

JIS

JAPANESE INDUSTRIAL STANDARD

**Test Code for Performance and
Accuracy of Knee Type
Vertical Milling Machines**

JIS B 6204—1986

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Test Code for Performance and Accuracy of
Knee Type Vertical Milling Machines

B 6204-1986

1. Scope

This Japanese Industrial Standard specifies the test code for operating performance, rigidity, machine accuracy and working accuracy of knee type vertical milling machines of 1500 mm or less in travel amount of table in X-axis direction.

Remarks 1. The axis of machine used in this standard shall be as follows [see JIS B 6310]:

Z axis: Z axis shall be taken in a parallel direction to the main spindle (vertical direction).

X axis: X axis shall be taken in a longitudinal direction of table in a plane perpendicularly intersecting Z axis (right and left direction).

Y axis: Y axis shall be taken in a direction perpendicular to Z axis and X axis (front and rear direction).

2. The units, numerical values and formulae in this standard are in accordance with conventional units and are appended for reference.

2. Operating Test Methods

2.1 Function Test The function test shall be carried out according to Table 1.

Table 1

No.	Test item	Test method	Reference Corresponding No. of 3.2 in JIS B 6201
1	Starting, stopping and working operation of main spindle	Carry out starting and stopping (including braking) concerning positive and reverse revolution at a suitable spindle speed 10 times continuously to test the smoothness and security of working.	1-11
2	Converting operation of spindle speed	Concerning all marked speeds ⁽¹⁾ , convert the spindle speed to test the smoothness of working and the security of indication.	1-12

Table 1 (Continued)

No.	Test item	Test method	Reference Corresponding No. of 3.2 in JIS B 6201
3	Converting operation of feed speed	Convert the feed speed on all marked feeds concerning X-axis direction feed of table and on three feed speeds of the lowest, medium and the highest for no-stage converting speed type to test the smoothness of working and the security of indication. Concerning Y-axis direction ⁽²⁾ , and Z-axis direction of table feeds and Z-axis direction feed of spindle head or spindle sleeve, carry out the similar test on an arbitrary feed.	1-22
4	Hand-feed operation of spindle head or spindle sleeve	Travel the spindle head or spindle sleeve by hand-feed handle to test the smoothness and uniformity of working over the whole length of moving. Furthermore, at an arbitrary position of moving, carry out micro-feed by micro-hand-feed handle to test the smoothness and uniformity of working.	1-27
5	Hand-feed operation of table	Travel the table by hand-feed handle in X-axis, Y-axis ⁽²⁾ and Z-axis directions to test the smoothness and the uniformity of working over the whole length. Further, test the security of function of micrometer collar.	1-27
6	Putting on and off of power feed of spindle head or spindle sleeve and operation of automatic stopping device	Test the smoothness and security of working of putting on and off of power feed of spindle head or spindle sleeve, and concerning the setting of command position and working of automatic stopping device of spindle head or spindle sleeve, test the smoothness and security respectively.	1-26 1-31 1-32

Table 1 (Continued)

No.	Test item	Test method	Reference Corresponding No. of 3.2 in JIS B 6201
7	Operation of putting on-and-off device for power feed and quick traverse of table	Concerning the power feed and quick traverse in X-axis direction, Y-axis direction ⁽²⁾ and Z-axis direction of table, test the smoothness and security respectively on setting position of putting on-and-off manually and automatically and on the working.	1-21 1-31
8	Operation of clamping	Concerning each clamping mechanism of table, saddle, knee and spindle head or spindle sleeve, clamp at an arbitrary position of respective moving to test the security.	1-33
9	Electric device	Before and after the operating test, respectively once test the insulation condition. However, this does not apply to the circuit using semiconductor or the like.	1-51
10	Safety device	Test the safety relating to the operator and the security of machine protection function (see JIS B 6014).	1-52
11	Lubricating device	Test the security of function of oil tightness, suitable distribution of oil amount, etc.	1-53
12	Oil-hydraulic device	Test the security of function of oil-tightness, pressure regulation, etc.	1-54
13	Attachments	Test the security of function.	1-55
14	Backlash eliminator of feed screw	Test the security of function.	1-56

Notes (1) In the case of infinite variable speed, the operation shall be carried out on three speeds of the lowest, medium and highest.

(2) In the case of ram type, the Y-axis direction feed of spindle head shall be included.

2.2 No-Load Operation Test The no-load operation test shall be carried out as follows:

- (1) **Main Spindle Relation** Starting from the lowest speed of main spindle, operate on each stage, successively at the highest speed continue the operation, as a rule, for 30 to 60 min to measure each item specified in Table 2 Recording Form 1-1 [see 3.3 of JIS B 6201].

Further, observe the vibration and noise. In the case where the vibration and noise are made particularly problem, these shall be tested in accordance with JIS B 6003 and JIS B 6004.

Table 2. Recording Form 1-1

No.	Measuring time h·min	Spindle speed min ⁻¹ {rpm}		Temperature °C			Required electric power (power source frequency Hz)			Description
		Marking	Actual measurement	Spindle bearing		Room tempera- ture	Voltage V	Current A	Input kW	
				Upper	Lower					

- (2) **Feed Relation** Concerning three feed speeds of the lowest, medium and highest, and quick traverse, measure each item specified in Table 3 Recording Form 1-2 (see 3.3 of JIS B 6201).

Concerning the machine of which motors for feed and for main spindle are separated, measure only on the motor for feed.

Concerning the machine of which motors are not separated, record the effect in the description column and at this time allow the main spindle to be at the lowest speed.

Further, observe the vibration and noise. In the case where the vibration and noise are made particularly problem, these shall be tested in accordance with JIS B 6003 and JIS B 6004.

Table 3. Recording Form 1-2

No.	X-axis direction feed of table					Y-axis direction feed of table ⁽³⁾					Z-axis direction feed of table					Z-axis direction feed of main spindle ⁽⁴⁾					Description
	Marking	Actual measuring	Required electric power (power source frequency Hz)			Feed speed mm/min	Required electric power (power source frequency Hz)	Feed speed mm/min	Required electric power ⁽⁵⁾ (power source frequency Hz)	Feed speed mm/min	Required electric power ⁽⁵⁾ (power source frequency Hz)	Feed speed mm/min	Required electric power ⁽⁵⁾ (power source frequency Hz)	Feed speed mm/min	Required electric power ⁽⁵⁾ (power source frequency Hz)						
			Voltage V	Current A	Input kW											Voltage V	Current A	Input kW	Voltage V	Current A	

Notes ⁽³⁾ The speed and its direction ($\pm$) shall be recorded.

⁽⁴⁾ When the required electric power for feed generates difference due to the direction, those shall, respectively, be recorded.

⁽⁵⁾ Even the overall stroke is fed, when the measuring time is so short that the measuring of electric power is remarkably difficult, the measuring of quick traverse or maximum feed may be omitted.

2.3 Loading Operation Test For the loading operation test, carry out the cutting power test and the chatter test to measure the required electric power.

Further, observe the vibration, noise and condition of finished surface (see 3.4 of JIS B 6201).

In the case where the vibration and noise are made particularly problem, these shall be tested in accordance with JIS B 6003 and JIS B 6004.

Further, the cutting shall be dry cutting.

For the cutting power test, test that it is able to withstand the definite electric power at the high speed cutting, and for chatter test, test the stability of cutting. Carry out surface cutting under the following conditions to measure the required electric power, and observe the condition of chatter (see Table 4 Recording Form 2) (see No. 3-11 and 3-14 of JIS B 6201).

Table 4. Recording Form 2

Material of work		Diameter of tool		Number of cutting edge													
No.	Cutting conditions							Required electric power ⁽⁶⁾ (power source frequency Hz)							Cutting amount per 1 kW cm ³ /min	Chatter condition	Description
								Electric power for main spindle			Electric power for feed						
	Spindle speed (n) min ⁻¹ (rpm)	Cutting speed (V _c) m/min	Cutting depth (a) mm	Cutting width (b) mm	Feed speed (V _f) mm/min	Feed per one cutting edge (S _e) mm	Cutting amount cm ³ /min	Voltage V	Current A	Loading input kW	No-load input kW	(⁷) Cutting power kW	Voltage V	Current A			

Notes ⁽⁶⁾ Concerning the machine of which electric motors for main spindle and for feed are not separated, it shall be inscribed in the column of electric power for main spindle and the effect, be recorded in the description column.

⁽⁷⁾ It means the difference of loading input from the no load input.

⁽⁸⁾ The required electric power in the case where the cutting amount per 1 kW shall be the sum of loading input for main spindle and loading input for feed.

(1) Tool As a rule, the tool shall be cemented carbide face milling cutter, its diameter, be in accordance with Table 5 and required item, be recorded according to Table 6 Recording Form 3.

Table 5

Unit: mm

Travel amount of table in X-axis direction	Diameter
500 max.	Not specified particularly
Exceeding 500 up to and including 1000	75 to 150 (about)
Exceeding 1000 up to and including 1500	150 to 200 (about)