



INSPECTION & TEST REPORT

REPORT NUMBER : 101R1606

CONSIGNER : Monkula Enterprise Co., Ltd.

INSPECTION : The Product Inspection of the Compound
ITEM Damped Tool with Long Overhangs

(Tool Overhang : 10 Multiples of the Tool Diameter & 372 mm)

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發給

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1. INSPECTION RESULTS

Tool overhang : 10 multiples of the Tool Diameter			
ITEM	TITLE	TARGET VALUE	INSPECTION RESULTS
A	Distance range of inner bore depth of the workpiece	0~320mm	Tool overhang: 320mm Machining depth of the internal diameter of the workpiece in the axial direction: 80.79mm
B	Surface roughness of the workpiece (Ra)	0.7 μ m	0.57 μ m
C	Machining roundness of the workpiece	± 0.02 mm	At the machining depth 20mm, the roundness is 0.00465mm. At the machining depth 40mm, the roundness is 0.00230mm. At the machining depth 60mm, the roundness is 0.00235mm.
Tool overhang : 372 mm			
ITEM	TITLE	INSPECTION RESULTS	
A	Distance range of inner bore depth of the workpiece	Tool overhang: 372mm Machining depth of the internal diameter of the workpiece in the axial direction: 101mm	
B	Surface roughness of the workpiece (Ra)	2. 22 μ m	
C	Machining roundness of the workpiece	At the machining depth 25mm, the roundness is 0.01235mm. At the machining depth 50mm, the roundness is 0.0071mm. At the machining depth 75mm, the roundness is 0.0072mm.	

2. INSPECTION STEPS

Tool overhang : 10 multiples of the Tool Diameter			
STEP	DESCRIPTION	METHOD	REMARK
A	Distance range of inner bore depth of the workpiece	As described in item 3-1 (A) in the "Inspection Methods"	
B	Surface roughness of the workpiece (Ra)	As described in item 3-1 (B) in the "Inspection Methods"	
C	Machining roundness of the workpiece	As described in item 3-1 (C) in the "Inspection Methods"	
Tool overhang : 372 mm			
STEP	DESCRIPTION	METHOD	REMARK
A	Distance range of inner bore depth of the workpiece	As described in item 3-2 (A) in the "Inspection Methods"	
B	Surface roughness of the workpiece (Ra)	As described in item 3-2 (B) in the "Inspection Methods"	
C	Machining roundness of the workpiece	As described in item 3-2 (C) in the "Inspection Methods"	

3. INSPECTION METHODS

3-1. Tool overhang : 10 multiples of the Tool Diameter

A. Distance Range of Inner Bore Depth of the Workpiece

- (1) Clamp the workpiece onto the spindle, and mount the tool onto the turret side.
- (2) Edit the machining program in the controller. The program contains the speed of spindle, feed rate, and radial position of machining, etc., during the machining. The speed of spindle S is 300m/min, the feed rate F is 0.06mm/rev, and the radial position of machining is 80mm, as shown in Figure 3-1-1.
- (3) Execute the machining program. When machining, the axis Z starts from the position of $Z1.0$ to $Z-81$ at the feed rate $F0.06$ to travel through the workpiece in order to complete the radial machining of inner bore. After the machining, retract the tool to the position of $X200$ and the position of $Z150$.
- (4) Measure the tool overhang (from the plane of the tool holder to the machining point of the tool) with the measuring tape. Measure the machining depth of inner diameter of the workpiece in the axial direction with the vernier caliper. The machining depth of internal diameter of the workpiece in the axial direction is the length of the workpiece, as shown in Figure 3-1-2 and Figure 3-1-3.
- (5) The inspection result of distance range of inner diameter of the workpiece is:
the tool overhang is 320mm (as shown in Figure 3-1-2), and the machining depth of inner diameter of the workpiece in the axial direction is 80.79mm (as shown in Figure 3-1-3).

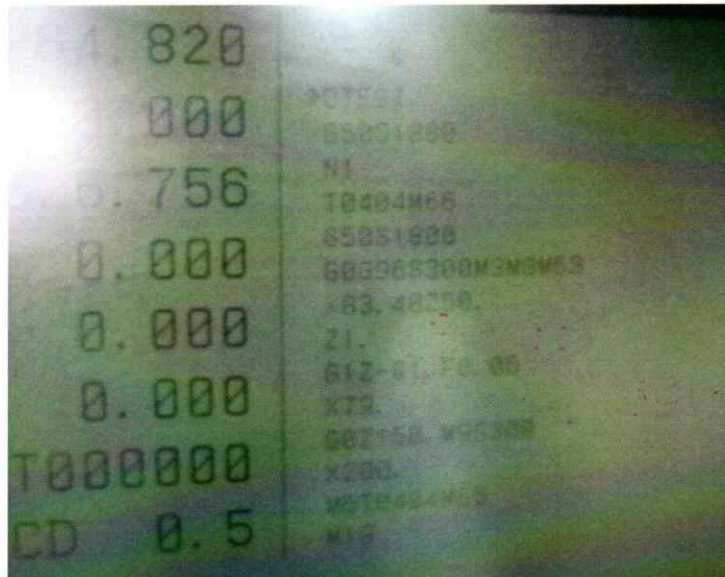


Figure 3-1-1 Machining program

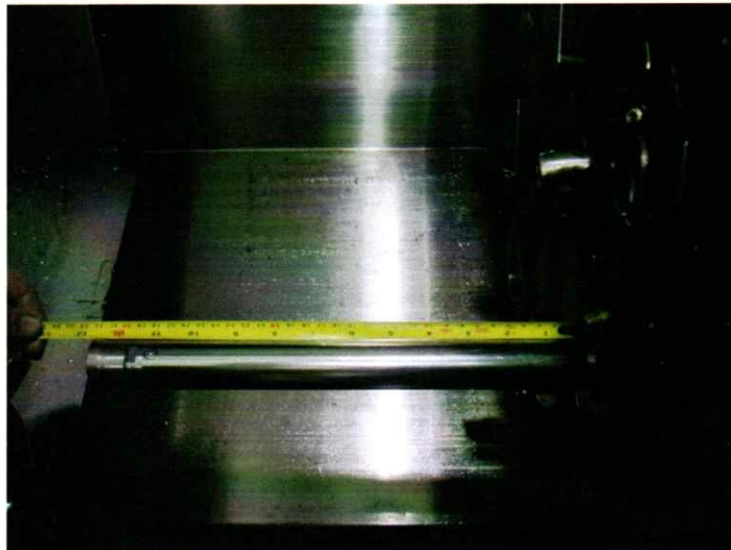


Figure 3-1-2 Tool overhang

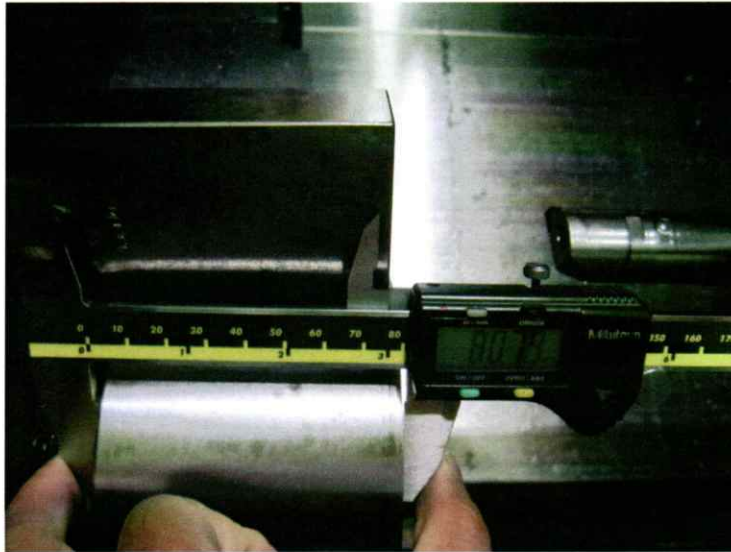


Figure 3-1-3 Machining depth of inner diameter of the workpiece in the axial direction (i.e. length of the workpiece)

B. Surface Roughness of the Workpiece

- (1) Activate the executive software and measurement hardware of the surface roughness measuring instrument.
- (2) Fix the workpiece onto the magnetic base which has the V-shaped opening. The magnetic base is fixed onto the measurement table of the surface roughness measuring instrument (as shown in Figure 3-1-4).
- (3) Set the measurement parameters and measurement items of the surface roughness measuring instrument. Refer to the JIS B0601 standard for the setting of measurement parameters. The major measurement parameters are measurement length, reference length and cut-off value. The measurement length is 4mm, the reference length is 0.8mm, and the cut-off value is 0.8mm. The evaluation value is the arithmetic mean roughness (Ra).
- (4) Adjust the X and Y axes positions of the measurement table, and the Z axis position of the stylus of the surface roughness measuring instrument. When the stylus contacts with the inner bore of the workpiece and the stylus reaches the stable measurement status, start measuring the surface roughness of the workpiece and record the measurement result.
- (5) The inspection result of the surface roughness of the workpiece is Ra 0.57 μ m (as shown in Figure3-1-5).

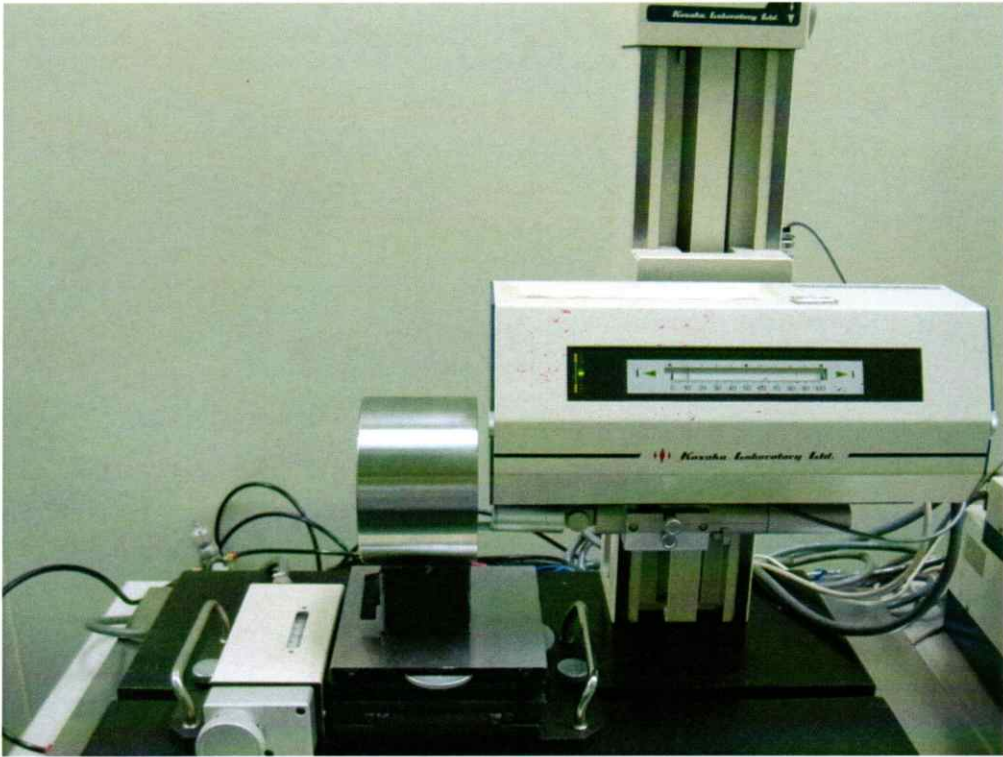


Figure 3-1-4 Actual measurement of surface roughness of the workpiece

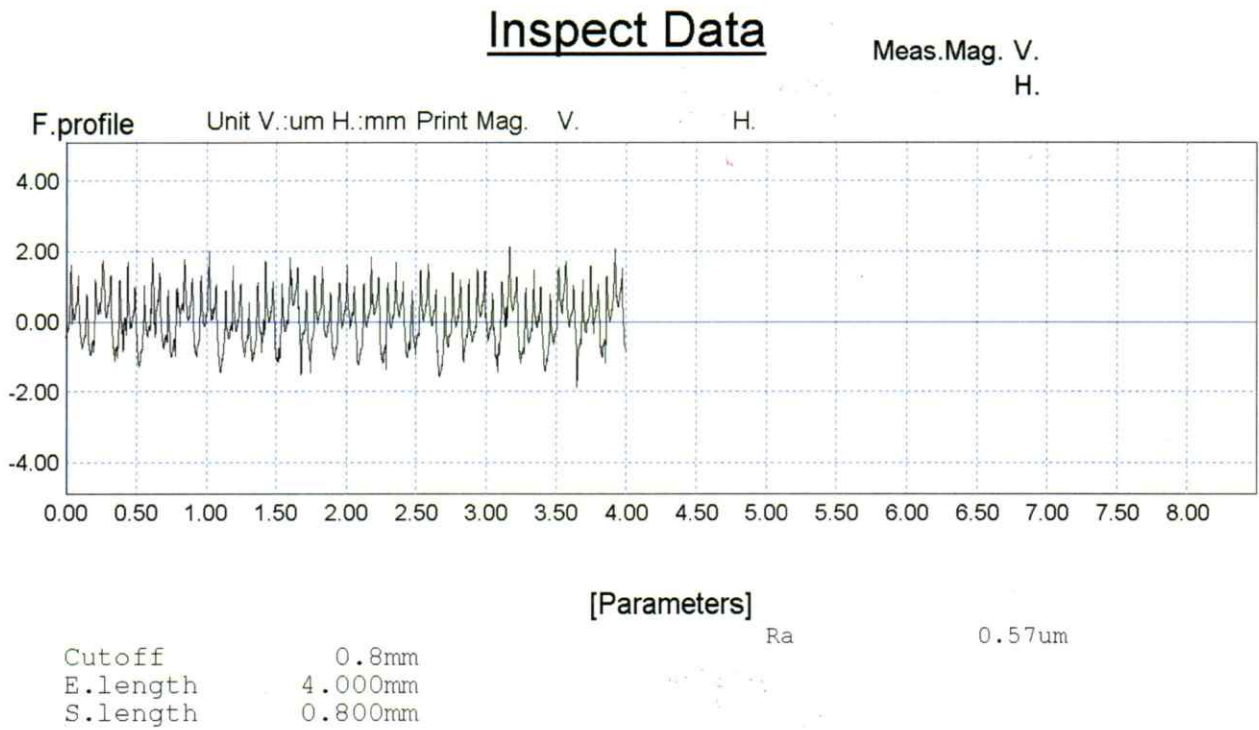


Figure 3-1-5 Measurement result of surface roughness of the workpiece

C. Machining Roundness of the Workpiece

- (1) Activate the executive software and measurement hardware of the roundness measuring machine.
- (2) Fix the workpiece onto the measurement table of the roundness measuring machine with the magnetic base (as shown in Figure 3-1-6).
- (3) Set the measurement parameters of the roundness machine. The major measurement parameters are measurement diameter of the workpiece, cut-off value and algorithm. The measurement diameter is 80mm, and the algorithm to get the value of roundness is the least-squares circle (LSC).
- (4) After the adjustment of the center and level of the workpiece, start measuring the Machining roundness of the workpiece and record the measurement result. The measurement locations are the ones that are 20mm, 40mm, and 60mm from the end of the workpiece (that is, the machining depth 20mm, 40mm, and 60mm).
- (5) The results of machining roundness of the workpiece (as shown in Figure 3-1-7) are:
At the machining depth 20mm, the machining roundness is 0.00465mm.
At the machining depth 40mm, the machining roundness is 0.00230mm.
At the machining depth 60mm, the machining roundness is 0.00235mm.

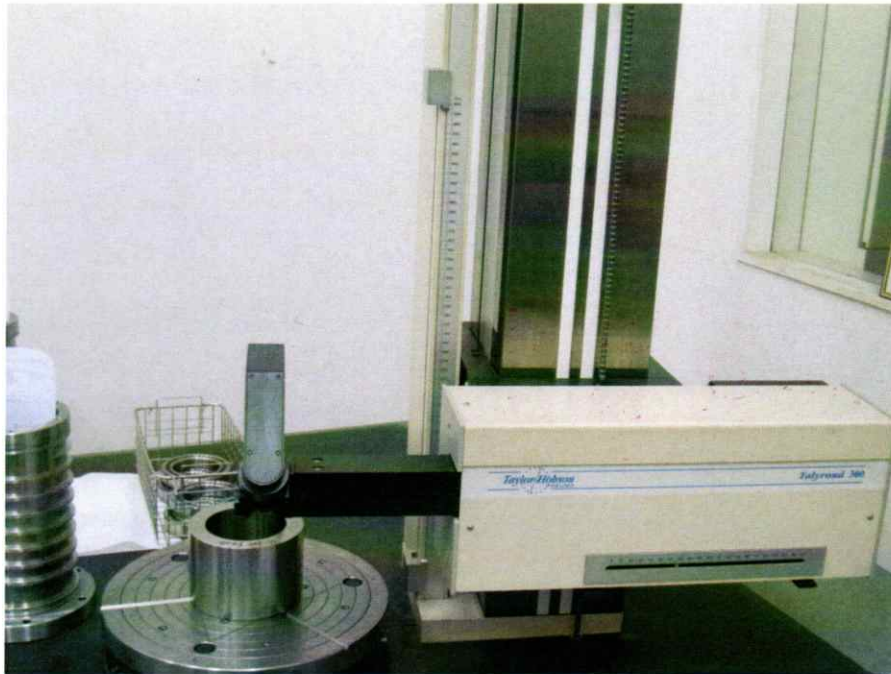


Figure 3-1-6 Actual measurement of machining roundness of the workpiece

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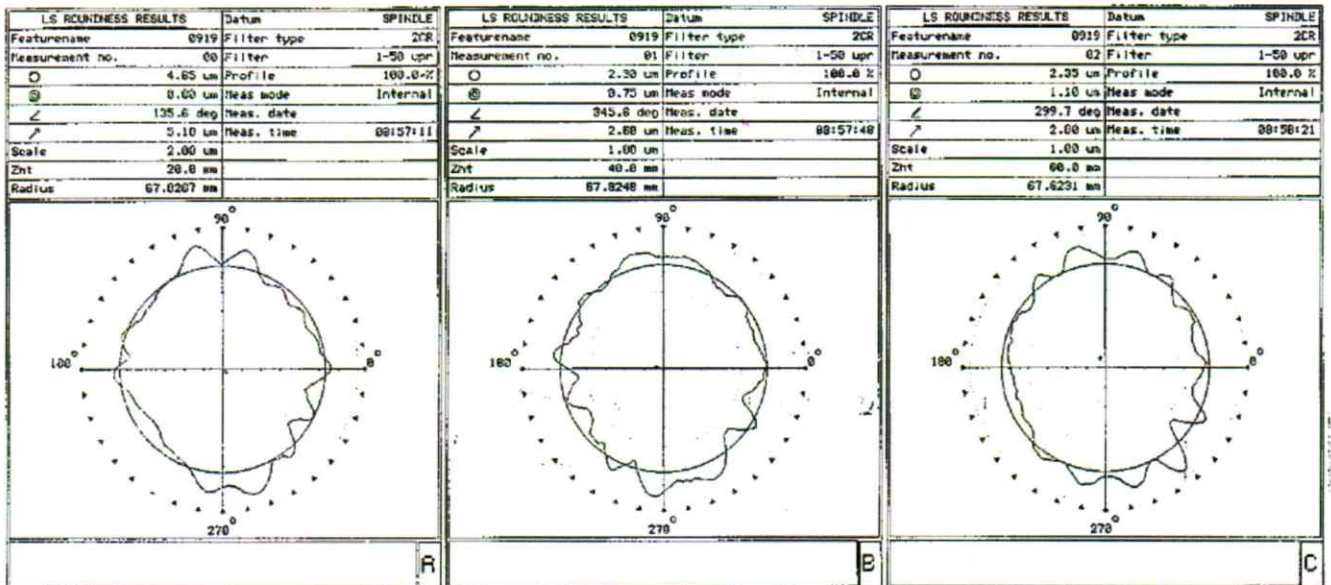


Figure 3-1-7 Measurement result of machining roundness of the workpiece

3-2 Tool overhang : 372 mm

A. Distance Range of Inner Bore Depth of the Workpiece

- (1) Clamp the workpiece onto the spindle, and mount the tool onto the turret side.
- (2) Edit the machining program in the controller. The program contains the speed of spindle, feed rate, and radial position of machining, etc., during the machining. And the speed of spindle S is 250m/min, the feed rate F is 0.2mm/rev, and the radial position of machining is 80mm, as shown in Figure 3-2-1.
- (3) Execute the machining program. When machining, the axis Z starts from the position of $Z1.0$ to $Z-102$ at the feed rate $F0.2$ to travel through the workpiece in order to complete the radial machining of inner bore. After the machining, retract the tool to the position of $X200$ and the position of $Z150$.
- (4) Measure the tool overhang (from the plane of the tool holder to the machining point of the tool) with the measuring tape. Measure the machining depth of inner diameter of the workpiece in the axial direction with the square ruler. The machining depth of internal diameter of the workpiece in the axial direction is the length of the workpiece, as shown in Figure 3-2-2 and Figure 3-2-3.
- (5) The inspection result of distance range of inner diameter of the workpiece is:
the tool overhang is 372mm (as shown in Figure 3-2-2), and the machining depth of inner diameter of the workpiece in the axial direction is 101mm (as shown in Figure 3-2-3).

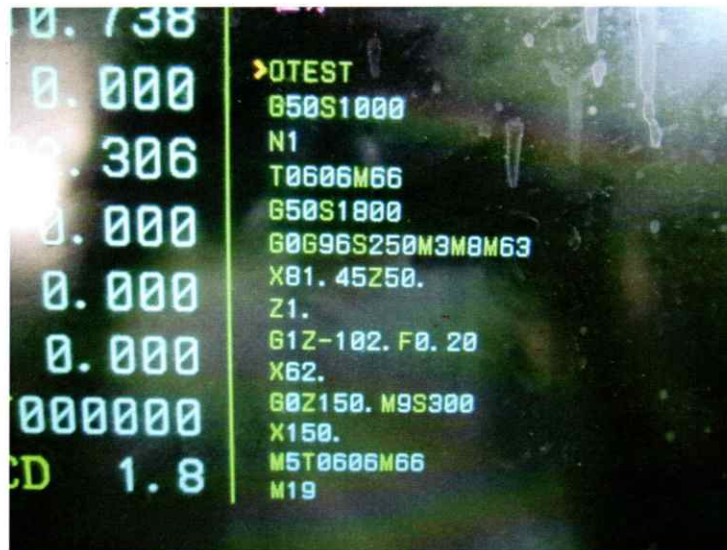


Figure 3-2-1 Machining program



Figure 3-2-2 Tool overhang

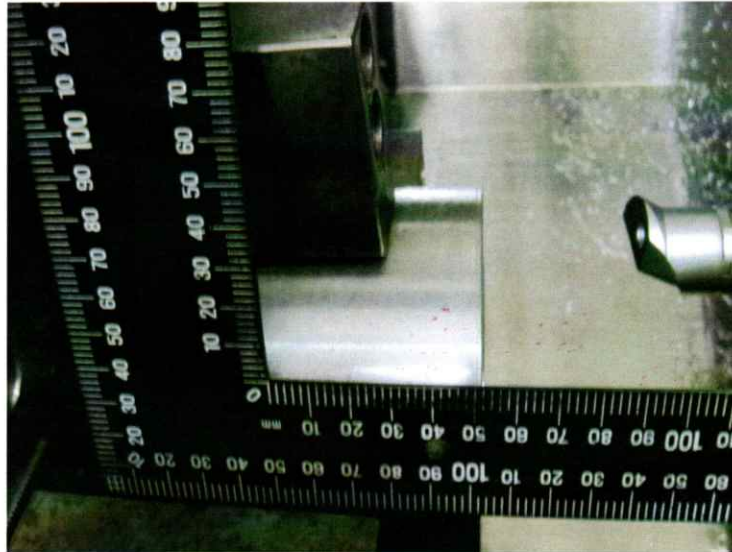


Figure 3-2-3 Machining depth of inner diameter of the workpiece in the axial direction (i.e. length of the workpiece)

B. Surface Roughness of the Workpiece

- (1) Activate the executive software and measurement hardware of the surface roughness measuring instrument.
- (2) Fix the workpiece onto the magnetic base which has the V-shaped opening. The magnetic base is fixed onto the measurement table of the surface roughness measuring instrument (as shown in Figure 3-2-4).
- (3) Set the measurement parameters and measurement items of the surface roughness measuring instrument. Refer to the JIS B0601 standard for the setting of measurement parameters. The major measurement parameters are measurement length, reference length and cut-off value. The measurement length is 4mm, the reference length is 0.8mm, and the cut-off value is 0.8mm. The evaluation value is the arithmetic mean roughness (Ra).
- (4) Adjust the X and Y axes positions of the measurement table, and the Z axis position of the stylus of the surface roughness measuring instrument. When the stylus contacts with the inner bore of the workpiece and the stylus reaches the stable measurement status, start measuring the surface roughness of the workpiece and record the measurement result.
- (5) The inspection result of the surface roughness of the workpiece is Ra 2.22 μ m (as shown in Figure 3-2-5).



Figure 3-2-4 Actual measurement of surface roughness of the workpiece

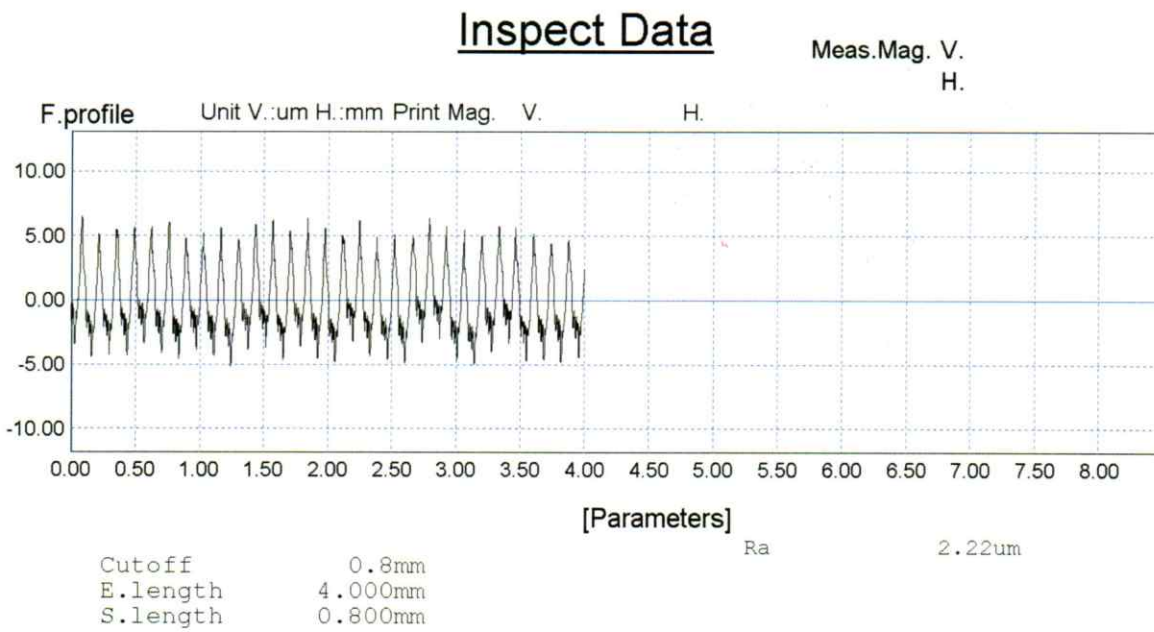


Figure 3-2-5 Measurement result of surface roughness of the workpiece

C. Machining Roundness of the Workpiece

- (1) Activate the executive software and measurement hardware of the roundness measuring machine.
- (2) Fix the workpiece onto the measurement table of the roundness measuring machine with the magnetic base (as shown in Figure 3-2-6).
- (3) Set the measurement parameters of the roundness machine. The major measurement parameters are measurement diameter of the workpiece, cut-off value and algorithm. The measurement diameter is 80mm, and the algorithm to get the value of roundness is the least-squares circle (LSC).
- (4) After the adjustment of the center and level of the workpiece, start measuring the Machining roundness of the workpiece and record the measurement result. The measurement locations are the ones that are 25mm, 50mm, and 75mm from the end of the workpiece (that is, the machining depth 25mm, 50mm, and 75mm).
- (5) The results of machining roundness of the workpiece (as shown in Figure 3-2-7) are:
At the machining depth 25mm, the machining roundness is 0.01235mm.
At the machining depth 50mm, the machining roundness is 0.00710mm.
At the machining depth 75mm, the machining roundness is 0.00720mm.



Figure 3-2-6 Actual measurement of machining roundness of the workpiece

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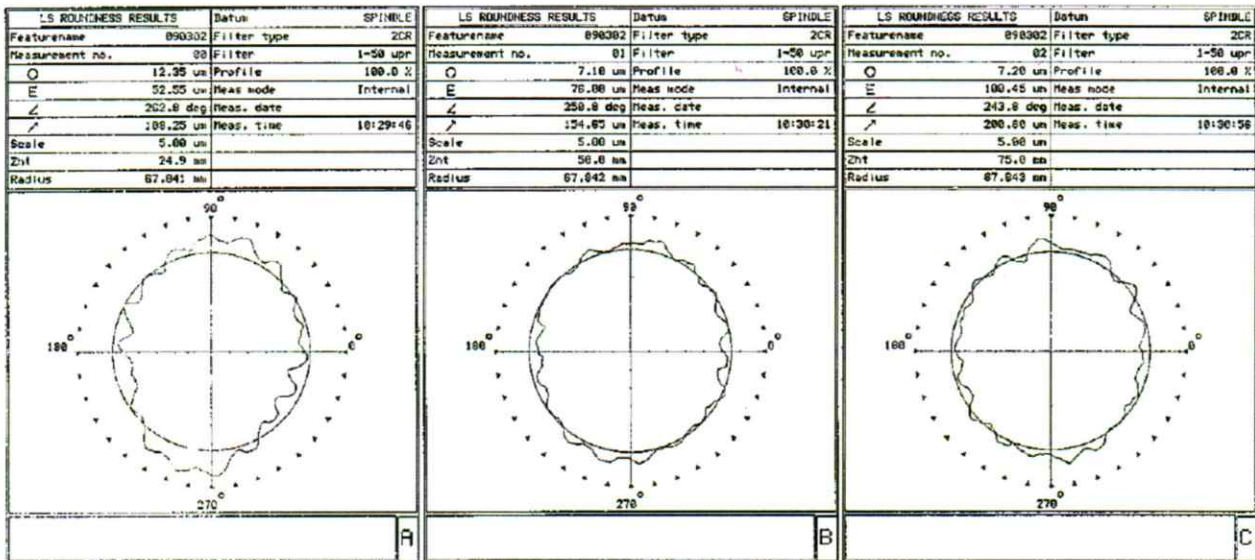


Figure 3-2-7 Measurement result of machining roundness of the workpiece

4. DESCRIPTION OF MAJOR INSTRUMENTS

I. SEF3500K Surface Roughness Measuring Instrument

Two-dimensional Roughness Measurement:

Measurement range: vertical 600 μ m, lateral 100mm.

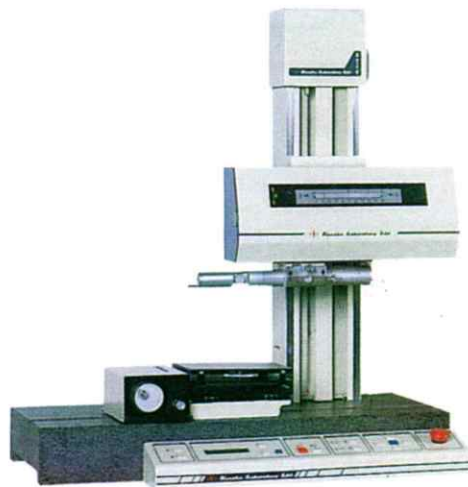
Measurement length: 0.25mm, 0.8 mm, 2.5 mm, 8 mm, 25 mm, 80 mm.

Feed rate: 0.05mm/s, 0.1 mm/s, 0.2 mm/s, 0.5 mm/s, 1 mm/s, 2 mm/s.

Measurement precision of straightness: 0.2 μ m/100mm.

Method of Operation:

- (1) Place the workpiece on the measurement table of the surface roughness measuring instrument.
- (2) Activate the air pressure, power, software and hardware of the surface roughness measuring instrument.
- (3) Set the measurement parameter of the surface roughness measuring instrument in the software.
- (4) Adjust the location of the object which is to be measured, and press the “auto” button on the hardware of the surface roughness measuring instrument, in order to allow the measurement stylus of the surface roughness measuring instrument to slowly descend to the surface of the object which is to be measured, and to gently touch the object. After the stylus indicator light stops flashing, press the “meas.” button in the software to start measurement.



II. Taylor Hobson Cylindrical Roundness Measuring Machine

Model of deep hole detector : Talyrond 300

Maximum Weight : 50Kg.

Maximum Height: 500mm.

Roundness limit of Error : Concentric Load within : $0.025 \mu\text{m} + 0.0003 \mu\text{m}/\text{mm}$

Eccentric Load 50Kg : $0.025 \mu\text{m} + 0.0001 \mu\text{m}/\text{mm}$

Method of Operation:

- (1) Place the workpiece on the measurement table of the cylindrical roundness measuring machine.
- (2) Activate the air pressure, power, software and hardware of the cylindrical roundness measuring machine.
- (3) Set the measurement parameter of the roundness or cylindricity in the software.
- (4) After the adjustment of the center and level of the workpiece, start measurement.

