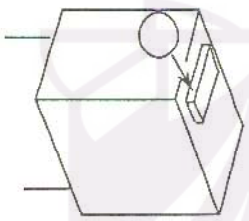
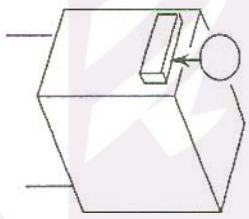
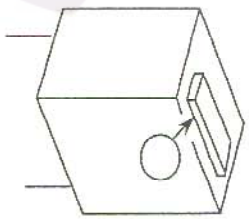
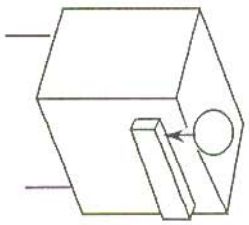
1. STATIC ACCURACY TEST

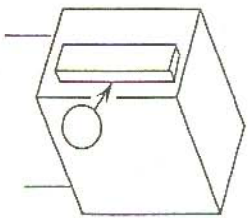
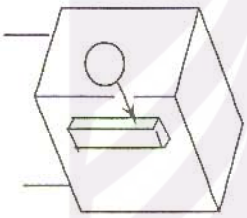
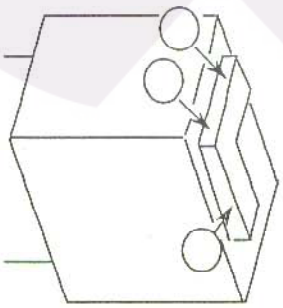
• These results are got after warm-up operation under the following conditions.

1. Axis travel : Full - stroke for each axis
2. Spindle speed : 0
3. Run time : 60 min.
4. Room temperature : 26 °C

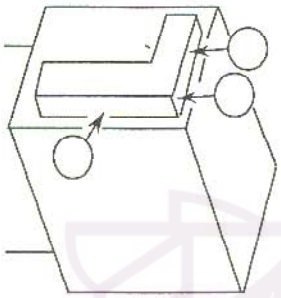
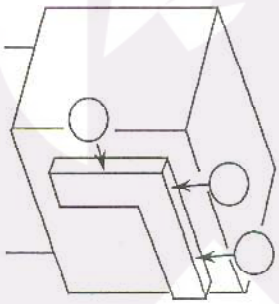
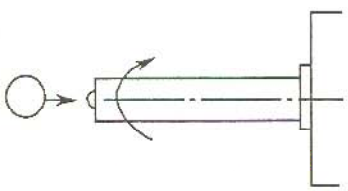
UNIT : mm

No.	Item	Measuring method	Sketch	Tolerance	Measured Value
1	Straightness of X axis motion	A surface block is mounted to the work spindle to secure a straightedge. (See Note 1) A dial test indicator is brought to bear on a long side of the straightedge and moved in the X direction to note the highest and lowest reading on the indicator. The maximum variation in the two readings is calculated to determine the straightness of X axis motion.	on X - Y plane 	0.006 per 300	0.003
			on X - Z plane 	0.006 per 300	0.002
Note(1) : The straightedge is secured to the surface block in such a manner that each reading at both ends coincides.					
2	Straightness of Y axis motion	A surface block is mounted to the work spindle to secure a straightedge. (See Note 1) A dial test indicator is brought to bear on a long side of the straightedge and moved in the Y direction to note the highest and lowest reading on the indicator. The maximum variation in the two readings is calculated to determine the straightness of Y axis motion.	on Y - X plane 	0.006 per 150	0.004
			on Y - Z plane 	0.006 per 150	0.003

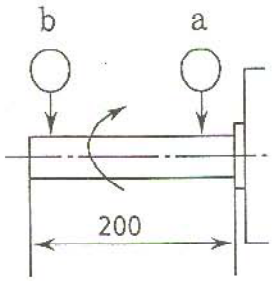
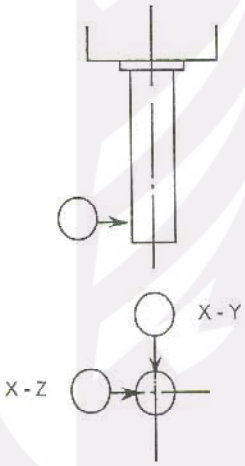
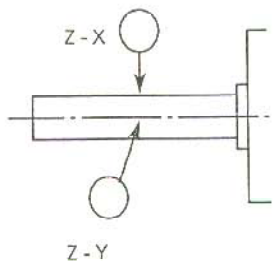
UNIT : mm

No.	Item	Measuring method	Sketch	Tolerance	Measured Value
3	Straightness of Z axis motion	A surface block is mounted to the work spindle to secure a straightedge. (See Note 1) A dial test indicator is brought to bear on a long side of the straightedge and the surface block is moved in the Z direction to note the highest and lowest reading on the indicator. The maximum variation in the two readings is calculated to determine the straightness of Z axis motion.	on Z - X plane 	0.006 per 300	0.003
			on Z - Y plane 	0.006 per 300	0.003
4	Right-angle relationship between two axis motions	A square is secured to one side of a surface block attached to the work spindle so that one side of the square is parallel to the X axis motion. A dial test indicator is brought to bear on the other side of the square and the Y axis is moved to note the highest and lowest reading on the indicator. The maximum variation in the two readings is calculated to determine the right angle between X and Y axis motions.	X - Y axis 	0.012 per 250	0.005

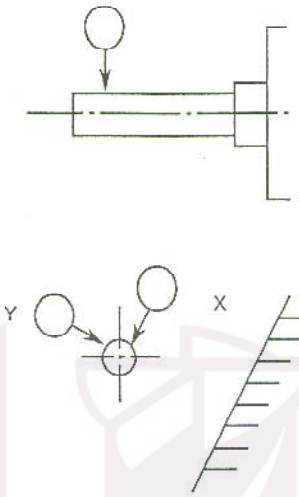
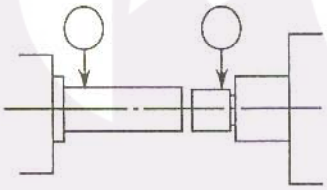
UNIT : mm

No.	Item	Measuring method	Sketch	Tolerance	Measured Value
4	Right-angle relationship between two axis motions	A square is secured to one side of a surface block attached to the work spindle so that one side of the square is parallel to the Z axis motion. A dial test indicator is brought to bear on the other side of the square and the X axis is moved to note the highest and lowest reading on the indicator. The maximum variation in the two readings is calculated to determine the right angle between X and Z axis motions.	X - Z axis 	0.012 per 250	0.009
		A square is secured to one side of a surface block attached to the work spindle so that one side of the square is parallel to the Y axis motion. A dial test indicator is brought to bear on the other side of the square and the Z axis is moved to note the highest and lowest reading on the indicator. The maximum variation in the two readings is calculated to determine the right angle between Y and Z axis motions.	Y - Z axis 	0.012 per 250	0.006
5	Tool spindle motion in Z axis direction	A test bar is inserted into the hole in the tool spindle. A dial test indicator is brought to bear on the end of the test bar to note the highest reading while the spindle is revolving.		0.005	0.002

UNIT : mm

No.	Item	Measuring method	Sketch	Tolerance	Measured Value
6	Runout in tool spindle hole	A test bar is inserted into the hole in the tool spindle. A dial test indicator is brought to bear on both ends of the test bar to note the highest and lowest reading while the spindle is revolving. The maximum variation in the two readings is calculated to determine the runout in the tool spindle hole.		(End of test bar close to tool spindle) 0.007 at a	0.002
				(End of test bar far from tool spindle) 0.012 at b	0.004
7	Parallelism between tool spindle centerline and X axis motion	A dial test indicator is brought to bear on the hole in the tool spindle before the spindle is moved in the X direction to note the highest and lowest reading. The maximum variation in the two readings is calculated to determine the parallelism between tool spindle centerline and X axis motion. B axis is located at 90° position.		X-Y 0.010 per 200	0.004
				X-Z 0.010 per 200	0.004
8	Parallelism between tool spindle centerline and Z axis motion	A dial test indicator is brought to bear on the hole in the tool spindle before the spindle is moved in the Z direction to note the highest and lowest reading. The maximum variation in the two readings is calculated to determine the parallelism between tool spindle centerline and Z axis motion. B axis is located at 0° position.		Z-X 0.010 per 200	0.004
				Z-Y 0.010 per 200	0.005

UNIT : mm

No.	Item	Measuring method	Sketch	Tolerance	Measured Value
9	Parallelism between tail stock centerline and Z axis motion	A test bar is inserted into the hole in the tail stock before a dial test indicator positioned on the X axis is brought to bear on the test bar. The tail stock is then moved in the Z direction to note the highest and lowest readings on the indicator. The maximum variation in the two readings is calculated to determine the parallelism between tail stock centerline and Z axis motion.		X - axis direction 0.010 per 75 Y - axis direction 0.010 per 75	0.005 0.005
10	Alignment between work spindle centerline and tailstock centerline	A test bar is inserted into each of the hole in the work spindle and tailstock and a dial test indicator positioned on the Xaxis slide is brought to bear on each of the test bars to note the two readings on the indicator. The maximum variation in the two readings is calculated to determine the alignment between the centerlines of work spindle and the tailstock. (See Note 2)		X - axis direction 0.020 Y - axis direction 0.020	0.007 0.003

Note(2) : The test bar should be held in such a place that the intermediate runout value is indicated in any measured direction.

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2. POSITIONING ACCURACY TEST

UNIT : mm · degree

No.	Item	Measuring method	Sketch	Tolerance	Measured Value
1	Positioning accuracy of linear motion	A scale is fixed parallel to each of the X,Y and Z axes. Each of the axes is positioned in positive and negative directions on its full stroke range; the X axis is positioned in 6 mm increments and the Y and Z axes are both positioned in 8 mm increments. The distance measured each time the corresponding axis is positioned is compared with the reference dimension on the scale. The maximum difference is taken as the measurement for each of the axes.	omission	X - axis direction 0.008	0.003
				Y - axis direction 0.008	0.005
				Z - axis direction 0.008	0.003
2	Positioning accuracy of rotary motion (C axis)	A scale is fixed to the work spindle. The spindle is then positioned at 5 intervals in both directions. Each time the spindle is turned 5°, the angle of the spindle rotation is measured to compare with the reference dimension on the scale. The maximum difference is taken as the measurement.	omission	0.005° per 360°	0.005

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3. REPEATABILITY TEST

UNIT : mm · degree

No.	Item	Measuring method	Sketch	Tolerance	Measured Value
1	Positioning accuracy of linear motion	A scale is fixed parallel to each of the X,Y and Z axes. Positioning of each of the axes is repeated seven (7) times to take measurement each time the corresponding axis is moved in increments of predetermined distance (6 mm increments for the X axis and 8 mm increments for Y and Z axes). The measured distances are compared to determine the maximum difference from the corresponding reference dimension. The obtained value is then divided by two, a plus/minus sign being affixed to be taken as the measurement.	omission	X - axis direction ± 0.002	± 0.001
				Y - axis direction ± 0.002	± 0.001
				Z - axis direction ± 0.002	± 0.001
2	Positioning accuracy of rotary motion (C axis)	A scale is fixed to the work spindle. Positioning of the spindle is repeated seven (7) times to take measurement each time the spindle is turned 5 ° intervals is repea-ted seven (7) times each time the spindle is turned. The measured angles are then compared to determine the maximum difference from the corresponding reference dimension on the scale. The obtained value is then divided by two, a plus/minus sign being affixed to be taken as the measurement.	omission	C - axis ± 0.001°	± 0.001

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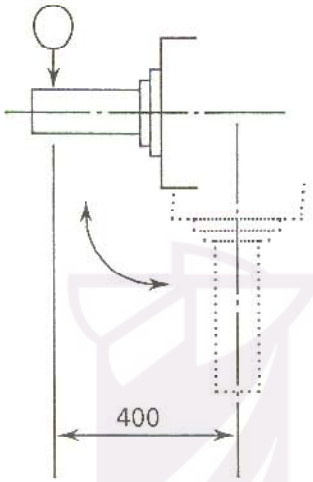
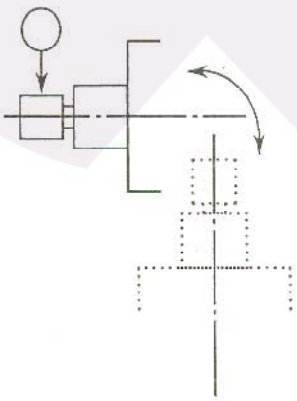
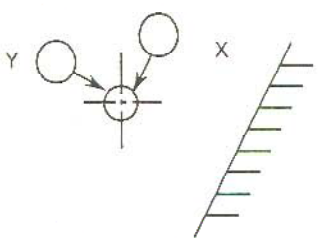
UNIT : mm

No.	Item	Measuring method	Sketch	Tolerance	Measured Value
3	Positioning accuracy of tool spindle (B axis)	Positioning of the tool spindle, in the same direction, is repeated seven (7) times to take measurement each time the spindle stops. The measured dimensions are then compared to determine the maximum difference from the corresponding reference dimension. The obtained value is then divided by two, a plus/minus sign being affixed to be taken as the measurement.		B - axis ± 0.003	± 0.001
4	Positioning accuracy of tailstock (direction of rotation)	Positioning of the tailstock, in the same direction, is repeated seven (7) times to take measurement each time it stops. The measured dimensions are then compared to determine the maximum difference from the corresponding reference dimension. The obtained value is then divided by two, a plus/minus sign being affixed to be taken as the measurement.	 	X - axis direction ± 0.002 Y - axis direction ± 0.002	± 0.001 ± 0.002

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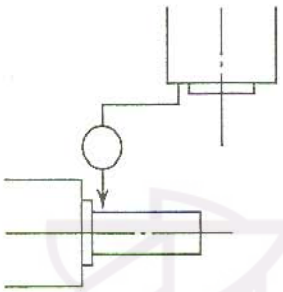
4. STATIC ACCURACY TEST ADDITIONAL ITEM

UNIT : mm

No.	Item	Measuring method	Sketch	Tolerance	Measured Value
1	Alignment between work spindle centerline and Z axis motion	A dial test indicator is brought to bear on the hole in the work spindle before the spindle is moved in the Z direction to note the highest and lowest reading.The maximum variation in the two readings is calculated to determine the parallelism between work spindle centerline and Z axis motion.		X - axis direction 0.007 per 200	0.003
				Y - axis direction 0.007 per 200	0.005

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TA3 MACHINING ACCURACY DATA

1. Boring Accuracy
2. Accuracy In Face Milling Using Face Mill Cutter
3. Accuracy In Four Faces Cutting With Face Mill Cutter
4. Positioning And Bore Diameter Accuracy In Boring
5. Accuracy In Side Face Cutting With End Mill
6. Accuracy In End Milling Under Linear Interpolation Mode
7. Accuracy In End Milling Under Circular Interpolation Mode
8. Standard Cutting Accuracy Turning
9. Standard Cutting Accuracy Facing

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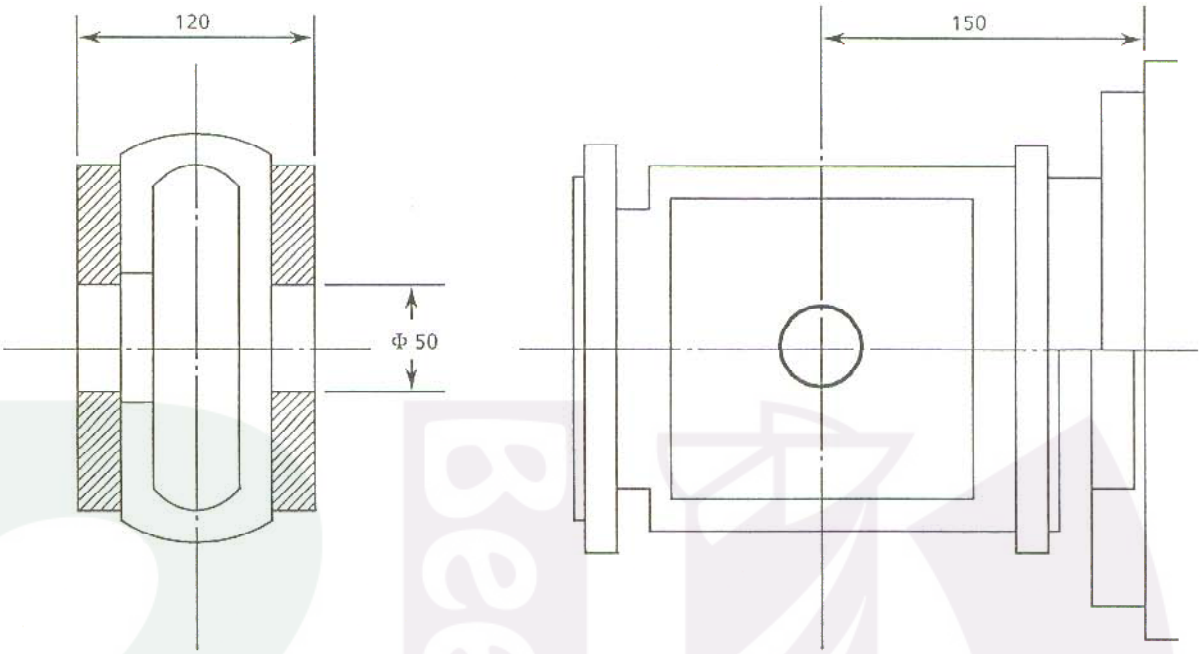
1. Boring Accuracy



UNIT : mm

	Tolerance (JIS)	Tolerance (TA3)	Measured Value
Roundness	0.01	0.005	0.004
Cylindricity	0.01 per 100	0.005 per 100	0.003

Cutting Data

Tool	:	BT40－BSB50－165
Shape of cutting	:	See above drawing.
Spindle Speed	:	510min^{-1} (V = 80m/min)
Feed Rate	:	F = 35mm/min (F = 0.07mm/rev)
Depth of Cut	:	0.2mm/Diameter
Material	:	FC20 or FC25
Measuring method	:	Comply with JIS B6336

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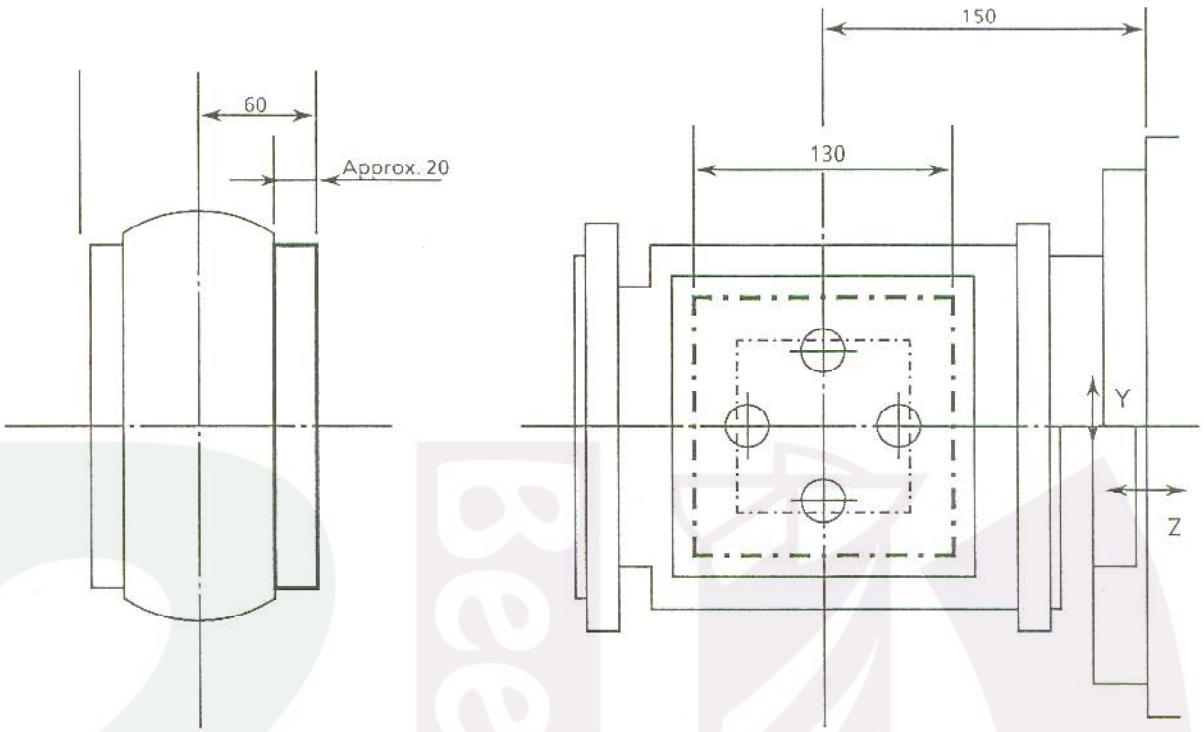
2. Accuracy In Face Milling Using Face Mill Cutter



UNIT : mm

	Tolerance (JIS)	Tolerance (TA3)	Measured Value
Flatness	0.01	0.01	0.004
Step	0.01	0.01	0.003

Cutting Data

Tool	:	BT40—FMC22 IGETALLOY PM50S
Spindle Speed	:	510min^{-1} (V = 80m/min)
Feed Rate	:	F = 120mm/min (0.08 × 3T = 0.24mm/rev)
Depth of Cut	:	0.1mm
Material	:	FC20 or FC25
Measuring method	:	Comply with JIS B6336

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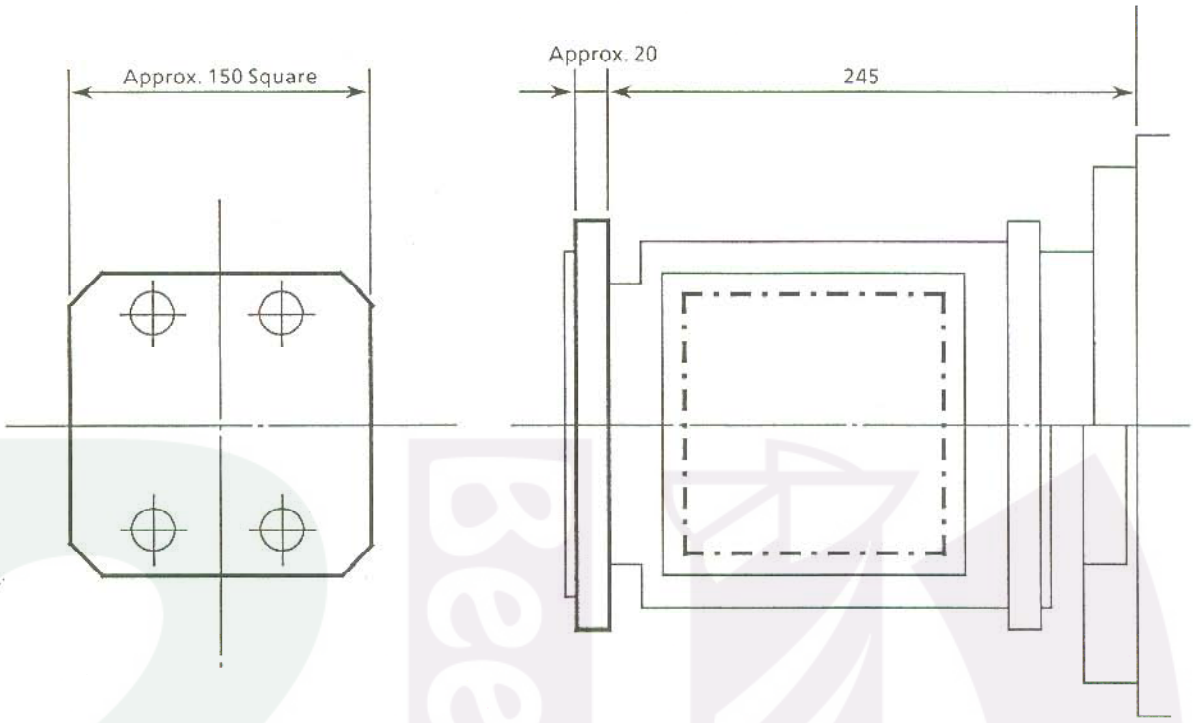
3. Accuracy In Four Faces Cutting With Face Mill Cutter



UNIT : mm

	Tolerance (JIS)	Tolerance (TA3)	Measured Value
Squareness	0.02 per 300	0.01 per 110	0.005
Parallelism	0.03 per 300	0.015 per 110	0.004

Cutting Data

Tool	:	BT40—FMA25.4—45(Holder)
		IGETALLOY DPG 4080R(Cutter)
Spindle Speed	:	510min^{-1} (V = 80m/min)
Feed Rate	:	F = 110mm/min (0.07 × 3T = 0.21mm/rev)
Depth of Cut	:	0.1mm
Material	:	FC20 or FC25
Measuring method	:	Comply with JIS B6336

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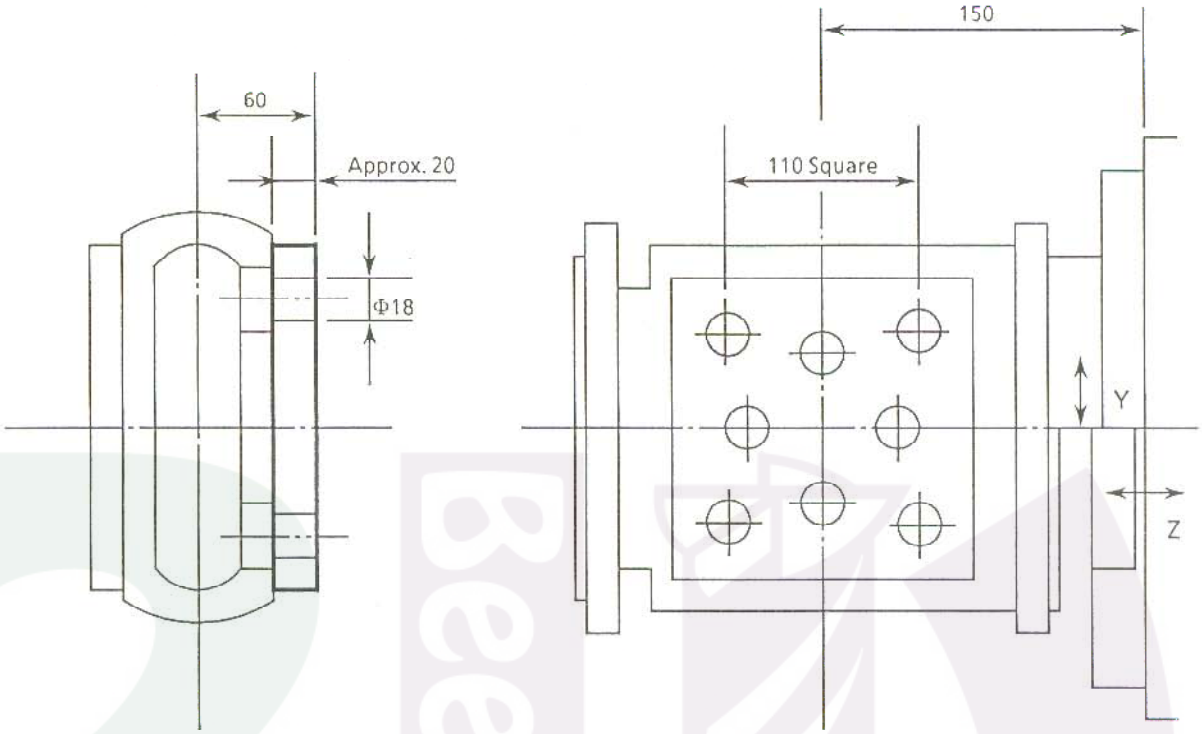
4. Positioning And Bore Diameter Accuracy In Boring



UNIT : mm

	Tolerance (JIS)	Tolerance (TA3)	Measured Value
Positioning Accuracy Along Axis	0.025 per 200	0.01 per 110	0.004
Diagonal Positioning Accuracy	0.035 per 400	0.017 per 155	0.005
Diameter Variation	0.025	0.007	0.003

Cutting Data

Tool	:	BT40－BCB14.5－105
Spindle Speed	:	760min^{-1} (V = 43m/min)
Feed Rate	:	F = 38mm/min (0.05mm/rev)
Depth of Cut	:	0.2mm/Diameter
Material	:	FC20 or FC25
Measuring method	:	Comply with JIS B6336

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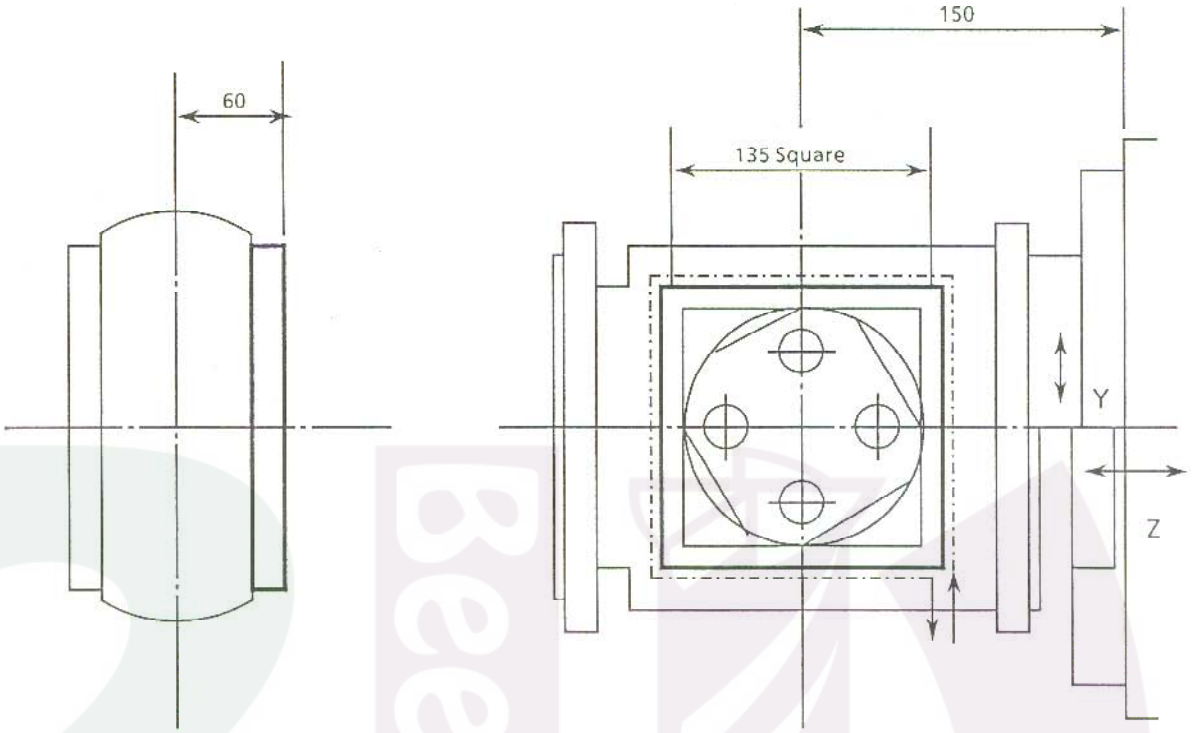
5. Accuracy In Side Face Cutting With End Mill



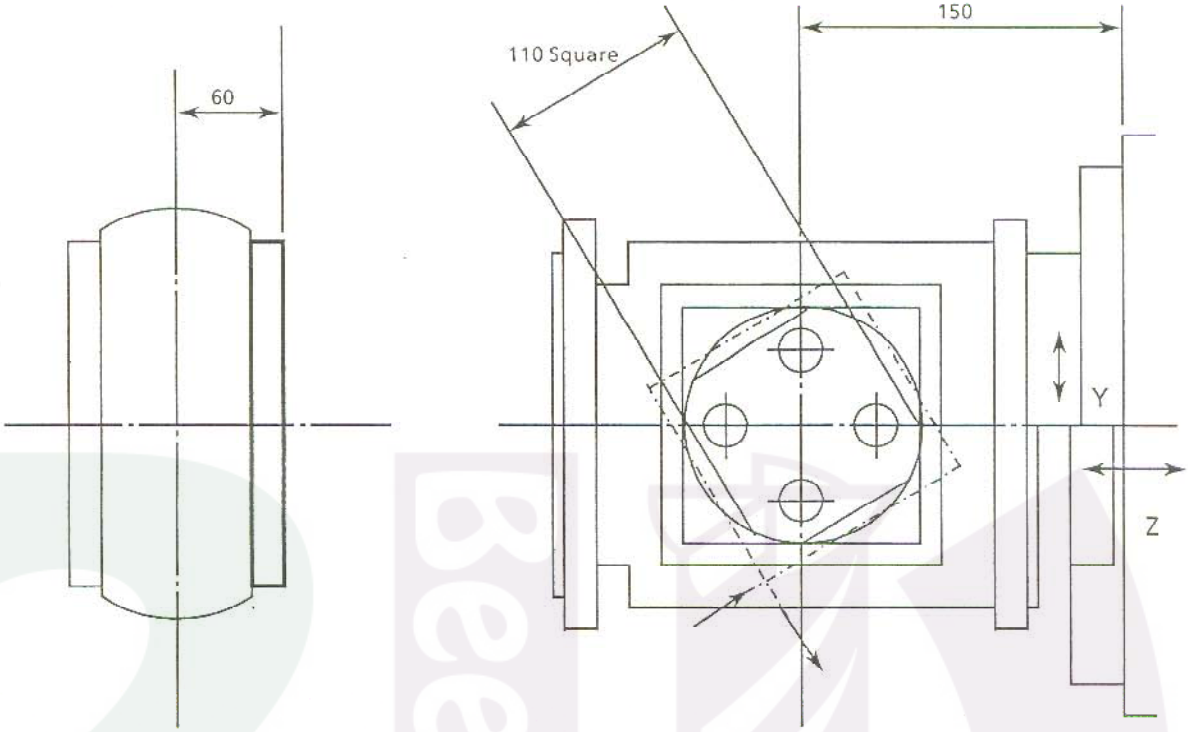
UNIT : mm

	Tolerance (JIS)	Tolerance (TA3)	Measured Value
Straightness	0.015 per 300	0.01 per 190	0.006
Parallelism	0.03 per 300	0.02 per 190	0.008
Dimension difference	0.05	0.03	0.010
Squareness	0.03 per 300	0.02 per 190	0.005

Cutting Data

Tool	:	BT40－C32－90 Φ20Tangsten carbide spiral end mill
Spindle Speed	:	950min-1 (V = 60m/min)
Feed Rate	:	F = 228mm/min (0.06 × 4T = 0.24mm/rev)
Depth of Cut	:	0.1mm (Single side)
Material	:	FC20 or FC25
Measuring method	:	Comply with JIS B6336

6. Accuracy In End Milling Under Linear Interpolation Mode



UNIT : mm

	Tolerance (JIS)	Tolerance (TA3)	Measured Value
Straightness	0.02 per 300	0.008 per 110	0.004
Parallelism	0.04 per 300	0.015 per 110	0.005
Squareness	0.04 per 300	0.015 per 110	0.003

Cutting Data

Tool	:	BT40－C32－90
		Φ20 Tangsten carbide 3blade spiral end mill
Spindle Speed	:	950min^{-1} (V = 60m/min)
Feed Rate	:	F = 95mm/min (0.025 × 4T = 0.1mm/rev)
Depth of Cut	:	0.1mm (Single side)
Material	:	FC20 or FC25
Measuring method	:	Comply with JIS B6336

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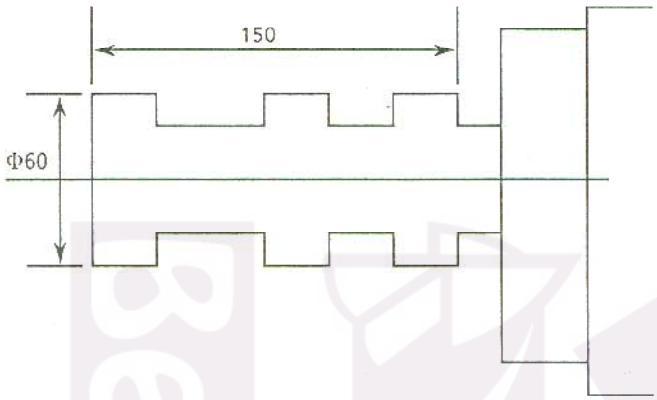
8. Standard Cutting Accuracy Turning



UNIT : mm

	Tolerance (JIS)	Tolerance (TA3)	Measured Value
Roundness		0.007	0.002
Cylindricity		0.015 per 150	0.012

Cutting Data

Cutting Speed : 750min^{-1} (V = 140m/min)
Feed Rate : 0.06mm/rev
Depth of Cut : 0.1mm
Material : BSBM

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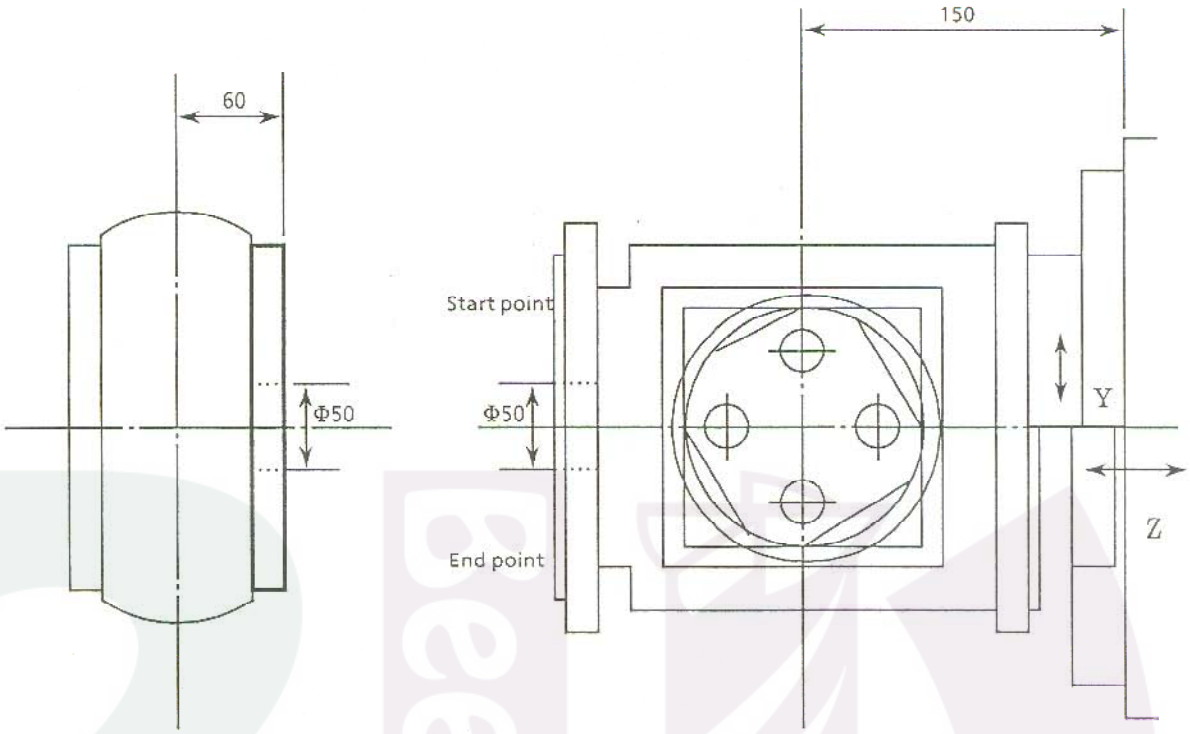
7. Accuracy In End Milling Under Circular Interpolation Mode



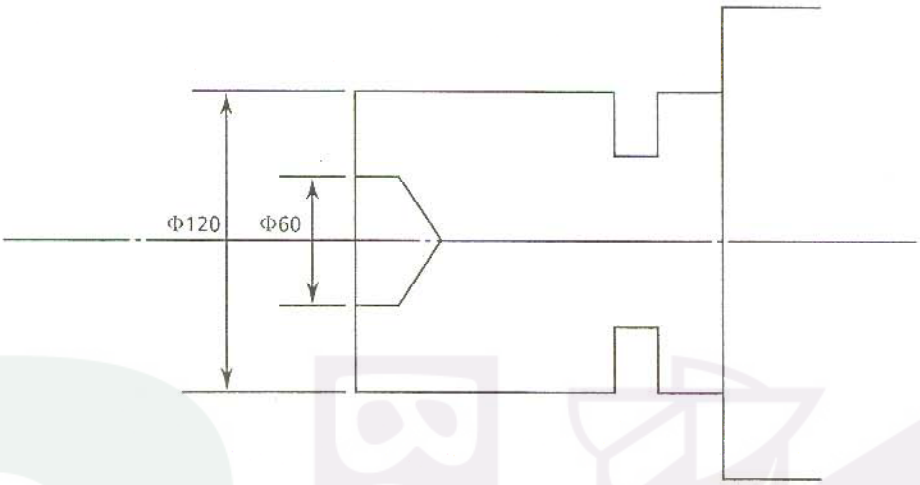
UNIT : mm

	Tolerance (JIS)	Tolerance (TA3)	Measured Value
Accuracy	0.04	0.026	X - Y 0.020 Y - Z 0.012

Cutting Data

Tool	:	BT40－C32－90 Φ20 Tangsten carbide 3blade spiral end mill
Spindle Speed	:	950min^{-1} (V = 60m/min)
Feed Rate	:	F = 100mm/min (0.025 × 4T = 0.1mm/rev)
Depth of Cut	:	0.1mm (Single side)
Material	:	FC20 or FC25
Measuring method	:	Complu with JIS B6336

9. Standard Cutting Accuracy Facing



UNIT : mm

	Tolerance (JIS)	Tolerance (TA3)	Measured Value
Flatness		0.010	0.003

Cutting Data

Cutting Speed : 800min-1 (V = 300m/min)
Feed Rate : 0.06mm/rev
Depth of Cut : 0.1mm
Material : BSBM