

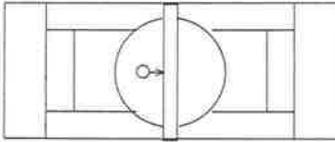
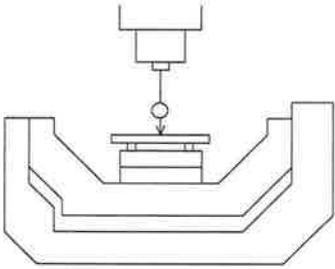
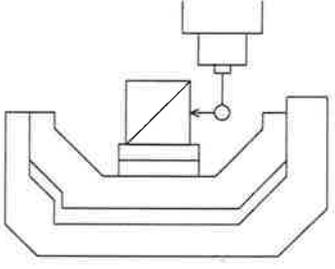
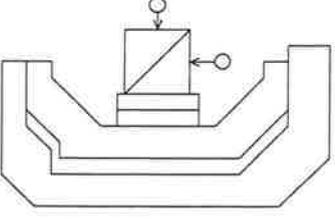
立形マシニングセンター検査成績表

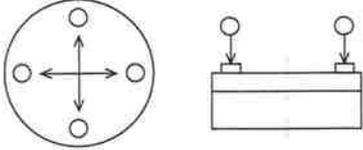
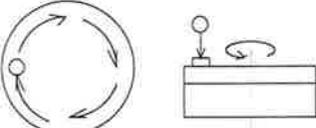
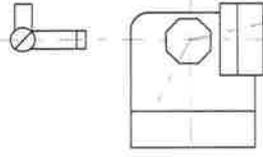
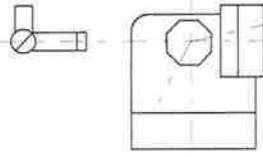
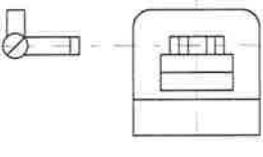
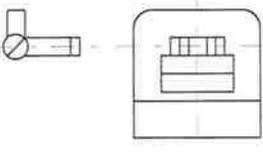
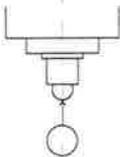
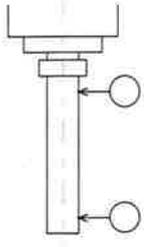
ACCURACY TEST CHARTS FOR MACHINING CENTER

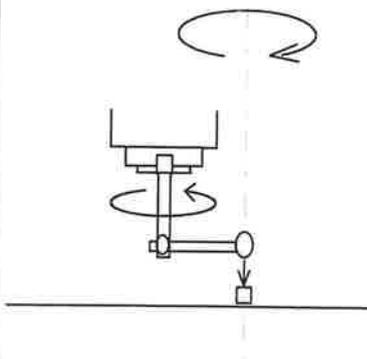
| | | | | | |
|------------|----------|--------------------|--------|------------------|--|
| 型式 Type | MU-5000V | 製造番号 Serial No. | 207303 | 制御装置番号 Nc No. | |
|------------|----------|--------------------|--------|------------------|--|

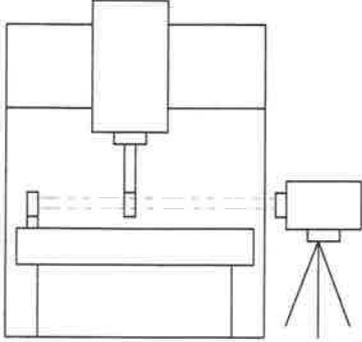
静的精度検査 Geometric accuracy test

検査実施日：2017. 11. 21
Inspection date : 21. Nov. 17
単位 Unit : mm

| 番号 No. | 検査事項 Item | 測定方法図 Measuring method | 許容値 Tolerance | 測定値 Actual result |
|-----------|---|--|-------------------|---|
| 1 | サドル (Y軸方向) 運動の真直度 Straightness of saddle travel (In Y-axis direction) |  | a Y-Z plane | 0.012 /1000 0.003 |
| | | | b X-Y plane | 0.012 /1000 0.002 |
| 2 | AC軸サドル (X軸方向) 運動の真直度 Straightness of AC-axis saddle travel (In X-axis direction) |  | a X-Y plane | 0.008 /800 0.003 |
| | | | b Y-Z plane | 0.040/m 全移動距離 Full travel 0.012 /m |
| | | | c Z-X plane | 0.060/m 全移動距離 Full travel 0.016 /m |
| 3 | 主軸頭 (Z軸方向) 運動の真直度 Straightness of spindlehead travel (In Z-axis direction) |  | a Y-Z plane | 0.005 /300 0.002 |
| | | | b Z-X plane | 0.005 /300 0.003 |
| 4 | 各軸 (X・Y・Z) 運動相互の直角度 Squareness of each axis motion with respect to other axis motion |  | a Y-Z axis | 0.010 /300 0.007 |
| | | | b Z-X axis | 0.010 /300 0.004 |
| | | | c X-Y axis | 0.008 /300 0.005 |

| 番号 No. | 検査事項 Item | 測定方法図 Measuring method | 許容値 Tolerance | 測定値 Actual result | |
|-----------|---|--|---|----------------------|-------|
| 5 | X, Y軸方向の運動と テーブル上面との平行度 Parallelism of X, Y- axis motion with respect to table surface |  A, C-axis 0° | 0.015 /500 | 0.004 | |
| | a Y-Z plane | | 0.015 /500 | 0.004 | |
| 6 | C軸テーブル上面の振れ Runout on C-axis table upper surface |  A-axis 0° | 0.015 | 0.006 | |
| 7 | A軸の割り出し精度 30° 毎に測定 A-axis positioning accuracy Measure the angles in increments of 30 degrees |  | ±5" | ±2.0" | |
| 8 | A軸の割り出し復帰精度 30° にて7回繰り返し Repeatability of A-axis Repeat positioning seven times to 30 degree position for mesurement |  | ±2" | ±1.0" | |
| 9 | C軸の割り出し精度 30° 毎に測定 C-axis positioning accuracy Measure the angles in increments of 30 degrees |  | ±5" | ±2.0" | |
| 10 | C軸の割り出し復帰精度 30° にて7回繰り返し Repeatability of C-axis Repeat positioning seven times to 30 degree position for mesurement |  | ±2" | ±1.5" | |
| 11 | 主軸Z方向の振れ Play of spindle in Z-axis direction |  | 0.002 | 0.001 | |
| 12 | 主軸穴の振れ Runout of spindle inner taper |  | 口元 At spindle side end of test bar | 0.004 | 0.002 |
| | | | 200mm先 At 200mm point from spindle end face | 0.008 | 0.005 |

| 番号 No. | 検査事項 Item | 測定方法図 Measuring method | 許容値 Tolerance | 測定値 Actual result |
|-----------|--|--|------------------|----------------------|
| 13 | X-Y平面と 主軸中心線との 直角度 Squareness of spindleline to X-Y plane |  | 0.010 /300 | 0.004 |
| | | | 0.010 /300 | 0.006 |

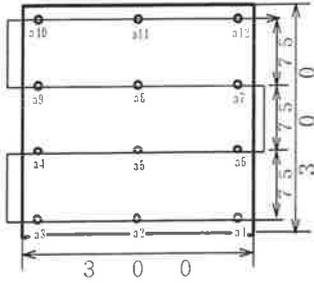
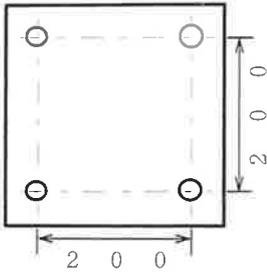
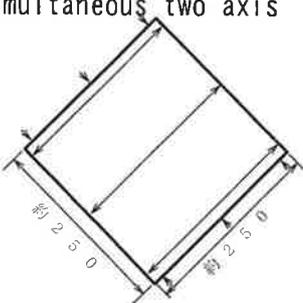
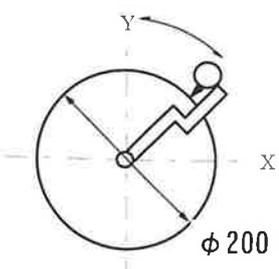
| 番号 No. | 検査事項 Item | 測定方法図 Measuring method | |
|--|---|--|--------------------------|
| 14 | 直進運動軸の位置決め精度 Accuracy and repeatability of positioning of linear 引用規格 Observations and references to ISO 10791-4:1998 JIS B6336-4:2000 |  | |
| X-axis | | 許容値 Tolerance | 測定値 Actual result |
| 両方向位置決め of 正確さ A Bidirectional accuracy of positioning A | | 0.0120 | 0.0018 |
| 一方向位置決め of 正確さ A ↑ 及び A ↓ Unidirectional accuracy of positioning A ↑ and A ↓ | | 0.0110 | A ↑ 0.0015 A ↓ 0.0014 |
| 両方向位置決め of 繰り返し性 R Bidirectional repeatability R | | 0.0080 | 0.0015 |
| 一方向位置決め of 繰り返し性 R ↑ 及び R ↓ Unidirectional repeatability R ↑ and R ↓ | | 0.0070 | R ↑ 0.0009 R ↓ 0.0007 |
| 反転値 B Reversal value of axis B | | 0.0050 | 0.0007 |
| 平均反転値 \bar{B} Mean reversal value \bar{B} | | 0.0030 | 0.0005 |
| 両方向位置決め of 系統偏差 E Bidirectional systematic deviation of positioning E | | 0.0090 | 0.0012 |
| 一方向位置決め of 系統偏差 E ↑ 及び E ↓ Unidirectional systematic deviation of positioning E ↑ and E ↓ | | 0.0080 | E ↑ 0.0008 E ↓ 0.0009 |
| 平均両方向位置決め偏差 M Range of the mean bidirectional positional deviation of the axis M | | 0.0080 | 0.0008 |
| Y-axis | | 許容値 Tolerance | 測定値 Actual result |
| 両方向位置決め of 正確さ A Bidirectional accuracy of positioning A | | 0.0120 | 0.0026 |
| 一方向位置決め of 正確さ A ↑ 及び A ↓ Unidirectional accuracy of positioning A ↑ and A ↓ | | 0.0110 | A ↑ 0.0019 A ↓ 0.0026 |
| 両方向位置決め of 繰り返し性 R Bidirectional repeatability R | | 0.0080 | 0.0021 |
| 一方向位置決め of 繰り返し性 R ↑ 及び R ↓ Unidirectional repeatability R ↑ and R ↓ | | 0.0070 | R ↑ 0.0014 R ↓ 0.0015 |
| 反転値 B Reversal value of axis B | | 0.0050 | 0.0007 |
| 平均反転値 \bar{B} Mean reversal value \bar{B} | | 0.0030 | -0.0003 |
| 両方向位置決め of 系統偏差 E Bidirectional systematic deviation of positioning E | | 0.0090 | 0.0014 |
| 一方向位置決め of 系統偏差 E ↑ 及び E ↓ Unidirectional systematic deviation of positioning E ↑ and E ↓ | | 0.0080 | E ↑ 0.0010 E ↓ 0.0012 |
| 平均両方向位置決め偏差 M Range of the mean bidirectional positional deviation of the axis M | | 0.0080 | 0.0011 |

| 番号 No. | 検査事項 Item | | |
|-----------|--|------------------|--------------------------|
| 14 | Z-axis | 許容値 Tolerance | 測定値 Actual result |
| | 両方向位置決め of 正確さ A Bidirectional accuracy of positioning A | 0.0100 | 0.0015 |
| | 一方向位置決め of 正確さ A ↑ 及び A ↓ Unidirectional accuracy of positioning A ↑ and A ↓ | 0.0090 | A ↑ 0.0014 A ↓ 0.0011 |
| | 両方向位置決め of 繰り返し性 R Bidirectional repeatability R | 0.0060 | 0.0013 |
| | 一方向位置決め of 繰り返し性 R ↑ 及び R ↓ Unidirectional repeatability R ↑ and R ↓ | 0.0050 | R ↑ 0.0013 R ↓ 0.0007 |
| | 反転値 B Reversal value of axis B | 0.0040 | 0.0003 |
| | 平均反転値 \bar{B} Mean reversal value \bar{B} | 0.0020 | 0.0002 |
| | 両方向位置決め of 系統偏差 E Bidirectional systematic deviation of positioning E | 0.0070 | 0.0008 |
| | 一方向位置決め of 系統偏差 E ↑ 及び E ↓ Unidirectional systematic deviation of positioning E ↑ and E ↓ | 0.0060 | E ↑ 0.0006 E ↓ 0.0005 |
| | 平均両方向位置決め偏差 M Range of the mean bidirectional positional deviation of the axis M | 0.0060 | 0.0005 |

備考

Remarks

- ・ ピッチ誤差補正機能 1 μm 単位で実施
The pitch error compensation function performs compensation in units of 1 μm .
- ・ バックラッシュ補正機能 1 μm 単位で実施
The backlash compensation function performs compensation in units of 1 μm .
- ・ 機械は測定の12時間以上前に設置され、水平出しが完了している
Measurements are done on the machine which is installed at least 12 hours before measurement and is completely leveled.
- ・ 環境温度変化は、測定12時間前及び測定中とも $\pm 0.5^\circ\text{C}/1$ 時間 以内のこと
The ambient temperature change has been within $\pm 0.5^\circ\text{C}/\text{hour}$ for 12 hours before measurement and during measurement.
- ・ 暖機運転は、測定と同じ運転で熱的に安定するまで行うこと
Warm-up run is performed with the same operation as in measurement until the machine is thermally stabilized.
- ・ 運転モードは、測定機の追従できる範囲内での早送り指令で実施
In the operation mode, axes are fed with rapid traverse commands within the range of feedrate at which the measuring instrument can follow.

| 工作精度検査保証値 GUARANTEED GEOMETRIC ACCURACIES | | 単位 Unit mm | |
|--|--|--|--|
| 番号 No. | 検査事項および測定方法 Item and illustration | 切削条件 Cutting conditions | 保証値 Guaranteed values |
| 1 | フライス削りの精度 Facing accuracy  | 平面度 Cutting tool: Carbide tip 4R face mill 6 blades Material: JIS FC250 cast iron Spindle speed: 320min ⁻¹ Cutting speed: 100m/min Depth of cut: 0.1mm Feedrate: 0.05mm/blade | Flatness 0.007 段差 Difference of step 0.005 |
| 2 | 中ぐり位置決め加工精度 Position accuracy by borings  | Cutting tool: Carbide tip Material: JIS FC250 cast iron Spindle speed: 800min ⁻¹ Cutting speed: 100m/min Depth of cut: 0.1mm Feedrate: 0.05mm/rev | 0.012 /200 |
| 3 | 直線切削精度 (同時2軸) Straight cutting accuracy on simultaneous two axis  | 平行度 Cutting tool: Carbide endmill $\phi 40$ Material: JIS FC250 cast iron Spindle speed: 600min ⁻¹ Cutting speed: 75m/min Depth of cut: 0.1mm Feedrate: 0.1mm/blade | Parallelism 0.010 /約250 Per approx. 250 |
| 4 | 円形削りの精度 Circular cutting accuracy  | 真円度 備考 送り方向が変わることによる削り残しや切り込みと思われる部分は測定しない。 Remarks: Those portions where undercut or overcut might occur due to change of cutting direction should not be measured. | Circularity 0.010 /約200 Per approx. 200 |