International Standard 8956

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Acceptance conditions for copying attachments, integral or otherwise, for lathes — Testing of the accuracy

Conditions de réception des dispositifs de copiage pour tours, intégrés ou non — Contrôle de la précision

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

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Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

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Acceptance conditions for copying attachments, integral or otherwise, for lathes — Testing of the accuracy

1 Scope and field of application

This International Standard describes both special tests and practical tests for copying attachments of general-purpose normal precision (centre lathes, vertical boring machines, capstan lathes or others) and copying lathes. These tests are intended to supplement the tests for the various types of lathes.

This International Standard applies to hydraulic and electric servo-controlled copying attachments but not to mechanically controlled ones.

It also applies to lathes with single-axis copying systems and to lathes where two axes are used in conjunction to produce a profile of up to 180° included angle. Turning machines equipped with two-axis systems of more than 180° capability are considered as special-purpose machines; this International Standard does not apply to such machines.

2 References

ISO 230/1, *Acceptance code for machine tools — Part 1: Geometric accuracy of the machine operating under no load or finishing conditions.*

ISO 1708, *Acceptance conditions for general purpose parallel lathes — Testing of the accuracy.*

ISO 3655, *Acceptance conditions for vertical turning and boring lathes with one or two columns with a single fixed or movable table — General introduction and testing of the accuracy.*

ISO 6155/1, *Acceptance conditions for horizontal spindle capstan, turret and single spindle automatic lathes — Testing of the accuracy — Part 1: Machinable bar diameters greater than* 25 mm.

3 Preliminary remarks

The preliminary remarks in ISO 1708, ISO 3655 and ISO 6155/1 are also applicable to this International Standard.

Tests carried out on copying lathes shall be performed with the copying unit in position on the machine or integral with it.

4 Definitions

4.1 single-axis copying system: A system in which a component shape is produced by the motion of two slides, one of which is under servo-control from the contact of a stylus against a template while the other has a pre-set generally constant feed motion. In this case the displacement axis of the stylus is always parallel to the displacement axis of the copying slide.

4.2 two-axis copying system: A system in which a component shape is produced by the motion of two slides, both of which are under servo-control from the contact of a stylus against a template.

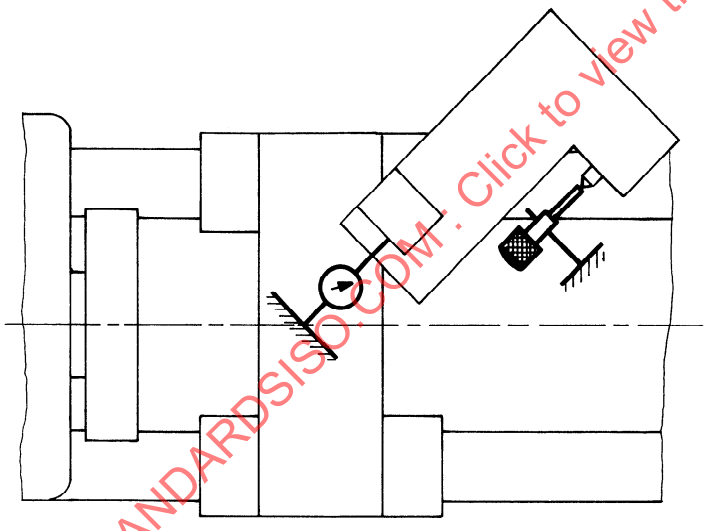
5 Acceptance conditions and permissible deviations

5.1 Special tests

5.1.1 Lathes with single-axis copying systems

The micrometer and dial gauge shall be mounted parallel with the servo-controlled axis under test.

The tests shall be performed at the end of each stroke and midway along the copying slide stroke.

No.	Diagram	Object
G1.1		Assessment of repeatability of positioning
G1.2		Measurement of dead zone
G1.3		Measurement of sensitivity

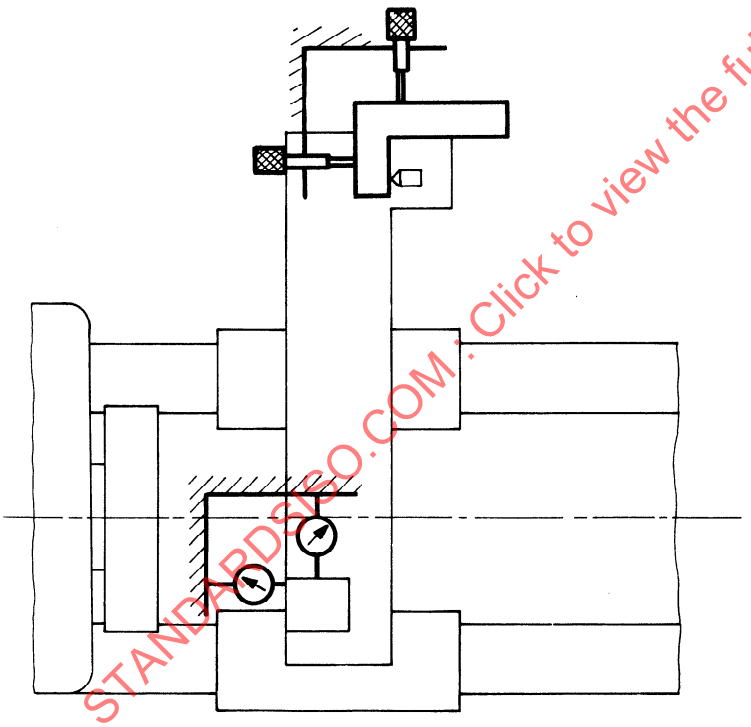
Permissible deviation		Measuring instruments	Observations
mm	in		
0,005 in five repeats	0.000 2	Dial gauge and template	Run the stylus rapidly down to the template, retract and repeat. Template and stylus profiles normal to copying axis.
0,02	0.000 8	Dial gauge and micrometer	Mount dial gauge in cutting tool position. Mount micrometer against stylus. Rotate micrometer slowly towards stylus and back. Observe total movement of micrometer for zero movement of dial gauge.
Number of discrete movements of dial gauge: ⩾ 10 for a 0,05 displacement of the micrometer	⩾ 10 0.002 0	Dial gauge and micrometer	Rotate micrometer very slowly in one or other direction of copying slide stroke. Observe number of discrete movements of the dial gauge in specified movement of micrometer. Carry out tests in both directions.

5.1.2 Lathes with two-axis copying systems

Each axis is tested independently.

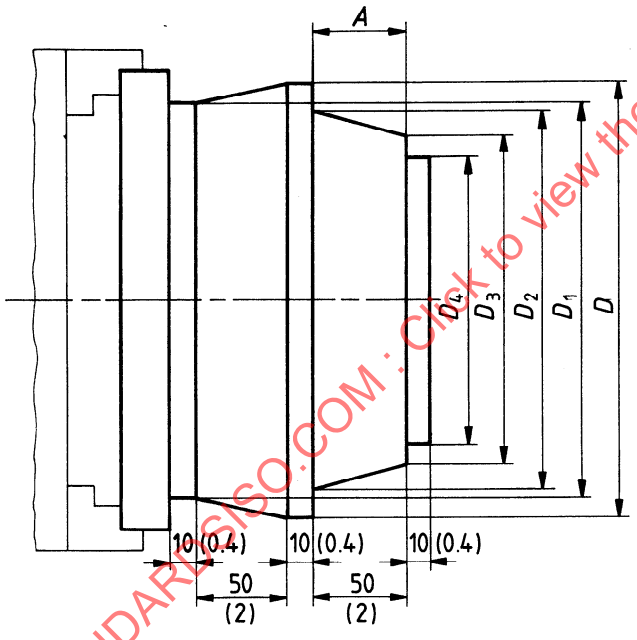
Micrometer and dial gauge shall be mounted parallel with the servo-controlled axis under test.

They shall be performed at the end of each stroke and midway along the copying slide stroke.

No.	Diagram	Object
G2.1		Assessment of repeatability of positioning
G2.2		Measurement of dead zone
G2.3		Measurement of sensitivity

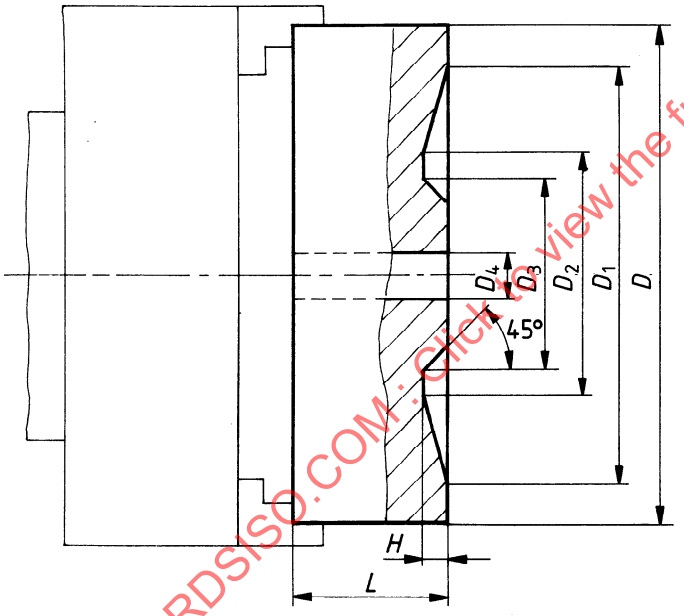
Permissible deviation		Measuring instruments	Observations
mm	in		
0,005 in five repeats	0.000 2	Dial gauge and template	Run the stylus rapidly down to the template, retract and repeat. Template and stylus profiles normal to copying axis under test.
0,03 normal to spindle axis 0,05 parallel to spindle axis	0.001 2 0.002 0	Dial gauge and micrometer	Mount dial gauge in cutting tool position. Mount micrometer against stylus in axis under test. Rotate micrometer very slowly towards stylus and back. Observe total movement of micrometer for zero movement of dial gauge.
Number of discrete movements of dial gauge: ⩾ 5 for a 0,05 displacement of the micrometer	⩾ 5 0.002 0	Dial gauge and micrometer	Rotate micrometer very slowly in one or other direction of copying slide stroke. Observe number of discrete movements of the dial gauge in specified movement of micrometer. Carry out tests in both directions.

5.2 Practical tests

No.	Diagram and test piece dimensions	Nature of test
P1	Dimensions in millimetres (inches in parentheses)  Material : steel	This test is for machines with chucking facilities only and without a tailstock. Machining three diameters, two shoulders and two tapers on cylindrical test pieces in chuck. $D = 0{,}5\ D_a$* up to 200 mm max. (8 in max.) For single-axis copying machines : $D_1 = D$ — 1 mm (0.04 in) $D_3 = D_2$ — 1 mm (0.04 in) $D_2 = D$ — 20 mm (0.8 in) $D_4 = D_3$ — 20 mm (0.8 in) For two-axis copying machines : $D_1 = D$ — 1,5 mm (0.06 in) $D_3 = D_2$ — 1,5 mm (0.06 in) $D_2 = D$ — 20 mm (0.8 in) $D_4 = D_3$ — 20 mm (0.8 in)

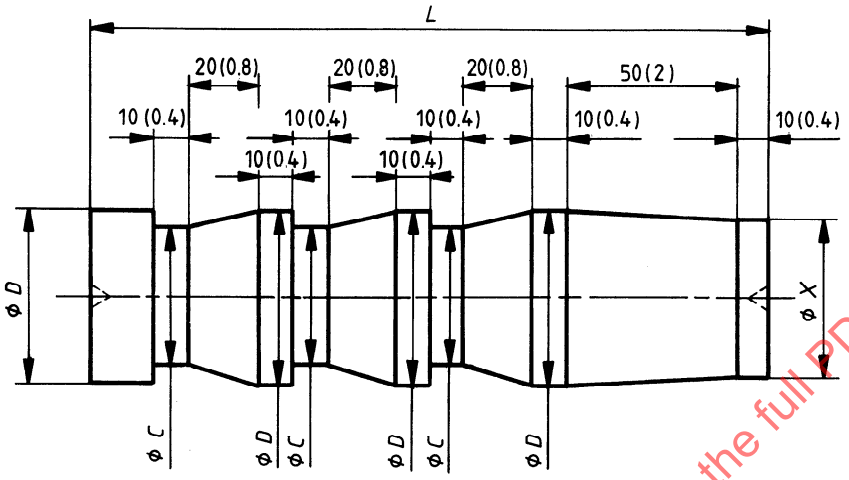
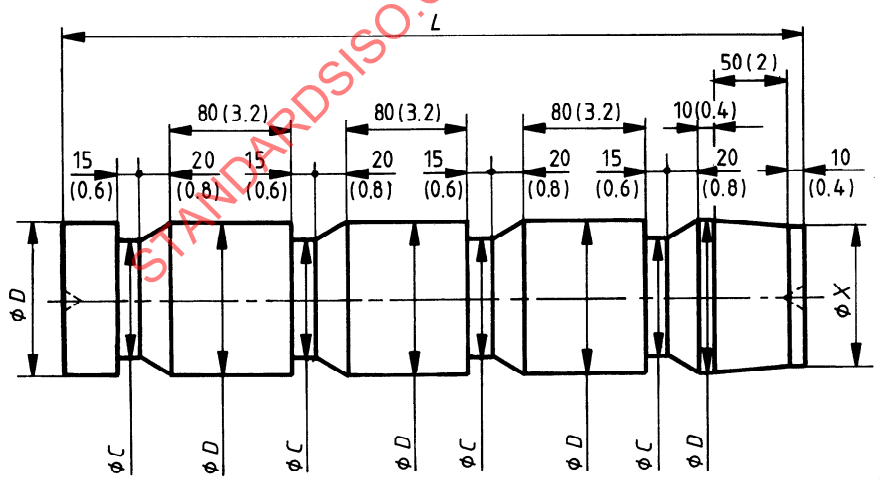
* D_a = maximum swing over cross-slide.

Cutting conditions	Checks to be applied	Permissible deviation				Measuring instruments	Observations
		single-axis		two-axis			
		mm	in	mm	in		
	1) Taper surfaces shall be regular and without steps.	—	—	—	—		
The axis of the template shall be set parallel of the axis of the spindle. The inclination angle of the copying unit to the axis of the machine and the measuring pressure shall be specified by the manufacturer.	2) Measurement of deviation $D - D_1$ compared to template.	± 0,025	± 0.001 0	± 0,03	± 0.001 2	Micrometer, depth gauge and profile projector	Includes the effect of dead zone twice.
	3) Measurement of deviation $D - D_2$ compared to template.	± 0,06	± 0.002 4	± 0,08	± 0.003 2		
	4) Measurement of deviation of shoulder length A compared to template.	± 0,04	± 0.001 6	± 0,05	± 0.002 0		

No.	Diagram and test piece dimensions	Nature of test
P2	 Material : steel	This test is for machines which have facing capabilities. Facing profile consisting of three faces and one taper on a cylindrical test piece in the chuck. $D = 0{,}5\ D_a$* or 160 mm (6.3 in) whichever is the smaller For single-axis copying machines : H = 0,5 mm (0.02 in) For two-axis copying machines : H = 0,75 mm (0.03 in) $D_1 = D$ — 40 mm (1.6 in) $D_2 = D$ — 90 mm (3.5 in) $D_3 = D$ — 110 mm (4.4 in) $D_4 = D$ — 150 mm (6 in) $L = \frac{D_a}{8}$

* D_a = maximum swing over bed.

Cutting conditions	Checks to be applied	Permissible deviation				Measuring instruments	Observations
		single-axis		two-axis			
		mm	in	mm	in		
The axis of the template shall be set perpendicular to the axis of the machine. The inclination angle of the copying unit to the axis of the machine and the measuring pressure shall be specified by the manufacturer. The facing shall be carried out from the outside diameter to the inside.	1) Taper surface to be regular and without steps.	—	—	—	—	Depth gauge, straight edge, slip gauges	Includes the effect of dead zone.
	2) Measurement of depth of recess H compared to template.	± 0,04	± 0.001 6	± 0,06	± 0.002 4		
	3) Check alignment of inner and outer ring faces (adjacent to diameters D and D_4) compared to template. Deviation should be allowed only in a concave direction.	± 0,04	± 0.001 6	± 0,05	± 0.002 0		

No.	Diagram and test piece dimensions	Nature of test
P3	Dimensions in millimetres (inches in parentheses) a) Minimum size test piece  L = distance between centres = 200 (8) min. $D = L/4$ $C = D - 10$ (0.4) Material : steel b) Maximum size test piece  L = distance between centres = 500 (20) max. $D = L/5$ $C = D - 10$ (0.4) Material : steel	This test is for machines which produce shaft-type workpieces and is used instead of test P1. For single-axis copying machines : $X = D - 1$ mm (0.04 in) For two-axis copying machines : $X = D - 1{,}5$ mm (0.06 in) Test pieces for machines of capacities between *a)* and *b)* may be suitably scaled.