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Second edition
2019-05

Bonded abrasive products — Limit deviations and run-out tolerances

Produits abrasifs agglomérés — Écarts limites et tolérances de battement

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

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

This second edition cancels and replaces the first edition (ISO 13942:2000), which has been technically revised. The main changes compared to the previous edition are as follows:

— Figures added for the following shape types: 2, 3, 4, 13, 16, 17, 17R, 18, 18B, 18P, 18R, 19, 19R, 20, 21, 22, 23, 24, 25, 26, 28, 29, 31A, 31B, 31C, 31D, 31E, 31F, 31G, 35, 36, 37, 39, 40, 52, 54 and 90; geometric tolerancing symbols for simple run-out (T_{PL} and T_{RL}) and the related datum are indicated on the drawings where values for these exist in this document;

— drawings for types 5, 7, 27, 38, 39 and 41 amended to show the geometric tolerancing symbols;

— new symbols for elevation of depressed centre (M), spindle diameter (S_d), spindle length (L_2) of mounted wheels and points, and internal radius of a segment (R_1) added;

— in Table 18, a new row for the outside diameter D > 1 800 mm added giving the corresponding limit deviations and run-out tolerances;

— in Table 20, the limit deviations of grinding wheel thickness for wheels with T, U ≤ 1,6 mm changed;

— Clause 5 added for general statements and requirements and Clause 13 added for mounted wheels and mounted points;

— normative reference to ISO 603 changed to be informative.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Bonded abrasive products — Limit deviations and run-out tolerances

1 Scope

This document specifies the essential limit deviations and run-out tolerances for bonded abrasive products.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 286-1, *Geometrical product specifications (GPS) — ISO code system for tolerances on linear sizes — Part 1: Basis of tolerances, deviations and fits*

ISO 286-2, *Geometrical product specifications (GPS) — ISO code system for tolerances on linear sizes — Part 2: Tables of standard tolerance classes and limit deviations for holes and shafts*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 286-1 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

4 Symbols and abbreviated terms

For symbols of dimensions, limit deviation and tolerances see Table 1.

Table 1 — Symbols and designations

Symbol of dimension	Designation	Symbol of limit deviation or tolerance
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_{H_1}

Table 1 *(continued)*

Symbol of dimension	Designation	Symbol of limit deviation or tolerance
J	Smallest diameter of taper cup wheel, dish wheels, tapered and hubbed wheels, tapered cones and plugs	—
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
L_2	Length of the spindle in spindle mounted wheels and mounted points	—
M	Elevation of the depressed centre	—
N	Depth of the relief	—
P	Recessed diameter	—
R	Radius of recessed grinding wheels, segments, cones and plugs	T_R
R_1	Internal radius of a curved segment	—
S_d	Diameter of the spindle in spindle mounted wheels and mounted points	—
T	Overall thickness	T_T
U	Smallest thickness of tapered, hubbed and depressed centre wheels	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 General

All dimensions and tolerances in this document are in millimetres.

The symbols for geometrical tolerances used in the figures are explained in ISO 1101 and ISO 5459.

Popular dimensions of products specified in this document are given in ISO 603-1 to ISO 603-18.

6 Straight grinding wheels, recessed, relieved and hubbed wheels

6.1 Relevant shape types according to ISO 525

Relevant shape types for straight grinding wheels for general applications according to ISO 525 are: Types 1, 3, 4, 5, 7, 20 to 26, 38 to 40. See Figures 1 to 15.

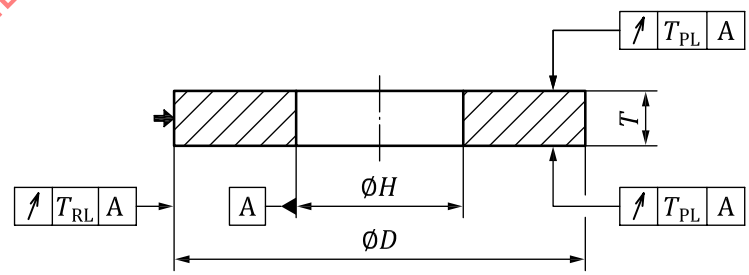


Figure 1 — Straight grinding wheel (Type 1)

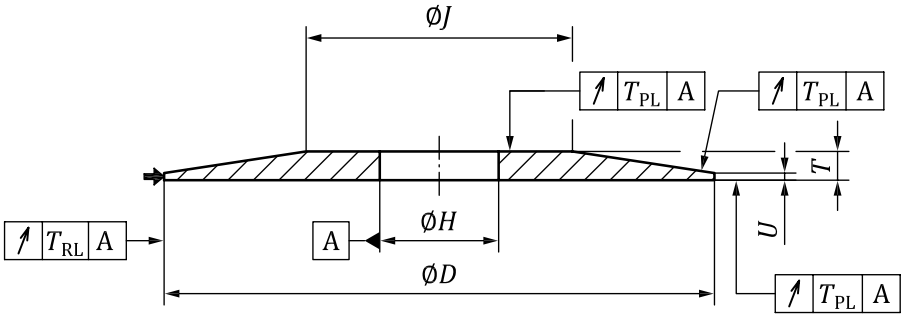


Figure 2 — Grinding wheel, tapered on one side (Type 3)

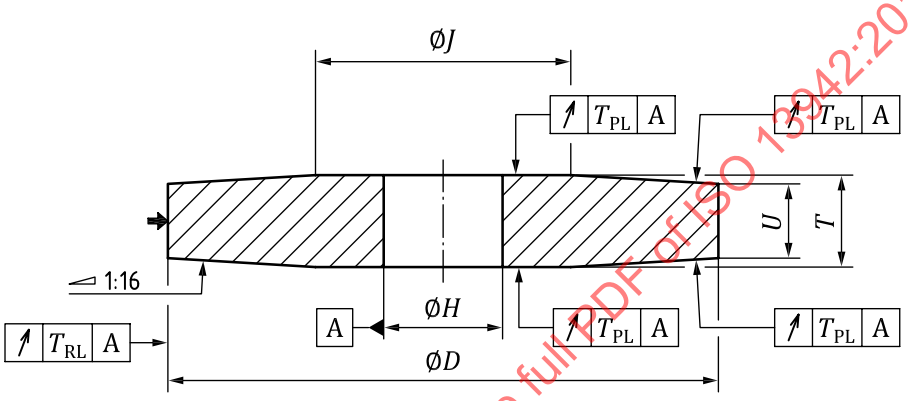


Figure 3 — Grinding wheel, tapered on both sides (Type 4)

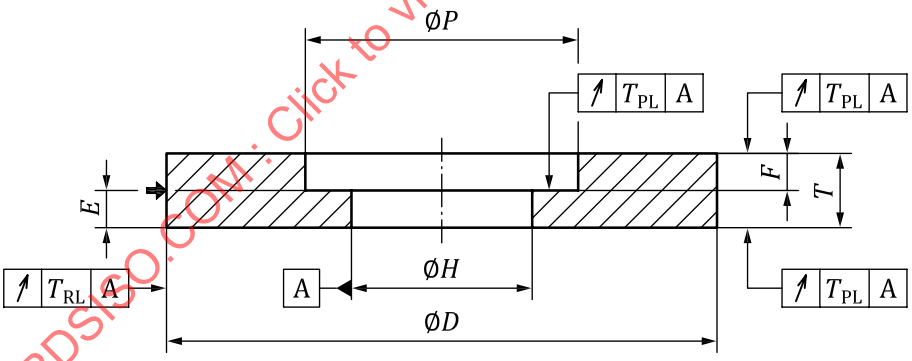


Figure 4 — Grinding wheel, recessed on one side (Type 5)

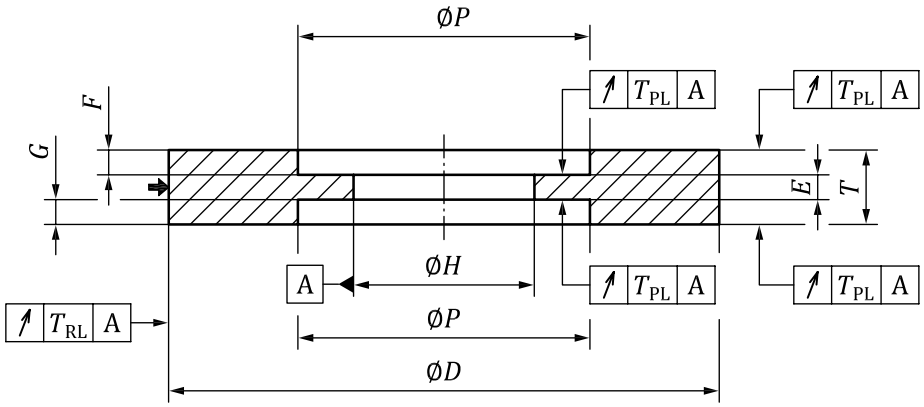


Figure 5 — Grinding wheel, recessed on both sides (Type 7)

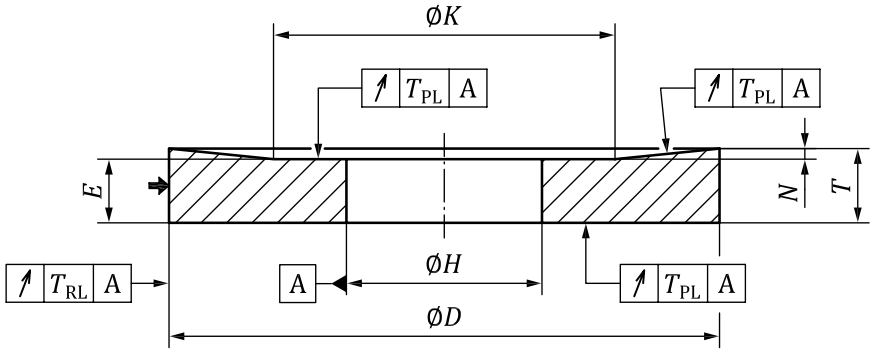


Figure 6 — Grinding wheel, relieved on one side (Type 20)

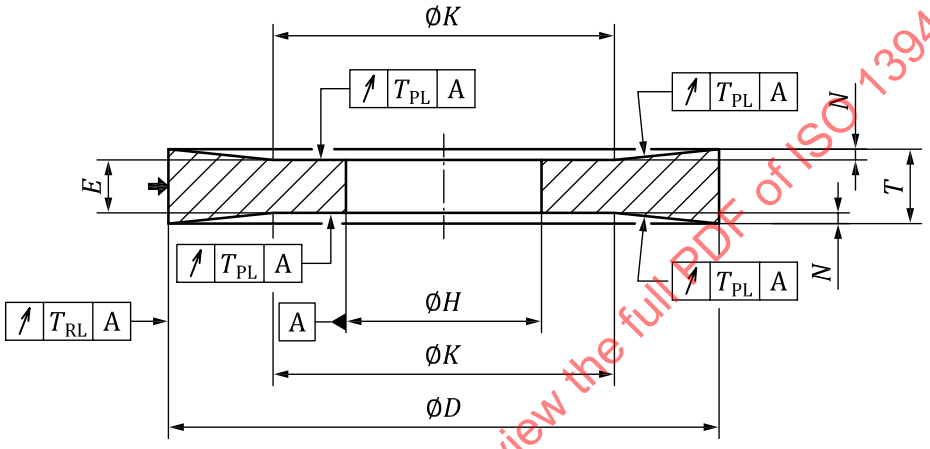


Figure 7 — Grinding wheel, relieved on both sides (Type 21)

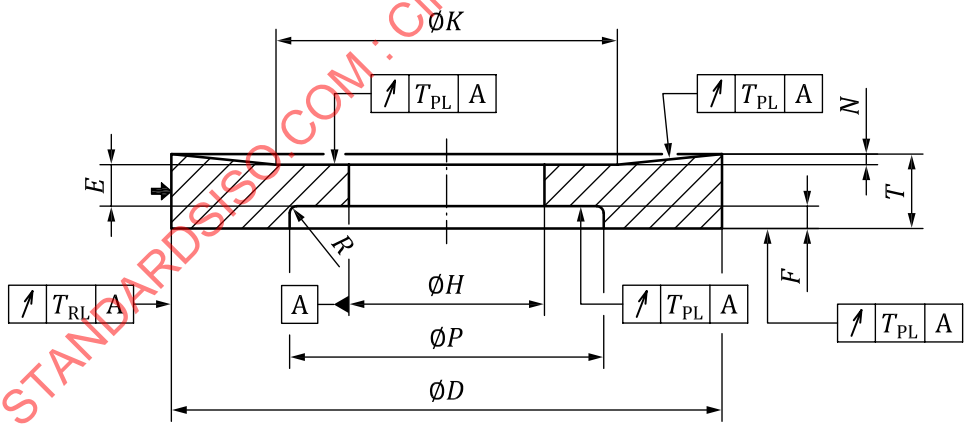


Figure 8 — Grinding wheel, relieved on one side, recessed on the other side (Type 22)

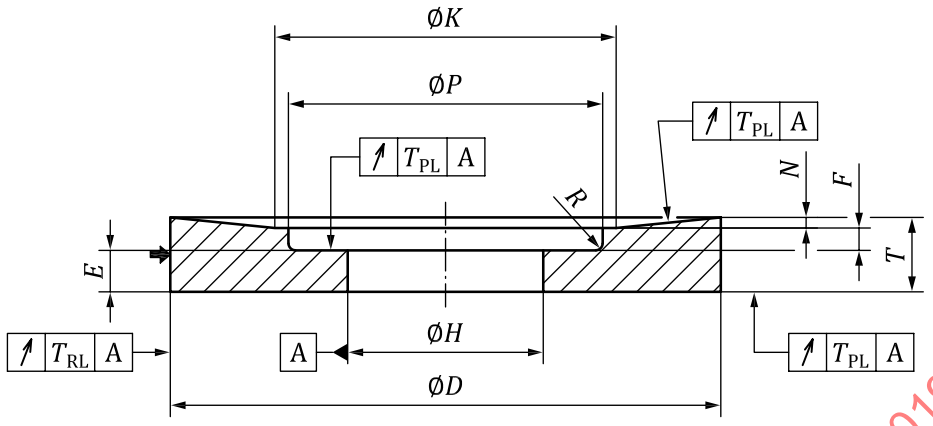


Figure 9 — Grinding wheel, relieved and recessed on one side (Type 23)

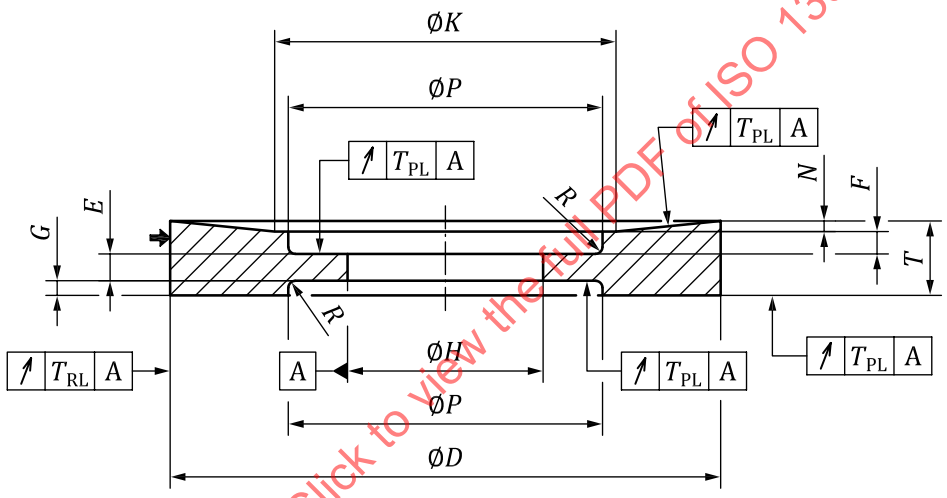


Figure 10 — Grinding wheel, relieved and recessed on one side, recessed on the other side (Type 24)

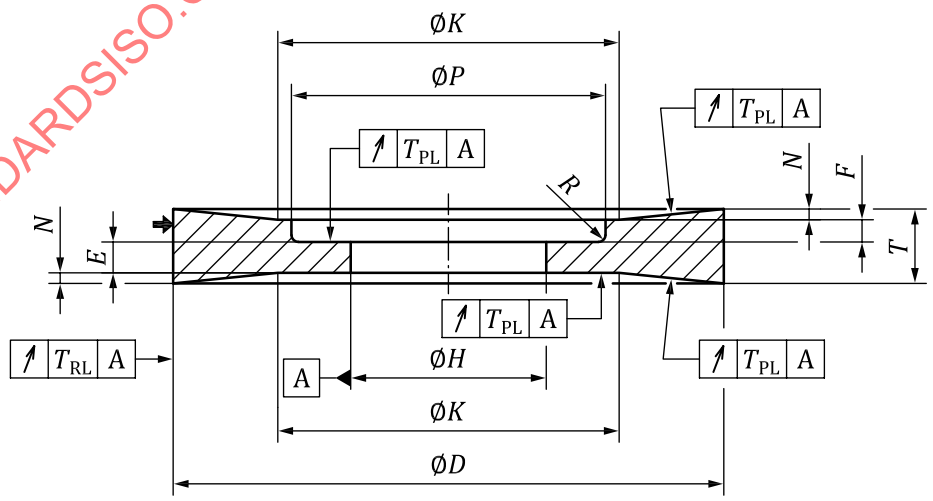


Figure 11 — Grinding wheel, relieved and recessed on one side, relieved on the other side (Type 25)

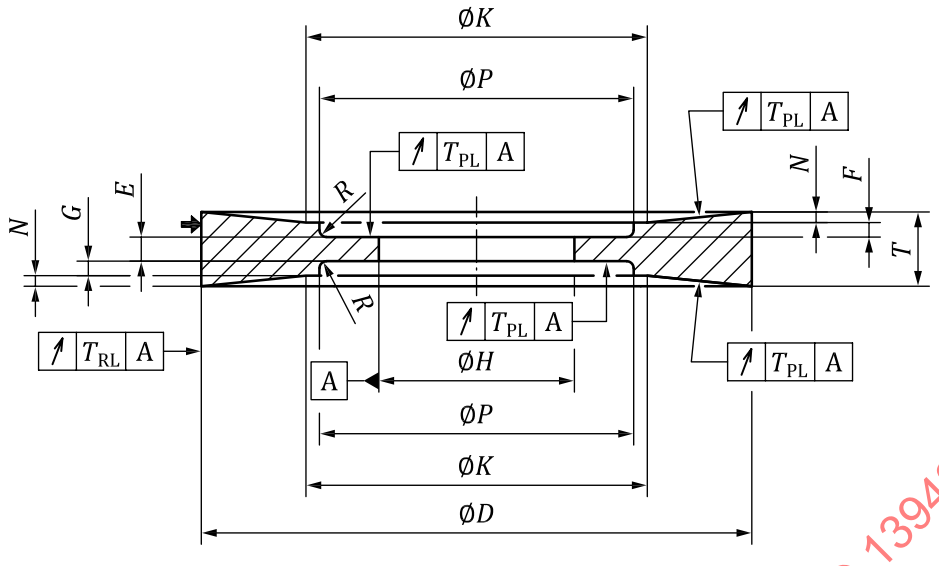


Figure 12 — Grinding wheel, relieved and recessed on both sides (Type 26)

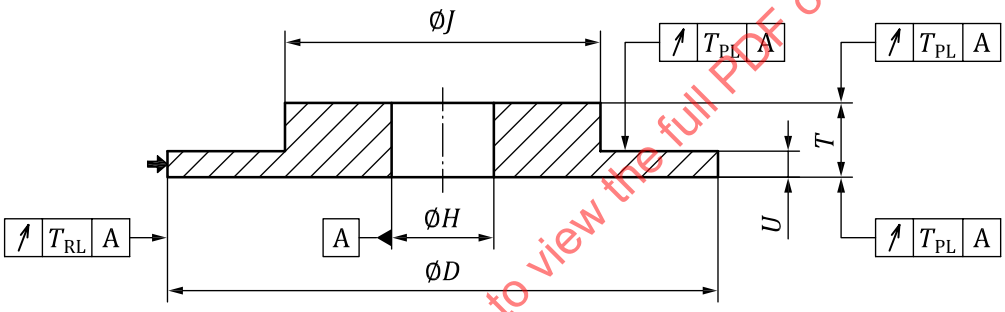


Figure 13 — Single hubbed grinding wheel (Type 38)

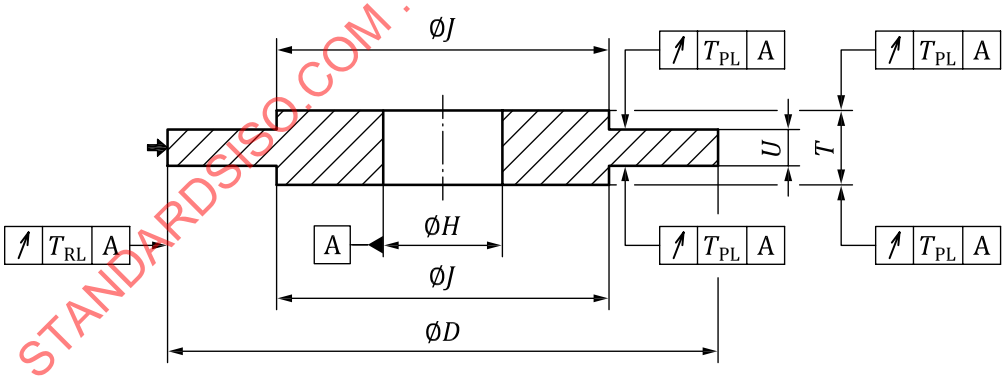


Figure 14 — Double hubbed grinding wheel (Type 39)

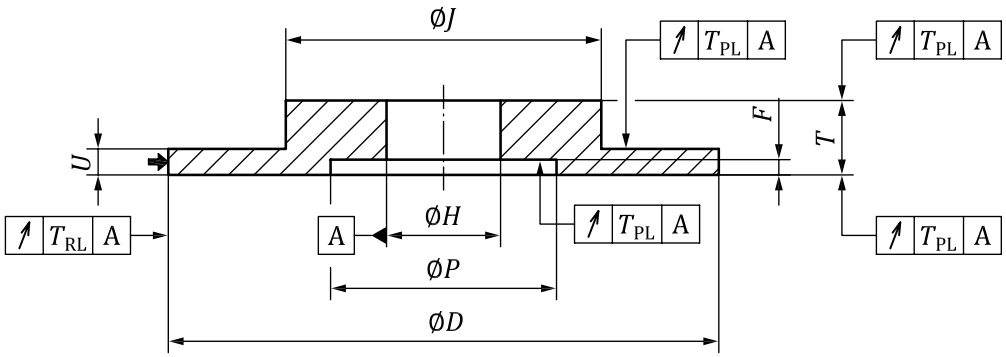


Figure 15 — Grinding wheel, hubbed on one side, recessed on the other side (Type 40)

6.2 Straight grinding wheels for general applications

6.2.1 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 of outside diameters and run-out tolerances

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

6.2.2 Limit deviations T_H of the hole diameter

The limit deviations of hole diameters are given in Table 3.

Table 3 — Limit deviations of hole diameters

H	T_H
$1,6 \leq H \leq 50,0$	+0,16 0
$50,0 < H \leq 80,0$	+0,19 0
$80,0 < H \leq 180,0$	+0,25 0
$180,0 < H \leq 250,0$	+0,29 0

Table 3 *(continued)*

H	T_H
250,0 < H ≤ 315,0	+0,32 0
315,0 < H ≤ 400,0	+0,36 0
400,0 < H ≤ 500,0	+0,40 0
500,0 < H	+0,44 0

6.2.3 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 of recess diameters and recess radii

P	T_P	R **maximum**
3,2 ≤ P ≤ 8,0	+0,8 0	0,8
8,0 < P ≤ 20,0	+1,2 0	1,2
20,0 < P ≤ 50,0	+2,0 0	2,0
50,0 < P ≤ 125,0	+3,2 0	3,2
125,0 < P ≤ 315,0	+5,0 0	5,0
315,0 < P ≤ 900,0	+8,0 0	8,0

6.2.4 Limit deviations T_T, T_U of grinding wheel thickness dimensions

The limit deviation T_T of the overall grinding wheel thickness T and the limit deviation T_U of the smallest thickness U as specified in Table 5 apply to the respective range of values for T.

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

T	T_T, T_U
$0,4 \leq T \leq 1,6$	+0,2 0
$1,6 < T \leq 5,0$	±0,4
$5,0 < T \leq 16,0$	±0,8
$16,0 < T \leq 50,0$	±1,5
$50,0 < T \leq 160,0$	±2,0
$160,0 < T \leq 500,0$	±3,5

6.2.5 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 are specified in Table 6.

Table 6 — Limit deviations of bore thicknesses

E	T_E
$1,6 \leq E \leq 5,0$	+0,8 0
$5,0 < E \leq 16,0$	+1,6 0
$16,0 < E \leq 50,0$	+2,4 0
$50,0 < E \leq 160,0$	+3,2 0

6.3 Straight grinding wheels for other applications not specified in 6.2

6.3.1 Examples of application

The limit deviations and tolerances as specified in 6.3 apply to the following fields of application, as examples:

— centreless grinding;

— thread grinding;

— generative grinding of gear teeth;

— profile grinding;

— slot grinding;

— crankshaft grinding;

— plunge grinding;

— ball grinding for bearings.

6.3.2 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 of outside diameters and run-out tolerances

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

6.3.3 Limit deviations T_H of the hole diameter

The specifications in 6.2.2 as well as the values in Table 3 apply to the limit deviations of the holes H.

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

The specifications in 6.2.3 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.

6.3.5 Limit deviations T_T of the grinding wheel thickness

The specifications in 6.2.4 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	±4,0
Thread grinding and race grinding	+0,2 0

6.3.6 Limit deviations T_E of thickness at bore

The specifications in 6.2.5 as well as the values in Table 6 apply to the limit deviations T_E of thickness at bore.

6.4 Grinding wheels for high-pressure grinding

The limit deviations and tolerances for grinding wheels used for high-pressure grinding are specified in Table 9, Table 10 and Table 11. Run-out tolerances for T_{PL} and T_{RL} are given in Table 2.

Table 9 — Limit deviations T_D of outside diameters

D	T_D
$400 \leq D < 500$	±5,0
$500 \leq D \leq 700$	±7,0
$700 < D \leq 1\,000$	±10,0

Table 10 — Limit deviations T_H of hole diameters

H	T_H
$127{,}0 \leq H \leq 203{,}2$	+0,46 +0,21
$203{,}2 < H \leq 304{,}8$	+0,55 +0,26
$304{,}8 < H$	+0,65 +0,33

Table 11 — Limit deviations T_T of thicknesses

T	T_T
$40 \leq T \leq 80$	±1,5
$80 < T \leq 152$	±2,0

6.5 Straight grinding wheels used in sets

6.5.1 General

The limit deviations as specified in 6.2 and 6.3 apply respectively to straight grinding wheels which are used in sets. Additional restrictions as specified in 6.5.2 and 6.5.3 shall be observed.

6.5.2 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.

6.5.3 Limit deviations T_T of the grinding wheel thickness

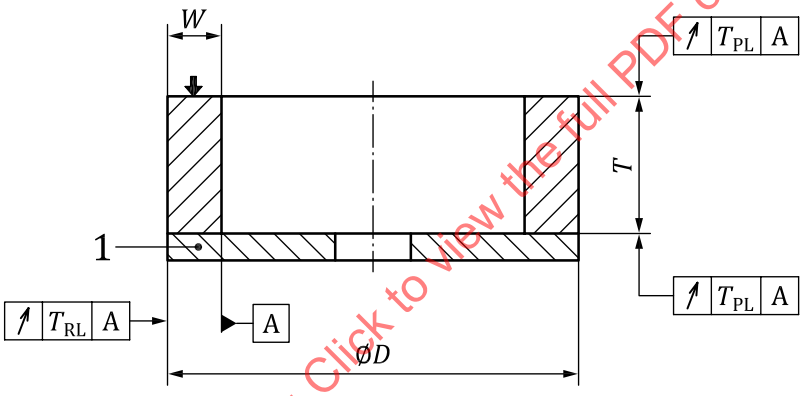
For grinding wheel sets with distance rings, the limit deviations T_T of each separate grinding wheel are ±0,2 mm. For grinding wheel sets without distance rings, neither the limit deviations T_T of the total thickness nor the limit deviations T_T of any partial width of several separate grinding wheels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

6.6 Cemented or clamped cylinder wheels and disc wheels

6.6.1 Relevant shape types according to ISO 525

Relevant shape types for cemented or clamped cylinder wheels and disc wheels according to ISO 525 are: Types 2, 35, 36 and 37. See Figures 16 to 19.

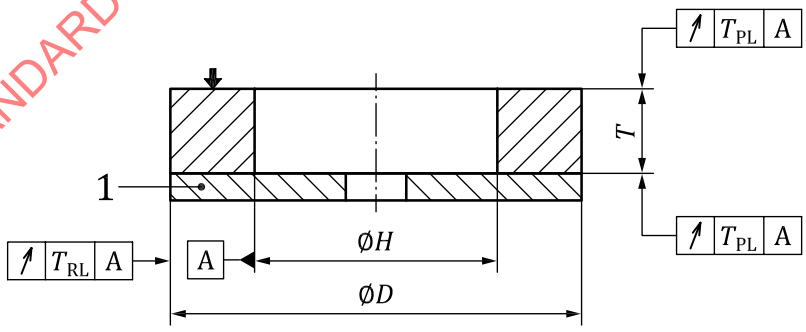
The limit deviations and tolerances as specified in 6.6 apply for surface grinding/side grinding.



Key

1 back-plate

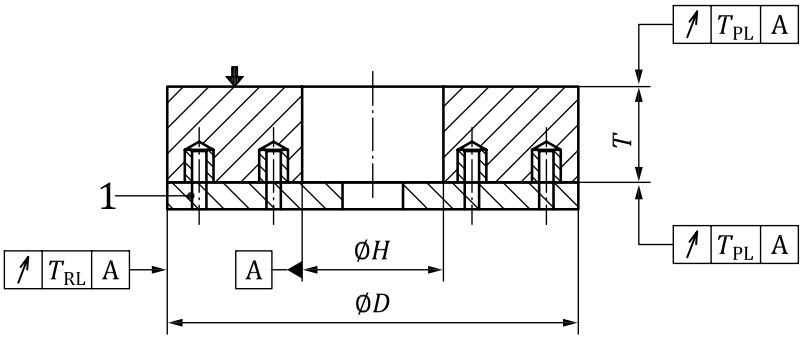
Figure 16 — Cylinder grinding wheel, cemented or clamped to a back-plate (Type 2)



Key

1 back-plate

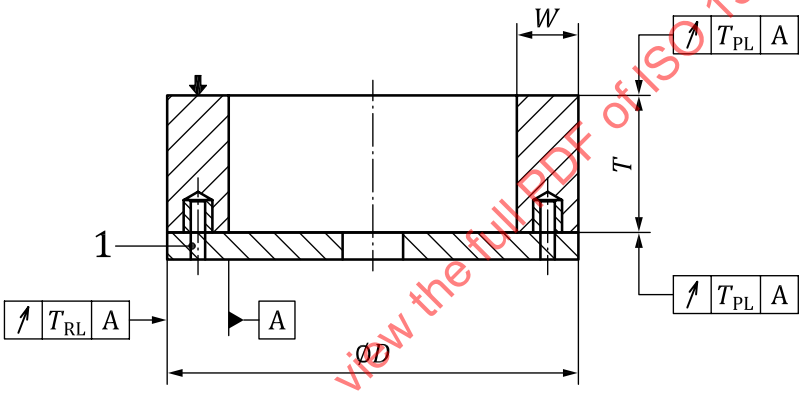
Figure 17 — Disc grinding wheel, cemented or clamped to a back-plate (Type 35)



Key

1 back-plate

Figure 18 — Disc grinding wheel with threaded inserts, fixed to a back-plate (Type 36)



Key

1 back-plate

Figure 19 — Cylinder grinding wheel with threaded inserts, fixed to a back-plate (Type 37)

6.6.2 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 of the outside diameter, the axial run-out tolerances T_{PL} and the radial run-out tolerances T_{RL} as specified in Table 12 apply to the nominal outside diameters D.

Table 12 — Limit deviations of nominal outside diameters and run-out tolerances

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

[a] Centring via the outside diameter.

[b] Other types of centring.

6.6.3 Limit deviations T_H of the hole diameter

The limit deviations T_H as specified in Table 13 apply only to the hole diameters H.

Table 13 — Limit deviations of hole diameters

H	T_H[a]	T_H[b]
$10 \leq H \leq 200$	+1 0	±1
$200 < H \leq 500$	+2 0	±2
$500 < H \leq 800$	+3 0	±3
[a] Centring via the hole. [b] Other types of centring.		

6.6.4 Limit deviations T_W of the wall thickness

The limit deviations T_W specified in Table 14 apply to the wall thickness W, Types 2 and 37. T_W only applies to cylinder wheels which are centred via the outside diameter.

Table 14 — Limit deviations of wall thicknesses

W	T_W
$W \leq 25$	±1,5
$25 < W \leq 50$	+2,0 −1,5
$50 < W$	+3,0 −1,5

6.6.5 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.

6.6.6 Limit deviations T_T of the grinding wheel thickness

The limit deviations T_T as specified in Table 15 apply to the grinding wheel types 2, 35, 36 and 37 for surface grinding/side grinding.

Table 15 — Limit deviations of grinding wheel thicknesses

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

7 Dish and cup wheels

7.1 Relevant shape types according to ISO 525

Relevant shape types for dish and cup wheels according to ISO 525 are: Types 6, 11, 12 and 13. See Figures 20 to 23.

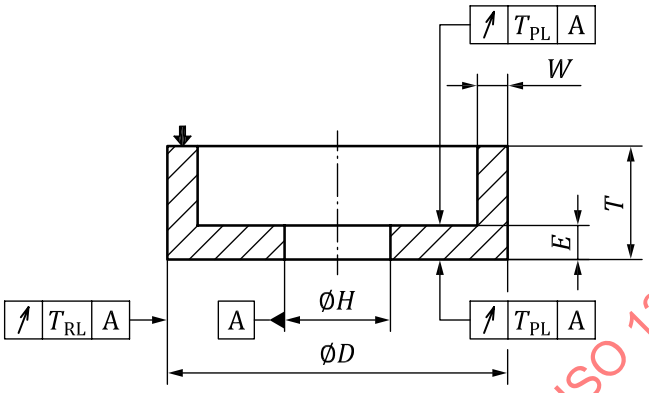


Figure 20 — Straight cup grinding wheel (Type 6)

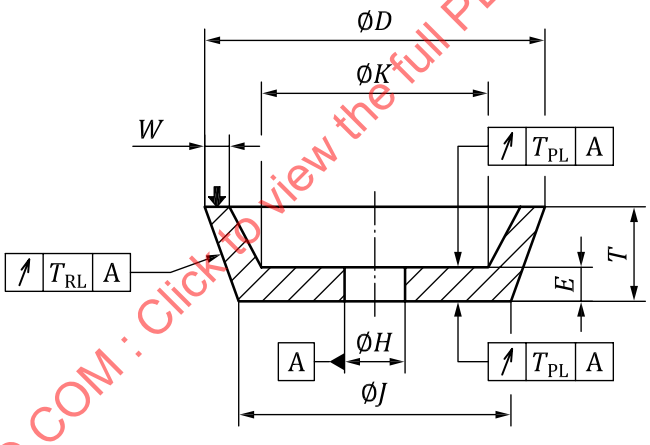


Figure 21 — Taper cup grinding wheel (Type 11)

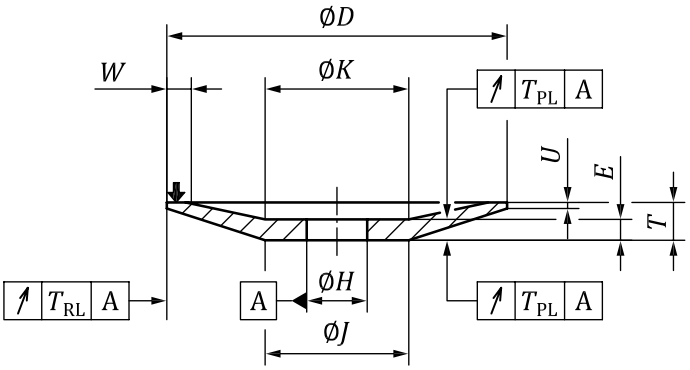


Figure 22 — Dish grinding wheel (Type 12)

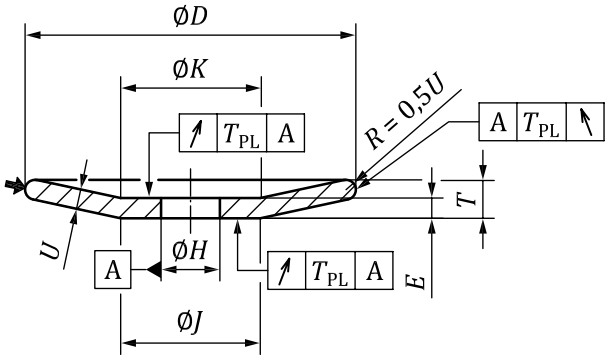


Figure 23 — Saucer grinding wheel (Type 13)

7.2 Dish and cup wheels for general applications

Limit deviations T_D, T_H, T_T and tolerances T_{PL}, T_{RL} are specified in 6.2.

Limit deviations T_E, T_U and T_W are specified in Table 16.

Table 16 — Limit deviations and run-out tolerances for dish and cup wheels for general applications

E, U, W	T_E	T_U, T_W
$E, U, W \leq 6$	+0,8 0	±0,5
$6 < E, U, W \leq 20$	+1,2 0	±0,8
$20 < E, U, W \leq 32$	+1,8 0	±1,2
$32 < E, U, W$	+2,4 0	±1,6

7.3 Dish and cup wheels for tool and cutter grinding

T_D, T_H and T_T are specified in 6.2.

Run-out tolerances T_{PL}, T_{RL} and limit deviations T_W, T_E and T_K are specified in Table 17.

Table 17 — 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

8 Grinding and cutting-off wheels

8.1 Relevant shape types according to ISO 525

Relevant shape types for grinding and cutting-off wheels according to ISO 525 are: Types 27, 28, 29, 41 and 42. See Figures 24 to 28.

8.2 to 8.4 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 fibre-reinforced.

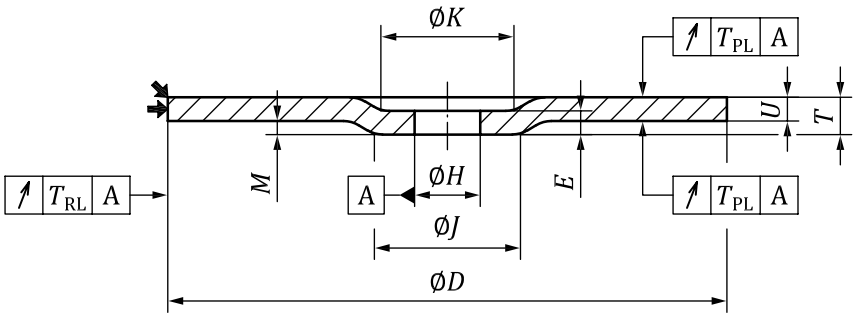


Figure 24 — Depressed centre grinding wheel for grinding or grinding/cutting-off (Type 27)

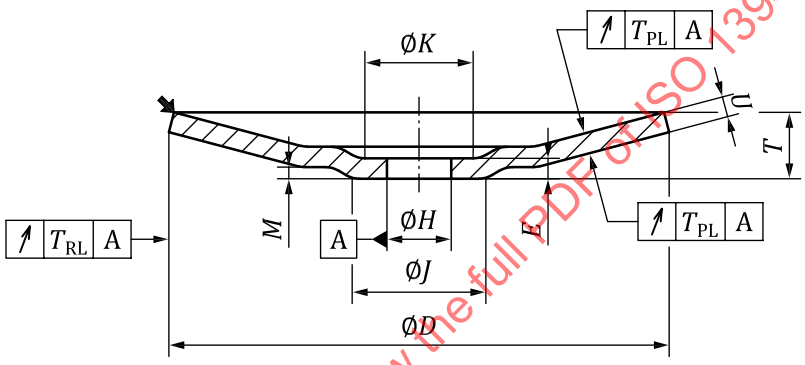


Figure 25 — Depressed centre grinding wheel, concave shaped (Type 28)

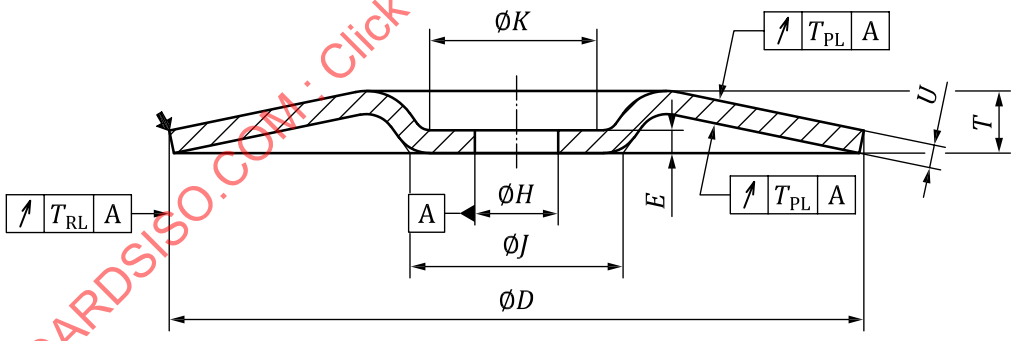


Figure 26 — Depressed centre grinding wheel, convex shaped (Type 29)

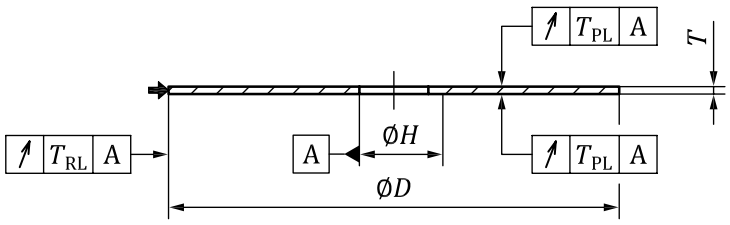


Figure 27 — Flat cutting-off wheel (Type 41)

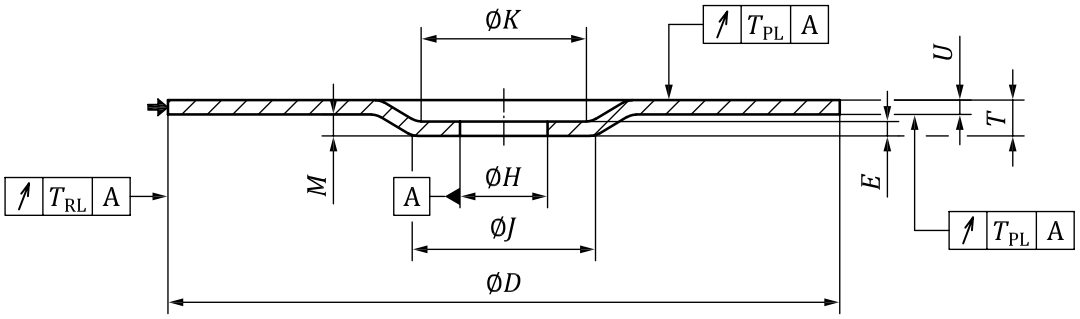


Figure 28 — Depressed centre cutting-off wheel (Type 42)

8.2 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 are specified in Table 18.

Table 18 — Limit deviations of outside diameters and run-out tolerances

D	T_D	T_{RL}	T_{PL}	
			$U, T > 2,5$	$U, T \leq 2,5$
$30 \leq D \leq 100$	±2,0	0,5	0,5	0,6
$100 < D \leq 150$	±2,5	0,6	0,6	0,8
$150 < D \leq 200$	±3,0	0,8	0,8	1,1
$200 < D \leq 300$	+5,0 −1,0	1,0	1,0	1,4
$300 < D \leq 400$	+6,0 0	1,2	1,2	1,5
$400 < D \leq 600$	+10,0 0	1,2	1,2	
$600 < D \leq 1\,000$	+15,0 0	1,6	1,6	
$1\,000 < D \leq 1\,800$	+20,0 0	2,0	2,0	
$1\,800 < D$	+20,0 0	2,5	2,5	

8.3 Limit deviations T_H of the hole diameter

The limit deviations T_H as specified in Table 19 apply to the hole diameters H.

Table 19 — Limit deviations of hole diameters

H	T_H
$H \leq 30$	+0,16 0
$30 < H \leq 50$	+0,25 0
$50 < H \leq 80$	+0,30 0
$80 < H \leq 120$	+0,35 0
$120 < H \leq 180$	+0,40 0
$180 < H \leq 250$	+0,46 0
NOTE The limit deviations of holes $H > 30$ mm correspond to H12.	

8.4 Limit deviations T_T and T_U of the grinding wheel thickness

The limit deviations T_T and T_U as specified in Table 20 apply to grinding wheels.

Table 20 — Limit deviations of grinding wheel thicknesses

T, U	T_T, T_U
$T, U \leq 1,6$	+0,3 −0,1
$1,6 < T, U \leq 4,0$	±0,4
$4,0 < T, U \leq 5,0$	±0,6
$5,0 < T, U \leq 6,0$	±0,8
$6,0 < T, U \leq 10,0$	±1,0
$10,0 < T, U \leq 16,0$	±1,2

9 Segments

Relevant shape types for segments according to ISO 525 are: Types 31A, 31B, 31C, 31D, 31E, 31F and 31G. See Figures 29 to 35.

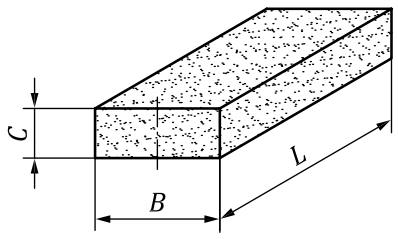


Figure 29 — Grinding segment, rectangular shape (Type 31A)

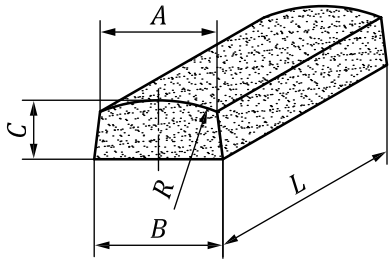


Figure 30 — Grinding segment, trapezoidal shape, with outer radius (Type 31B)

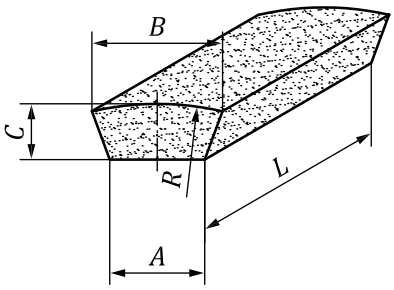


Figure 31 — Grinding segment, with outer radius (Type 31C)

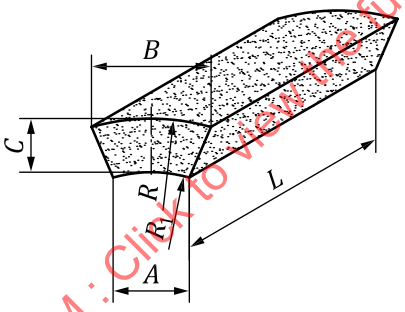


Figure 32 — Grinding segment, with outer and inner radius (Type 31D)

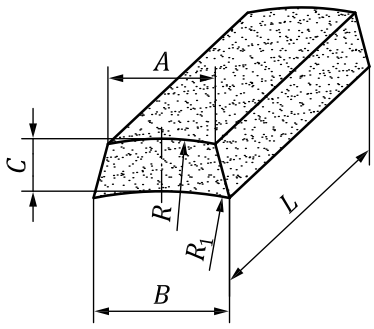


Figure 33 — Grinding segment, trapezoidal shape, with outer and inner radius (Type 31E)

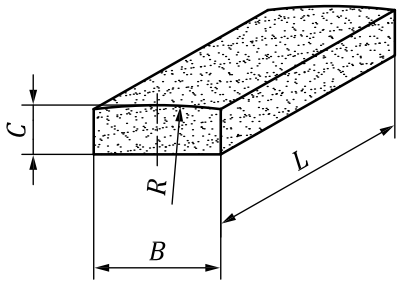


Figure 34 — Grinding segment, rectangular shape, with outer radius (Type 31F)

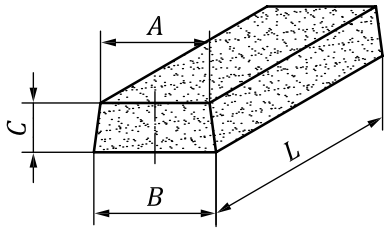


Figure 35 — Grinding segment, trapezoidal shape (Type 31G)

The limit deviations as specified in Table 21 apply to the thickness C, width B (or B and A), and length L of the segments.

NOTE For dimensions see ISO 603-5.

Table 21 — Limit deviations of thickness, width and length

T_A, T_B	T_C	T_L
0 −1	±1	±3

10 Cones and plugs with threaded insert

Relevant shape types for cones and plugs with threaded insert according to ISO 525 are: Types 16, 17, 17R, 18, 18B, 18P, 18R, 19 and 19R. See Figures 36 to 44.

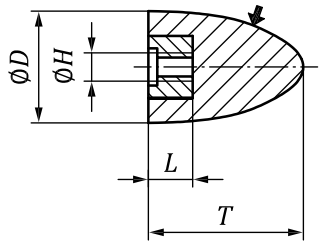


Figure 36 — Tapered grinding cone, curved, with threaded insert (Type 16)