INTERNATIONAL STANDARD

ISO 13942

First edition
2000-12-15

Bonded abrasive products — Limit deviations and run-out tolerances

Produits abrasifs agglomérés — Écarts limites et tolérances de battement

Reference number
ISO 13942:2000(E)

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Printed in Switzerland

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established 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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 13942 was prepared by Technical Committee ISO/TC 29, *Small tools*, Subcommittee SC 5, *Grinding wheels and abrasives*.

Bonded abrasive products — Limit deviations and run-out tolerances

1 Scope

This International Standard specifies the essential limit deviations and run-out tolerances, in millimeters, for bonded abrasive products as specified in ISO 603-1 to ISO 603-16.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 286-1:1988, *ISO system of limits and fits — Part 1: Bases of tolerances, deviations and fits*.

ISO 286-2:1988, *ISO system of limits and fits — Part 2: Tables of standard tolerance grades and limit deviations for holes and shafts*.

ISO 603-1, *Bonded abrasive products — Dimensions — Part 1: Grinding wheels for external cylindrical grinding between centres*.

ISO 603-2, *Bonded abrasive products — Dimensions — Part 2: Grinding wheels for centreless external cylindrical grinding*.

ISO 603-3, *Bonded abrasive products — Dimensions — Part 3: Grinding wheels for internal cylindrical grinding*.

ISO 603-4, *Bonded abrasive products — Dimensions — Part 4: Grinding wheels for surface grinding/peripheral grinding*.

ISO 603-5, *Bonded abrasive products — Dimensions — Part 5: Grinding wheels for surface grinding/face grinding*.

ISO 603-6, *Bonded abrasive products — Dimensions — Part 6: Grinding wheels for tool and tool room grinding*.

ISO 603-7, *Bonded abrasive products — Dimensions — Part 7: Grinding wheels for manually guided grinding*.

ISO 603-8, *Bonded abrasive products — Dimensions — Part 8: Grinding wheels for deburring and fettling/snagging*.

ISO 603-9, *Bonded abrasive products — Dimensions — Part 9: Grinding wheels for high-pressure grinding*.

ISO 603-10, *Bonded abrasive products — Dimensions — Part 10: Stones for honing and superfinishings*.

ISO 603-11, *Bonded abrasive products — Dimensions — Part 11: Hand finishing sticks*.

ISO 603-12, *Bonded abrasive products — Dimensions — Part 12: Grinding wheels for deburring and fettling on a straight grinder*.

ISO 603-13, *Bonded abrasive products — Dimensions — Part 13: Grinding wheels for deburring and fettling on a vertical grinder*.

ISO 603-14, *Bonded abrasive products — Dimensions — Part 14: Grinding wheels for deburring and fettling/snagging on an angle grinder*.

ISO 603-15, *Bonded abrasive products — Dimensions — Part 15: Grinding wheels for cutting-off on stationary or mobile cutting-off machines*.

ISO 603-16, *Bonded abrasive products — Dimensions — Part 16: Grinding wheels for cutting-off on hand held power tools*.

3 Terms and definitions

For the purposes of this International Standard, the following terms and definitions apply.

For further terms and definitions, see also ISO 286-1. It should be noted that some of the terms are defined in a more restricted sense than in common usage.

3.1
shaft
external feature of a workpiece, including features which are not cylindrical

3.2
hole
internal feature of a workpiece, including features which are not cylindrical

3.3
size
number, expressing in a particular unit, the numerical value of a linear dimension

3.3.1
basic size
nominal size
size from which the limits of size are derived by the application of the upper and lower deviations

NOTE The basic size can be a whole number or a decimal number, e.g. 32; 15; 8,75; 0,5 etc.

3.3.2
actual size
size of a feature, obtained by measurements

3.3.3
limits of size
the two extreme permissible sizes of a feature, between which the actual size should lie, the limits of size being included

3.3.3.1
maximum limit of size
greatest permissible size of a feature

3.3.3.2
minimum limit of size
smallest permissible size of a feature

3.4
deviation
algebraic difference between a size (actual size, limit of size, etc.) and the corresponding basic size

NOTE Symbols for shaft deviations are lower case letters (*es*, *ei*) and symbols for hole deviations are upper case letters (*ES*, *EI*).

3.4.1
limit deviations
upper deviation and lower deviation

3.4.1.1
upper deviation
ES, *es*
algebraic difference between the maximum limit of size and the corresponding basic size

3.4.1.2
lower deviation
EI, *ei*
algebraic difference between the minimum limit of size and the corresponding basic size

3.5
size tolerance
difference between the maximum limit of size and the minimum limit of size, i.e. the difference between the upper deviation and the lower deviation

NOTE The tolerance is an absolute value without sign.

4 Symbols and designations

See Table 1.

Table 1 — Symbols and designations

Symbol of dimension	Designation	Symbol of limit deviation
A	Smallest width of a trapezoidal segment	T_A
B	Width of a segment, stick or stone	T_B
C	Thickness of a segment, stick or stone	T_C
D	Outside diameter of abrasive products	T_D
E	Thickness at bore of cup, dish, recessed and relieved wheels	T_E
F	Depth of the 1st recess	—
G	Depth of the 2nd recess	—
H	Abrasive product bore diameter, thread diameter of wheels with threaded insert	T_H
H_1	Diameter of counterbore	T_{H1}
J	Smallest diameter of taper cup wheel, dish wheels, tapered and hubbed wheels	—
K	Internal diameter of recess of taper cup wheel and dish wheels	T_K
L	Length of segments, length of thread bore of wheels with threaded insert, sticks and stones	T_L
N	Depth of the relief	—
P	Recessed diameter	—
R	Radius of recessed grinding wheels, segments, cones and plugs	T_R
T	Overall thickness	T_T
U	Smallest thickness of tapered, hubbed and depressed centre wheels, e.g. in Type 4 or Type 38	T_U
W	Rim width of cups, cylinders and dishes	T_W
—	Axial run-out tolerance	T_{PL}
—	Radial run-out tolerance	T_{RL}

5 Straight grinding wheels, recessed, relieved and hubbed wheels

5.1 Types involved

Types 1, 3, 4, 5, 7, 20 to 26, 38 and 39. See Figures 1 to 5.

Type 1

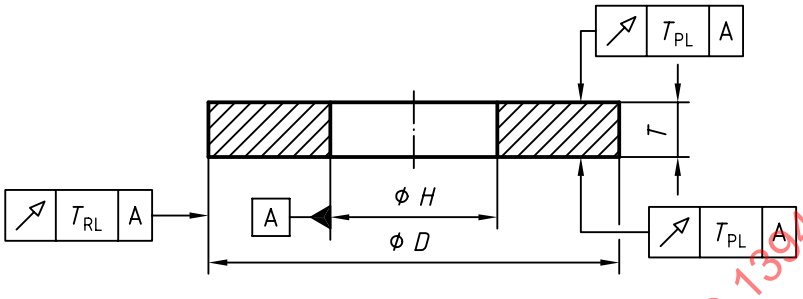

Figure 1 — Straight grinding wheel, e.g. as specified in ISO 603-1

Type 5

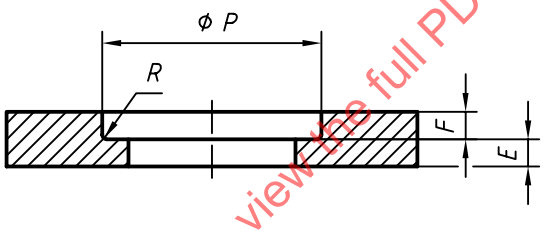

Figure 2 — Grinding wheel recessed on one side, e.g. as specified in ISO 603-1

Type 7

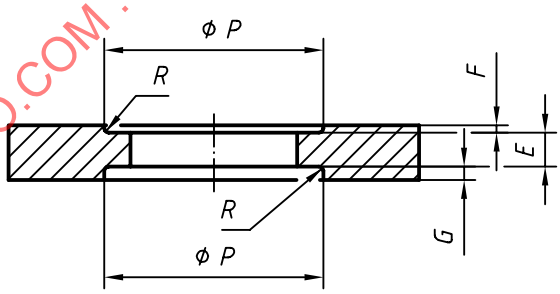

Figure 3 — Grinding wheel recessed on both sides, e.g. as specified in ISO 603-1

Type 38

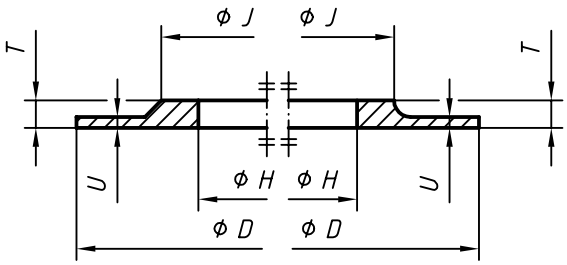

Figure 4 — Hubbed wheel, e.g. as specified in ISO 603-1

Type 39

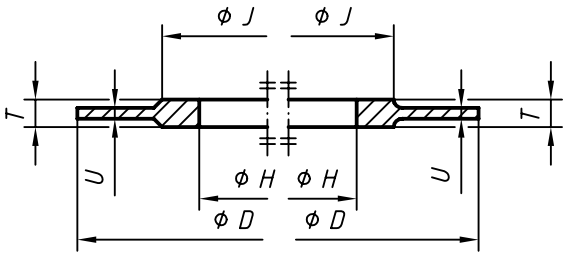

Figure 5 — Double hubbed wheel, e.g. as specified in ISO 603-1

5.2 Straight grinding wheels for general applications

5.2.1 Limit deviations T_D of the outside diameter, axial run-out tolerance T_{PL} and radial run-out tolerances, T_{RL}

The limit deviations of the outside diameter, the axial run-out tolerances, T_{PL} and the radial run-out tolerances, T_{RL} as specified in Table 2 apply to the respective range of diameters D.

Table 2 — Limit deviations for outside diameters and run-out tolerances

D	T_D	T_{PL}	T_{RL}
$3 \leqslant D \leqslant 8$	± 0,5	—	0,3
$8 < D \leqslant 20$	± 0,8	0,2	0,3
$20 < D \leqslant 50$	± 1,2	0,2	0,3
$50 < D \leqslant 125$	± 2	0,2	0,4
$125 < D \leqslant 300$	± 3,2	0,3	0,5
$300 < D \leqslant 762$	± 5	0,3	0,6
$762 < D \leqslant 2\,000$	± 8	0,4	0,8

5.2.2 Limit deviations T_H of the hole diameter

The limit deviations of the hole diameters $H > 30$ mm correspond to the tolerance class H11 as specified in ISO 286-2:1988, Table 6. For hole diameters $H < 30$ mm, the limit deviations are larger than H11 for technical reasons of manufacture. The limit deviations of hole diameters are given in Table 3.

Table 3 — Limit deviations for hole diameters

H	T_H
$1{,}6 \leqslant H \leqslant 50$	$^{+0{,}16}_{0}$
$50 < H \leqslant 80$	$^{+0{,}19}_{0}$
$80 < H \leqslant 180$	$^{+0{,}25}_{0}$
$180 < H \leqslant 250$	$^{+0{,}29}_{0}$
$250 < H \leqslant 315$	$^{+0{,}32}_{0}$
$315 < H \leqslant 400$	$^{+0{,}36}_{0}$
$400 < H \leqslant 500$	$^{+0{,}4}_{0}$
$500 < H$	$^{+0{,}44}_{0}$

5.2.3 Limit deviations T_P of the recess diameter and assignment of radii R

The limit deviations T_P of the recess diameter as specified in Table 4 apply to the respective range of diameters P.

The values for the radii R in the recess are a function of the recess diameter P and are maximum dimensions.

Table 4 — Limit deviations for recess diameters and recess radii

P	T_P	R max.
$3{,}2 \leqslant P \leqslant 8$	$^{+0{,}8}_{0}$	0,8
$8 < P \leqslant 20$	$^{+1{,}2}_{0}$	1,2
$20 < P \leqslant 50$	$^{+2}_{0}$	2
$50 < P \leqslant 125$	$^{+3{,}2}_{0}$	3,2
$125 < P \leqslant 315$	$^{+5}_{0}$	5
$315 < P \leqslant 900$	$^{+8}_{0}$	8

5.2.4 Limit deviations of T_T and of the grinding wheel thickness T_U

The limit deviations T_T of the overall grinding wheel thicknesses and of the smallest thicknesses T_U as specified in Table 5 apply to the respective range of thickness T.

Table 5 — Limit deviations of overall thicknesses T_T and of the smallest thickness T_U

T	T_T	T_U
$0{,}4 \leqslant T \leqslant 1{,}6$	$^{+0{,}2}_{0}$	
$1{,}6 < T \leqslant 5$	± 0,4	
$5 < T \leqslant 16$	± 0,8	
$16 < T \leqslant 50$	± 1,5	
$50 < T \leqslant 160$	± 2	
$160 < T \leqslant 500$	± 3,5	

5.2.5 Limit deviations T_E of thickness at bore

For grinding wheels with one recess (see type 5), or grinding wheels with two recesses (see type 7), the limit deviations of thickness at bore as specified in Table 6.

Table 6 — Limit deviations for bore thicknesses

E	T_E
$1{,}6 \leqslant E \leqslant 5$	$^{+0{,}8}_{0}$
$5 < E \leqslant 16$	$^{+1{,}6}_{0}$
$16 < E \leqslant 50$	$^{+2{,}4}_{0}$
$50 < E \leqslant 160$	$^{+3{,}2}_{0}$

5.3 Straight grinding wheels for special applications

5.3.1 Scope

The limit deviations and tolerances as specified in 5.3.2 to 5.3.6 apply to the following fields of application:

— centreless grinding;

— thread grinding;

— generative grinding of gear teeth;

— profile grinding;

— slot grinding;

— crankshaft grinding;

— plunge grinding;

— grinding of balls for rolling bearings.

5.3.2 Limit deviations T_D of the outside diameter, axial run-out tolerance, T_{PL} and radial run-out tolerance, T_{RL}

The limit deviations T_D of the outside diameter, the axial run-out tolerances, T_{PL} and the radial run-out tolerances, T_{RL} as specified in Table 7 apply to the respective range of diameters D.

Table 7 — Limit deviations for outside diameters and run-out tolerances

D	T_D	T_{PL}	T_{RL}
$3 \leqslant D \leqslant 8$	± 0,3	—	0,3
$8 < D \leqslant 20$	± 0,5	0,2	0,3
$20 < D \leqslant 50$	± 0,8	0,2	0,3
$50 < D \leqslant 125$	± 1,2	0,2	0,4
$125 < D \leqslant 300$	± 2	0,2	0,4
$300 < D \leqslant 762$	± 3,2	0,2	0,5
$762 < D \leqslant 2\ 000$	± 5	0,3	0,6

5.3.3 Limit deviations T_H of the hole diameter

The specifications in 5.2.2 as well as the values in Table 3 apply to the limit deviations of the holes H.

5.3.4 Limit deviations T_P of the recess diameters and assignment of radii R

The specifications in 5.2.3 as well as the values in Table 4 apply to the limit deviations T_P of the recess diameters and the assignment of radii R.

5.3.5 Limit deviations T_T of the grinding wheel thickness

The specifications in 5.2.4 as well as the values in Table 5 apply to the limit deviations T_T of the grinding wheel thickness for the fields of application:

— thread grinding;

— generative grinding of gear teeth;

— profile grinding;

— slot grinding;

— saw sharpening;

— plunge grinding;

— tool grinding.

The values as specified in Table 8 apply to the limit deviations T_T of the grinding wheel thickness for the field of applications:

— centreless grinding;

— crankshaft grinding;

— grinding of balls;

— thread grinding;

— race grinding.

Table 8 — Limit deviations for selected fields of application

Field of application	T_T
Centreless grinding	± 1,6
Crankshaft grinding	$^{+0,4}_{0}$
Grinding of balls	± 4
Thread grinding and race grinding	$^{+0,2}_{0}$

5.3.6 Limit deviations T_E of thickness at bore

The specifications in 5.2.5 as well as the values in Table 6 apply to the limit deviations T_E of thickness at bore.

5.4 Grinding wheels for high-pressure grinding

The limit deviations and tolerances for grinding wheels used for high-pressure grinding are specified in Table 9. Run-out tolerances for T_{PL} and T_{RL} are as in Table 2.

Table 9 — Limit deviations and tolerances for high-pressure grinding

D	T_D	T	T_T	H	T_H
406	± 5	$40 \leqslant T \leqslant 80$	± 1,5	$152,4 \leqslant H \leqslant 203,2$	$^{+0,46}_{+0,21}$
508	± 5,5			$203,2 < H \leqslant 304,8$	$^{+0,55}_{+0,26}$
610		$80 < T \leqslant 125$	± 2		
914	± 7			$304,8 < H$	$^{+0,65}_{+0,33}$

5.5 Straight grinding wheels used in sets

5.5.1 General

In principle, the limit deviations as specified in 5.2 and 5.3 apply respectively to straight grinding wheels which are used in sets. However, additional restrictions as specified in 5.5.2 and 5.5.3 are to be observed.

5.5.2 Limit deviations T_D of the outside diameter

The actual size of the outside diameters D of the separate grinding wheels shall not deviate by more than 1 mm within a grinding wheel set.

5.5.3 Limit deviations T_T of the grinding wheel thickness

For grinding wheel sets with distance rings the limit deviations T_T of each separate grinding wheel are $\pm$ 0,2 mm. For grinding wheel sets without distance rings, neither the limit deviations T_T of the total thickness nor the limit deviations T_T of any partial width of several separate grinding wheels shall exceed the values as specified in Table 5.

5.6 Cemented or clamped cylinder wheels and disc wheels

5.6.1 Types involved

Types 2, 35, 36 and 37.

The limit deviations and tolerances as specified in 5.6.2 and 5.6.3 apply for surface grinding/side grinding.

5.6.2 Limit deviations T_D of the outside diameter, axial run-out tolerance, T_{PL} and radial run-out tolerance, T_{RL}

The limit deviations T_D for the outside diameter, the axial run-out tolerances, T_{PL} and the radial run-out tolerances, T_{RL} as specified in Table 10 apply to the standardized nominal outside diameters D.

Table 10 — Limit deviations for nominal outside diameters and run-out tolerances

D	T_D [a]	T_D [b]	T_{PL}	T_{RL}
$D \leqslant 406$	$^{0}_{-1}$	$^{+1}_{-2}$	0,6	
$406 < D \leqslant 610$	$^{0}_{-2}$	$^{+2}_{-4}$	0,8	
$610 < D \leqslant 1\,067$	$^{0}_{-3}$	$^{+3}_{-6}$	1	

[a] Centering via the outside diameter.
[b] Other types of centering.

5.6.3 Limit deviations T_H of the hole diameter

The limit deviations T_H as specified in Table 11 apply only to the hole diameters H.

Table 11 — Limit deviations for hole diameters

H	T_H [a]	T_H [b]
$10 \leqslant H \leqslant 200$	$^{+1}_{0}$	± 1
$200 < H \leqslant 500$	$^{+2}_{0}$	± 2
$500 < H \leqslant 800$	$^{+3}_{0}$	± 3

a Centering via the hole.
b Other types of centering.

5.6.4 Limit deviations T_W of the wall thickness

The limit deviations T_W specified in Table 12 apply to the wall thickness W, types 2 and 37. T_W only applies to cylinder wheels which are centered via the outside diameter.

Table 12 — Limit deviations for wall thicknesses

W	T_W
$W \leqslant 25$	± 1,5
$25 < W \leqslant 50$	$^{+2,0}_{-1,5}$
$50 < W$	$^{+3,0}_{-1,5}$

5.6.5 Limit deviations T_D of the outside diameter of grinding wheel sets

For grinding wheel sets of the same outside diameter, the actual size may deviate from the nominal size of the grinding wheels by 1 mm.

5.6.6 Limit deviations T_T of the grinding wheel thickness

The limit deviations T_T as specified in Table 13 apply to the grinding wheel types 2, 35, 36 and 37 for surface grinding/side grinding.

Table 13 — Limit deviations for grinding wheel thicknesses

T	T_T
$16 \leqslant T \leqslant 50$	± 1,5
$50 < T \leqslant 160$	± 2,5

6 Dish and cup wheels

6.1 Types involved

Types 6, 11 and 12. See Figures 6, 7 and 8.

Type 6

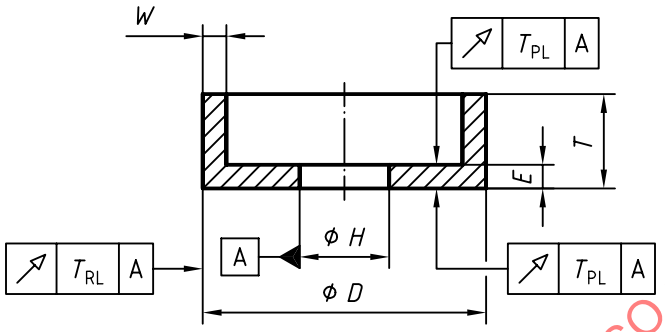

Figure 6 — Straight cup wheel, e.g. as specified in ISO 603-5

Type 11

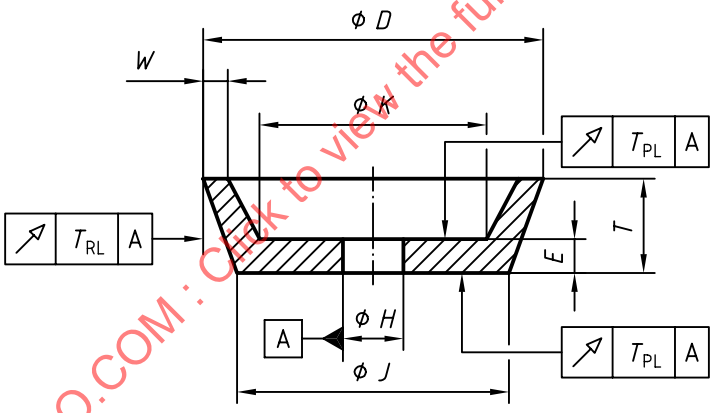

Figure 7 —Taper cup wheel, e.g. as specified in ISO 603-6

Type 12

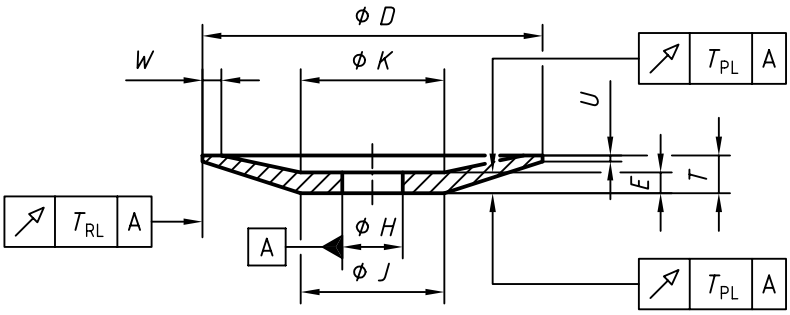

Figure 8 — Dish wheel, e.g. as specified in ISO 603-6

6.2 Dish and cup wheels for general applications

Limit deviations T_D, T_H, T_T and tolerances T_{PL}, T_{RL} as specified in 5.2

Limit deviations T_E, T_U and T_W as specified in Table 14.

Table 14 — Limit deviations and run-out tolerances for dish and cup wheels for general applications

E, U, W	T_E	T_U	T_W
E, U, $W \leqslant 6$	$^{+0,8}_{0}$	± 0,5	
$6 < E$, U, $W \leqslant 20$	$^{+1,2}_{0}$	± 0,8	
$20 < E$, U, $W \leqslant 32$	$^{+1,8}_{0}$	± 1,2	
$32 < E$, U, W	$^{+2,4}_{0}$	± 1,6	

6.3 Dish and cup wheels for tool grinding

T_D, T_H and T_T as specified in 5.2.

Run-out tolerances T_{PL}, T_{RL} and limit deviations T_W, T_E and T_K as specified in Table 15.

Table 15 — Limit deviations and run-out tolerances for dish and cup wheels for tool grinding

T_{PL}	T_{RL}	T_W	T_E	T_K
0,2	0,3	± 0,4	± 0,4	± 0,4

7 Grinding wheels for cutting-off, deburring and fettling/snagging

7.1 Scope

7.2 to 7.4 apply to flat wheels for cutting-off and depressed centre wheels for deburring, fettling and snagging with resinoid bond or other thermosetting organic bonds, resinoid bond fiber-reinforced. See Figures 9 and 10.

Types 41, 42

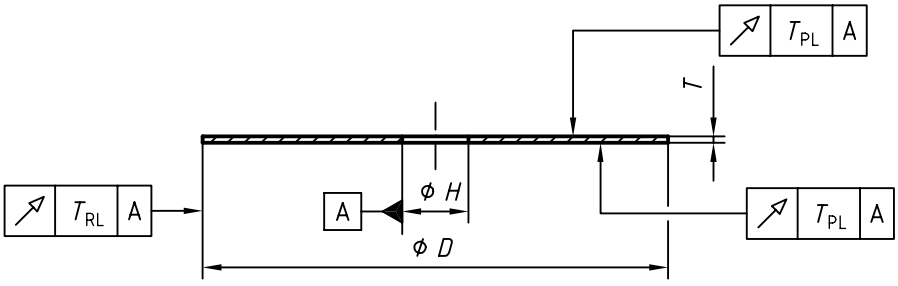

Figure 9 — Type 41 flat cutting-off wheel, e.g. as specified in ISO 603-16

Types 27, 28

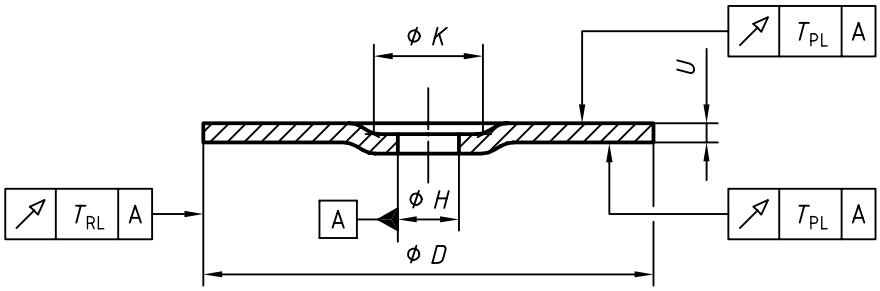

Figure 10 — Type 27 depressed centre wheel, e.g. as specified in ISO 603-14

7.2 Limit deviations T_D of the outside diameter, axial run-out tolerance, T_{PL}, and the radial run-out tolerance, T_{RL}

Limit deviations and tolerances as specified in Table 16.

Table 16 — Limit deviations for outside diameters and run-out tolerances

D	T_D	T_{PL}	T_{RL}
$30 \leqslant D \leqslant 100$	± 2	0,5	
$100 < D \leqslant 150$	± 2,5	0,6	
$150 < D \leqslant 200$	± 3	0,8	
$200 < D \leqslant 300$	$^{+5}_{-1}$	1	
$300 < D \leqslant 400$	$^{+6}_{0}$	1,2	
$400 < D \leqslant 600$	$^{+10}_{0}$	1,2	
$600 < D \leqslant 1\,000$	$^{+15}_{0}$	1,6	
$1\,000 < D \leqslant 1\,800$	$^{+20}_{0}$	2	