
**Test conditions for horizontal internal
type broaching machines — Testing of
accuracy**

*Conditions de réception des machines horizontales à brocher les
intérieurs — Contrôle de l'exactitude*



6 Geometric tests

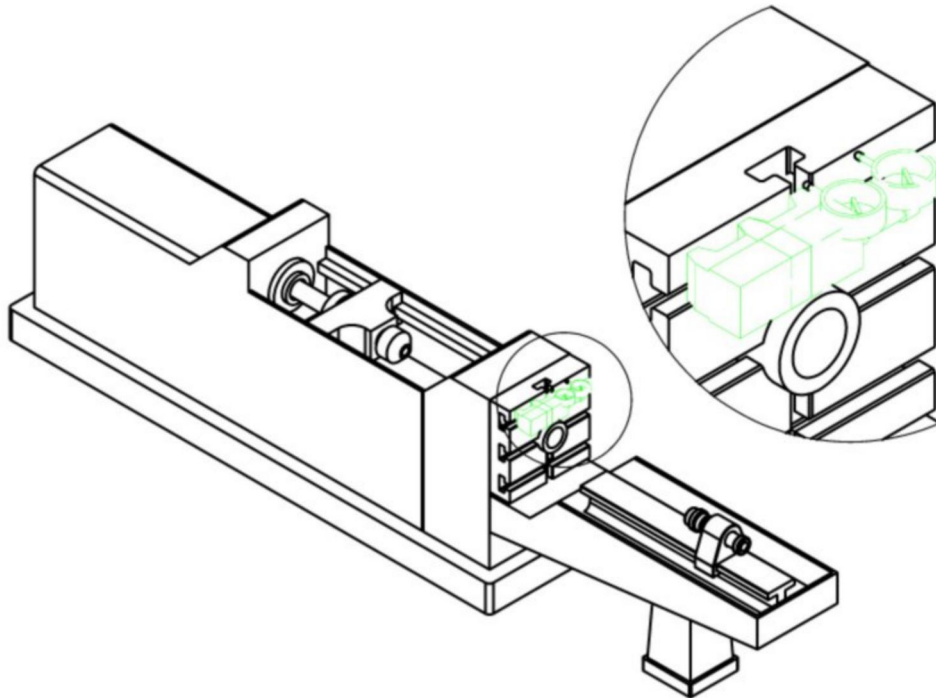
Object

Checking of flatness of the face plate

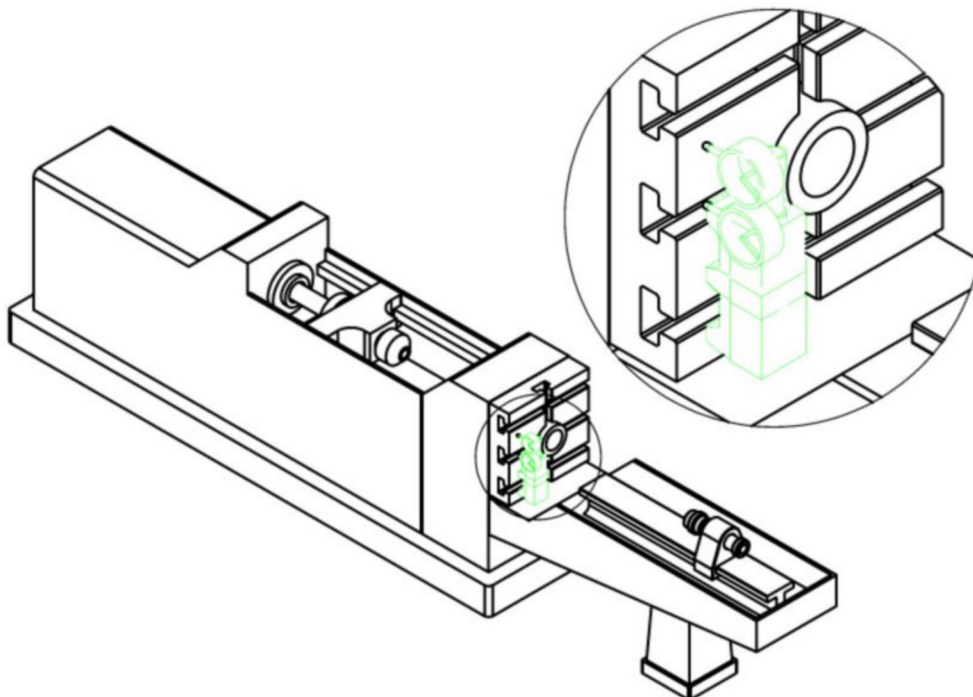
G1

Diagram

First step of measurement in horizontal direction



Second step of measurement in vertical direction

**Tolerance**

0,025 for a measuring length of up to 300

Total tolerance: 0,050

Measured deviation

Measuring instruments

Dial gauge with metrological carriage.

Observations and references to ISO 230-1:2012, 12.1.3.5 and 12.2

In order to determine flatness of the rectangular surface which is a vertical plane, a dial gauge with a special base is used. In the first step, measurements shall be carried out at a number of positions equally spaced in horizontal directions. In the second step, measurements are performed in vertical directions by the same dial gauge with its special base with equally spaced measuring distances. For more details and interpretation of obtained results, refer to ISO 230-1:2012, 12.2.4.

Object

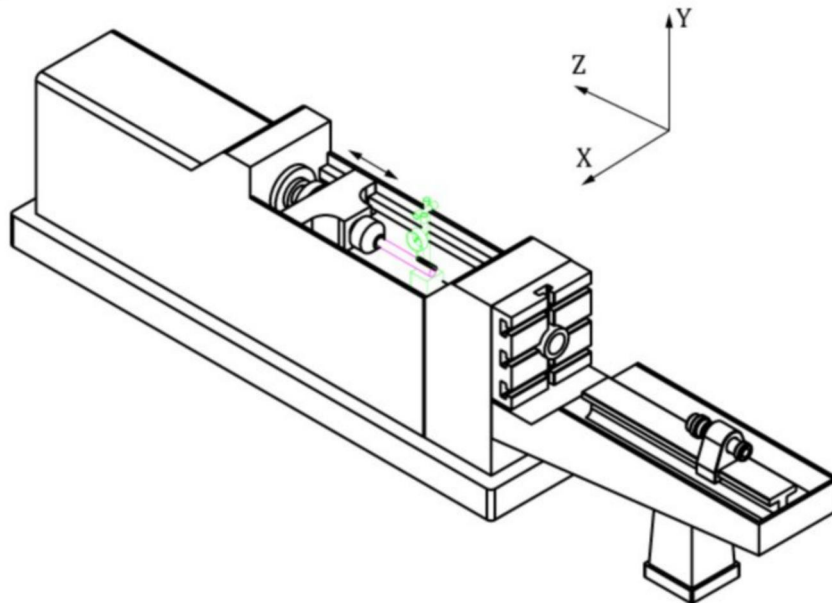
G2

Checking of parallelism error of the pulling chuck hole axis to its movement (Z-axis):

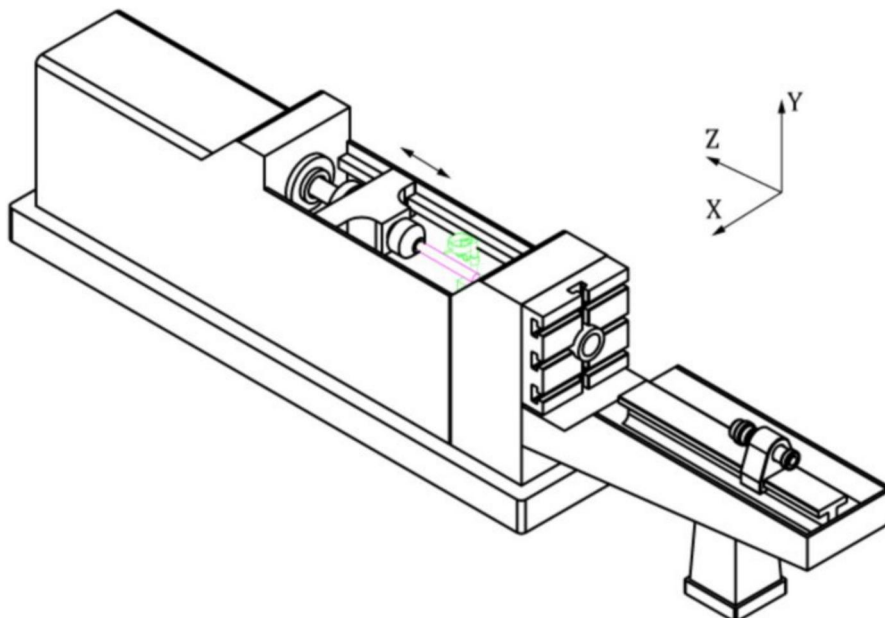
- a) in vertical YZ plane ($E_{A0ZChuckHole}$);
- b) in horizontal ZX plane ($E_{B0ZChuckHole}$).

Diagram

- a) in vertical YZ plane



- b) in horizontal ZX plane

**Tolerance**

For a) and b)

0,050 / 300 (0,165 / 1 000) or 33''

Measured deviation	
a)	b)
Measuring instruments	
Test mandrel and dial gauge.	
Observations and references to ISO 230-1:2012, 12.3.2.5.1	
for a)	
Fix the dial gauge base on a fixed part of the machine. Contact the stylus of the dial gauge along Y direction to the test mandrel which is inserted to the pulling chuck. While the dial gauge is fixed, move the test mandrel attached to the pulling block along the Z-axis and record vertical variations.	
for b)	
Fix the dial gauge base on a fixed part of the machine. Contact the stylus of the dial gauge along X direction to the test mandrel which is inserted to the pulling chuck. While the dial gauge is fixed, move the test mandrel attached to the pulling block along the Z-axis and record horizontal variations.	

Object

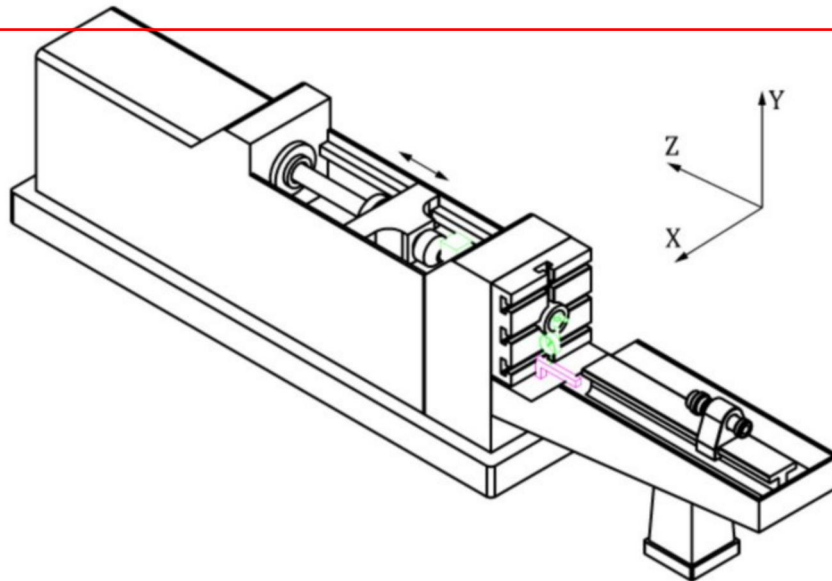
G3

Checking of squareness of the pulling chuck movement (Z-axis) to the face plate:

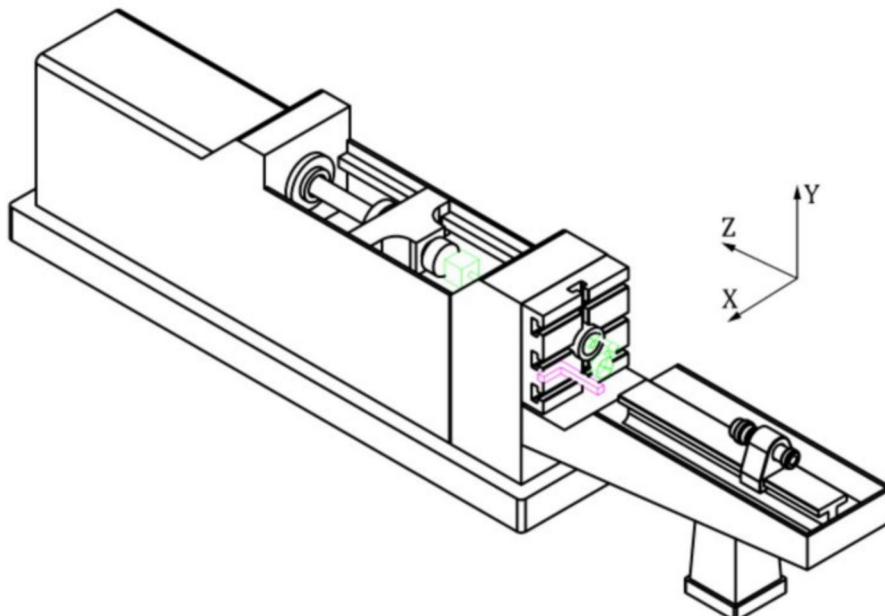
- a) in vertical YZ plane;
- b) in horizontal ZX plane.

Diagram

- a) in vertical YZ plane



- b) in horizontal ZX plane

**Tolerance**

For a) and b)

0,035 / 300 (0,115 / 1 000) or 23''

Measured deviation	
a)	b)
Measuring instruments	
Square and dial gauge.	
Observations and references to ISO 230-1:2012, 12.4.5	
For a)	
<p>Fix a square on the face plate while one measuring side of the square is oriented along Y direction. Set the base of the dial gauge on the pulling chuck. Contact the stylus of the dial gauge to the measuring face of the square in YZ plane along Y direction. Move the dial gauge attached to pulling block (Z-axis) in front of the square and record the variations of the dial gauge and also the first and the last positions of Z-axis.</p> <p>The squareness error is the difference between the readings at two ends of the square divided by the predetermined stroke of Z-axis at those positions.</p>	
For b)	
<p>Fix a square on the face plate while one measuring side of the square is oriented along X direction. Set the base of the dial gauge on the pulling chuck. Contact the stylus of the dial gauge to the measuring face of the square in ZX plane along X direction. Move the dial gauge attached to pulling block (Z-axis) in front of the square and record the variations of the dial gauge and also the first and the last positions of Z-axis.</p> <p>The squareness error is the difference between the readings at two ends of the square divided by the predetermined stroke of Z-axis at those positions.</p>	

Object

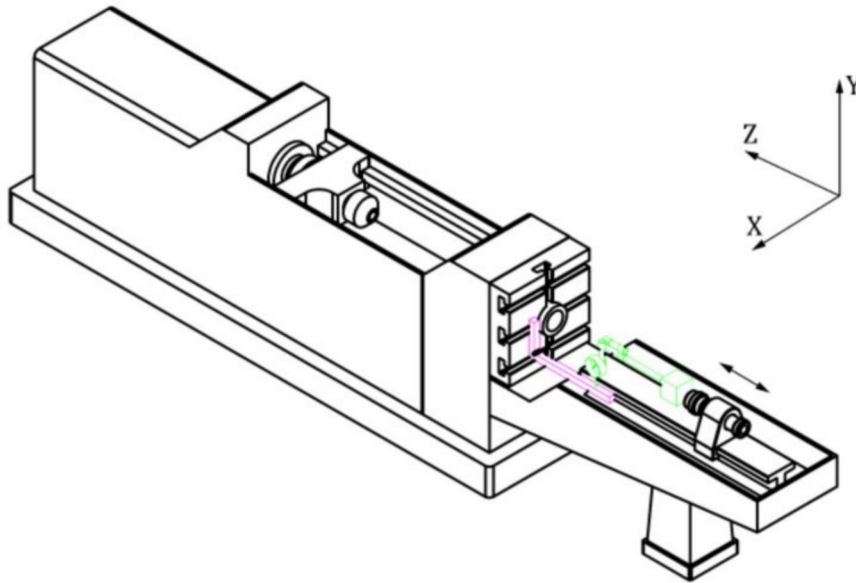
G4

Checking of squareness of the retrieving chuck movement (W-axis) to the face plate:

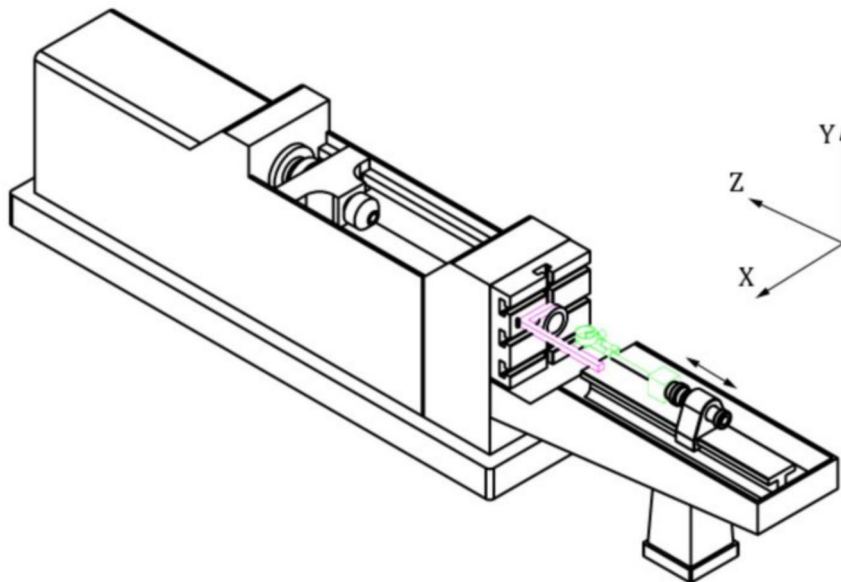
- a) in vertical YZ plane;
- b) in horizontal ZX plane.

Diagram

- a) in vertical YZ plane



- b) in horizontal ZX plane

**Tolerance**

For a) and b)

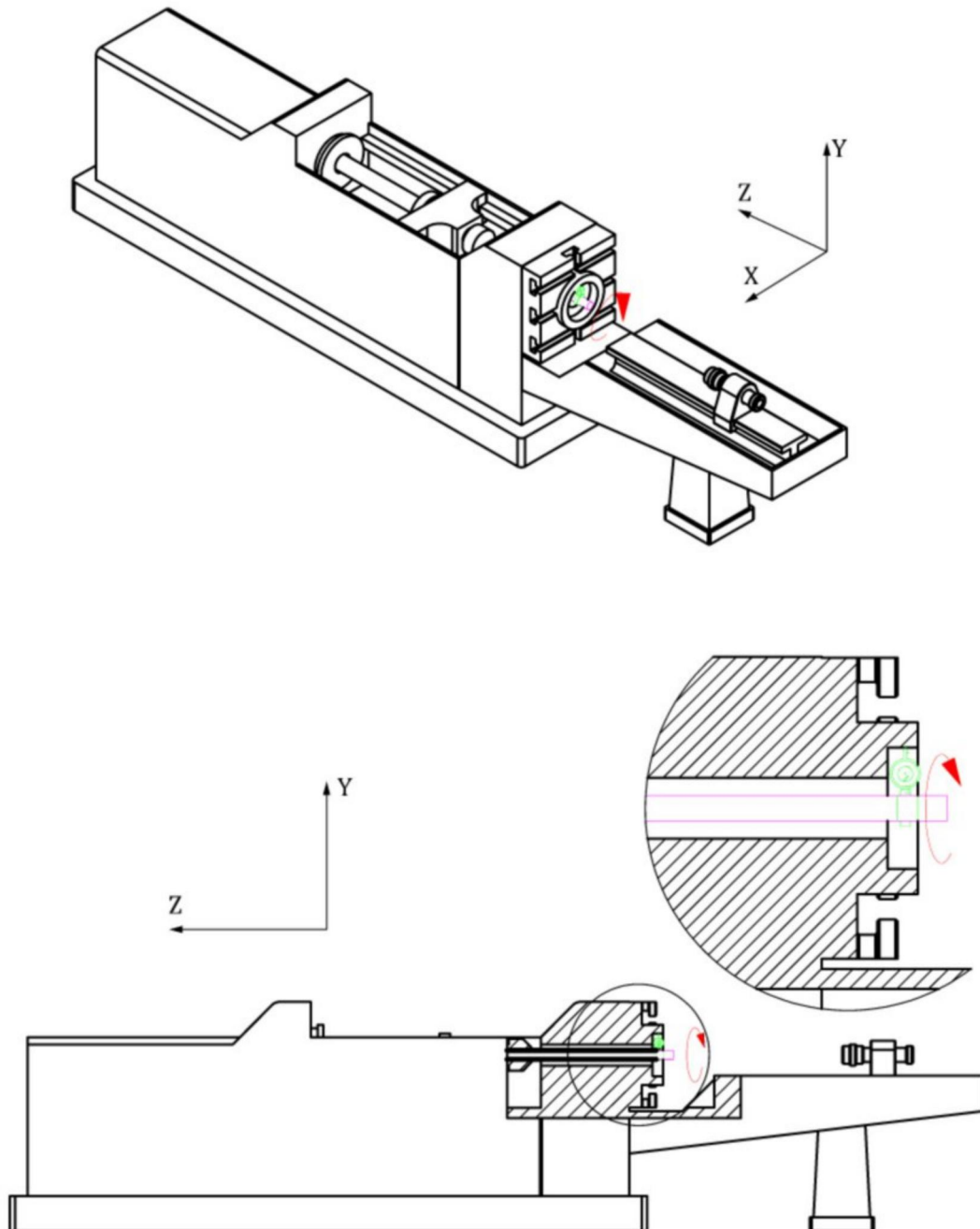
0,075 / 300 (0,250 / 1 000) or 50''

Measured deviation	
a)	b)
Measuring instruments	
Square and dial gauge.	
Observations and references to ISO 230-1:2012, 12.4.5	
For a)	
Fix a square on the face plate while one measuring side of the square is oriented along Y direction. Set the base of the dial gauge on the retrieving chuck. Contact the stylus of the dial gauge to the measuring face of the square in YZ plane along Y direction. Move the dial gauge attached to retrieving chuck (W-axis) in front of the square and record the variations of the dial gauge and also the first and the last positions of W-axis.	
The squareness error is the difference between the readings at two ends of the square divided by the predetermined stroke of W-axis at those positions.	
For b)	
Fix a square on the face plate while one measuring side of the square is oriented along X direction. Set the base of the dial gauge on the retrieving chuck. Contact the stylus of the dial gauge to the measuring face of the square in ZX plane along X direction. Move the dial gauge attached to retrieving chuck (W-axis) in front of the square and record the variations of the dial gauge and also the first and the last positions of W-axis.	
The squareness error is the difference between the readings at two ends of the square divided by the predetermined stroke of W-axis at those positions.	

Object

G5

Checking of radial offset of coaxiality deviation of the pulling chuck hole axis to the centre hole of the face plate

Diagram**Tolerance**

0,050

Measured deviation**Measuring instruments**

Test mandrel and dial gauge mounted on a bush¹⁾.

¹⁾ For more information about the bush (ring), refer to ISO 230-1:2012, 12.3.4.

Observations and references to ISO 230-1:2012, 10.2 and 12.3.4

Fix the dial gauge ring-type base on the test mandrel which is inserted to the pulling chuck. Contact the stylus of the dial gauge radially to the central hole of work support bush. By swivelling the dial gauge on the test mandrel and touching the hole surface, record maximum and minimum deviations of the dial gauge. Radial offset of coaxiality deviation is the half value of the deviation between maximum and minimum readings of the dial gauge.

Object

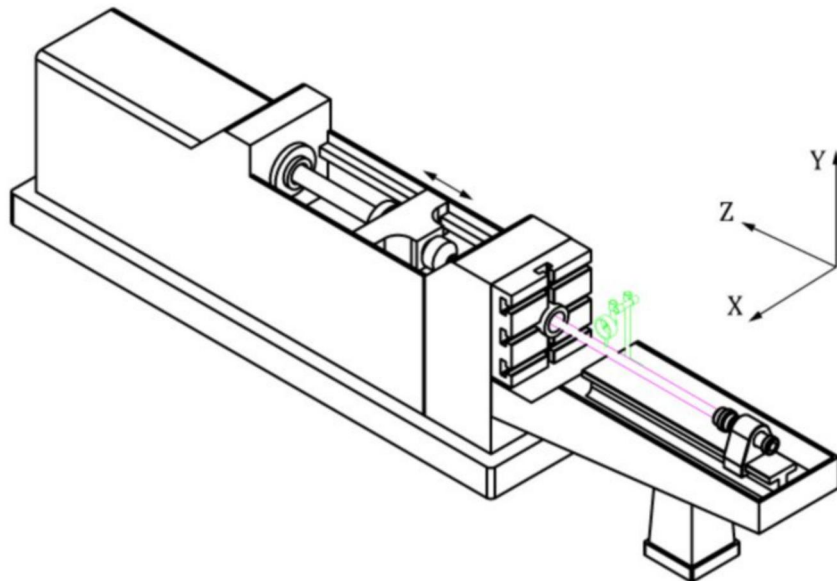
G6

Checking of radial offset of coaxiality deviation of the retrieving chuck hole axis to the pulling chuck hole axis:

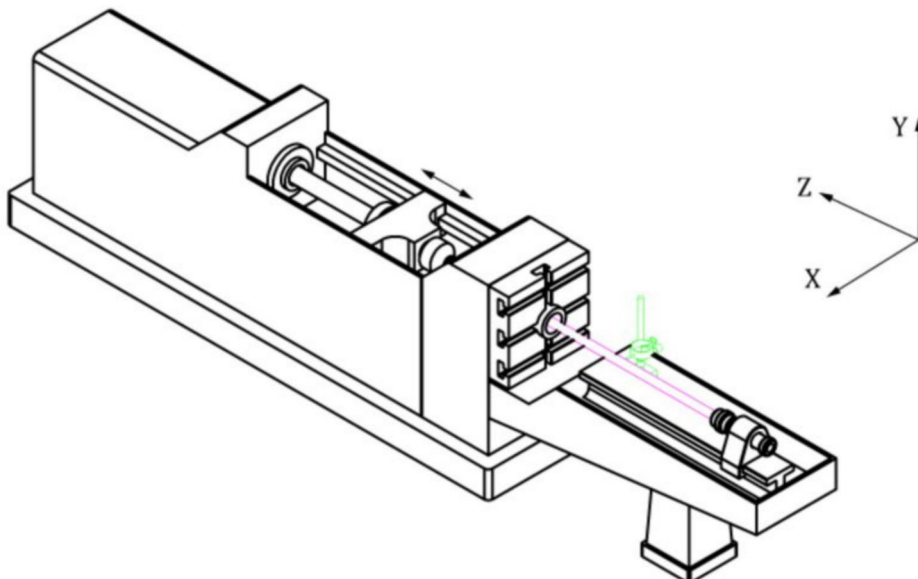
- in vertical YZ plane (vertical offset);
- in horizontal ZX plane (horizontal offset).

Diagram

- in vertical YZ plane



- in horizontal ZX plane

**Tolerance**

For a) and b)

0,060 over a measuring length of 500

Measured deviation	
a)	b)
Measuring instruments	
Test mandrel and dial gauge.	
Observations and references to ISO 230-1:2012, 10.2 and 12.3.4	
For a)	
Fix a test mandrel between the retrieving chuck hole and the pulling chuck hole. Set the dial gauge base on a fixed part of the machine. Contact the stylus of the dial gauge along Y direction to the test mandrel. While the dial gauge is fixed, move the test mandrel fixed between the two chucks by simultaneous motion of Z-axis and W-axis and record vertical variations of the dial gauge.	
For b)	
Fix a test mandrel between the retrieving chuck hole and the pulling chuck hole. Set the dial gauge base on a fixed part of the machine. Contact the stylus of the dial gauge along X direction to the test mandrel. While the dial gauge is fixed, move the test mandrel fixed between the two chucks by simultaneous motion of Z-axis and W-axis and record horizontal variations of the dial gauge.	

7 Machining tests

Because of the diversity of shape of components produced by horizontal internal type broaching machines, practical tests with determined shapes have not been introduced in this document. If the user requests to carry out a machining test, details of this test shall be stated in agreement with the manufacturer. The following information should be stated in the agreement and final test result:

- test piece (i.e. material, dimensions);
- broach (i.e. material, geometry, tooling and sharpening process);
- conditions of internal broaching operation (i.e. cutting speed, coolant, fixturing);
- geometry of broached features (i.e. technical drawing, dimensions, tolerance);
- measuring instrument for checking the accuracy of finished test piece (i.e. resolution, uncertainty).