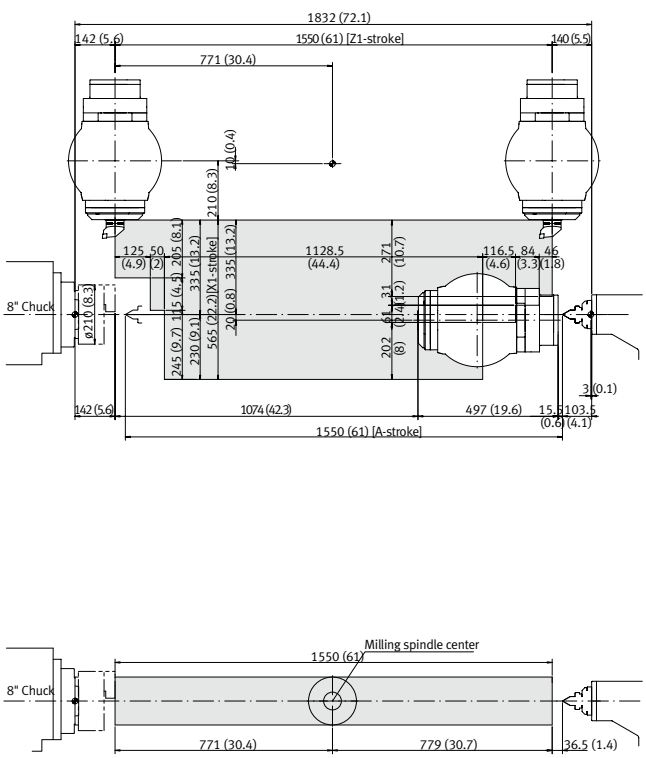
PUMA MX2100S



PUMA MX2100ST



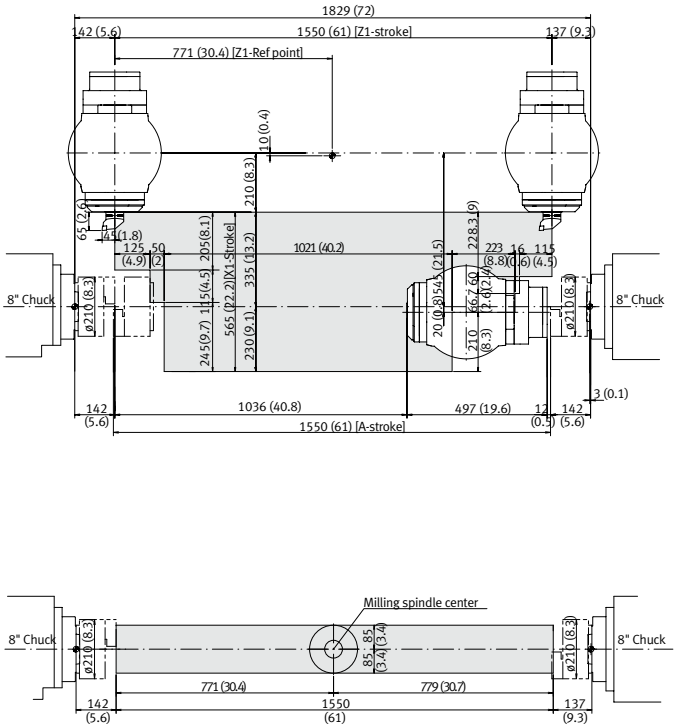
PUMA MX2100L



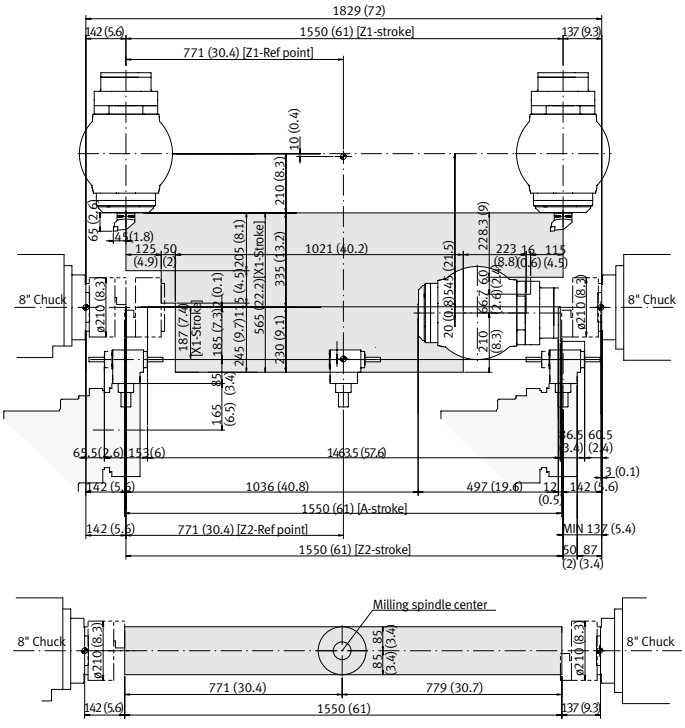
Working Range

Unit : mm (inch)

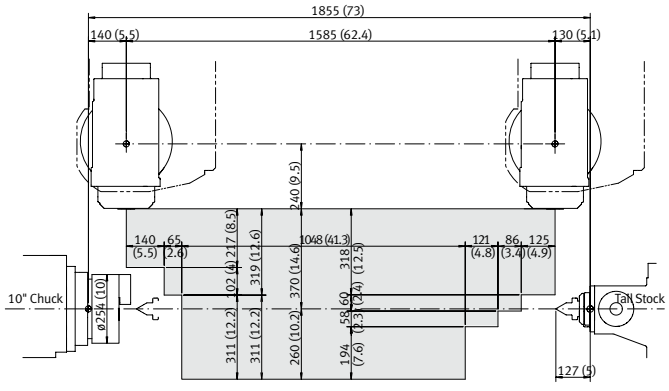
PUMA MX2100LS



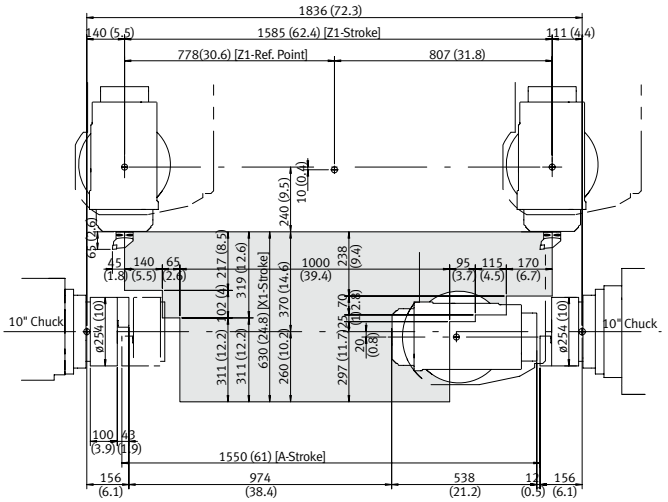
PUMA MX2100LST



PUMA MX2600



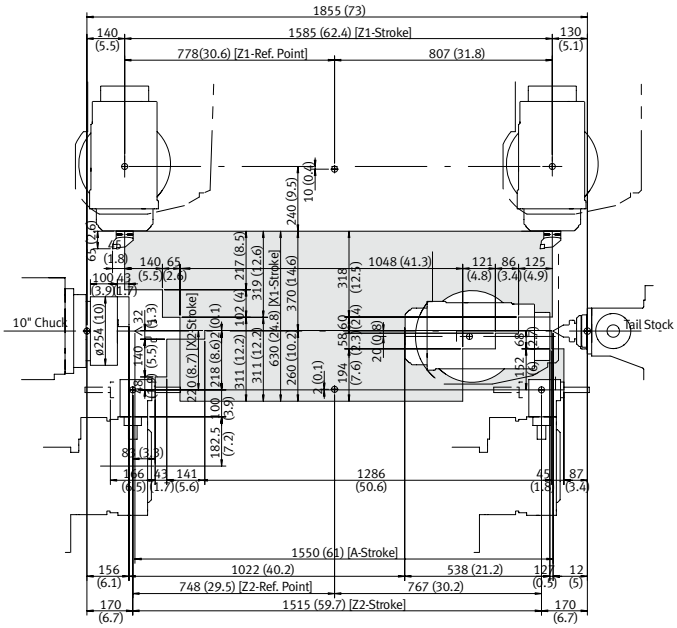
PUMA MX2600S



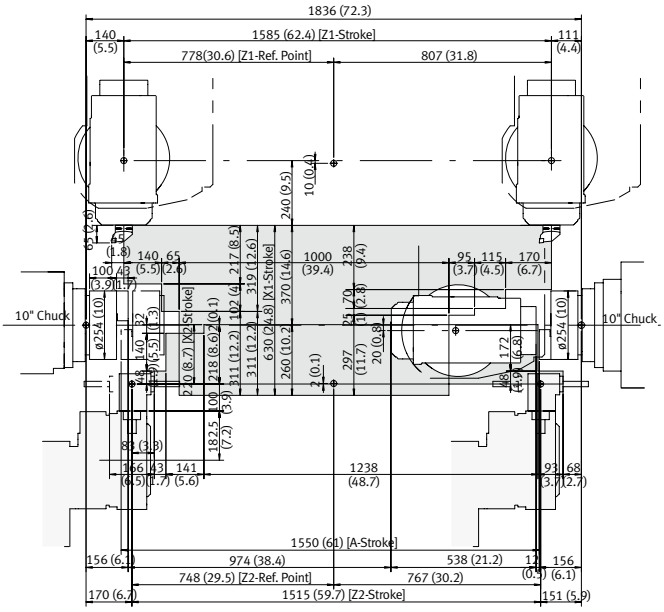
Working Range

Unit : mm (inch)

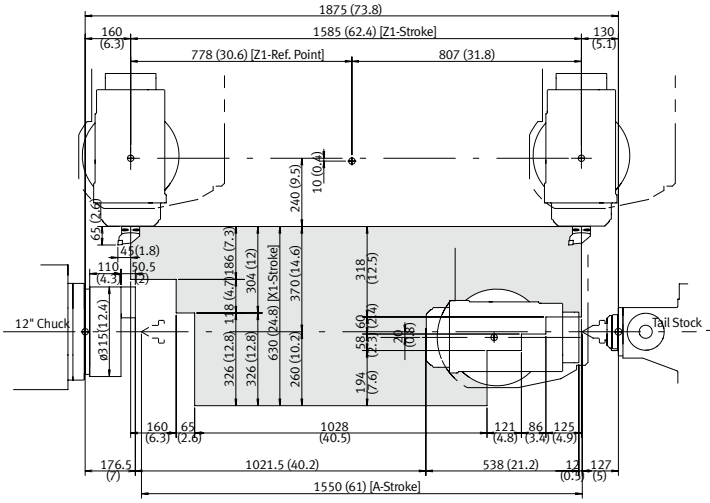
PUMA MX2600T



PUMA MX2600ST



PUMA MX3100



PUMA MX3100S