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DEUTSCHE NORMEN

March 1980

Mechanical Fasteners

Technical Conditions of Delivery

Components for Bolted Connections Made Mainly from Materials Exhibiting a High Impact Strength at Low Temperature or from Materials with a High Temperature Strength

DIN 267 Part 13

Mechanische Verbindungselemente; Technische Lieferbedingungen; Teile für Schraubenverbindungen, vorwiegend aus kaltzähen oder warmfesten Werkstoffen

Contents

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Explanations on pages 13 and 14

1 Scope and general remarks

The technical conditions of delivery in accordance with this Standard apply to mechanical fasteners (primarily bolts, nuts and extension sleeves) which are manufactured mainly from materials exhibiting a high impact strength at low temperature or from materials with a high temperature strength.

The stipulations concerning surfaces, screw threads and tolerances in Sections 4 to 7 apply to:

- standardized or non-standardized components in accordance with the examples illustrated in Section 6, provided that a product class in accordance with this Standard is specified.
- similar standardized or non-standardized components, provided that a product class in accordance with this Standard is specified.

The reference to the product class can be made generally in Standards or drawings, or in the designation of the components concerned (see Section 11). If there is no mention of a product class, then either DIN 267 Part 2 or DIN ISO 4759 Part 1 (at present still in draft form) shall apply.

The tolerances apply to the individual dimension specified in the product Standards (or drawings) concerned in each instance.

2 Other relevant Standards

DIN 267 Part 1 *)	Mechanical fasteners; technical conditions of delivery, synopsis and general information
DIN 2510 Part 2	Bolted connections with reduced shank; metric thread with large clearance, nominal dimensions and limits
DIN 2510 Part 3	Bolted connections with reduced shank; stud-bolts
DIN 2510 Part 4	Bolted connections with reduced shank; studs
DIN 2510 Part 5	Bolted connections with reduced shank; hexagon nuts
DIN 2510 Part 6	Bolted connections with reduced shank; cap nuts
DIN 2510 Part 7	Bolted connections with reduced shank; extension sleeves
DIN 7168 Part 1	General tolerances, linear and angular dimensions
DIN 7168 Part 2 (Preliminary Standard)	General tolerances, form and position
DIN 17 240	Heat resisting and highly heat resisting materials for bolts and nuts; quality specifications
DIN 17 440	Stainless steels; quality specifications
DIN ISO 6157 Part 1	(at present still in draft form) Mechanical fasteners; surface defects on screws with M5 to M39 screw threads
DIN ISO 6157 Part 2	(at present still in draft form) Mechanical fasteners; surface defects on nuts with M5 to M39 screw threads
Stahl-Eisen Werkstoffblatt (Steel Iron Material Sheet) 680	Steels with a high impact strength at low temperature; quality specifications

*Note: Further Parts of DIN 267 are not listed in the above Section because general stipulations which apply to these Parts are laid down in DIN 267 Part 1 *).*

3 Product classes

Three product classes (previously referred to as executions, see Explanations) have been provided for bolted connections made mainly from materials exhibiting a high impact strength at low temperature or from materials with a high temperature strength; these product classes have had certain tolerances allocated to them in respect of individual dimensions and characteristics (see Sections 4 to 7).

As regards the dimensions without tolerance indication, DIN 7168 Part 1 and Part 2 (Preliminary Standard) apply, and in particular:

Table 1.

Product class		Tolerance
new	previously	
T1	f	DIN 7168 – fR
T2	m	DIN 7168 – mS
T3	mg	DIN 7168 – gT

Note: Contrary to the previous stipulations in DIN 267 Part 13, new symbols have been chosen for the product classes (executions), in order to avoid any possibility of confusion or mix-up with DIN 267 Part 2 or with DIN ISO 4759 Part 1 or DIN 267 Part 6 (see Explanations).

*) Subsequent edition at present still in draft form

4 Surfaces

Table 2. **Averaged peak-to-valley heights** [1] R_z, **maximum peak-to-valley heights** R max **and profile heights** [2] P_t **(values in µm)**

Surfaces			Roughness								
			T1			T2			T3		
Feature	Sizes over	Sizes up to	Bolt	Nut	Extension sleeve	Bolt	Nut	Extension sleeve	Bolt	Nut	Extension sleeve
Screw thread flanks	–	M 39	0,5/P_t 6,3	0,5/P_t 10	–	0,5/P_t 6,3	0,5/P_t 10	–	0,5/P_t 6,3	0,5/P_t 25	–
	M 39	M 56	1,5/P_t 6,3	1,5/P_t 10		1,5/P_t 6,3	1,5/P_t 10		1,5/P_t 6,3	1,5/P_t 25	
	M 56	–				1,5/P_t 10			1,5/P_t 10		
Screw thread root	–	M 56	0,5/P_t 6,3	0,5/P_t 63	–	0,5/P_t 6,3	0,5/P_t 63	–	0,5/P_t 6,3	optional	–
	M 56	–				0,5/P_t 10			0,5/P_t 10		
Seating faces	–	M 30	1,5/P_t 10	1,5/P_t 10	–	1,5/P_t 10	1,5/P_t 16	1,5/P_t 10	1,5/P_t 10	1,5/P_t 25	–
	M 30	M 80 X 6	5/P_t 10	5/P_t 16		5/P_t 10	5/P_t 16	R_z 10	5/P_t 10	5/P_t 25	
	M 80 X 6	–	R_z 10	R_z 16		R_z 10	R_z 16		R_z 10	R_z 25	
Shank and transition to screw thread	all		R max. 10	–	–	R max. 16	–	–	R max. 16	–	–
Key faces of nut	all		R_z 100	R_z 63	–	R_z 100	R_z 63	–	optional	optional	–
Axial holes	all		R max. 25	–	–	R max. 25	–	–	–	–	–
Remaining faces [3]	all		R_z 40 or 0,5/P_t 40	R_z 25 or 0,5/P_t 25	–	R_z 40 or 0,5/P_t 40	R_z 25 or 0,5/P_t 25	R_z 25 or 0,5/P_t 25	R_z 100 or 0,5/P_t 100	R_z 100 or 0,5/P_t 100	–

1) See DIN 4768 Part 1
2) See DIN 4771
3) The roughness indication of the profile heigth P_t only applies if the necessary measuring stretch l_m for a measurement of R_z in accordance with DIN 4768 Part 1 is not present.

5 Screw threads

Table 3.

Feature	Product class		
	T1	T2	T3
Screw thread profile	Screw thread profile according to DIN 13		
Internal thread (nut)	Tolerance zone 6H in accordance with DIN 13 Part 14		
External thread (bolt)	Thread limits in accordance with DIN 2510 Part 2		

Note: If fastener components such as hexagon bolts in accordance with DIN 931, with an external screw thread in accordance with DIN 2510 Part 2, are paired with nuts in accordance with DIN 934 (height 0.8 d), then a diminished resistance to stripping of the screw thread must be allowed for by virtue of the increased thread clearance. In individual cases it may be necessary to carry out a check calculation.

6 Dimensional tolerances

The bolts, nuts and extension sleeves illustrated here are only examples. The tolerances apply analogously to other kinds of bolts, nuts and extension sleeves.

6.1 Double-ended stud bolts

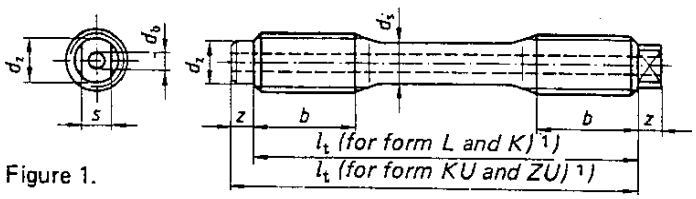


Figure 1.

Feature		Tolerance Product class T1	T2	T3
	b	+ IT 15	+ IT 15	–
	d_b	H13	H13	–
	d_s	h12	h12	–
	d_z	h13	h13	–
	l_t	js13	js15	–
	s	h13	h13	–
	z	js14	js15	–

6.2 Studs (with reduced shank or solid shank)

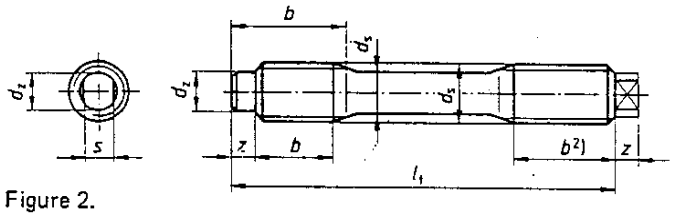


Figure 2.

Feature		Tolerance Product class T1	T2	T3
	b	+ IT 15	+ IT 15	–
	d_s	h12	h12	–
	d_z	h13	h13	–
	l_t	js13	js15	–
	s	h13	h13	–
	z	js14	js15	–

6.3 Cap screws (with reduced shank or solid shank)

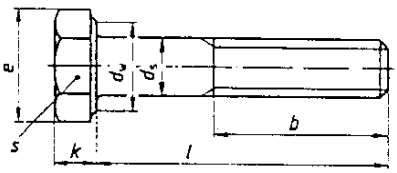


Figure 3.

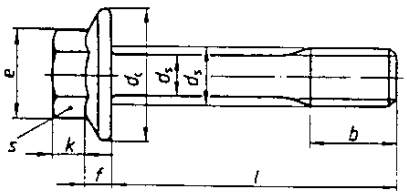
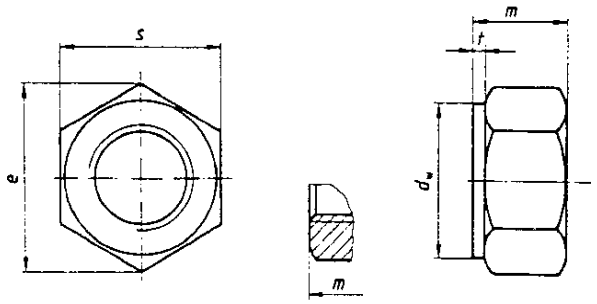
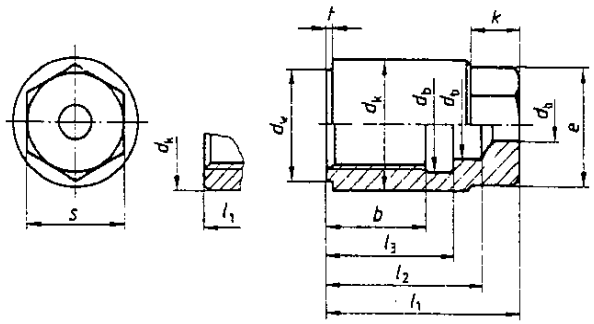
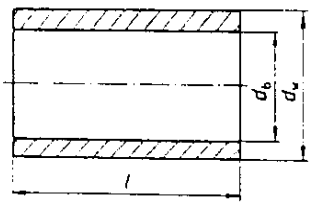


Figure 4.

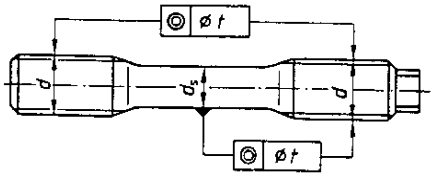
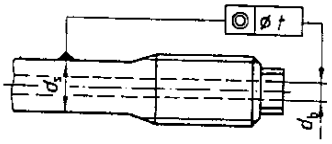
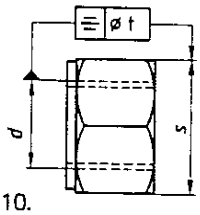
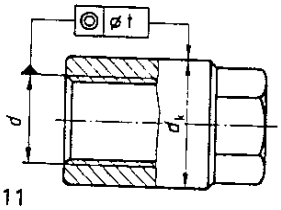
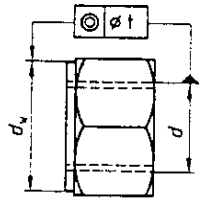
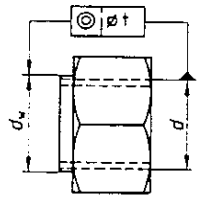
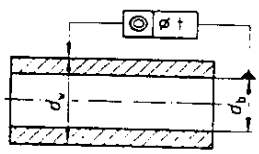
Feature		Tolerance Product class T1	T2	T3
	b^2)	+ IT 15	+ IT 15	+ IT 15
	d_c	h13	h13	h13
	d_s	h12	h12	h12
	d_w	d_w min. = s min. – IT 15		
	e	e min. ≧ 1,13 s min.		
	f	js14	js14	js15
	k	js14	js14	js15
	l	js15	js15	js16
	s	h13 ≦ s 30 h14 > s 30		h14 ≦ s 19 h15 > s 19

1) Form L, K, KU and ZU, see DIN 2510 Part 3

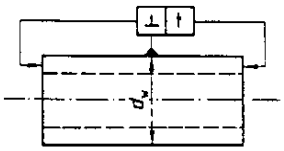
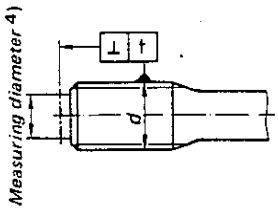
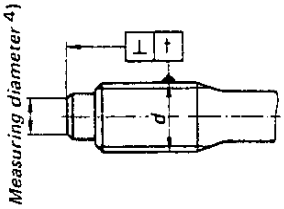
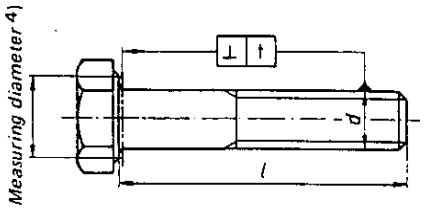
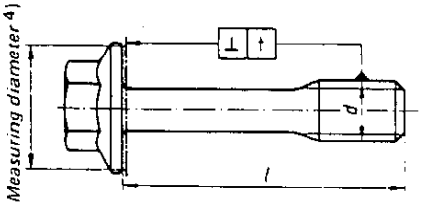
2) Tolerance + 1.5 P in the case of solid shank studs (P = Thread pitch)

Feature		Tolerance Product class T1	T2	T3
6.4 Nuts				
6.4.1 Hexagon nuts				
 Figure 5.	d_w	h13	h13	h13
	e	e min. ≧ 1,13 s min.		
	m	+ IT 14	+ IT 14	+ IT 15
	s	h13 ≦ s 30 h14 > s 30		h15
	t	js14	js14	js14
6.4.2 Cap nuts				
 Figure 6.	b	JS15	JS15	–
	d_b	H13	H13	–
	d_k	h13	h13	–
	d_w	h13	h13	–
	e	e min. ≧ 1,13 s min.		–
	k	js14	js14	–
	l_1	h14	h14	–
	l_2	+ IT 15	+ IT 15	–
	l_3	+ IT 15	+ IT 15	–
	s	h13 ≦ s 30 h14 > s 30		–
	t	js14	js14	
6.5 Extension sleeves				
 Figure 7.	d_b	H13	H14	–
	d_w	h13	h13	–
	l	h14	h14	–

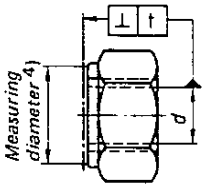
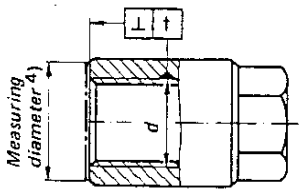
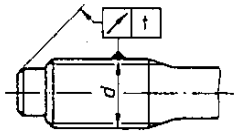
3) In the case of nuts in accordance with DIN 934, the tolerances in accordance with DIN ISO 4759 Part 1 or DIN 267 Part 2 apply to m.

Feature	Tolerance t Product class T1	T2	T3
7 Form and positional tolerances The form and positional tolerances are independent of the manufacturing, measurement and testing methods **7.1 Coaxiality tolerance, symmetry tolerance**			
 Figure 8.	2 IT 10	2 IT 13	–
 Figure 9.	2 IT 13	2 IT 14	–
 Figure 10.  Figure 11	2 IT 12	2 IT 13	2 IT 14 (only applies to Fig. 10)
 Figure 12.	2 IT 12	2 IT 13	2 IT 14
 Figure 13. Used in conjunction with extension sleeve D (also applies to cap nuts)	2 IT 12	2 IT 12	2 IT 12
 Figure 14.	2 IT 11	2 IT 11	–

N o t e : If the screw thread nominal diameter is entered as reference (datum) element, then the take up or measurement occurs in the thread flank.

Feature	Tolerance t Product class T1	T2	T3
7.2 Perpendicularity tolerance (Values for t in mm)  Figure 15.	–	d_w ≦ 56: t = 0,02 d_w > 56 ≦ 90: t = 0,03 d_w > 90 ≦ 125: t = 0,04 d_w > 125: t = 0,05	–
 Figure 16.	t = 0,0175 X Measuring diameter		–
 Figure 17.	t = 0,009 X Measuring diameter	t = 0,0175 X Measuring diameter	–
 Figure 18.	t = 0,05 for l ≦ 60; t = 0,1 for l > 60 ≦ 120 t = 0,15 for l > 120	for d ≦ M 39: t = 0.009 X Measuring diameter for d > M 39: t = 0.0045 X Measuring diameter	
 Figure 19.		for d ≦ M 39: t = 0.009 X Measuring diameter for d > M 39: t = 0.0045 X Measuring diameter	

[4]) Bolts and nuts manufactured by non-cutting shaping (re-forming) do not in all cases exhibit their solid (full) surface at the outer edges. On such components, the perpendicularity tolerance t applies to a measuring diameter amounting to 0.8 times the respective dimension, e. g. 0.8 d_k, 0.8 d_w.

Feature	Tolerance t Product class		
	T1	T2	T3
 Figure 20.	0.05 for each measuring diameter	for $d \leqq$ M 39: t = 0.009 X Measuring diameter for $d >$ M 39: t = 0.0045 X Measuring diameter	for $d \leqq$ M 39: t = 0.0175 X Measuring diameter for $d >$ M 39: t = 0.009 X Measuring diameter
 Figure 21.	0.05 for each measuring diameter	for $d \leqq$ M 39: t = 0,009 X Measuring diameter for $d >$ M 39: t = 0.0045 X Measuring diameter	–
7.3 Running tolerance  Figure 22	0,05	0,1	–
4) See page 7			

8 Materials and strength classes

The materials and strength classes featured in Tables 4 to 8 are used as a general rule. They are classified according to:

8.1 Temperatures from – 253 to lower than – 10 °C (Table 4)

8.2 Temperatures from – 10 to + 300 °C (Tables 5 and 6)

8.3 Temperatures above + 300 °C (Tables 7 and 8)

In so far as the strength values of bolts and nuts are not covered by DIN ISO 898 Part 1, DIN 267 Part 4 and Part 11, the following material Standards shall apply:

DIN 17 240 Heat resisting and highly heat resisting materials for bolts and nuts; quality specifications

DIN 17 440 Stainless steels; quality specifications

Stahl-Eisen Werkstoffblatt (Steel Iron Material Sheet) 680 Steels with a high impact strength at low temperature; quality specifications

If any additional conditions are specified, they must be mutually agreed at the time of placing the purchase order, e. g. in accordance with:

AD (Pressure Vessel Study Group) Memorandum W 2 Austenitic Steels

AD Memorandum W 7 Materials for pressure vessels; bolts and nuts of ferritic steels

AD Memorandum W 10 Materials for low temperatures

TRD 106 Technical Regulations for Steam Boilers; bolts and nuts of steel

8.1 Temperatures from – 253 to lower than – 10 °C

Table 4. Materials

Material				Rough indication of the usual lower temperature limit in continuous operation 2)
Code number	Number	according to	Identification symbol	
26 CrMo 4	1.7219	Stahl-Eisen Werkstoffblatt (Steel Iron Material Sheet) 680	KA	- 65 °C
12 Ni 19	1.5680		KB	- 140 °C
X 12 CrNi 18 9	1.6900		KC	- 253 °C
X 10 CrNiTi 18 10	1.6903		KD	- 253 °C
X 5 CrNi 18 9	1.4301	DIN 267 Part 11 or AD-W 10	A2 1)	- 196 °C
X 5 CrNi 19 11	1.4303		A2 1)	- 196 °C
X 10 CrNiTi 18 9	1.4541		A2 1)	- 196 °C
X 5 CrNiMo 18 10	1.4401		A4 1)	- 60 °C
X 10 CrNiMoTi 18 10	1.4571		A4 1)	- 60 °C

1) The reference number relating to the desired strength class should be appended to the identification symbol A2 and A4, e. g. A2 – 70 (see DIN 267 Part 11), in so far as sufficient space is available to do this. If a specific material is desired, then the code number of the material or the material number shall be stated in lieu of the steel group in accordance with DIN 267 Part 11. This also applies to components above M39.

2) In this respect see also AD-Merkblatt (AD Memorandum) W10 and Stahl-Eisen Werkstoffblatt (Steel Iron Material Sheet) 680

8.2 Temperatures from – 10 to + 300 °C

Table 5. Strength classes (materials)

Strength class 1)		Identification symbol	
Bolt according to DIN ISO 898 Part 1	Nut according to DIN 267 Part 4	Bolt according to DIN 267 Part 13	Nut according to DIN 267 Part 8
4.6–2 2)	5–2 2)	4.6–2	5–2
5.6–2 2)	5–2 2)	5.6–2	5–2
8.8	8	8.8	8

1) The values of the strength classes apply to room temperature.

2) By appending –2 to the identification symbol of the strength class, basic Bessemer steel (Thomas steel) is excluded. In addition, a minimum notched bar impact test energy of 25 Joule (ISO test piece with a U notch) is stipulated for bolts 4.6–2.

Table 6. Yield points at elevated temperatures

Strength class	Minimum yield point R_{eH} or $R_{p\,0,2}$ in N/mm² at				
	+ 20 °C	+ 100 °C	+ 200 °C	+ 250 °C	+ 300 °C
4.6–2	240	210	190	170	140
5.6–2	300	250	210	190	160
8.8 1)	640	590	540	510	480

1) The minimum yield points (yield points at elevated temperatures) for temperatures from + 100 to + 300 °C are only rough guideline values for the time being in the case of the strength class 8.8, because they are as yet not backed by sufficient data.

8.3 Temperatures over + 300 °C

Table 7. **Materials**

Material according to DIN 17 240 [1]			Rough indication of the usual higher temperature limit in continuous operation (according to DIN 17 240) [7]
Code number	Number	Identification symbol	
C 35 N [2]	1.0501	Y	+ 350 °C
Ck 35	1.1181	YK	+ 350 °C [3]
Cq 35	1.1172	YQ	+ 350 °C [3]
24 CrMo 5	1.7258	G	+ 400 °C [4]
21 CrMoV 5 7	1.7709	GA	+ 540 °C
40 CrMoV 4 7	1.7711	GB	+ 540 °C
X 22 CrMoV 12 1	1.4923	V [6]	+ 580 °C
X 19 CrMoVNbN 11 1	1.4913	VW	+ 580 °C
X 8 CrNiMoBNb 16 16	1.4986	S	+ 650 °C
X 5 NiCrTi 26 15 [5]	1.4980	SD	+ 700 °C
NiCr 20 TiAl	2.4952	SB	+ 700 °C

1) See Explanations in this connection

2) Does not apply to bolts

3) In the case of nuts, the usual higher temperature limit in continuous operation can be 50 °C higher.

4) In the case of nuts made from 24 CrMo 5 material, there is no indication of the higher service temperature in DIN 17 240. Taking the relevant strength properties of the nut material into consideration, or if there is an adequate amount of experience available as support, this "rough indication" temperature in accordance with DIN 17 240 Section 1.1 (July 1976 edition) may be exceeded, e. g. as stated in DIN 2507 Part 2 (see also Explanations under I in this connection).

5) Not featured in DIN 17 240 (aviation material No. 1.4944)

6) Identification symbol VH applies to the material X 22CrMo V 12 1 with the higher strength values (yield point or $R_{p\,0.2} \geqq 700$ N/mm²) according to DIN 17 240

7) Within the confines of the stipulations in DIN 17 240, July 1976 edition, Section 1.1, the temperatures indicated may be exceeded.

Table 8. **Appropriate material combinations (pairings) for bolt and nut**

Material	
Bolt	Nut
Ck 35 Cq 35	C 35 N, Ck 35, Cq 35
24 CrMo 5	Ck 35, Cq 35, 24 CrMo 5
21 CrMoV 5 7	24 CrMo 5 21 CrMoV 5 7
40 CrMoV 4 7	21 CrMoV 5 7
X 22 CrMoV 12 1 X 19 CrMoVNbN 11 1	X 22 CrMoV 12 1
X 8 CrNiMoBNb 16 16	X 8 CrNiMoBNb 16 16
X 5 NiCrTi 26 15	X 5 NiCrTi 26 15
NiCr20TiAl	NiCr20TiAl

N o t e : If extension sleeves are used in conjunction with bolted connections made from materials in accordance with Section 8.3, then these extensions sleeves should preferably be made of the same material as the corresponding bolt.

At high temperatures and under exploitation to the fullest extent of the strength values of the bolt material, the relaxation characteristics of the bolted connection are considerably diminished, if too soft a material is selected for the nut. For this reason, the determining strength properties (yield point at elevated temperature, relaxation characteristics) of the nut material in relation to the bolt material should not be allowed to fall below a factor of 0.7 *in the case of such connections.*

9 Marking

Fasteners in accordance with this Standard must be marked with the trade mark of origin and with the material symbol or the strength class in accordance with Tables 4, 5 and 7, in so far as available space will permit it.

The location for the marking shall be selected in accordance with DIN 267 Part 8, Part 11, DIN 2510 Part 3 to Part 7 or DIN ISO 898 Part 1, unless something to the contrary has been agreed.

10 Testing

10.1 Testing of mechanical properties and of materials

In cases where fasteners are manufactured by machining without any subsequent heat-treatment, the testing of the steels used in accordance with the relevant steel Standards will suffice. In the case of cold or hot-formed parts, the testing should take place after the final heat-treatment (as far as possible on the finished component). These tests shall be carried out for

a) bolts and similar components with property classes (according to Section 8.2) in accordance with DIN ISO 898 Part 1,

b) nuts and similar components with strength classes (according to Section 8.2) in accordance with DIN 267 Part 4,

c) components in accordance with DIN 267 Part 11, according to the stipulations featured therein,

d) components made from steels with a high impact strength at low temperatures (according to Section 8.1) and from steels with a high temperature strength (according to Section 8.3), in accordance with DIN ISO 898 Part 1 or DIN 267 Part 4.

10.2 Extent of testing

As regards mutually agreed tests, Standard DIN 267 Part 5 shall apply in respect of the extent of testing for dimensional accuracy, finish, mechanical properties and/or material, unless any different or additional stipulations have been mutually agreed at the time of placing the purchase order.

10.3 Proof of quality characteristics

A certificate in respect of material tests according to DIN 50 049 can be mutually agreed as proof of the quality characteristics.

10.4 Inspection in respect of surface defects

DIN ISO 6157 Part 1 (at present still in draft form) or DIN ISO 6157 Part 2 (at present still in draft form) applies to the inspection in respect of surface defects.

Relating to sizes exceeding M 39 subject to agreement.

11 Designation

The designation of components for bolted connections made mainly from steels with a high impact strength at low temperature or from steels with a high temperature strength shall be selected in accordance with the respective product Standards, e. g. DIN 2510 (see also Explanations).

If components in accordance with existing general product Standards are required to comply with the special conditions in accordance with DIN 267 Part 13, then the relevant product class must be specified in the designation, e. g.:

Hexagon bolt DIN 931 – M 12 X 60 – 8.8 – T1

Hexagon nut DIN 934 – M 12 – 8 – T2

Appendix A

Fundamental tolerances and tolerance zones

In order to facilitate the practical application of this Standard, the fundamental tolerances and tolerance zones mentioned in Sections 6 and 7 are reproduced in the Table below.

Values in mm

Nominal dimension range	Fundamental tolerances						Tolerance zones External dimensions								Inside dimensions	
	IT10	IT11	IT12	IT13	IT14	IT15	h12	h13	h14	h15	js13	js14	js15	js16	H13	H14
from 1 to 3	0,04	0,06	0,10	0,14	0,25	0,40	0 / - 0,10	0 / - 0,14	0 / - 0,25	0 / - 0,40	± 0,07	± 0,125	± 0,20	± 0,30	+ 0,14 / 0	+ 0,25 / 0
over 3 to 6	0,048	0,075	0,12	0,18	0,30	0,48	0 / - 0,12	0 / - 0,18	0 / - 0,30	0 / - 0,48	± 0,09	± 0,15	± 0,24	± 0,375	+ 0,18 / 0	+ 0,30 / 0
over 6 to 10	0,058	0,09	0,15	0,22	0,36	0,58	0 / - 0,15	0 / - 0,22	0 / - 0,36	0 / - 0,58	± 0,11	± 0,18	± 0,29	± 0,45	+ 0,22 / 0	+ 0,36 / 0
over 10 to 18	0,07	0,11	0,18	0,27	0,43	0,70	0 / - 0,18	0 / - 0,27	0 / - 0,43	0 / - 0,70	± 0,135	± 0,215	± 0,35	± 0,55	+ 0,27 / 0	+ 0,43 / 0
over 18 to 30	0,084	0,13	0,21	0,33	0,52	0,84	0 / - 0,21	0 / - 0,33	0 / - 0,52	0 / - 0,84	± 0,165	± 0,26	± 0,42	± 0,65	+ 0,33 / 0	+ 0,52 / 0
over 30 to 50	0,10	0,16	0,25	0,39	0,62	1,00	0 / - 0,25	0 / - 0,39	0 / - 0,62	0 / - 1,00	± 0,195	± 0,31	± 0,50	± 0,80	+ 0,39 / 0	+ 0,62 / 0
over 50 to 80	0,12	0,19	0,30	0,46	0,74	1,20	0 / - 0,30	0 / - 0,46	0 / - 0,74	0 / - 1,20	± 0,23	± 0,37	± 0,60	± 0,95	+ 0,46 / 0	+ 0,74 / 0
over 80 to 120	0,14	0,22	0,35	0,54	0,87	1,40	0 / - 0,35	0 / - 0,54	0 / - 0,87	0 / - 1,40	± 0,27	± 0,435	± 0,70	± 1,10	+ 0,54 / 0	+ 0,87 / 0
over 120 to 180	0,16	0,25	0,40	0,63	1,00	1,60	0 / - 0,40	0 / - 0,63	0 / - 1,00	0 / - 1,60	± 0,315	± 0,50	± 0,80	± 1,25	+ 0,63 / 0	+ 1,00 / 0
over 180 to 250	0,185	0,29	0,46	0,72	1,15	1,85	0 / - 0,46	0 / - 0,72	0 / - 1,15	0 / - 1,85	± 0,36	± 0,575	± 0,925	± 1,45	+ 0,72 / 0	+ 1,15 / 0
over 250 to 315	0,21	0,32	0,52	0,81	1,30	2,10	0 / - 0,52	0 / - 0,81	0 / - 1,30	0 / - 2,10	± 0,405	± 0,65	± 1,05	± 1,60	+ 0,81 / 0	+ 1,30 / 0
over 315 to 400	0,23	0,36	0,57	0,89	1,40	2,30	0 / - 0,57	0 / - 0,89	0 / - 1,40	0 / - 2,30	± 0,445	± 0,7	± 1,15	± 1,80	+ 0,89 / 0	+ 1,40 / 0
over 400 to 500	0,25	0,40	0,63	0,97	1,55	2,50	0 / - 0,63	0 / - 0,97	0 / - 1,55	0 / - 2,50	± 0,485	± 0,775	± 1,25	± 2,00	+ 0,97 / 0	+ 1,55 / 0

Explanations

This subsequent edition of DIN 267 Part 13 contains the following amendments and additions in comparison with the July 1968 edition:

a) The editorial arrangement has been harmonized with the recently compiled new Parts of DIN 267.

b) The previous executions f, m and mg have been re-designated "product classes" T1, T2 and T3 without any fundamental re-adjustment being involved thereby. This re-designation has been necessitated by the need to avoid any possible future mix-ups with the executions m, mg and g in accordance with DIN 267 Part 2, and with the product classes A, B and C in accordance with DIN ISO 4759 Part 1. For this reason, a Section entitled "Designation" has also been incorporated in this Standard, which for instance specifies that apart from standardized components in accordance with DIN 2510, components in accordance with other DIN Standards can also be ordered with the special requirements of the product classes in accordance with DIN 267 Part 13.

c) The data relating to the surfaces (peak-to-valley heights) of the components have been defined more accurately. For this purpose, recourse has been had to the new Standard DIN 4771 "Measurement of the profile height P_t of surfaces". The following apply:

P_t for all surfaces in respect of which shortened measuring sections in comparison with R_z have to be adopted,

R_z for all surfaces in respect of which the measuring sections required for R_z are available, and

R max for all surfaces in respect of which even individual outliers in the peak-to-valley heights cannot be permitted for reasons of the notch effect.

d) The data relating to the permissible dimensional deviations have been supplemented, to enable even non-standardized components, such as hexagon bolts with reduced shank to be supplied in accordance with DIN 267 Part 13.

e) The permissible deviations relating to form and position have been harmonized with DIN 7184 and the data supplemented in part.

f) The previous four temperature ranges have been re-grouped into three ranges. The specified temperatures relate generally to the rulings laid down in the AD Memoranda published by the Pressure Vessel Working Group, i. e. to charging media temperatures of pressure vessels, which ignore temperatures conditioned by the weather. In so far as weathering influences have to be taken into account additionally for fasteners, the relevant calculation rules must be taken into consideration.

g) For temperatures from − 253 to below − 10 °C, materials in accordance with DIN 17 440 (DIN 267 Part 11) have been adopted in addition. Furthermore, the usual lower temperature limits in continuous operation have been specified as a rough guide. For reasons of reduction in the number of available grades (rationalization) and of economic procurement, only what appeared to be a rational selection of possible materials has been put forward for the materials.

h) In the − 10 to + 300 °C temperature range, the strength classes 6.6 for bolts and 6 for nuts have been deleted. These strength classes are hardly used at all for bolted connections in accordance with DIN 267 Part 13. In addition the strength class 6.6 is not featured in DIN ISO 898 Part 1.

j) In the case of temperatures above + 300 °C, the materials featured in the new edition of DIN 17 240 have been adopted. In this context, new identification symbols have been chosen for the products, unless the materials are absolutely identical with the former ones. Again in this temperature range, the upper temperature limits have been quoted as a rough indication in continuous operation.

Because it will not be possible to switch over from the former materials to the new ones without a certain transition period, we reproduce below a piece of information in this connection, taken from the Explanations to DIN 17 240, July 1976 edition:

Grade 21 CrMoV5 7 replaces grades 24 CrMoV 5 5 and 21 CrMoV 5 11. These last two grades do not exhibit better values than the new grade, particularly

in respect of their creep rupture behaviour, as one might have been led to expect on the basis of the data and information contained in DIN 17 240 Part 1 and Part 2, January 1959 edition; this is confirmed by investigations of the Study Group on High Temperature Strength Materials, in which steel manufacturers and steel users work together. However, bolts and nuts made from these two old steels which are still in stock can be used without reservations in lieu of bolts and nuts made from steel 21 CrMoV 5 7.

Material X 5 NiCrTi 26 15 (Material number 1.4980) has been included in Table 7 on account of its many years of application, despite the fact that it is featured neither in DIN 17 240 nor in the AD Memorandum W7. It is however featured also as aviation material 1.4944 and under other designations. The properties of the material appear in the documentation (catalogues) of the individual steel manufacturers. Acceptance test certificates are issued by the Technical Inspectorate on the basis of individual approvals.

k) On the basis of present experience, a table featuring appropriate material combinations (pairings) for temperatures above + 300 °C has been adopted for the first time.

l) According to DIN 17 240, Section 1.1 (July 1976 edition), the upper limit temperatures adopted in Table 7 and designated as rough indications may be exceeded on condition that the material properties are adequate to withstand the operating duty stresses.

The determining factor is the overall stressing of the material by temperature, mechanical loading and the surrounding media during the planned working time.

m) The Sections dealing with marking and testing have been delineated more accurately and harmonized with existing Standards.

n) The contents of the Standard have been harmonized as far as possible with the stipulations relating to plants requiring supervision in accordance with paragraph 24 of the Factory Act (AD Memoranda, Technical Regulations relating to Steam Boilers), and reference has been made to these stipulations.

In the course of the elaboration of this subsequent edition of DIN 267 Part 13, there was no unanimous consensus in respect of the scope. The July 1968 edition of the Standard specified size, form and positional tolerances primarily only for bolted connections with a reduced shank in accordance with DIN 2510. The data relating to materials and strength classes on the other hand were equally applicable also to other bolted connections without any restrictions or addenda. Consequently it was at first contemplated to split the Standard into two parts, i. e. to include the size, form and positional tolerances in DIN 2510, and to leave the data relating to materials and strength classes in DIN 267 in the form of generally valid Technical Conditions of Delivery for components for bolted connections made mainly from steels with a high impact strength at low temperature and from high temperature strength steels.

This splitting of the Standard into two parts was however not proceeded with after confirmation had been received, mainly from users, that DIN 267 Part 13 in its previous version was also being used for non-standardized components, and that it was desired not to have to give up this possibility of use, which would have been the case if the data relating to the tolerance stipulations had been incorporated in DIN 2510.

Examples of application

In order to facilitate the application of the Standard to manufacturing drawings, four examples are illustrated below, in which all the necessary data have been entered, including the data relating to form and position.

Example 1: Stud DIN 2510 – HS M 100 X 6 X 480 – T2

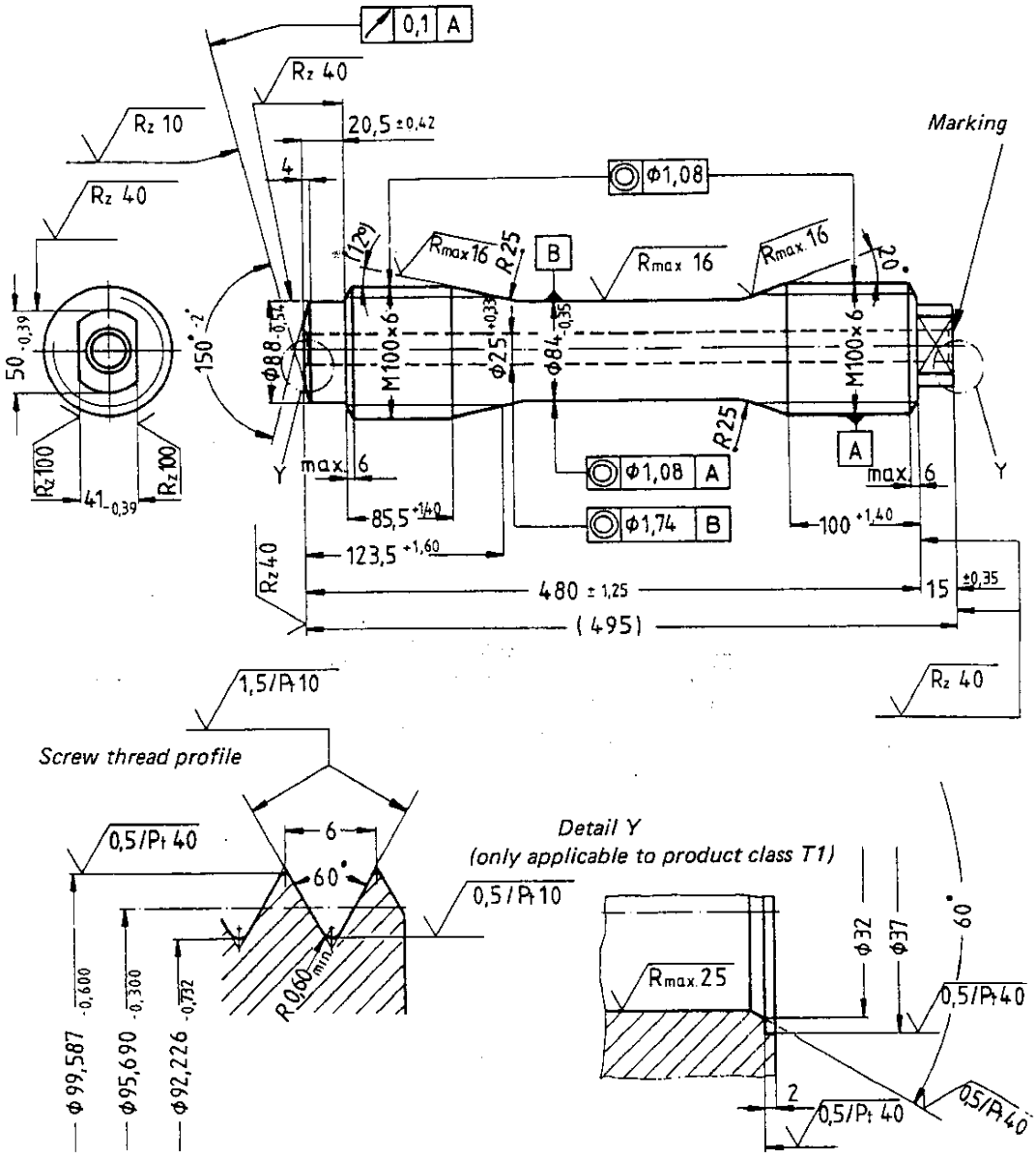


Figure 23. The reference element for A is the nominal thread diameter, the take up and measurement are effected at the thread flank

Example 2: Hexagon nut DIN 2510 – TF M 100 X 6 – T2

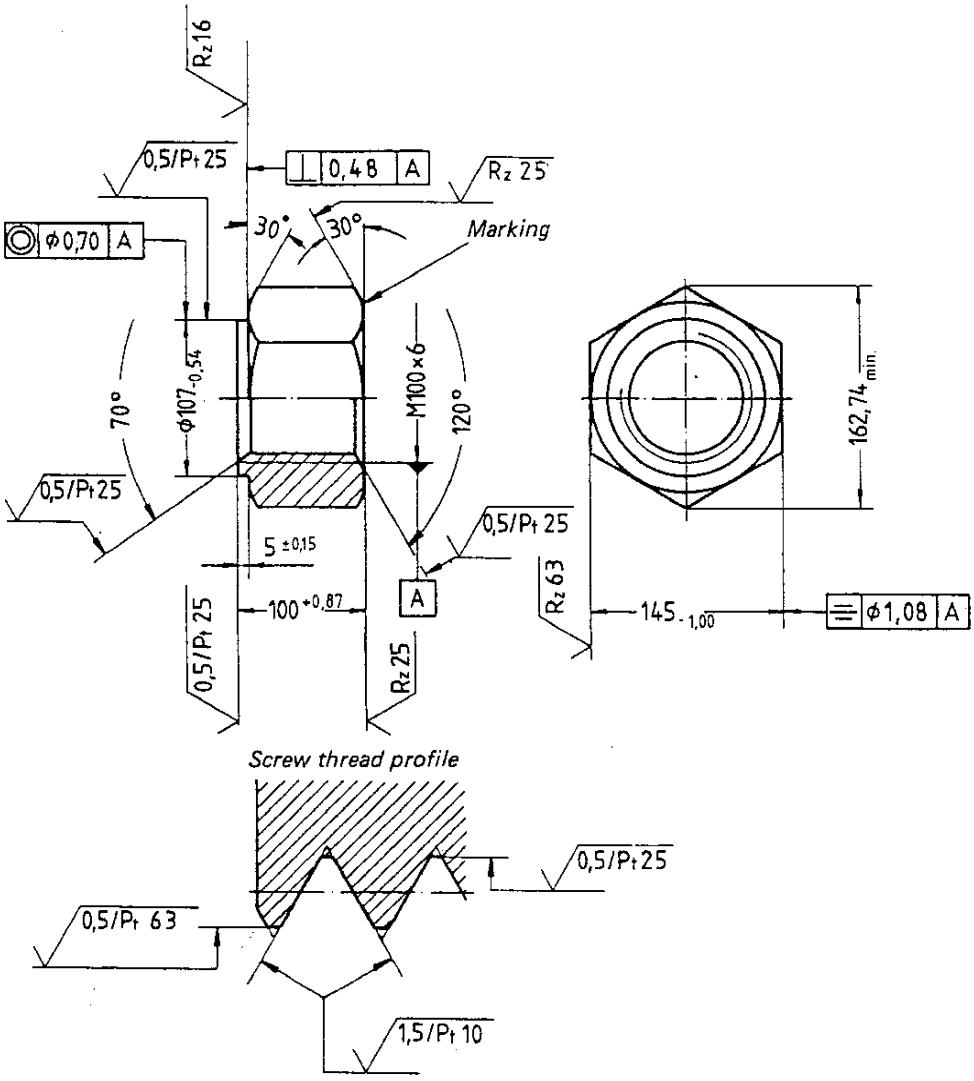


Figure 24. The reference element for A is the nominal thread diameter, the take up is effected at the thread flank

Example 3: Cap nut DIN 2510 – BF M 100 X 6 – T2

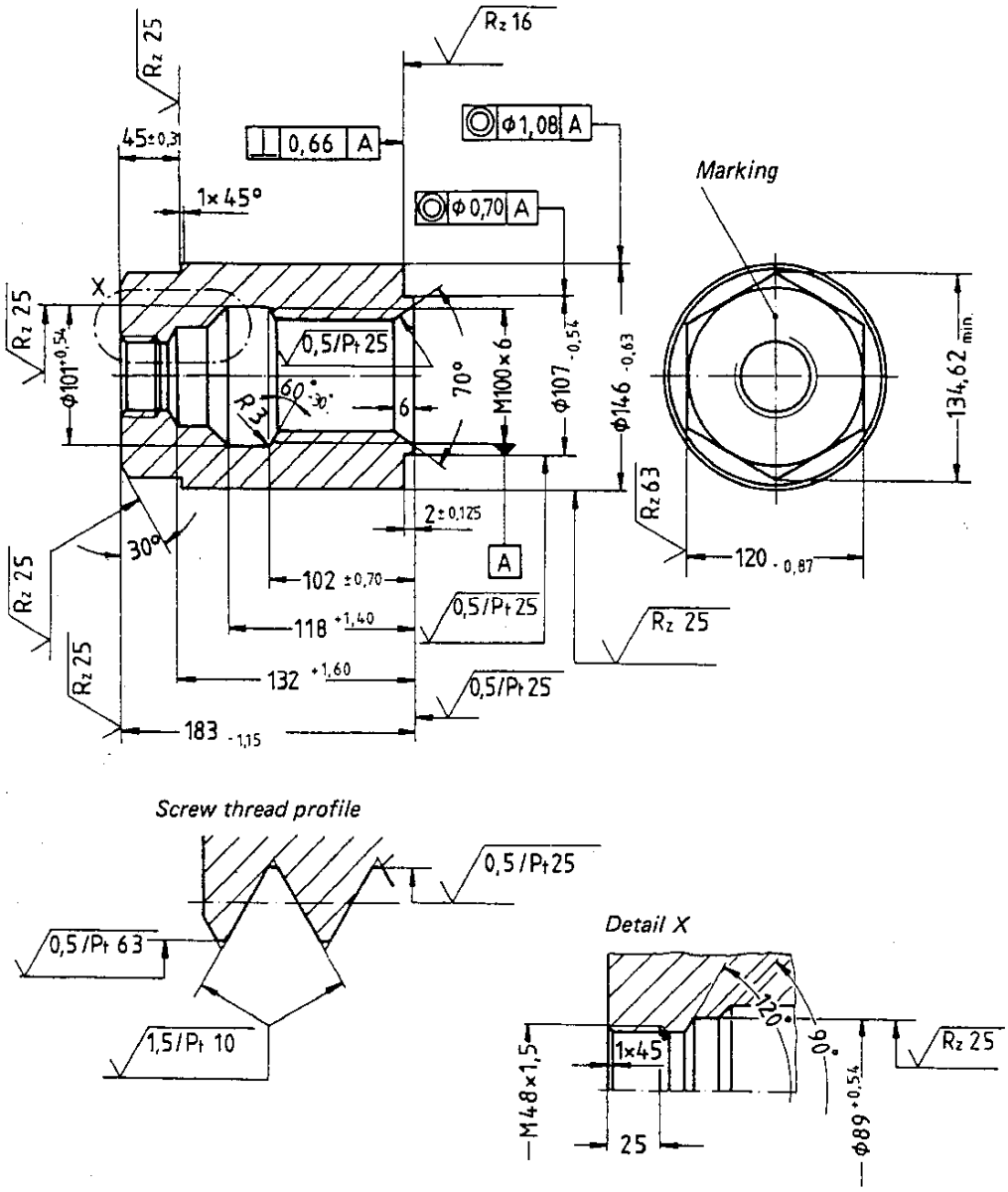


Figure 25. The reference element for A is the nominal screw thread diameter, the take up is effected at the thread flank

Example 4:

Extension sleeve DIN 2510 – D 146 X 100 – T2

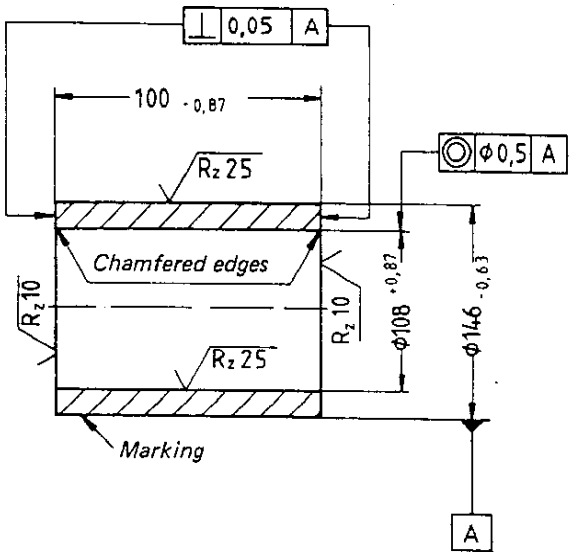


Figure 26.