

PBM Series

Smartcenter

Intelligent Precision Boring & Milling Machining Center

- Hartrol plus controller
- 5-year warranty on guideways
- Maximum cutting torque : 6494N-m(PBM-135)
- W-axis supported by two linear guideways
- B-axis repetitive positioning accuracy: ±8"



Hartrol Plus[®]
From tradition to intelligent



Website



Facebook



Hartford has sold more than 50,000 machines to all over the world, accumulated more than 37,000 customers, who absolutely affirm Hartford's manufacturing experience and ingenious machine manufacture technology. We insist on providing customers with the best quality machining centers. We will devote more carefully, in order to continuously enhance the technical level of manufacture and applications.

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Hartford

Hartrol · Smartcenter · Robocell

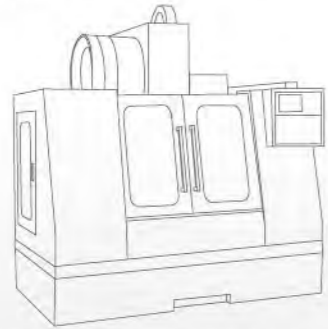
We manufacture intelligent machines only

What is Smartcenter?

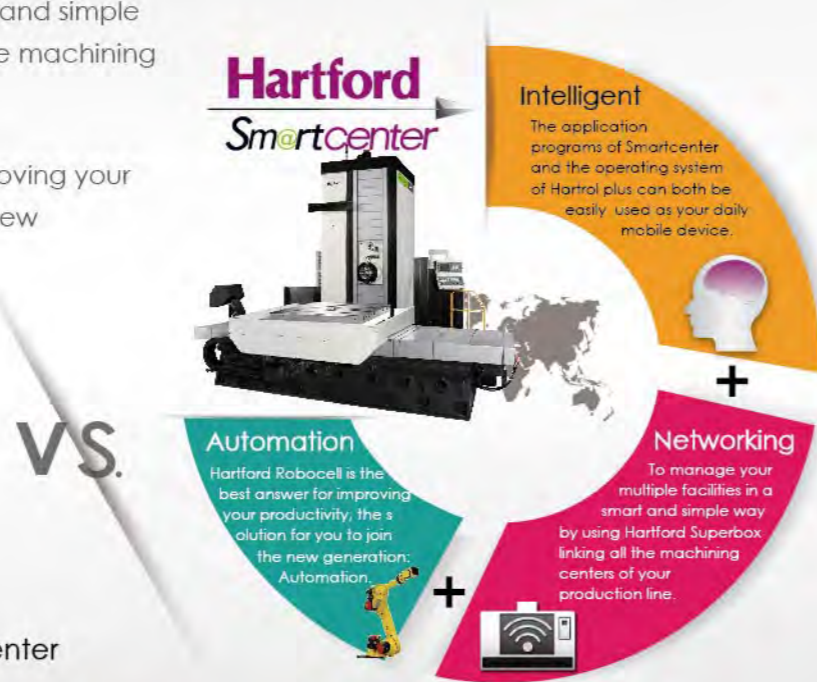
Optimized Cutting Efficiency

Smartcenter is Smart machining center. To put it simply, an intelligent machining center. HartfordSmartcenter has three major advantages:

- Intelligent :
 1. Intelligent operating interface / 2. Intelligent machining / 3. Intelligent quality control /
 4. Intelligent maintenance system, to help our customer reach the ultimate goal: Zero Down Time.
- Networking :
To manage your multiple facilities in a smart and simple way by using Hartford Superbox linking all the machining centers of your production line.
- Automation :
Hartford Robocell is the best answer for improving your productivity, the solution for you to join the new generation: Automation.



The regular standard machining center



Hartford Smartcenter will help you become an intelligent manager

The main technologies of Hartford smartcenter include intelligent managing system, status monitoring, alarm predicting, machine status diagnosis, crash preventing, 3D program simulation, machining efficiency improving...etc.. All the intelligent functions help you control the machine status and assure the job quality.

Hartford smartcenter APP

set and inspect	ZDT	Machining Programming Analysis	Machining Time Estimation	Machining Path Simulation	Utilization Statics	Machining Condition Computing	User connect
Spindle Loading Monitor	AFC	Message Board	MG.TN	Calculator	Online E-books	File Transfer	Account Management
Spindle Bearing Diagnosis	HartCAM	CCD	Automatic Door	Broken Tool Detection System	Integrated Information Monitor Screen	7-24h Service	7-24h Service
Spindle Collision Protection G Sensor	CTS Leakage Detect	i-Factory	Idling Stop	Remote Desk Connection			

The functions mentioned above will need to option the Hartrol plus controller or Dual screen with Fanuc controller.

The optimized cutting efficiency and capability of Hartford Precision Boring is your best partner.



1. Component of wind power generation



2. Vertical machine head

Actual Cutting Test

Model: PBM-135

- Spindle: 2,500 rpm Gear type, 26kW
- Cutting material : S45C



Face milling

Tool diameter	Ø160 mm
Feed rate	2,550 mm/min
Cutting depth	2.5 mm
Cutting width	120 mm
Spindle speed	500 rpm
Cutting volume	765 cc/min



Tapping

Tool diameter	M42 x P4.5mm
Feed rate	315 mm/min
Cutting depth	60 mm



Drilling

Tool diameter	Ø76 mm
Feed rate	120mm/min
Cutting depth	30 mm

All the test results featured in this catalogue were produced under strict testing condition in a special zed testing environment. Under different testing conditions and in less than ideal testing environments, that the test results may vary from those shown in this catalogue.

Tough, rugged and durable for MVP

With the extra rigid structure design, the Hartford PBM series precision boring milling machine features greater durability, stability and accuracy.

The picture shows PBM-135



Oversized column design (PBM-135)

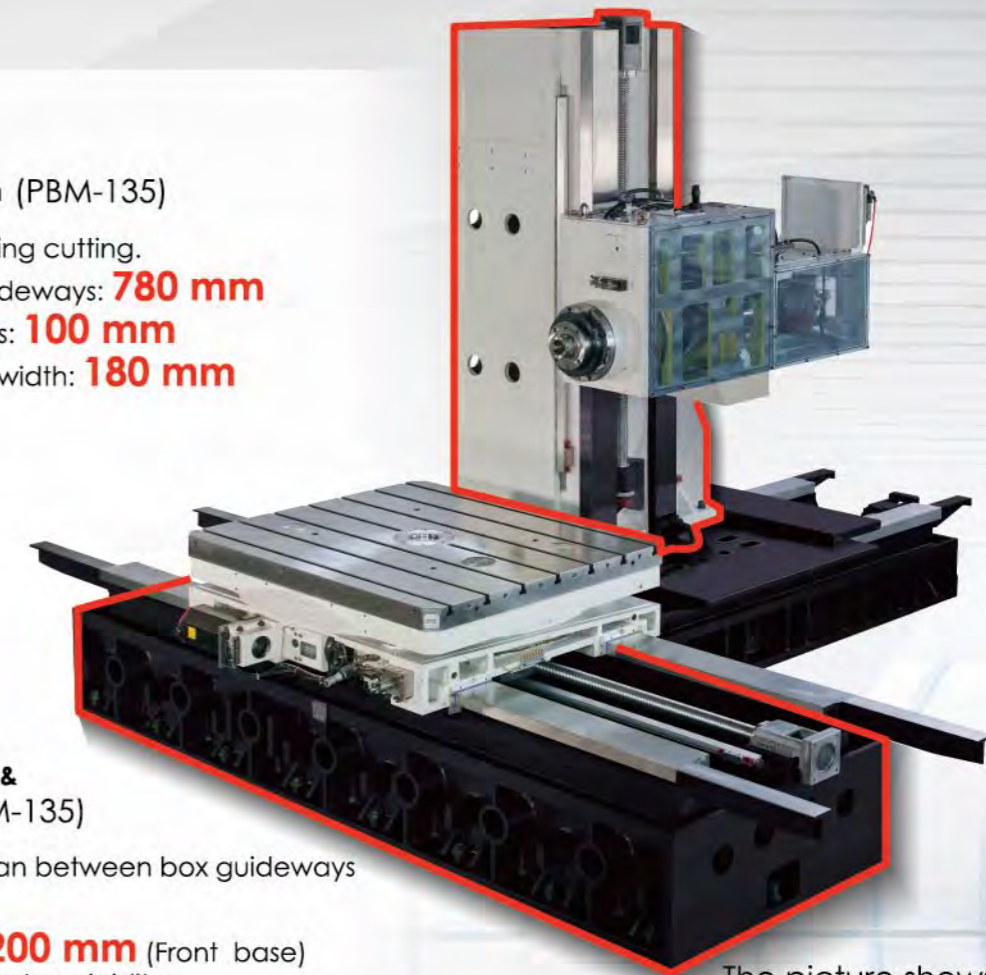
- For greater stability during cutting.
- Span between box guideways: **780 mm**
- Box guideway thickness: **100 mm**
- Box guideway surface width: **180 mm**

Specially design on front & rear base structure (PBM-135)

- Widen base design, span between box guideways **1080 mm**,
box guideway width: **200 mm** (Front base)
- Increased machine structure rigidity.
- Span between box guideway: **1140 mm**,
box guideway width: **250 mm** (Rear base)

X/Y/Z direct-connected drive system

- X & Z axis are designed with planetary reducer enhance the overall axial drive torque.
- Y axis is direct-connect drive delivers high speed and less noise.



The picture shows PBM-115



Full range of box guideway five-year warranty

Warranty coverage will not apply under the following conditions,

- 1.Improper operation (collision)
- 2.Lack of regular cleaning of accumulated debris causing damaged to the linear rails & carriages.

High Rigidity & High Accuracy Spindle

Heavy duty precision spindle

- The spindle supported by D4 class bearings guarantee superior dynamic running accuracy.
- Bearings & gear box are designed with cooling lubrication system so that spindle thermal problem can be reduced and prolong lifespan of parts.
- PBM-115 Spindle diameter: ϕ 110mm
- PBM-135 Spindle diameter: ϕ 130 mm
- PBM-115 W-axis travel: 500 mm
- PBM-135 W-axis travel: 700 mm



W-axis supported by two linear guideways

- Increases the supported rigidity of W-axis.
- Increase the accuracy of W-axis.
- Delivers greater supporting capacity.



Gear-driven spindle

- The spindle is driven by gear box.
- Allowing for 4-step speed change delivers higher torque output and durability.
- Spindle torque is **6494N-m** (PBM-135)



High rigidity spindle stock

- The spindle stock is a high rigid box type construction.
- Ensures maximum stability during boring cutting.

A Variety of Accessories

Universal head

- Spindle taper: #50
- Max. tool diameter: ϕ 200
- Tool clamping: Manual
- Max. power: 55 kW
- Max. speed: 1000 rpm
- Indexing method: Manual



90 degree head

- Spindle taper: #50
- Max. tool diameter: ϕ 200
- Tool clamping: Manual
- Max. power: 55 kW
- Max. speed: 1000 rpm
- Indexing method: Manual



90 degree extension

- Spindle taper: #50
- Max. tool diameter: ϕ 150
- Tool clamping: Manual
- Max. power: 38 kW
- Max. speed: 1000 rpm
- Indexing method: Manual



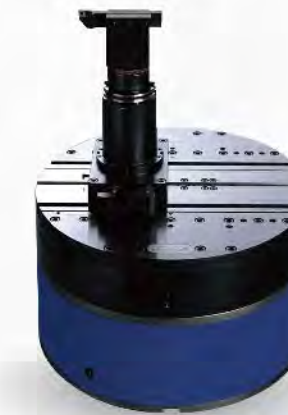
Quill support

- Spec.:
- 300L (PBM-115)
- 300L (PBM-135)
- 500L (PBM-135)
- Max. speed: 1500 rpm



U-axis head(UT-360S)

- Travel: 120 mm
- Feedrate: 400 mm
- Max. speed: 500 rpm
- Torque: 400 N-m
- Weight: 130 kg



Angle plate

- With standard fixtures provide customer a requirement fixtures on machining.



Intelligent Controller- Hartrol Plus


What is Hartrol Plus?

Hartrol plus is a brand new intelligent controller Hartrol , Hartnet and Hartford electrical function together which developed and made by Hartford.

HMI and operation is user friendly, it can achieve :

1. Internet connection, collect and analyze data, monitoring by portable device
2. Intelligent control: Auto revise human error and operating basis
3. Real time update new APPs

The difference between Hartrol plus and others

Function	Hartrol Plus P1 	Others
Screen Size	19"Multi-touch Panel	10.4" (OPT:15")
Look Ahead Block	2700(G5P20000)	400(1000 Max.)
Hard Drive	32GB SSD	NO
Smoothing Interpolation	SSS 4G	Option
Industry 4.0	Hartford UserConnect	NO



Hartrol Plus 5 Major intelligent Functions

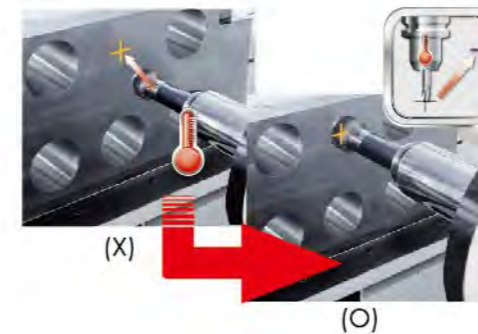
The integrated intelligent functions of Hartrol plus could achieve your machining requirements. For more Hartrol Plus functions, please contact our sales person.



Hartrol plus Multi-information monitor

Integrated multi-information screen makes your machining much more convenient.

- 1 3 axes Feed rate
- 2 Spindle speed / Tool number / Spindle speed override
- 3 Feed rate Feed rate Override
- 4 Job Machining remaining time / Batch Machining remaining time.




Thermal compensation on spindle(opt.)

No worries about HEAT!!

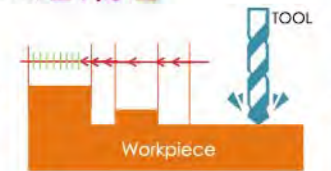
- Machine with compensation
 - #40 spindle thermal extension is within 0.03mm
 - #50 spindle thermal extension is within 0.02mm
 - Machine without compensation
 - Spindle thermal extension is around 0.10mm
- Notes: Above test is under room temperature



AFC(opt.)

Machining efficiency is increased by 21% 

- Controls the feed rate depending on the machining situation
- Adjusting feed rate automatically
 - Lengthen your tool life
 - Reduce machining time



The Intelligent Controller You Should Have

With three major solutions, Hartrol Plus takes you machining to the next level.

Highly optimized and intelligent controls bring even more capabilities and productivity to your metal cutting processes.

With ease use, advanced automation, and smart data collection, Hartrol plus is essential tool for enhancing performance on your production floor.

Intelligent Support

Cost down to 20%

- Multi Touch Screen
- CCD remote management
- E-book
- Remote Management
- Cutting Condition Calculator
- Stand-by Mode

Hartrol Plus

Intelligent Functions

Productivity increased 23%

- HartCAM
- AFC= Automatic Feedrate Control.
- SSS-4G
- Machining Time Countdown for Single Block
- Optimized Machining Program
- Automatic measurement

Intelligent Design

Efficiency increased 20%

- MES(Manufacturing Execution System)
- Machine Utilization Management
- Operator Performance Management
- 24 Hours a Day Management
- Remote Management
- Hartford Userconnect

Hartford UserConnect



- Alert Notification
- Remote Diagnoses
- Remote Value Enhancement
- Remote Monitoring & Management



Set & Inspect(opt.)

Graphical user interfaces for part setting, inspection, tool setting

- Ease of use
- Increasing usability
- Eliminating manual set-up tasks
- Increasing efficiency



Hartford ZDT

Eliminate machine down time and increase efficiency. ZDT—

- 1.Ease of use
- 2.Check parts status clearly
- 3.Eliminating unexpected down time
- 4.Instand notification to your machine and your protable device

Spindle Torques

Machine Dimension

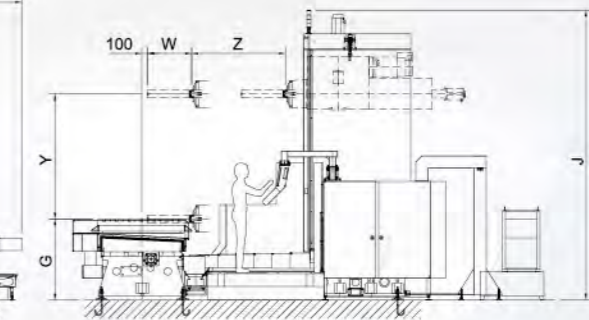
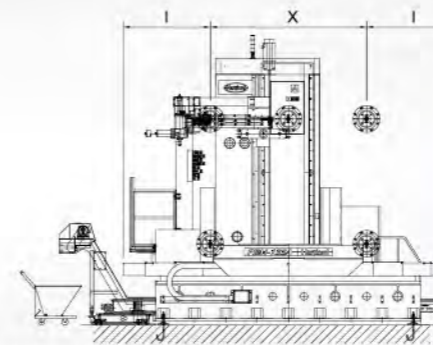
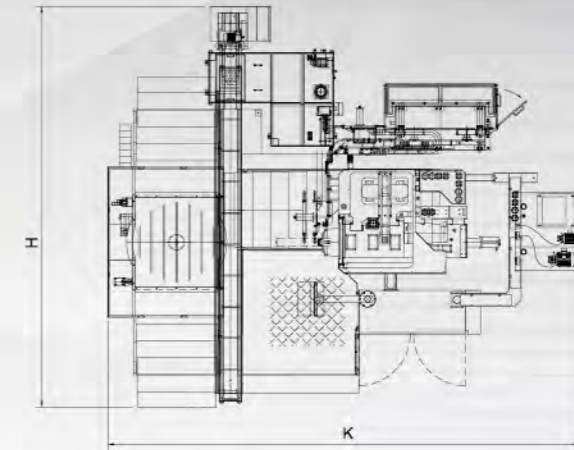
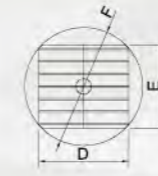
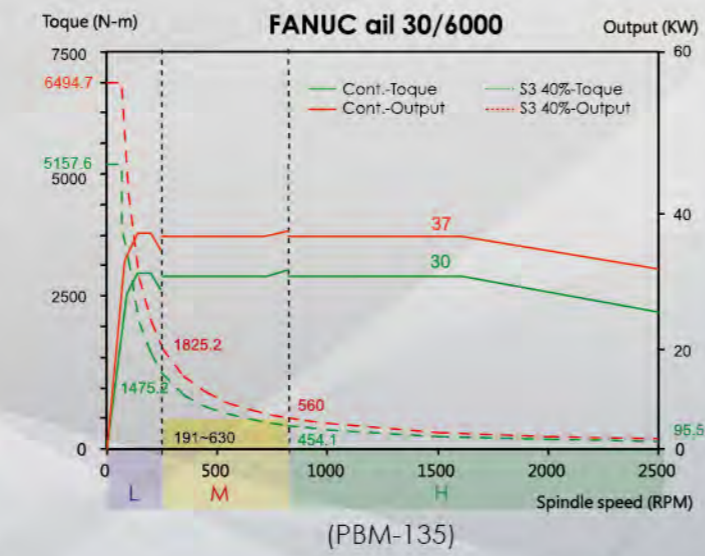
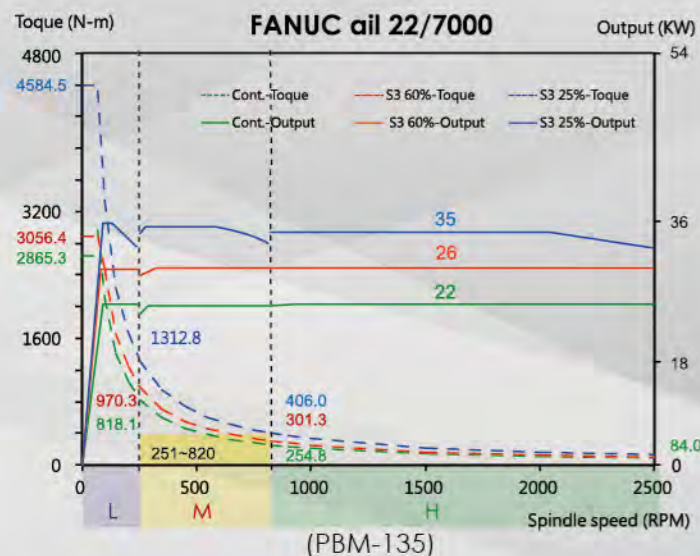
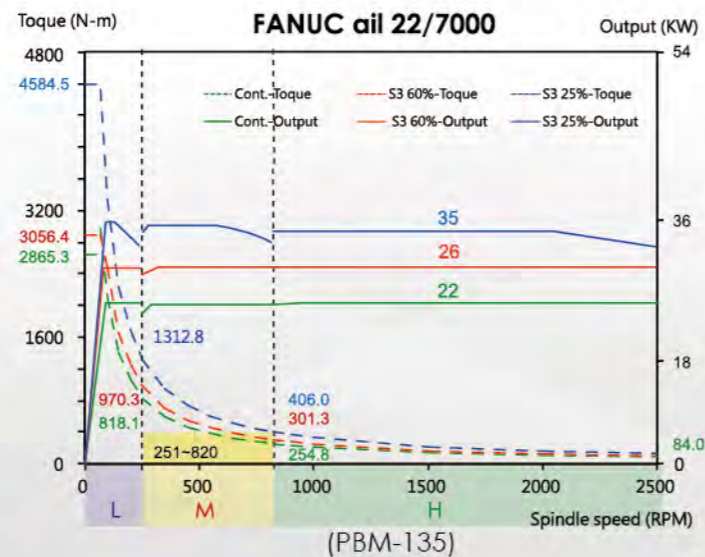
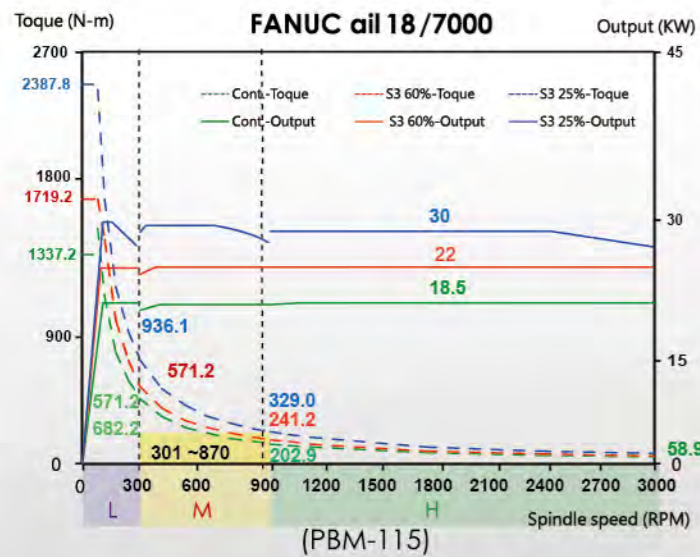
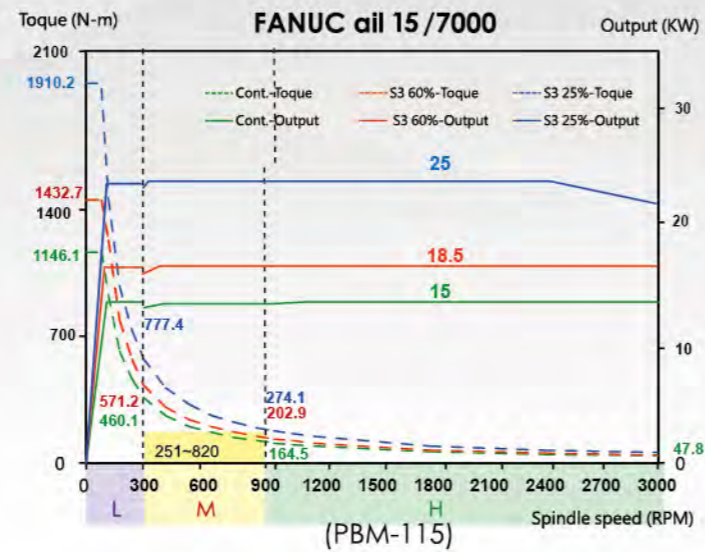
Spindle torques diagram

- #50 gear type spindle 2500 rpm(PBM-135)
- #50 gear type spindle 3000 rpm(PBM-115)

BBT option

- Dual contact between the contact and the flanges.
- Improves the rigidity, accuracy, speed and performance.
- Radial deflection, vibration and deviation are significantly reduced.

Note: Spindle max. speed is unavailable for long-term running



(Picture shown without gurarng)

Unit:mm

Model	X X-axis travel	Y Y-axis travel	Z Z-axis travel	W W-axis travel	D Length of table	E Length of table
PBM-115A	2000	1600	1500	500	1600	1400
PBM-135A, X=2.5M	2500	2000 (2500 opt.)	1500 (2000 opt.)	700	1600	1400
PBM-135B, X=2.5M	2500	2000 (2500 opt.)	1500 (2000 opt.)	700	1800	1600
PBM-135A, X=3M	3000	2000 (2500 opt.)	1500 (2000 opt.)	700	1600	1400
PBM-135B, X=3M	3000	2000 (2500 opt.)	1500 (2000 opt.)	700	1800	1600
PBM-135A, X=4M	4000	2000 (2500 opt.)	1500 (2000 opt.)	700	1600	1400
PBM-135B, X=4M	4000	2000 (2500 opt.)	1500 (2000 opt.)	700	1800	1600
PBM-135P2	2000	2000 (2500 opt.)	1500 (2000 opt.)	700	2000	1500
PBM-135P3	3000	2000 (2500 opt.)	1500 (2000 opt.)	700	3000	1500

Unit:mm

Model	F Max.table size	G Distance from floor to table	H Width of machine (including frame)	I Distance from spindle to frame	J Height of machine	K Height of machine
PBM-115A	∅2400 x 1600H	1300	5463	1493	4188	7256
PBM-135A, X=2.5M	∅2400 x 2000H	1400	6417	1493	4740(5240 opt.)	7635(8135 opt.)
PBM-135B, X=2.5M	∅2400 x 2000H	1400	6417	1493	4740(5240 opt.)	7635(8135 opt.)
PBM-135A, X=3M	∅3000 x 2000H	1400	7417	1770	4740(5240 opt.)	7635(8135 opt.)
PBM-135B, X=3M	∅3000 x 2000H	1400	7417	1770	4740(5240 opt.)	7635(8135 opt.)
PBM-135A, X=4M	∅3500 x 2000H	1400	8417	1846	4740(5240 opt.)	7635(8135 opt.)
PBM-135B, X=4M	∅3500 x 2000H	1400	8417	1846	4740(5240 opt.)	7635(8135 opt.)
PBM-135P2	2000L x 1500W	1150	6417	1743	4740(5240 opt.)	7615(8115 opt.)
PBM-135P3	3000L x 1500W	1150	8410	2343	4740(5240 opt.)	7615(8115 opt.)

Inspection Results

Straightness of table (X-axis) moves in R&L direction

Inspection item	Hartford PBM
R&L direction (vertical surface)	0.03 / 1000 mm
Forward & backward direction (vertical surface)	0.03 / 1000 mm

Spindle hole runout

Inspection item	HartfordPBM
Fixed side(20mm)	0.015 / 20 mm
At 300mm of testbar	0.025 / 300mm

Positioning & repetitive accuracy of linear movement (PBM-135A)

Inspection item	Positioning accuracy	Repetitive accuracy
X / Y / Z -axis	±0.010/ Full travel	±0.006/ Full travel
W -axis	±0.010/ Full travel	±0.005/ Full travel

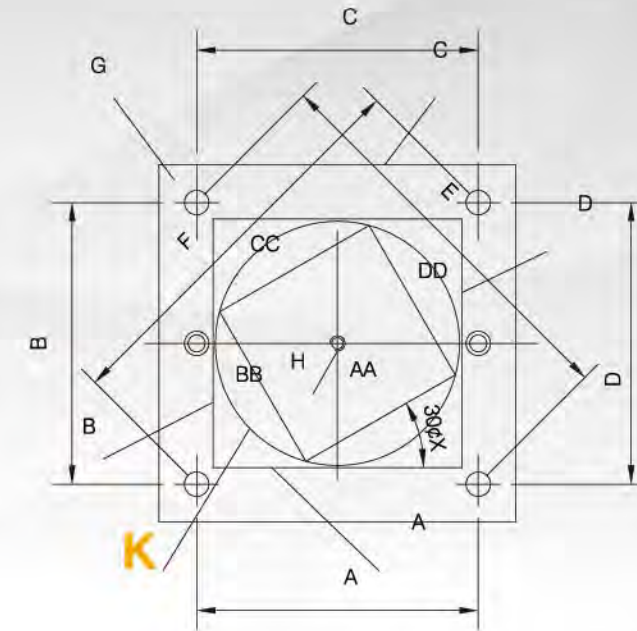
Positioning & repetitive accuracy of linear movement with linear scale (PBM-135A)

Inspection item	Positioning accuracy	Repetitive accuracy
X / Y / Z -axis	±0.007/ Full travel	±0.003/ Full travel
W -axis	±0.010/ Full travel	±0.005/ Full travel

Boring accuracy report: 0°-180° boring (PBM-135A)

Inspection item	JIS standard	Measured value
X -axis deviation	0.06 / 1000 mm	0.03
Z -axis deviation	0.06 / 1000mm	0.03

2D



	Inspection item	Tolerance	Test result	Remarks
Boring positioning accuracy	Positioning accuracy A (300mm)	0.025	0.0078	(⊕)
	Positioning accuracy B (300mm)	0.025	0.0062	(⊕)
	Positioning accuracy C (300mm)	0.025	0.0076	(⊕)
	Positioning accuracy D (300mm)	0.025	0.0056	(⊕)
	Positioning accuracy E (300mm)	0.035	0.0057	(⊕)
	Positioning accuracy F	0.035	0.0134	(⊕)
Circular cutting	Roundness K	0.04	0.0096	(○)
	Straightness A	0.015	0.0047	(—)
	Straightness B	0.015	0.0052	(—)
	Straightness C	0.015	0.0055	(—)
	Straightness D	0.015	0.0046	(—)
Side milling accuracy	Squareness A&B	0.03	0.0140	(⊥)
	Squareness B&C	0.03	0.0146	(⊥)
	Squareness C&D	0.03	0.0148	(⊥)
	Squareness D&A	0.03	0.0141	(⊥)
	Parallelism A&C	0.03	0.0122	(//)
	Parallelism B&D	0.03	0.0112	(//)
Linear interpolation end milling accuracy	Straightness AA	0.02	0.0020	(—)
	Straightness BB	0.02	0.0044	(—)
	Straightness CC	0.02	0.0027	(—)
	Straightness DD	0.02	0.0021	(—)
	Squareness AA & BB	0.04	0.0028	(⊥)
	Squareness BB & CC	0.04	0.0048	(⊥)
	Squareness CC & DD	0.04	0.0056	(⊥)
	Squareness DD & AA	0.04	0.0058	(⊥)
	Parallelism AA & CC	0.04	0.0050	(//)
	Parallelism BB & DD	0.004	0.0060	(//)

Inspection accuracy on each machine may vary with accessories and cutting conditions

Machine Specifications

Model	Unit	PBM-115 A	PBM-135 A/B	PBM-135 A/B	PBM-135 A/B	PBM-135P2	PBM-135P3
Table			(X=2.5M)Standard	(X=3M)	(X=4M)	Plane table type	Plane table type
Working surface	mm	1400x1600(A)	1400x1600 (A) / 1600x1800 (B)	1400x1600 (A) / 1600x1800 (B)	1400x1600 (A) / 1600x1800 (B)	1500x2000	1500x3000
T-slot(Size×Number×Pitch)	mm	22x7x220(A)	22x7x200 (A) / 22x7x225 (B)	22x7x200 (A) / 22x7x225 (B)	22x7x200 (A) / 22x7x225 (B)	22x200x7	22x200x7
Max. table load	Kg	8000(A)	8000(A) / 12000(B)	8000 (A) / 12000 (B)	8000 (A) / 12000 (B)	10000	12000
Min. indexing degree	deg.	0.001	0.001	0.001	0.001	-	-
Max. rpm	rpm	2	2	2	2	-	-
Max. rotating range	mm	2400	2400	3000	3000	-	-
Travel							
Longitudinal travel (X-axis)	mm	2000	2500	3000	4000	2000	3000
Cross travel (Y-axis)	mm	1600	2000 (2500 opt.)	2000 (2500 opt.)	2000 (2500 opt.)	2000 (2500 opt.)	2000 (2500 opt.)
Vertical travel (Z-axis)	mm	1500	1500 (2000 opt.)	1500 (2000 opt.)	1500 (2000 opt.)	1500 (2000 opt.)	1500 (2000 opt.)
W-axis travel	mm	500	700	700	700	700	700
Spindle							
Spindle diameter	mm	110	130	130	130	130	130
Spindle sleeve	mm	225	245	245	245	245	245
Spindle nose taper		#50	#50	#50	#50	#50	#50
Spindle speed (Gear type)	rpm	3000	2500	2500	2500	2500	2500
Feed							
Cutting feed rate (X · Y · Z axis)	m/min	6/6/6	5/5/5	5/5/5	5/5/5	5/5/5	5/5/5
Rapid traverse (X · Y · Z axis)	m/min	12/12/12	10/10/10	10/10/10	10/10/10	10/10/10	10/10/10
Rapid traverse (W-axis)	m/min	6	6	6	6	6	6
Motor							
Spindle motor(Fanuc)	kw	18.5 (22/26 opt.)	26(37 opt.)	26(37 opt.)	26(37 opt.)	26(37 opt.)	26(37 opt.)
ATC							
Tool storage capacity	Pcs	32 (60 opt.)	40 (60 opt.)	40 (60 opt.)	40 (60 opt.)	40 (60 opt.)	40 (60 opt.)
Max. tool weight	Kg	25	25	25	25	25	25
Max. tool size (diameter×length)	mm	125x400	125x400	125x400	125x400	125x400	125x400
Max. adjacent tool size(dia.x length)	mm	250x400	250x400	250x400	250x400	250x400	250x400
Positioning Accuracy							
3 axes laser positioning accuracy (JIS B6330)							
Positioning accuracy/Full travel	mm	±0.008	±0.008	±0.010	±0.010	±0.008	±0.010
Repetitive positioning accuracy	mm	±0.003	±0.003	±0.003	±0.003	±0.003	±0.003
3 axes laser positioning accuracy (VDI 3441)/Repeated 5 times							
Positioning accuracy	mm	0.015	0.015	0.015	0.015	0.015	0.015
Repetitive positioning accuracy	mm	0.012	0.012	0.013	0.013	0.013	0.013
VDI3441 accuracy available upon order request							
Other							
Coolant Capacity (L)	L	310	310	310	310	310	310
Required Air Pressure	kg/cm ²	6.5	6.5	6.5	6.5	6.5	6.5
Electric power consumption	KVA	65	65	65	65	65	65
Machine dimension	mm	6800x8250(CTS:7000x10000)	7370x8550(CTS:8080x10340)	8370x8550	9370 x 8550	7370x8550	9370x8550
Machine Weight	kg	25000/27000	30000/32000	32000/34000/35000	34000/36000/37000	30000	34000

Standard & Optional Electrical Functions

Standard-Mechanical

- B-axis 0.001°
- Fluorescent lamp x1 (full-enclosed)
- RS-232 interface
- Spindle oil cooler
- Tool ARM Type Tool Magazine_40 pcs
- Automatic Power OFF
- 2500 rpm gear type spindle (PBM-135)
- Work finish lamp
- Air blast through spindle
- MPG
- Lubrication system
- Convection Heat Exchanger In Control Box

- X, Y, Z-axis linear scale system(FAGOR)
- B-axis linear scale system (Heidenhain)
- Mist coolant system
- Table side air blast

Optional-Mechanical

- Full-enclosed splash guard (For CTS)
- Coolant through system
- Full-enclosed splash guard
- Universal milling head
- 90 degree milling head

Optional-Mechanical

- 90 degree extension head
- Coolant system
- Shaft Support Block
- Portable chip bucket
- Link type chip conveyor
- Auto. tool probe
- Foot Switch for spindle Clamp/Unclamp
- Air gun
- Wash down hose
- Oil skimmer
- X, Y, Z-axis linear scale system(Heidenhain)

Electrical

Hartrol (Standard)

- Workpiece calibration by MPG directly
- Parameter package
- Tool magazine display(Oi&31i only)
- Tool status display
- Utilization rate of machining
- Machining time countdown
- B-axis workpiece calibration (manually)

Hartnet (Optional)

- Management system of utilization
- Machining time countdown
- Convenient file transfer

Electrical (Optional)

- Lifting function against gravity
- Retraction for rigid tapping
- Intelligent MPG