

# DUGARD

Expertise with Imagination

**DUGARD**  
**5 Axis**

Dugard X5-320

5 Axis Vertical Machining Centre

Engineered for machining complex parts



**DUGARD** Machine  
Tools

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## 5 Axis Machining Centre with Integrated 2 Axis Rotary Table Engineered for machining complex parts

The Dugard X5 5 axis high speed VMC features 5 axis simultaneous or 4+1 axis applications. The standard machine is fitted with an integrated 2 axis rotary table size Ø320mm.

Better accuracy, more productivity, less manpower, higher profitability. The machine is designed for high speed, high precision and high productivity machining that is suitable for such industries as aerospace, automotive industries, mould making or job shops.

Heavy duty construction offers high rigidity, with major parts of the machine constructed of high quality cast iron, which offers superior stability. The column design is an inverted Y shape construction for superior rigidity and stability. The pre-tensioned Class C3 ballscrews are used in all three axes. All servo motors are directly coupled to ballscrews, giving more responsive positioning and dramatically reduced backlash.

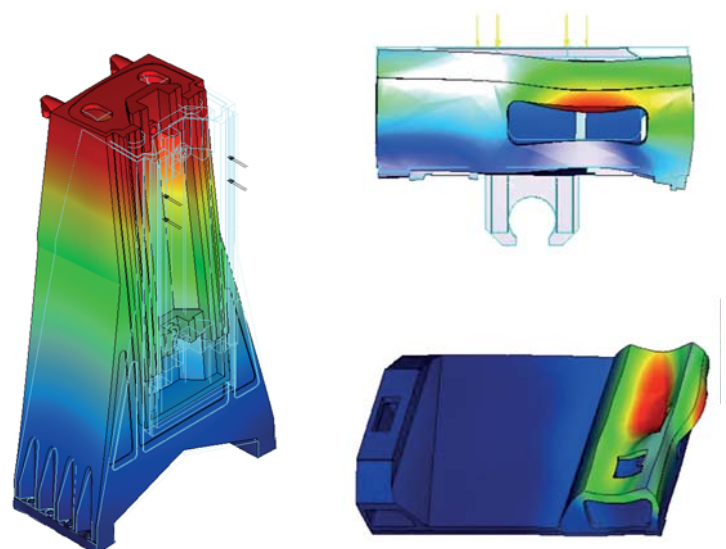
<b>Table size</b>	Ø320mm
<b>Workpiece dimensions</b>	Ø400 x H350mm
<b>Table load</b>	100kg
<b>Spindle motor</b>	15kW Fanuc
<b>Feedrate</b>	A axis - 25rpm C axis - 25rpm
<b>Spindle taper</b>	#40
<b>Linear rapid speed</b>	36/36/30 m/min
<b>Tool capacity</b>	30 tools



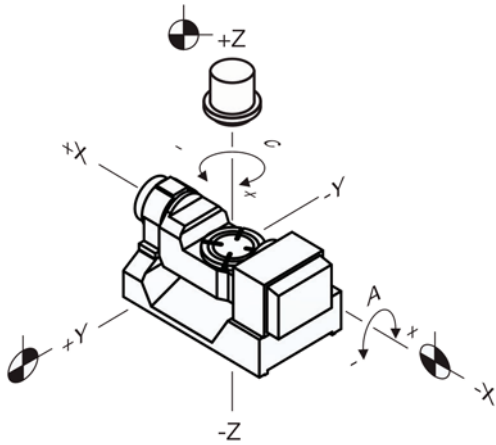
Machine shown with optional accessories

## Topology Analysis & Finite Element Method (FEM)

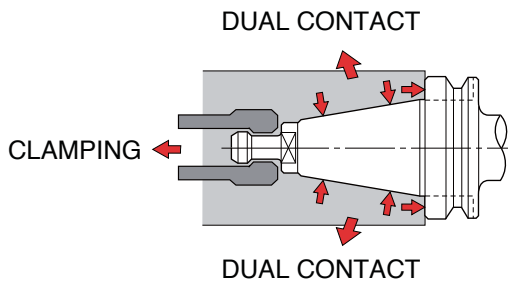
Simulation uses topology analysis & FEM methods to calculate the displacements and stresses in machine design due to operational loads such as: cutting forces and loading pressures, to ensure superior stability and rigidity



# Machine Structure



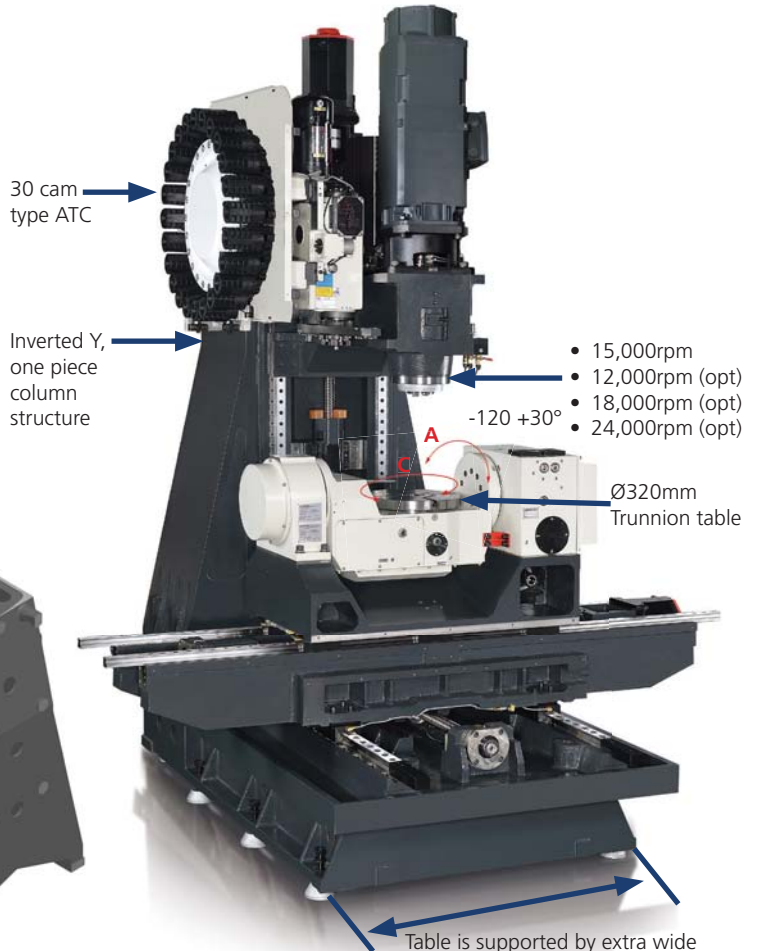
Axis arrangement ISO 841



BBT taper dual contact spindle



Inverted Y axis, one piece column structure

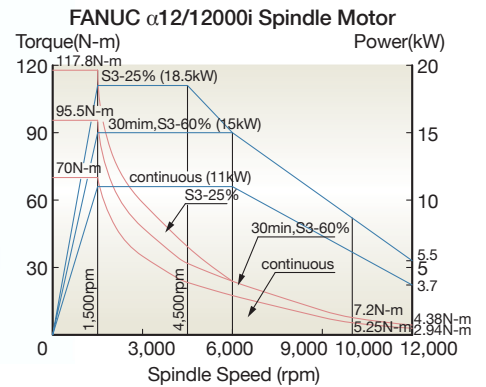


Machine shown with optional accessories

## Spindle

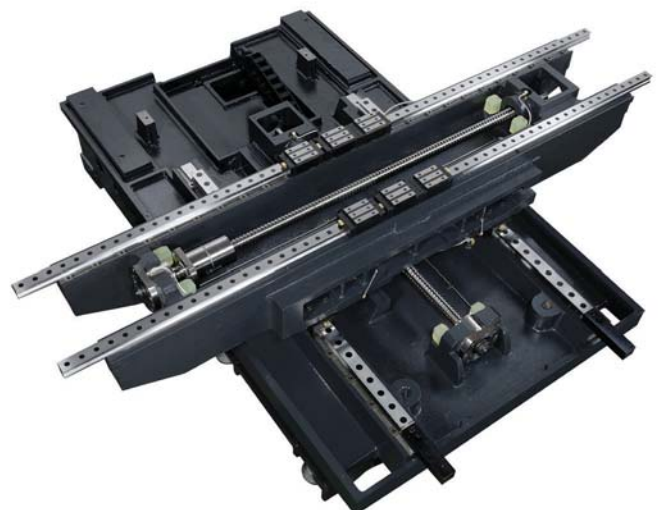
- Spindle design: Big-diameter BBT spindle design uses four-piece, P4 class, high precision, angular contact ball bearings to increase spindle rigidity and loading capacity and to maintain high accuracy during high-speed machining
- Direct spindle for low noise, vibration and thermal expansion

Spindle taper #40  
 Spindle speed 15,000rpm (12,000, 18,000, 24,000rpm opt)  
 Transmission type direct drive  
 Spindle dia 70mm



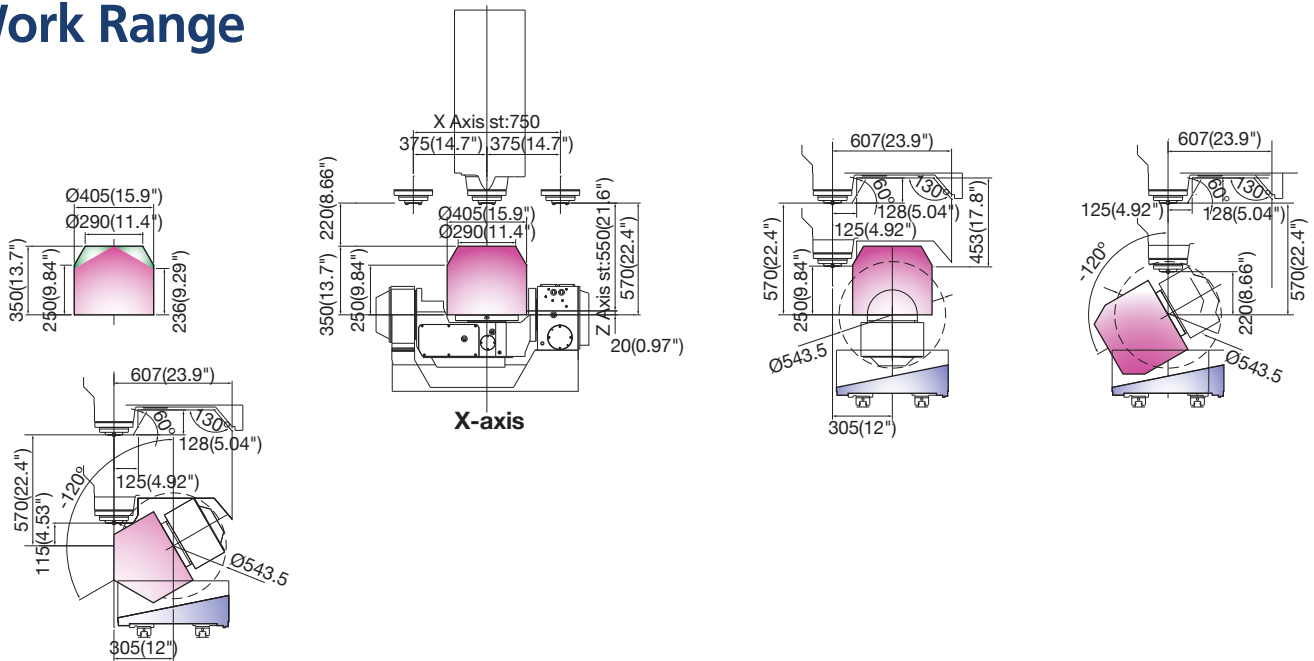
## Heavy Duty Roller Linear Ways

- Large Y axis travel gives more capacity for machining wider parts
- All linear axes are directly coupled with ballscrew and servo motor to reduce vibration and backlash
- Standard linear roller guide ways in all three axes





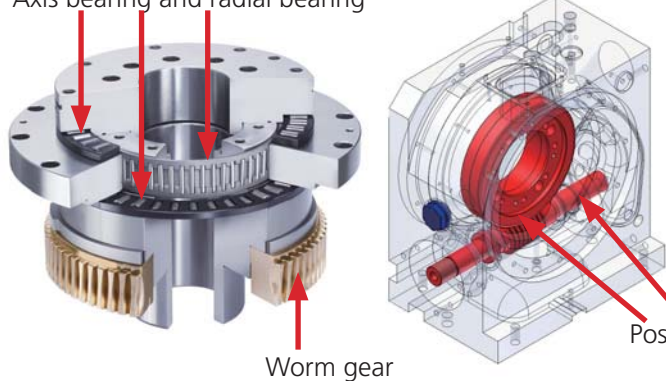
# Work Range



Workpiece Dimensions

## 2 Axis Rotary Table

A heavy duty 3 piece cross roller bearing provides excellent part loading and machining capability.  $\pm 10''$  angle encoder for A axis  
 Axis bearing and radial bearing



	A axis tilting	C axis rotation
Table load	100kg	100kg
Through hole	Ø50mm	Ø50mm
Indexing accuracy	12 secs	20 secs
Repeatability accuracy	5 secs	10 secs
Min input increment	0.001°	0.001°
Max table rotation speed	25rpm	25rpm
Clamping torque	140 kg-m	70 kg-m
Braking pressure (air source)	5 kgf/cm <sup>2</sup>	5 kgf/cm <sup>2</sup>

Positioning by worm and worm gear



## Tool Magazine System

- Tool shank #40
- Tool capacity 30 station (40 / 48 station opt)
- Max tool length 300mm
- Max tool weight 7kg
- Max tool diameter 76mm with adjacent tool  
125mm without adjacent tool
- Driven type Cam type



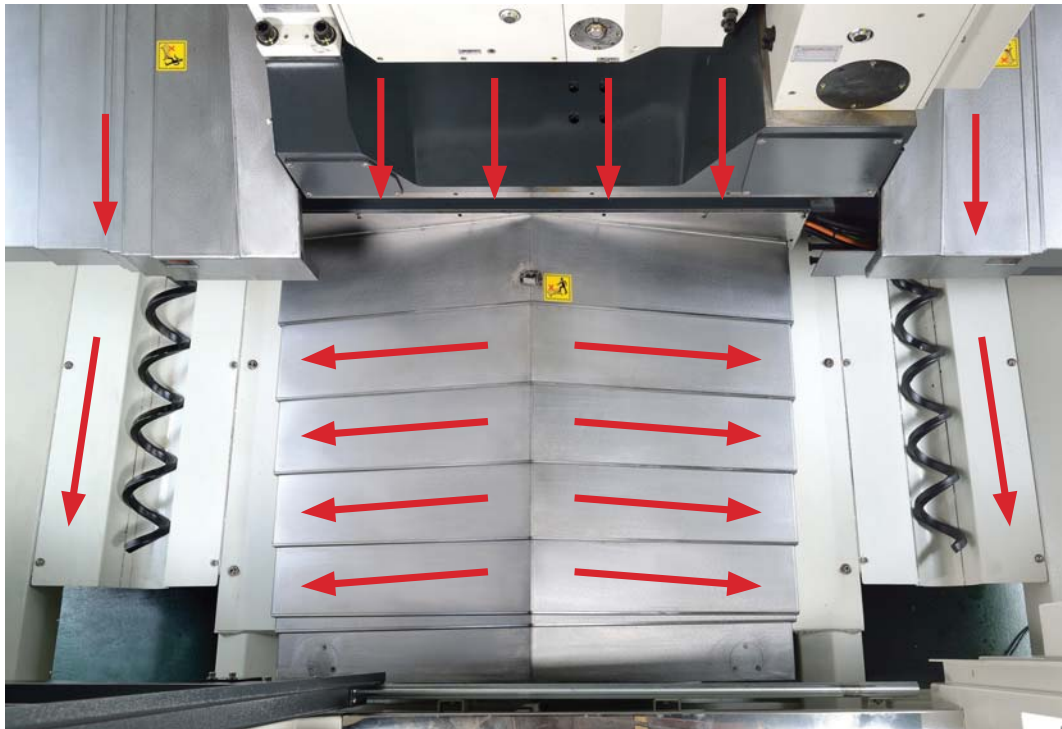
### Automatic Tool Changing System

- Tool change time 2.5 sec tool to tool  
4.3 sec chip to chip

Allowable Loading Capacity		100kg
		100kg
Allowable Work Movement		100Nm
Allowable Load (When Table Clamped)		16,000N
		700Nm
		1,400Nm

# Efficient Chip Disposal Design Built-In as Standard

Automatic chip flushing system brings cutting chips to the front of the machine base. Screw system takes cutting chips to the chip conveyor, which is located at the front of the machine base



## Application



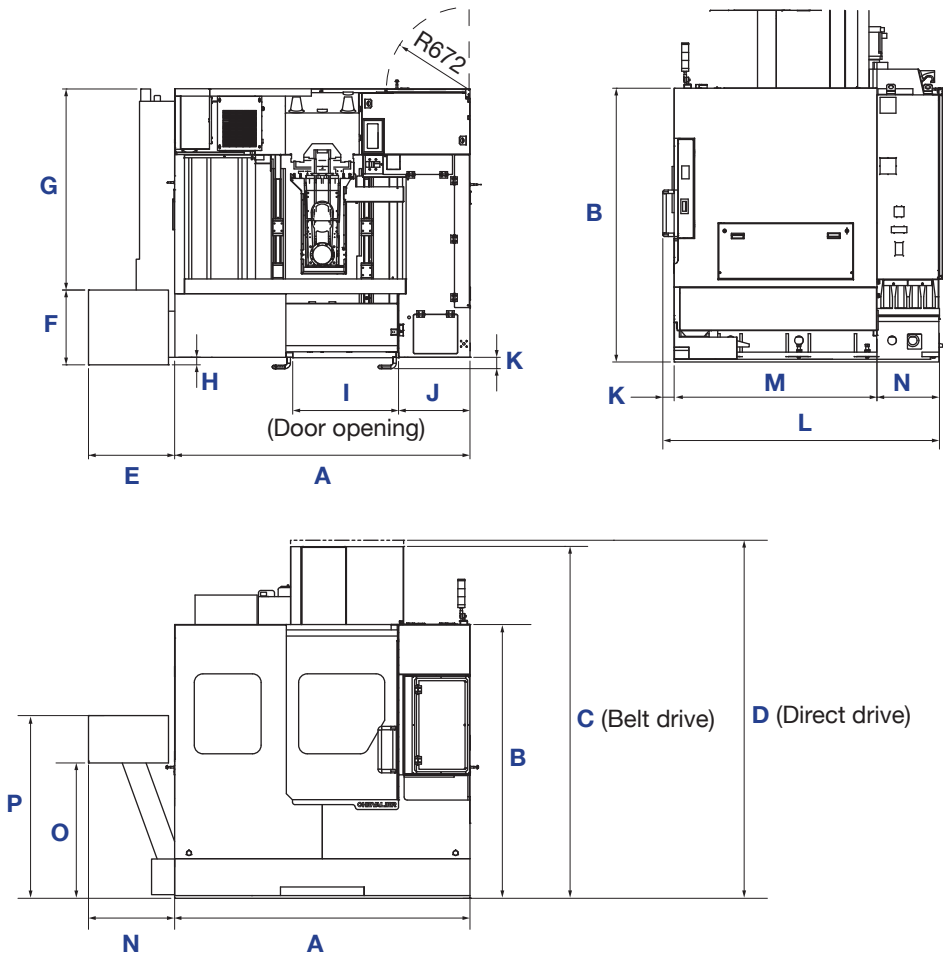
Name of the workpiece	Cutting material	Tool	Cutting Mode	Speed (rpm)	Feed rate (mm/min)	Total time
Standard part 102*102*45 (mm)	AL-6061	EDM D12	Rough	6000	1800	1:01:40
		DRILL D12	Rough	1800	80	
		EDM D10	Rough	6000	1200	
		EDM D10	Finish	4200	480	
		Chamfering D6	Finish	8000	600	



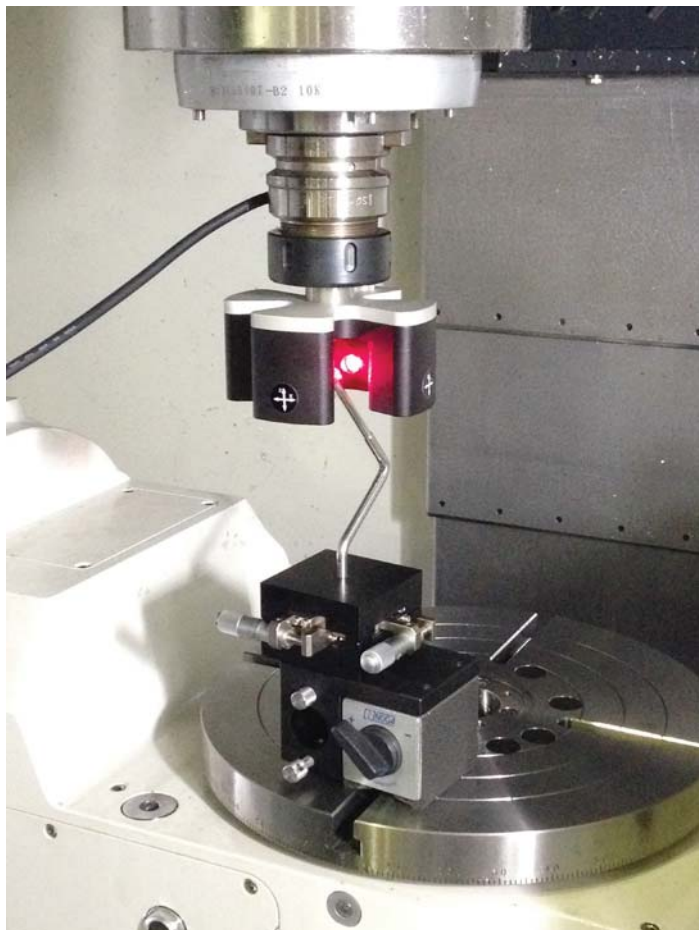
Name of the workpiece	Cutting material	Tool	Cutting Mode	Speed (rpm)	Feed rate (mm/min)	Total time
Honeycomb 100*100*40 (mm)	AL-6061	EDM D10	Rough	8000	2400	1:21:57
		DRILL D10	Rough	2000	80	
		EDM D4	Rough	8000	1200	
		EDM D4	Finish	10,000	1000	



# Dimensional Drawing



	Dugard X5-320
A	2400mm
B	2225mm
C	860mm
D	3020mm
E	700mm
F	608mm
G	1634mm
H	61mm
I	820mm
J	580.5mm
K	92mm
L	2248mm
M	1648mm
N	508mm
O	1100mm
P	1485mm



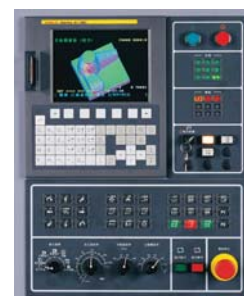
## Inspection

After assembling, all machines are measured and calibrated by laser calibration, ball bar testing and non bar dynamic accuracy measuring

### Optical type non bar five axis machine tool dynamic accuracy measurement and compensation system

This measurement technology includes measuring and compensating the static/dynamic backlash of the transmission axis can be compensated to 1µm, and the rotary axis static backlash error can be compensated to 0.001°. Thus the machining accuracy of the machine can be increased

## Choice of digital controls



### Fanuc OiMF Alpha Package

- 10.4" TFT LCD colour monitor
- Background edit
- Manual Guide i
- AICC with 200 block look ahead (opt)

Specification	Dugard X5-320
Fanuc OiMF control	
Working table size	Ø320mm
Workpiece dimensions	Ø400 x H350mm
Table load	100kg
X axis	750mm
Y axis	610mm
Z axis	550mm
Rapid speed	36 / 36 /30 m/min
Cutting feed rate	12 / 12 / 12 m/min
VDI3441 positioning	0.010mm
VDI3441 repeatability	0.007mm
A axis positioning	12 sec
C axis positioning (while with optional angle encoder)	20 sec
A axis repeatability	5 sec
C axis repeatability (while with optional angle encoder)	10 sec
A axis	+30°/-120°
C axis	360°
A/C axis rotation speed	25rpm
Spindle taper	BT40 (CAT opt)
Spindle power	10/14kW
Spindle speed	15,000rpm (12,000/18,000/24,000rpm opt)
Pull stud	MAS-P40T-1
Spindle centre to column	685mm
Spindle nose to table surface	20~520mm
Tool storage capacity	30 station ATC (40/48 station opt)
Max tool dia with adjacent tool	76mm
Max tool dia without adjacent tool	125mm
Max tool length	300mm
Max tool weight	7kg
Air source	5.5 kg/ cm <sup>2</sup>
Water tank capacity	570L
Total power consumption (approx)	25KVA
Floor space W x L x H	2450 x 2200 x 3020mm
Machine weight	7050kg

## Standard Equipment

- Direct drive spindle (15,000rpm)
- Spindle air seal
- Cutting blast
- Spindle oil chiller
- Fanuc OiMF control
- 10.4" TFT monitor
- User friendly control panel
- Remote MPG
- RS232/USB interface/Ethernet
- Fully enclosed guarding
- 3 axes telescopic cover
- 30+1 arm type ATC
- A axis angle encoder ( $\pm 10^\circ$ )
- Automatic way lubrication
- Pneumatic system
- Rear chip flush
- Electric cabinet power indication lamp
- Air gun
- LED work lamp
- 3 colour warning lamp
- Coolant system
- Tool box
- Operation manual
- Levelling bolts and pads
- High pressure through spindle coolant
- Internal dual-screw chip augers
- Lift-up chip conveyor
- Oil skimmer
- Water gun
- Transformer

## Machine Options

- Direct drive spindle (12,000, 18,000, 24,000rpm)
- 40,48 station chain type ATC
- 3 axes linear scales
- C axis angle encoder ( $\pm 5^\circ$ )
- Workpiece measurement system
- Tool length measurement
- Air conditioner for electric cabinet

\*Specifications are subject to change without prior notice

meeting all your requirements, each one features user-friendly operation, powerful functions and maximum reliability



### Siemens 828D

- 10.4" TFT LCD colour monitor
- Shopmill conversational programming
- Super high speed
- USB/PC card storage



### Heidenhain TNC 640

- 15" TFT LCD colour monitor
- 21GB NC programme memory
- Intelligent machining
- Fast USB 2.0 interface for increased connectivity



# **DUGARD** Machine Tools

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