INTERNATIONAL STANDARD

ISO 14581

Second edition
2022-12

Fasteners — Hexalobular socket countersunk flat head screws (common head style) with reduced loadability

Fixations — Vis à tête fraisée (tête commune) à six lobes internes à capacité de charge réduite

Reference number
ISO 14581:2022(E)

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Contents

Page

Foreword

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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).

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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 2, *Fasteners*, Subcommittee SC 11, *Fasteners with metric external thread,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 185, *Fasteners*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 14581:2013), which has been technically revised.

The main changes are as follows:

— the whole standard (including title) has been improved to clearly point out that these hexalobular socket countersunk flat head screws with common head style have reduced loadability because of their head design (head dimensions and penetration of the hexalobular socket);

— for M2 to M4, partially threaded screws without underhead reinforcement (formerly designated as “shoulder”) and normative reference to ISO 3508 for x_{max} (see figure footnote e) have been added (see Figure 1 b);

— for M5 to M10, underhead reinforcement has been modified from a radius to a conical shape as adjustment to manufacturing conditions and normative reference to ISO 3508 for x_{max} (see figure footnote e) has been added (see Figure 2 b);

— detailed head configuration has been added (see Figure 3);

— shank diameter d_s has been added in Table 1;

— minimum head height k_{min} has been added as reference dimension in Table 1;

— radius r has been specified for all head configurations (see Figures 1 and 2), and r_{min} has been added in Table 1;

— shortest standard lengths l_{nom} have been increased in Table 1;

— calculations for M2 and M2,5 have been added in Table 3 for steel screws; as their minimum ultimate tensile loads for full loadability are not specified in ISO 898-1 and ISO 3506-1, they have been calculated with the same formulae accordingly (see Table A.1, Annex A);

— the minimum ultimate tensile loads were recalculated and have been changed to more precise values for steel screws with property classes 4.8 (M3 and M6), 8.8 (M5), and for stainless steel screws with property classes 50 (M3, M6 and M8) and 70 (M3, M6, M8 and M10); see Table 3;

— property class 10.9 has been added (see Table 2);

— specifications for labelling have been added as new subclause 6.2;

— reference to ISO 15065 for countersinks has been added.

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.

Fasteners — Hexalobular socket countersunk flat head screws (common head style) with reduced loadability

1 Scope

This document specifies the characteristics of hexalobular socket countersunk flat head screws with reduced loadability due to head design, in steel and stainless steel, with metric coarse pitch threads M2 to M10, and with product grade A.

If in certain cases other specifications are requested, stainless steel grades can be selected from ISO 3506-1, and dimensional options from ISO 888 or ISO 4753.

NOTE 1 The reduced loadability (related to the countersunk head dimensions in combination with penetration of the hexalobular socket specified in this document) implies a limitation of ultimate tensile load shown by a specific marking (property class preceded by a zero). The loadability in the head is assumed to be 80 % of that in the thread for all sizes and all property classes; see Table 3.

NOTE 2 Hexalobular socket countersunk head screws (high head) with full loadability are specified in ISO 14582, but these products are not interchangeable, because of different head heights.

NOTE 3 Particular attention is needed to ensure alignment of the countersunk head with the bearing surface of the countersink in the assembly.

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 225, *Fasteners — Bolts, screws, studs and nuts — Symbols and descriptions of dimensions*

ISO 888, *Fasteners — Bolts, screws and studs — Nominal lengths and thread lengths*

ISO 898-1, *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 1: Bolts, screws and studs with specified property classes — Coarse thread and fine pitch thread*

ISO 965-1, *ISO general purpose metric screw threads — Tolerances — Part 1: Principles and basic data*

ISO 1891-4, *Fasteners — Vocabulary — Part 4: Control, inspection, delivery, acceptance and quality*

ISO 3269, *Fasteners — Acceptance inspection*

ISO 3506-1, *Fasteners — Mechanical properties of corrosion-resistant stainless steel fasteners — Part 1: Bolts, screws and studs with specified grades and property classes*

ISO 3508, *Thread run-outs for fasteners with thread in accordance with ISO 261 and ISO 262*

ISO 4042, *Fasteners — Electroplated coating systems*

ISO 4753, *Fasteners — Ends of parts with external ISO metric thread*

ISO 4759-1, *Tolerances for fasteners — Part 1: Bolts, screws, studs and nuts — Product grades A, B and C*

ISO 6157-1, *Fasteners — Surface discontinuities — Part 1: Bolts, screws and studs for general requirements*

ISO 7721, *Countersunk head screws — Head configuration and gauging*

ISO 8991, *Designation system for fasteners*

ISO 8992, *Fasteners — General requirements for bolts, screws, studs and nuts*

ISO 10664, *Hexalobular internal driving feature for bolts and screws*

ISO 10683, *Fasteners — Non-electrolytically applied zinc flake coating systems*

3 Terms and definitions

No terms and definitions are listed in this document.

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

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

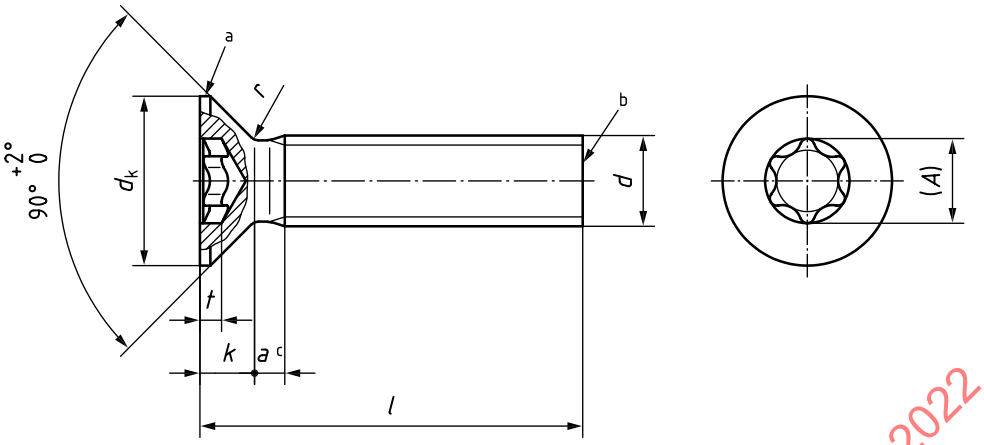
— IEC Electropedia: available at https://www.electropedia.org/

4 Dimensions and gauging of the head

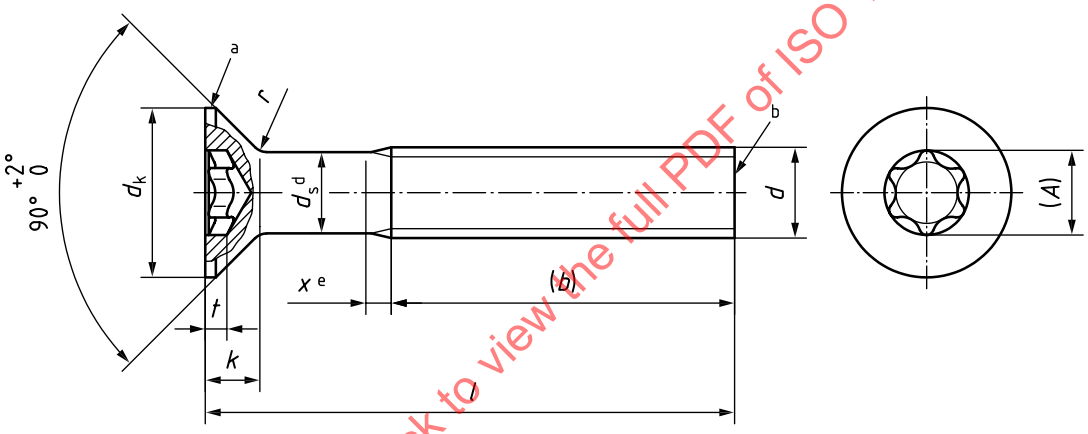
4.1 Dimensions

Dimensions shall be in accordance with Figures 1 to 3 and with Table 1.

Symbols and descriptions of dimensions are specified in ISO 225.



a) Fully threaded screws



b) Partially threaded screws

a Contour of the head flat or rounded.

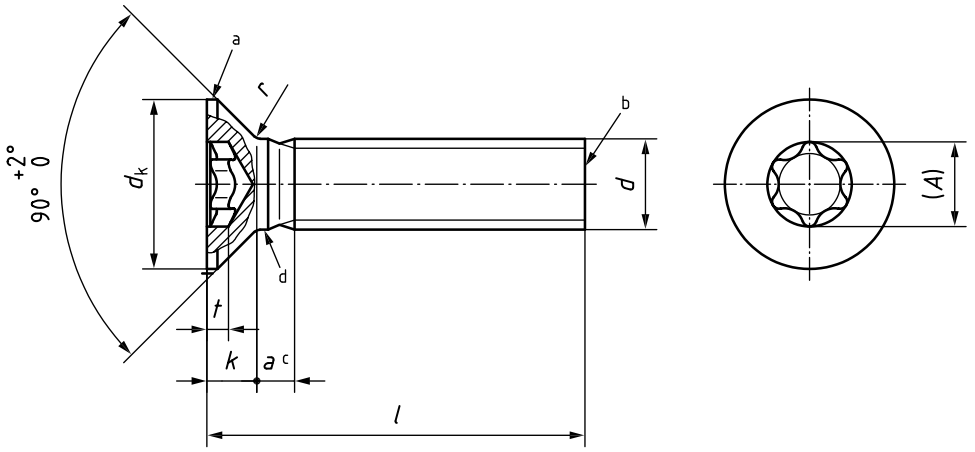
b As-rolled end (RL) in accordance with ISO 4753.

c $a_{max} \leq 2P$ for screws without underhead reinforcement.

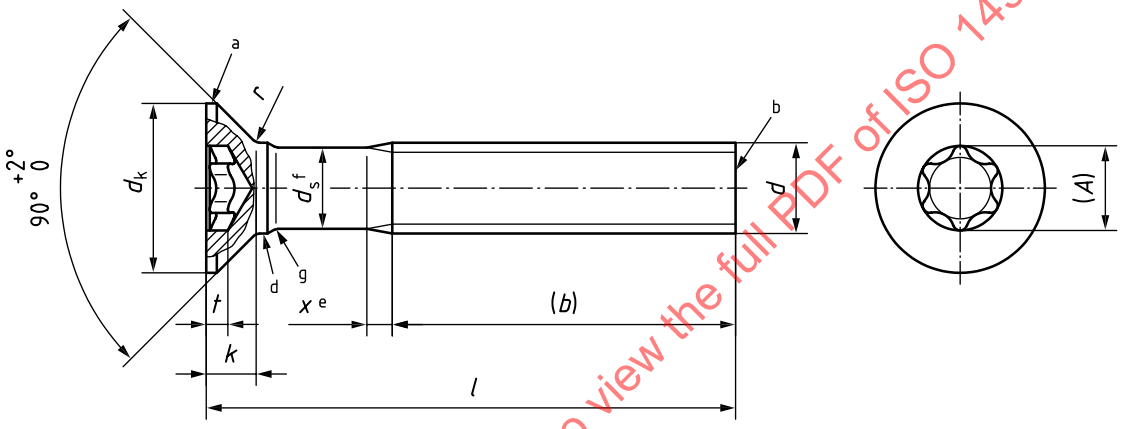
d Shank diameter d_s is approximately equal to the pitch diameter.

e $x_{max} \approx 2{,}5P$, as specified in ISO 3508.

Figure 1 — Screws M2 to M4, without underhead reinforcement



a) Fully threaded screws



b) Partially threaded screws

a Contour of the head flat or rounded.

b As-rolled end (RL) in accordance with ISO 4753.

c $a_{max} \leq 2{,}5P$ for screws with underhead reinforcement.

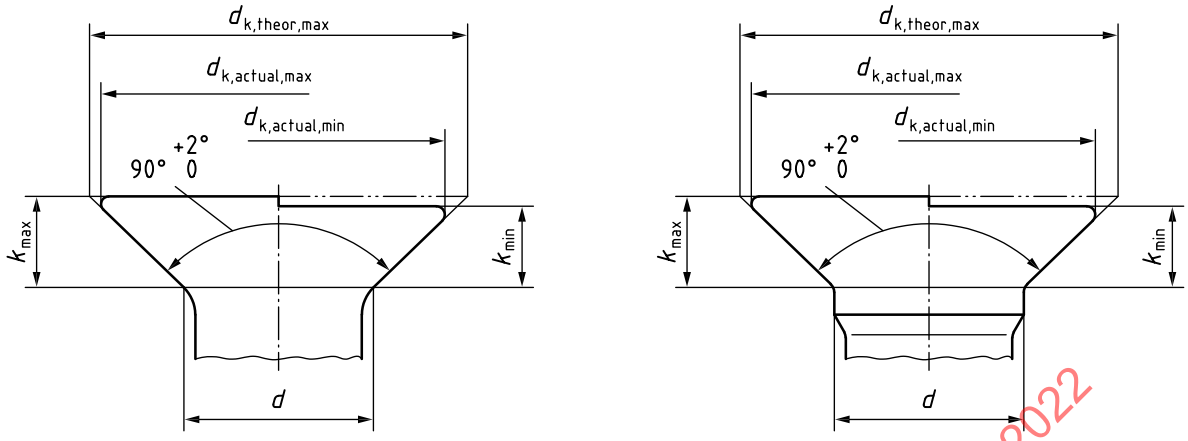
d Any shape of the underhead reinforcement is at the discretion of the manufacturer, but it shall not exceed diameter *d*.

e $x_{max} \approx 2{,}5P$, as specified in ISO 3508.

f Shank diameter d_s is approximately equal to the pitch diameter.

g Smooth transition between underhead reinforcement and the shank at the discretion of the manufacturer.

Figure 2 — Screws M5 to M10, with underhead reinforcement



a) Without underhead reinforcement **b) With underhead reinforcement**

Figure 3 — Countersunk head configuration

NOTE k_{max} is in accordance with ISO 7721. k_{min} is calculated by taking into account $d_{k,actual,min}$, the maximum angle (92°) and $D_{a,min}$ of the gauge (see ISO 7721).

Table 1 — Dimensions for hexalobular socket countersunk flat head screws

Dimensions in millimetres

Thread, d				**M2**	(M2,5)	**M3**	(M3,5)	**M4**	**M5**	**M6**	**M8**	**M10**
				without underhead reinforcement					with underhead reinforcement			
P [a]				0,4	0,45	0,5	0,6	0,7	0,8	1	1,25	1,5
a			max.	0,80	0,90	1,00	1,20	1,40	2,00	2,50	3,13	3,75
b [b]			ref.	25	25	25	38	38	38	38	38	38
d_k	theoretical		max.	4,4	5,5	6,3	8,2	9,4	10,4	12,6	17,3	20
	actual		max.	3,80	4,70	5,50	7,30	8,40	9,30	11,30	15,80	18,30
			min.	3,50	4,40	5,20	6,94	8,04	8,94	10,87	15,37	17,78
d_s			≈	1,70	2,15	2,60	3,05	3,50	4,40	5,30	7,10	8,90
k		nom. =	max.	1,20	1,50	1,65	2,35	2,70	2,70	3,30	4,65	5,00
			min. [c]	0,985	1,224	1,369	1,995	2,333	2,28	2,81	4,06	4,40
r [d]			max.	0,5	0,6	0,8	0,9	1,0	1,3	1,5	2,0	2,5
			min.	0,1	0,1	0,1	0,15	0,2	0,2	0,25	0,4	0,4
x			max.	1,00	1,10	1,25	1,50	1,75	2,00	2,50	3,20	3,80
Hexalobular socket [e]	Socket No.			**6**	**8**	**10**	**15**	**20**	**25**	**30**	**45**	**50**
	A		ref.	1,75	2,40	2,80	3,35	3,95	4,50	5,60	7,95	8,95
	t		max.	0,64	0,79	0,83	1,32	1,53	1,51	1,78	2,54	2,80
			min.	0,51	0,66	0,70	1,16	1,14	1,12	1,39	2,15	2,41

l [f]			Range of standard lengths between the stepped bold lines (white area)								
nom.	min.	max.									
5	4,76	5,24									
6	5,76	6,24									
8	7,71	8,29									
10	9,71	10,29									
12	11,65	12,35									
(14)	13,65	14,35									
16	15,65	16,35									
20	19,58	20,42									
25	24,58	25,42									
30	29,58	30,42									
35	34,50	35,50									
40	39,50	40,50									
45	44,50	45,50									
50	49,50	50,50							b	b	b	b
(55)	54,05	55,95								b	b	b
60	59,05	60,95								b	b	b

Screws with too short lengths

Length by agreement in accordance with ISO 888

Screws with nominal lengths up to 30 mm for M2 to M3 and up to 45 mm for M3,5 to M10 are fully threaded, and in this case, b is for reference only and corresponds to $l - (k + a)$. Screws with longer nominal lengths are partially threaded.

NOTE Sizes shown in brackets are non-preferred dimensions.

[a] P is the pitch of the thread.

[b] For partially threaded screws, b is for reference only.

[c] Values for k_{min} are given for reference only (see Figure 3).

[d] r_{min} according to ISO 885; $r_{max} = d/4$ rounded to one decimal place.

[e] The acceptance procedure for the hexalobular socket and corresponding gauges are specified in ISO 10664.

[f] The shortest standard lengths are specified as $l_{nom} \approx 2d + 2P$ up to M5 and $l_{nom} = 2d$ for M6 and above.

4.2 Gauging of head

Gauging of the head and dimensions of the gauges allowing the control of the head dimensions shall be in accordance with ISO 7721.

NOTE For dimensions and designation of countersinks suitable for countersunk flat head (common head style), see ISO 15065.

5 Requirements and reference International Standards

The requirements specified in the International Standards listed in Table 2 shall apply. The minimum ultimate tensile loads of full size fasteners shall meet the minimum values specified in Table 3.

If functional and geometrical constraints allow it, fasteners with full loadability should be used, for example screws in accordance with ISO 14582.

Table 2 — Requirements and reference International Standards

Material		**Steel**	**Stainless steel**
General requirements	International Standard	ISO 8992	
Thread	Tolerance class	6g [a]	
	International Standard	ISO 965-1	
Mechanical properties	Property class	4.8, 8.8, 10.9	—
	Grade and property class	—	A2-50, A4-50 A2-70, A4-70
	International Standard	ISO 898-1 [b]	ISO 3506-1 [b]
	Symbol	04.8, 08.8, 010.9	A2-050, A4-050 A2-070, A4-070 [c]
Tolerances	Product grade	A	
	International Standard	ISO 4759-1	
Hexalobular socket	International Standard	ISO 10664	
Surface condition		As processed (no coating) Electroplated coatings as specified in ISO 4042 Non-electrolytically applied zinc flake coatings as specified in ISO 10683	Clean and bright and/or Passivated [d]
		Additional requirements or other finishes or coatings shall be agreed between the purchaser and the supplier.	
Surface integrity		Limits for surface discontinuities as specified in ISO 6157-1	As agreed [e]
Acceptability		Acceptance inspection as specified in ISO 3269	

[a] Depending on the type of coating to be applied, another tolerance position of the thread may be specified for the uncoated fastener in accordance with the relevant coating standard.

[b] The minimum ultimate tensile loads for these screws with reduced loadability are specified in Table 3.

[c] For fully threaded screws which, due to their short thread length, cannot be tensile tested in accordance with ISO 3506-1, the symbol shall not include the property class but just the stainless steel grade.

[d] See e.g. ISO 16048.

[e] See e.g. ISO 6157-1.

Table 3 — Minimum ultimate tensile loads — Reduced loadability

Thread d	Minimum ultimate tensile load N				
	Property class				
	4.8	8.8	10.9	50	70
	Symbol				
	04.8	08.8	010.9	050	070
M2	700	1 330	1 730	830	1 170
M2,5	1 140	2 180	2 820	1 360	1 900
M3	1 700	3 220	4 190	2 020	2 820
M3,5	2 280	4 340	5 640	2 710	3 800
M4	2 950	5 620	7 300	3 510	4 920
M5	4 770	9 120	11 800	5 680	7 940
M6	6 770	12 900	16 800	8 080	11 300
M8	12 300	23 400	30 500	14 700	20 600
M10	19 500	37 100	48 300	23 200	32 500

Minimum ultimate tensile loads $F_{m,min}$ (for screws with full loadability) are calculated from the exact figures of $A_{s,nom}$ in accordance with ISO 898-1 and ISO 3506-1 and rounded up to three significant digits; minimum ultimate tensile loads for screws with reduced loadability are 80 % of $F_{m,min}$, rounded to three significant digits.

Minimum ultimate tensile loads for screws M2 and M2,5 with full loadability are not specified in ISO 898-1 or ISO 3506-1; they are given in Annex A to support the calculation of the reduced minimum tensile loads specified in this Table.

6 Marking and labelling

6.1 Marking on product

Marking on screws shall be:

— for steel fasteners, as specified in ISO 898-1;

— for stainless steel fasteners, as specified in ISO 3506-1.

6.2 Labelling on package

Labelling on the package shall be in accordance with ISO 898-1 or ISO 3506-1 and shall include at least:

— the reference to this document, i.e. ISO 14581;

— the thread size d and nominal length l;

— for steel fasteners, the property class symbol;

— for stainless steel fasteners, the grade and property class symbol ;

— the type of surface condition (finish and/or coating);

— the manufacturer's and/or distributor's identification and/or name;

— the manufacturing lot number as specified in ISO 1891-4;

— the quantity of pieces in the package.