

## Forms and dimensions of undercuts

**DIN**  
**509**

ICS 01.100.20; 25.020

Supersedes  
August 1966 edition.

Descriptors: Undercuts, types, dimensions, technical drawings.

Freistiche – Formen, Maße

*In keeping with current practice in standards published by the International Organization for Standardization (ISO), a comma has been used throughout as the decimal marker.***Foreword**This standard has been prepared by the *Normenausschuß Technische Grundlagen* (Fundamentals in Technology Standards Committee).**Amendments**

The standard has been completely revised.

**Previous edition**

DIN 509: 1956-04, 1966-01, 1966-08.

Dimensions in mm

**1 Scope and field of application**

This standard specifies undercuts on turned parts and in bores, and gives details of the indication of undercuts on drawings.

**2 Normative references**

This standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and titles of the publications are listed below. For dated references, subsequent amendments to or revisions of any of these publications apply to this standard only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

- |            |   |
|------------|---|
| DIN 250    | Rounding radii  |
| DIN 4768   | Determination of surface roughness parameters $R_a$ , $R_z$ , and $R_{max}$ , using electric stylus instruments – Concepts and measuring conditions |
| DIN 4967-1 | Indexable hardmetal inserts with rounded corners, with partly cylindrical fixing hole – 7° normal clearance   |
| DIN 4967-2 | Indexable hardmetal inserts with rounded corners, with partly cylindrical fixing hole – 11° normal clearance  |
| DIN 4968   | Indexable hardmetal inserts with rounded corners, without fixing hole   |
| DIN 4969-1 | Ceramic indexable inserts with rounded corners, without fixing hole   |
| DIN 6784   | Edges of workpieces – Concepts and indications on drawings  |

Continued on pages 2 to 6.

Translation by DIN-Sprachendienst.

In case of doubt, the German-language original should be consulted as the authoritative text.

### 3 Concepts

In addition to the concepts relating to edges of workpieces (see DIN 6784), the following concept applies.

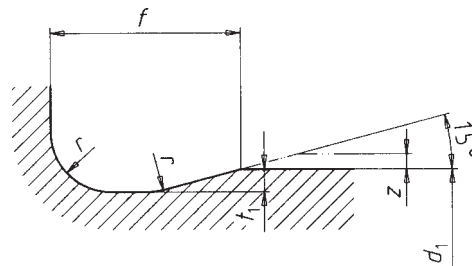
#### Undercut

Internal deviation from the ideal shape of a (rota-symmetrical) workpiece corner, either chamfered or rounded, of specified dimensions, producing a groove on the periphery or in a hole of a workpiece to provide clearance for subsequent machining (or assembly) operations.

### 4 Dimensions

#### 4.1 Type E undercut

Type E undercuts are suitable if no great demands are placed on the shoulder in service and the cylindrical surface is intended for subsequent machining. They are also suitable for workpieces which will be matched with a component that has a relatively large counterbore or will not be in contact with the shoulder.

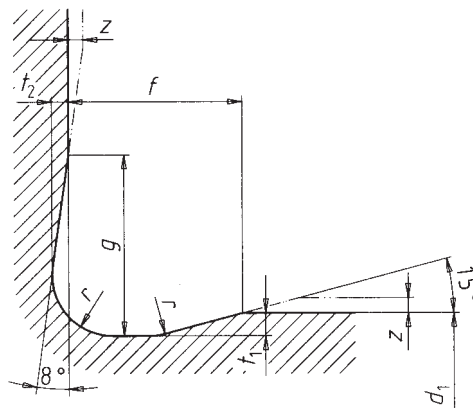


$z$  Machining allowance  
 $d_1$  Workpiece diameter

**Figure 1: Undercut for workpieces with a cylindrical surface intended for subsequent machining**

#### 4.2 Type F

Type F undercuts are to be used on workpieces with surfaces which are perpendicular to each other, intended for subsequent machining.

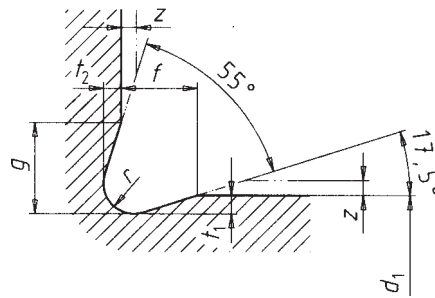


$z$  Machining allowance  
 $d_1$  Workpiece diameter

**Figure 2: Undercut for workpieces with shoulder and a cylindrical surface intended for subsequent machining**

### 4.3 Type G

Type G undercuts are to be used on workpieces not subjected to substantial fatigue stresses in service and thus require an undercut with a small included angle.

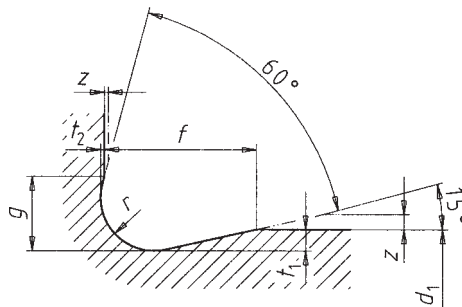


$z$  Machining allowance  
 $d_1$  Workpiece diameter

**Figure 3: Undercut with a smaller transition**

### 4.4 Type H

Type H undercuts are to be used on workpieces similar to those specified for type F (but with a greater included angle).



$z$  Machining allowance  
 $d_1$  Workpiece diameter

**Figure 4: Undercut with a larger transition**

## 5 Surface roughness

The roughness of undercut surfaces shall be such that the arithmetical mean deviation of the profile,  $R_a$ , is  $3,2 \mu\text{m}$  and the maximum two point height of the profile,  $R_{\text{max}}^*$ , is  $25 \mu\text{m}$ . Any other surface roughness parameters shall be subject to agreement.

## 6 Designation

Designation of a type E undercut, with a radius,  $r$ , of 0,8 mm and a depth,  $t_1$ , of 0,3 mm:

Undercut DIN 509 – E 0,8 × 0,3

Designation of a type E undercut, with a radius,  $r$ , of 0,8 mm, a depth,  $t_1$ , of 0,3 mm, and with  $R_a = 1,6 \mu\text{m}$  and  $R_{\text{max}} = 16 \mu\text{m}$ :

Undercut DIN 509 – E 0,8 × 0,3 –  $R_a$  1,6 –  $R_{\text{max}}$  16

\*) As defined in DIN 4768.

**Table 1: Undercut dimensions**

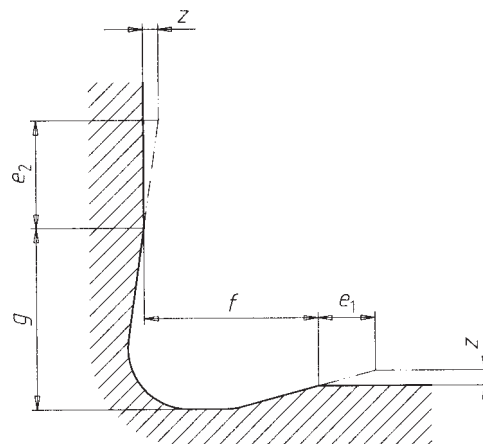
Type	$r^1)$ $\pm 0,1$		$t_1$ $+0,1$ 0	$f$ $+0,2$ 0	$g$	$t_2$ $+0,05$ 0	Corresponding diameter $d_1^{2)}$ for workpieces		
	Series 1	Series 2					subjected to a normal stress concentration	subjected to higher fatigue loads	
E and F	—	0,2	0,1	1	(0,9)	0,1	Over 1,6 up to 3	—	
	G	0,4		—	2				(1,1)
E and F			—		0,6	1	(1,2)		0,2
	H	0,8		—		2	(1,4)		0,1
E and F			—		0,3	2,5	(2,1)		0,2
	H	—		0,3		2	(1,1)		
E and F			1,2		1	0,2	2,5		(1,8)
	H	—		—		0,4	4		(3,2)
E and F			—		—	0,2	2,5		(2)
	H	—		—		0,4	4		(3,4)
E and F			1,6		—	0,3	4	(3,1)	0,2
	H	—		—					
E and F			2,5		—	0,4	5	(4,8)	0,3
	H	—		—					

1) Undercuts with series 1 radii as specified in DIN 250 are to be given preference. For types G and H, the radii conform to those specified for indexable hardmetal inserts as in DIN 4967, DIN 4768 and DIN 4769-1.

2) Components with a short shoulder and thin-walled components are excepted. When a workpiece has different diameters, it may be convenient for manufacturing reasons to use the same form and size of undercut at several points.

## 7 Machining allowance

The machining allowance  $z$  given in table 2 shifts the start of the shoulder or the cylindrical surface by the amount  $e_2$  and  $e_1$ , respectively, this amount depending on the magnitude of  $z$  and the relevant entry and runout angles of the undercut.

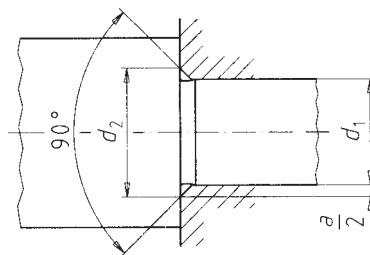


**Figure 5: Machining allowance (notation)**

**Table 2: Machining allowance**

z	Types E and F		Type G $e_1$ and $e_2$	Type H	
	$e_1$	$e_2$		$e_1$	$e_2$
0,1	0,37	0,71	0,32	0,45	0,37
0,15	0,56	1,07	0,48	0,68	0,56
0,2	0,75	1,42	0,63	0,9	0,75
0,25	0,93	1,78	0,79	1,13	0,93
0,3	1,12	2,14	0,95	1,35	1,12
0,4	1,49	2,85	1,27	1,8	1,49
0,5	1,87	3,56	1,59	2,26	1,87
0,6	2,24	4,27	1,9	2,71	2,24
0,7	2,61	4,98	2,22	3,16	2,61
0,8	2,99	5,69	2,54	3,61	2,99
0,9	3,36	6,40	2,85	4,06	3,36
1,0	3,73	7,12	3,17	4,51	3,73

**8 Counterbores on mating part**



**Figure 6: Counterbores on mating part**

**Table 3: Determination of dimension a**

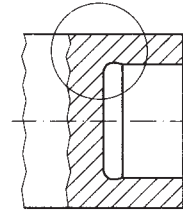
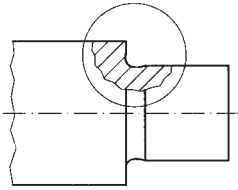
Undercut size, $r \times t_1$	Minimum size of a for type			
	E	F	G	H
0,2 × 0,1	0,2	0	—	—
0,4 × 0,2	0,4	0	0	—
0,6 × 0,2	0,8	0,2	—	—
0,6 × 0,3	0,6	0	—	—
0,8 × 0,3	—	—	—	0,8
0,8 × 0,3	1,0	0	—	—
1,0 × 0,2	1,6	0,8	—	—
1,0 × 0,4	1,2	0	—	—
1,2 × 0,2	2,0	0,5	—	—
1,2 × 0,3	—	—	—	1,5
1,2 × 0,4	1,6	0	—	—
1,6 × 0,3	2,6	1,1	—	—
2,5 × 0,4	4,0	1,7	—	—
4,0 × 0,5	7,0	4,0	—	—

## 9 Indications on drawings

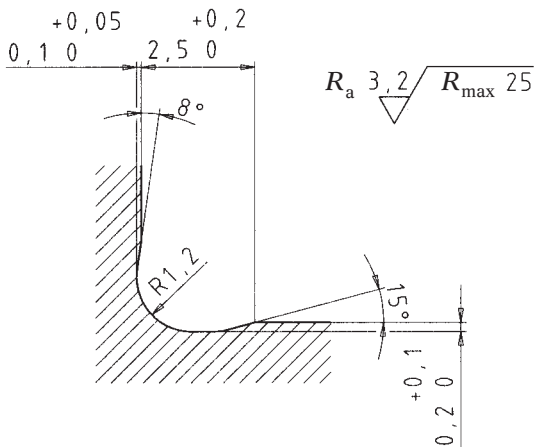
On technical drawings, undercuts may either be shown in detail, giving all dimensions, or schematically, giving only the designation.

EXAMPLE: Undercut F  $1,2 \times 0,2$

Undercut E  $1,2 \times 0,22$



Detail X



Detail Y

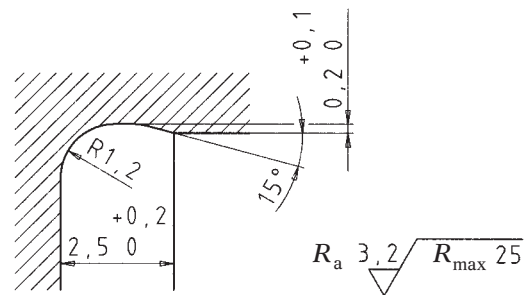


Figure 7: Complete indication for F  $1,2 \times 0,2$  undercut

Figure 8: Complete indication for E  $1,2 \times 0,2$  undercut

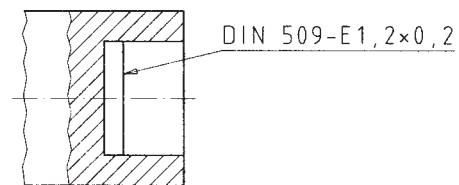
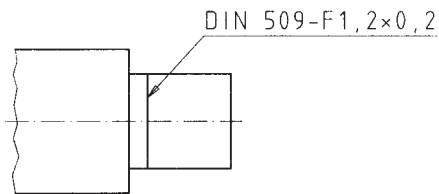


Figure 9: Simplified indication for F  $1,2 \times 0,2$  undercut

Figure 10: Simplified indication for E  $1,2 \times 0,2$  undercut

### Explanatory notes

Forms and dimensions of types G and H undercuts conform to those for indexable inserts as specified in DIN 4967-1 and DIN 4969-1 or as in DIN 4967, DIN 4968 or DIN 4969-1. For economic reasons, it is recommended that undercuts should be produced using these inserts.