INTERNATIONAL STANDARD ISO 2632/I

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

TC 57

Roughness comparison specimens — Part I : Turned, ground, bored, milled, shaped and planed

Échantillons de comparaison viso-tactile de rugosité — Partie I : Tournage, rectification, alésage, fraisage, rabotage et planage

Рабочие образцы шероховатости — Часть I: обточенные, шлифованные, расточенные, фрезерованные и строганные

First edition — 1975-05-15

UDC 621.795 **Ref. No. ISO 2632/I-1975 (E)**

Descriptors : test equipment, machining, surface condition, roughness, sensory analysis, visual inspection, comparison.

Price based on 5 pages

FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up has the right to be represented on that Committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

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.

International Standard ISO 2632/I was drawn up by Technical Committee ISO/TC 57, *Metrology and properties of surfaces,* and circulated to the Member Bodies in May 1972.

It has been approved by the Member Bodies of the following countries :

Belgium	Italy	South Africa, Rep. of
Canada	Japan	Spain
Czechoslovakia	Netherlands	Sweden
Egypt, Arab Rep. of	New Zealand	Switzerland
Finland	Norway	Thailand
Germany	Poland	United Kingdom
Hungary	Portugal	U.S.S.R.
Ireland	Romania	

The Member Body of the following country expressed disapproval of the document on technical grounds :

France

Printed in Switzerland

Roughness comparison specimens — Part I : Turned, ground, bored, milled, shaped and planed

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies the characteristics of specimens of turned, ground, bored, milled, shaped and planed surfaces which are intended for tactile and visual comparison with workpiece surfaces of similar lay, produced by similar machining methods.

2 REFERENCES

ISO 3, *Preferred numbers — Series of preferred numbers.*

ISO/R 468, *Surface roughness.*

3 DEFINITIONS

3.1 roughness comparison specimen : A specimen surface of known average roughness height (R_a) representing a particular machining or other production process. The specimen is used to give design personnel guidance on the feel and appearance of the particular production process and roughness grade, and to enable workshop personnel to evaluate and control workpiece surfaces by tactile and visual comparison with the specimen surface.

3.2 lay : The direction of the predominant surface pattern, ordinarily determined by the process used in producing the surface.

Other terms used to describe surface characteristics or measurement are defined in ISO/R 468.

4 METHODS OF MANUFACTURE

The specimens shall be manufactured as follows :

4.1 By electro-forming positive replicas of master surfaces.

4.2 By making positive replicas in plastics of master surfaces. By coating or otherwise, the feel and appearance of the natural machined surface should be represented.

4.3 By direct application of the production process which the specimen is intended to represent (individually machined specimens).

5 SURFACE CHARACTERISTICS

Master surfaces for reproduction, their resultant electro-formed and plastics replicas, and individually machined specimens (see 4.1, 4.2 and 4.3) shall exhibit only the characteristics resulting from the natural action of the machining process which they are intended to represent. They shall not contain pseudo surface irregularities such as can be induced, for instance, in grinding, by abnormal conditions.

6 RANGES OF ROUGHNESS GRADES

The ranges of roughness grades are to be as given in table 1, overleaf.

7 SAMPLING LENGTHS

The sampling lengths given in table 2 overleaf are to be used in evaluating the specimens. In the case of repetitive profiles, the sampling length shall be rounded-off to include the nearest greater whole number of cycles (see note under table 2).

TABLE 1 — **Ranges of roughness grades of roughness comparison specimens**

Mean arithmetic deviation R_a							
Grinding		**Turning and boring**		**Milling**		**Shaping and planing**	
μm	μin	μm	μin	μm	μin	μm	μin
0,025	1						
0,05	2						
0,1	4						
0,2	8						
0,4	16	0,4	16	0,4	16		
0,8	32	0,8	32	0,8	32	0,8	32
1,6	63	1,6	63	1,6	63	1,6	63
3,2	125	3,2	125	3,2	125	3,2	125
		6,3	250	6,3	250	6,3	250
		12,5	500	12,5	500	12,5	500
						25,0	1 000

NOTES

1 The values given in table 1 are selected from one of the preferred series of ISO/R 468. In cases when it is necessary to provide specimens in intermediate values, these should be chosen from the R 10 series of preferred numbers.

2 Certain of the finer values are included primarily to give design office personnel some idea of the differences that can be detected (between, say, 0,025, 0,05 and 0,1 μm) by visual means.

TABLE 2 — **Sampling lengths**

Mean arithmetic deviation R_a		Sampling length							
		Grinding		**Turning and boring**		**Milling**		**Shaping and planing**	
μm	μin	mm	in	mm	in	mm	in	mm	in
0,025	1	0,25	0.01						
0,05	2	0,25	0.01						
0,1	4	0,25	0.01						
0,2	8	0,25	0.01						
0,4	16	0,8	0.03	0,8	0.03	0,8	0.03		
0,8	32	0,8	0.03	0,8	0.03	0,8	0.03	0,8	0.03
1,6	63	0,8	0.03	0,8	0.03	2,5	0.1	0,8	0.03
3,2	125	2,5	0.1	2,5	0.1	2,5	0.1	2,5	0.1
6,3	250			2,5	0.1	8,0	0.3	2,5	0.1
12,5	500			2,5	0.1	8,0	0.3	8,0	0.3
25,0	1 000							8,0	0.3

NOTE — The dominant spacing of the specimen surfaces shall be not greater than the given sampling length.

8 CALIBRATION

Sufficient readings shall be taken across the direction of lay of the surface at evenly distributed positions to enable the mean value and the standard deviation to be determined. 25 readings have been found sufficient for many engineering surfaces but this number may be decreased for periodic surfaces or increased to meet excessive scatter of results.

The mean value of the readings should not vary from the nominal value by an amount greater than the percentage of the nominal value as given in table 3.

The standard deviation from the mean value should not be greater than an amount equal to the percentage of the nominal value as given in table 3.

The figures are to be based on readings obtained with an instrument working correctly in accordance with ISO . . .[1] and which includes from 3 to 6 sampling lengths within a traversing length. If the instrument used for a determination has a known or assumed error, this error should be taken into consideration. If other numbers of sampling lengths are included in the instrument reading the value for standard deviation so derived from the 25 readings should be calculated in accordance with ISO . . .[2].

TABLE 3 — **Tolerance values for roughness comparison specimens**

Type of specimen	**Tolerance on mean value** (percentage of nominal value)		**Standard deviation** (percentage of effective value)
Ground	+ 12	− 17	9
Turned	+ 12	− 17	4
Bored	+ 12	− 17	4
Milled	+ 12	− 17	12
Shaped	+ 12	− 17	4
Planed	+ 12	− 17	4

NOTE — The values for standard deviation have been derived from measurements using instruments each having a traversing length containing from 3 to 6 sampling lengths. When other instruments which do not have this characteristic are used, the values for standard deviation should be derived in accordance with ISO . . .[2].

9 LAY

9.1 Direction

The general direction of the lay should preferably be parallel to the shorter side of the specimen. In cases such as fine peripheral milling, when the surface irregularities resulting from imperfections of cutting edges appear to be of greater consequence than the surface irregularities resulting from cutter feed, the dominant lay shall still be parallel to the shorter side of the specimen although the feed marks may be parallel to the longer side.

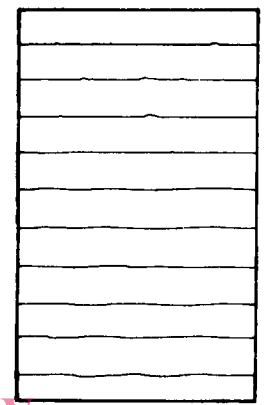
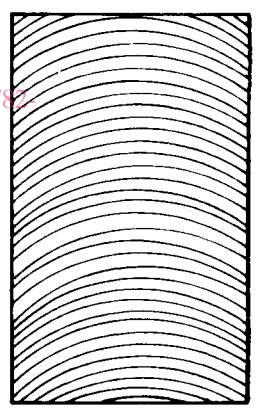
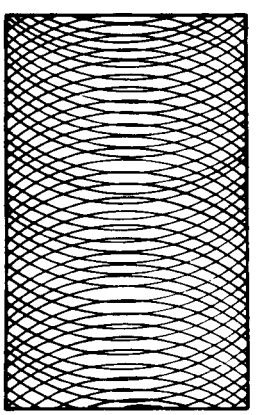
1) In preparation.

2) International Standard on specimen calibration (in preparation).

9.2 Lay characteristics

The lay characteristics should be as given in table 4.

TABLE 4 — **Lay characteristics**

Lay description	Production process represented	Form of specimen	Stylised representation of lay characteristics
straight lay	peripheral grinding	flat cylindrical convex	
	turning	cylindrical convex	
	boring	cylindrical concave	
	peripheral milling	flat	
	shaping	flat	
	planing	flat	
arcuate lay	end milling	flat	
	face turning	flat	
crossed arcuate lay	end milling	flat	
	side-wheel grinding	flat	
	cup-wheel grinding	flat	

10 MARKING

Each specimen, or its mounting, should be marked with the following :

10.1 The mark "ISO" together with the roughness number (see table 5).

10.2 The nominal R_a value expressed in micrometres and, where required, also in micro-inches.

10.3 The production process represented by the specimen, i.e. ground, turned, etc.

TABLE 5 – **Nominal values and related roughness numbers of roughness comparison specimens**

Roughness number	Nominal values of R_a	
	μm	μin
N1	0,025	1
N2	0,05	2
N3	0,1	4
N4	0,2	8
N5	0,4	16
N6	0,8	32
N7	1,6	63
N8	3,2	125
N9	6,3	250
N10	12,5	500
N11	25	1 000

NOTES

1 Consideration will be given to the inclusion of requirements for the marking of other parameters as these are defined and adopted.

2 Marking should not be applied to the reference surface of the specimen.