

JIS

JAPANESE INDUSTRIAL STANDARD

**Test Code for Performance and
Accuracy of Horizontal Boring
Machines (Floor Type)**

JIS B 6222—1985

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Test Code for Performance and Accuracy of Horizontal Boring Machine (Floor Type) B 6222-1985

1. Scope

This Japanese Industrial Standard specifies the test method and accuracy inspection regarding the operational performance of the horizontal boring machine (floor type).

- Remarks 1. Regarding the front, rear, right and left of machine, take the side with the spindle head facing to the column as the front of machine and the right side facing to the machine as the right of machine.
2. The units and numerical values given in { } in this standard are in accordance with the system of gravimetric unit and are appended for reference.

2. Running Test Methods

2.1 Functional Test The functional test of the horizontal boring machine (floor type) shall be in accordance with Table 1.

Applicable Standards:

JIS B 4105-Single Point Tools with Cemented Carbide Tips
JIS B 6003-Methods of Vibration Testing for Machine Tools
JIS B 6004-Method of Sound Level Measurement for Machine Tools
JIS B 6014-General Code of Safety for Machine Tools
JIS B 6201-Test Code for Performance and Accuracy of Machine Tools
JIS G 5501-Gray Iron Castings

Corresponding International Standard:

ISO 3070/II-Test conditions for boring and milling machines with horizontal spindle - Testing of the accuracy - Part II: Floor type machines

Reference Standards:

JIS B 7513-Precision Surface Plates
JIS G 3101-Rolled Steel for General Structure
JIS G 4051-Carbon Steels for Machine Structural Use

Table 1

Number	Test item	Test method	Reference The corresponding number of 3.2 of JIS B 6201
1	Starting, stopping and running operation of the main spindle and milling spindle ⁽¹⁾	Perform the starting and stopping [including the inching ⁽²⁾ and braking ⁽²⁾] at an adequate speed of main spindle for normal rotation and reverse rotation about 10 times continuously to test the smoothness and reliability of actuation.	1-11
2	Speed change operation of the main spindle and milling spindle ⁽¹⁾	Change the speed of main spindle concerning all marked speeds (in the case of stepless speed change, three speeds of the minimum, intermediate and maximum) to test the smoothness of actuation and the certainty of indication of the apparatus to be operated.	1-12
3	Starting, stopping and running operation ⁽²⁾ of the feed	Perform the starting and stopping [including the braking ⁽²⁾] at an adequate feed speed [or feed rate ⁽⁵⁾] for each of the main spindle, spindle head ⁽³⁾ and column ⁽⁴⁾ about five times continuously to test the smoothness and certainty of actuation.	1-21
4	Change operation ⁽²⁾ of the feed speed [or feed rate ⁽⁵⁾]	Change the feed speed [or feed rate ⁽⁵⁾] for three feeds of the lowest ⁽⁶⁾ , intermediate and highest ⁽⁶⁾ , and the quick feed ⁽²⁾ of each marking of the main spindle, spindle head ⁽³⁾ and column ⁽⁴⁾ and test the smoothness of actuation and the certainty of indication.	1-22 1-23
5	Hand feed operation ⁽²⁾	Move each of the main spindle, spindle head ⁽³⁾ and column ⁽⁴⁾ by hand feed and test the smoothness and uniformity of actuation extending the overall length of movement. Furthermore, test the reliability of the function of micrometer collar ⁽²⁾ .	1-27

Table 1 (Continued)

Number	Test item	Test method	Reference The correspond- ing number of 3.2 of JIS B 6201
6	Switching operation of the hand feed ⁽²⁾ , mechanical feed and quick feed	Test the smoothness and reliability of the switching of hand feed ⁽²⁾ , mechanical feed and quick feed for each of the main spindle, spindle head ⁽³⁾ and column ⁽⁴⁾ .	1-27 1-31
7	Operation ⁽²⁾ of automatic stop gear	Test the smoothness and reliability of the setting and actuation of the command position of the automatic stop gear for each of the main spindle, spindle head ⁽³⁾ and column ⁽⁴⁾ .	1-32
8	Clamping operation ⁽²⁾	Test the reliability and smoothness of the clamping operation at an arbitrary position of each movement of each clamping mechanism of the main spindle, spindle head ⁽³⁾ and column ⁽⁴⁾ .	1-33
9	Attaching and detaching ⁽⁷⁾ operation of tool	Test the reliability and smoothness of the attaching and detaching operations of tool.	1-41
10	Electric apparatus	Test the state of insulation one time respectively before and after the running test.	1-51
11	Safety device (including the emergency stop)	Test the safety for operators and the reliability of machine protecting function. [see JIS B 6014]	1-52
12	Lubrication device	Test the reliability of function of oil tightness, appropriate distribution of oil quantity and the like.	1-53
13	Oil hydraulic device ⁽²⁾	Test the reliability of function of oil tightness, pressure adjustment and the like.	1-54

Table 1 (Continued)

Number	Test item	Test method	Reference The correspond- ing number of 3.2 of JIS B 6201
14	Position reading device	Test the reliability of function.	1-55
15	Accessories	Test the reliability of function.	1-55

Notes (1) Test the machine driving separately from the main spindle.

(2) Test the machine having this function.

(3) Including the up-and downward (direction of Y axis) movement, right and left (direction of Z axis) movement of main spindle and the right and left (direction of Z axis) movements of quill or ram.

(4) Including the for-and backward (direction of X axis) movement and the right and left (direction of Z axis) movement of column.

(5) Test the machine using the electric motor for main spindle and the electric motor for feed in common.

(6) In the case of the feed rate, read instead as the smallest and the largest.

(7) Including the attachment and detachment of shank to the taper hole of main spindle.

2.2 No Load Running Test The no load running test of horizontal boring machine (floor type) shall be carried out as follows:

Run the main spindle and milling spindle⁽¹⁾ at each step of speed (three speeds of the lowest, intermediate and the highest in the case of stepless speed change) starting from the lowest speed. Continue that running at the highest speed for 30 to 60 min, as a rule. Measure each item specified in Record Form 1-1 of Table 2 [See 3.3 of JIS B 6201].

Further, run the main spindle at an adequate speed after the highest speed running. Take the feed speed [or the feed rate⁽⁵⁾] at the lowest⁽⁶⁾, intermediate, highest⁽⁶⁾ speeds and quick feed, and measure each item specified in Record Form 1-2 of Table 3 regarding each of them.

Furthermore, observe the vibration and noise. Where that vibration and noise come into question particularly, apply JIS B 6003 and JIS B 6004.

Table 2. Record Form 1-1

Number	Measured time (hour, minute)	Speed of main spindle or milling spindle rpm		Temperature °C			Required electric power (power source frequency Hz)			Description
		Indication	Actual measurement	Main spindle bearing		Room temperature	Voltage V	Current A	No load input kW	
				Front	Rear					

Table 3. Record Form 1-2

Speed of main spindle rpm		Feed speed mm/min [or feed rate ⁽⁵⁾ mm/rev]		Required electric power (Power source frequency Hz)			Description
		Indication	Actual measurement	Voltage V	Current A	Input kW	
Feed of main spindle (Z-axis direction)	Lowest ⁽⁶⁾						
	Intermediate						
	Highest ⁽⁶⁾						
	Quick feed ⁽²⁾						
Upward and downward feeds of spindle head (Y-axis direction)	Lowest ⁽⁶⁾						
	Intermediate						
	Highest ⁽⁶⁾						
	Quick feed ⁽²⁾						
Right and left feeds of spindle head ⁽⁸⁾ (Z-axis direction)	Lowest ⁽⁶⁾						
	Intermediate						
	Highest ⁽⁶⁾						
	Quick feed ⁽²⁾						
Forward and backward feeds of column (X-axis direction)	Lowest ⁽⁶⁾						
	Intermediate						
	Highest ⁽⁶⁾						
	Quick feed ⁽²⁾						
Right and left feeds of column ⁽²⁾ (Z-axis direction)	Lowest ⁽⁶⁾						
	Intermediate						
	Highest ⁽⁶⁾						
	Quick feed ⁽²⁾						

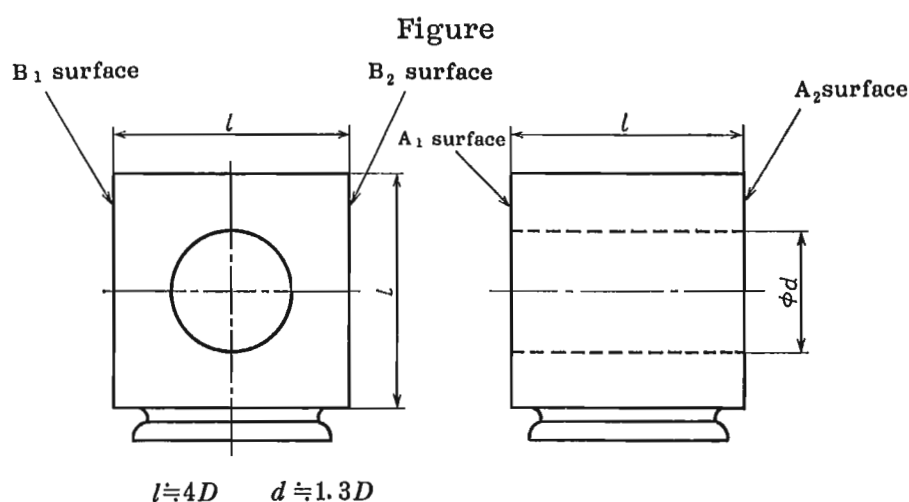
Note (6) The quill or ram is included in the spindle head.

Remark: In the item of the upward and downward feeds of the spindle head of Record Form 1-2 of Table 3, measure each of the upward feed and downward feed and record the discrimination of "upward" and "downward" in the description column. In other item, measure any one direction and record that direction in the description column.

2.3 No-Load Running Test For the no-load running test of the horizontal boring machine (floor type), the chatter test (boring by the main spindle) and the cutting power test (milling by the milling spindle) shall be carried out to measure the required electric power.

Furthermore, the vibration, noise and state of machined surface shall be observed (see 3.4 of JIS B 6201). JIS B 6003 and JIS B 6004 shall be applied where the vibration and noise come into question especially. The works shall be in accordance with the following and all of cuttings shall be dry cutting.

- (1) Materials The materials shall be FC 20 as specified in JIS G 5501, as a rule.
- (2) Form The form and dimensions shall be in accordance with following Figure.



where D : diameter of main spindle

2.3.1 Chatter Test The chatter test shall be a test of the stability of cutting and shall be performed by the stub boring of the main spindle while feeding that spindle to observe the state of chatter. (See number 3-14 of JIS B 6201).

This test shall be continued until the chatter is produced by increasing the feed in accordance with the following condition, and each item specified in Record Form 2-1 of Table 4 shall be measured. However, when the specified electric power has been attained before the chatter is produced, this test shall be stopped at that feed.

Table 4. Record Form 2-1

Material of work																
Number	Cutting condition						Class, form, etc. of tool	Position ⁽⁹⁾ of cutting edge		Required electric power (power source frequency Hz)					State of chatter	Description
	Main spindle speed (<i>n</i>) rpm	Cutting speed (<i>v</i>) m/min	Depth of cut (<i>t</i>) mm	Feed speed (<i>f</i>) mm/min	Feed rate (<i>s</i>) mm/rev	Cutting area (<i>t·s</i>) mm ²		Start of cutting mm	Completion of cutting mm	Voltage V	Current A	Load input (<i>W</i>) kW	No load input (<i>W</i> ₀) kW	Cutting power (<i>W</i> - <i>W</i> ₀) kW		

Note ⁽⁹⁾ The position of cutting edge is defined as a distance between the end face of milling spindle and the cutting edge.

(1) Tool The cutting tool shall be Form 31 or Form 32 specified in JIS B 4105, as a rule.

(2) Cutting Conditions

Cutting speed $v = 50 \text{ to } 80 \text{ (m/min)}$

Depth of cut $t = \frac{D}{25} \text{ (mm)}$

Diameter of boring $d = 1.3D \text{ to } 2D \text{ (mm)}$

Feed rate $s = \frac{D}{400} \text{ to } \frac{D}{160} \text{ (mm/rev)}$

where D : diameter of main spindle (mm)

(3) Cutting Method The d hole shall be bored in the work by the cantilever boring of main spindle while feeding that spindle. Furthermore, the distance between the surface of work to be cut and the end face of milling spindle shall be $2D$ and the final position of cutting shall be about $4D$.

2.3.2 Cutting Power Test The cutting power test shall be a test of the resistivity against the specified electric power, and the milling shall be performed by the milling spindle in accordance with the following conditions, and the required electric power shall be measured. (See Table 5 Record Form 2-2), (See number 3-11 of JIS B 6201).

Table 5. Record Form 2-2

Material of work		Required electric power (power source frequency Hz)														Quantity to be cut per 1 kW ⁽¹⁾ cm ³ /min /kW	Description			
Number	Cutting condition							Class, form, etc. of tool	Electric power for main spindle					Electric power ⁽¹⁾ for feed						
	Speed of main spindle (n) rpm	Cutting speed (v) m/ min	Depth of cut (t) mm	Feed speed (f) mm/ min	Feed per tooth (s') mm	Width of cut- ting (w) mm	Quantity to be cut cm ³ / min		Voltage V	Current A	Load input (W) kW	No load input (W ₀) kW	Cutting power (W- W ₀) kW	Voltage V	Current A			Load input (W') kW	No load input (W' ₀) kW	Feed power (W'- W' ₀) kW

Notes (1⁰) When using the electric motor for main spindle and the electric motor for feed in common, put in the column of electric power for main spindle and record the effect in the description column.

(1¹) The electric power required when obtaining the quantity to be cut per 1 kW shall be the sum of the load input for main spindle and load input for feed.

- (1) Tool The tool shall be a cemented carbide face milling cutter, as a rule, and its diameter shall be in accordance with Table 6.

Table 6

Unit: mm

Diameter of main spindle	Diameter of milling cutter
160 max.	150 to 300
Over 160	250 to 500

(2) Cutting Conditions

Cutting speed $v = 50$ to 80 (m/min)

Depth of cut $t \doteq \frac{D}{25}$ (mm)

Feed per tooth $s' \doteq 0.1, 0.2, 0.3, 0.4, 0.5$ (mm)

However, when the specified electric power has been attained, the test shall be stopped at that feed.

Width of cut $w \doteq$ diameter of milling cutter $\times \frac{2}{3}$ (mm)

where D : diameter of main spindle (mm)

- (3) Cutting Method Perform the milling of B₁ surface or of B₂ surface of work by feeding the column.