INTERNATIONAL STANDARD

ISO 10642

Third edition
2019-09

Fasteners — Hexagon socket countersunk head screws with reduced loadability

Fixations — Vis à tête fraisée à six pans creux à capacité de charge réduite

Reference number
ISO 10642:2019(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

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 2, *Fasteners*, Subcommittee SC 11, *Fasteners with metric external thread*.

This third edition cancels and replaces the second edition (ISO 10642:2004), which has been technically revised. It also incorporates the Amendment ISO 10642:2004/Amd.1:2012. The main changes compared to the previous edition are as follows:

— the whole standard has been improved to clearly point out that these hexagon socket countersunk head screws have reduced loadability because of their head design (head dimensions and penetration of the hexagon socket);

— screws made of stainless steel have been added;

— detailed head configuration has been added (see Figure 4);

— M2 and M2,5 have been added; 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 Annex A);

— the reference threaded length b has been increased to $3d$ for partially threaded screws M14 to M20, so that these screws can be tensile tested in accordance with ISO 3506-1 ($b \geq 3d$ is required to tensile test screws with reduced loadability);

— head height k_{min} has been added as reference dimension in Tables 1 and 2;

— wall thickness between driving feature and bearing face w_{min} has been replaced by the depth of the internal driving feature t_{max} (same method as for hexalobular internal drive);

— D_a, D_k and F are pointed out as gauge dimensions in Table 3 (see also Figure 5);

— the minimum nominal lengths of the standardized range have been determined in accordance with footnote g of Tables 1 and 2 and therefore the shorter lengths for M4 to M20 were deleted.

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 — Hexagon socket countersunk head screws with reduced loadability

1 Scope

This document specifies the characteristics of hexagon socket countersunk head screws with reduced loadability due to head design, in steel and stainless steel, with metric coarse pitch threads M2 to M20, and with product grade A.

NOTE 1 Other dimensional options are given in ISO 888, ISO 965-1 and ISO 4753.

NOTE 2 The reduced loadability (related to the countersunk head dimensions in combination with penetration of the hexagon socket specified in this document) implies a limitation of ultimate tensile load; see Table 5.

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 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, *Mechanical properties of corrosion-resistant stainless-steel fasteners — Part 1: Bolts, screws and studs*

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 6157-3, *Fasteners — Surface discontinuities — Part 3: Bolts, screws and studs for special requirements*

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

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 terminological databases for use in standardization at the following addresses:

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

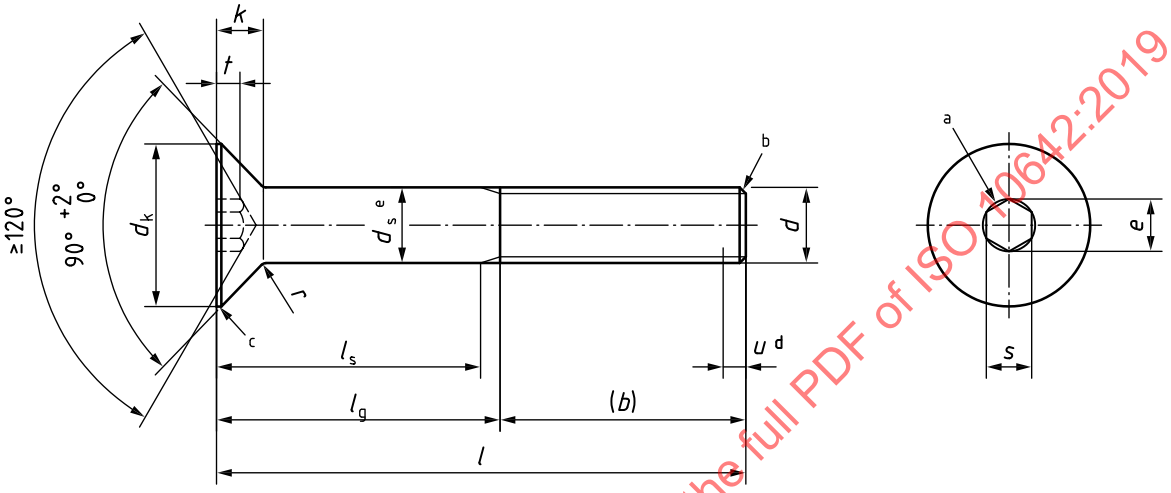
— IEC Electropedia: available at http://www.electropedia.org/

4 Dimensions and gauging of head

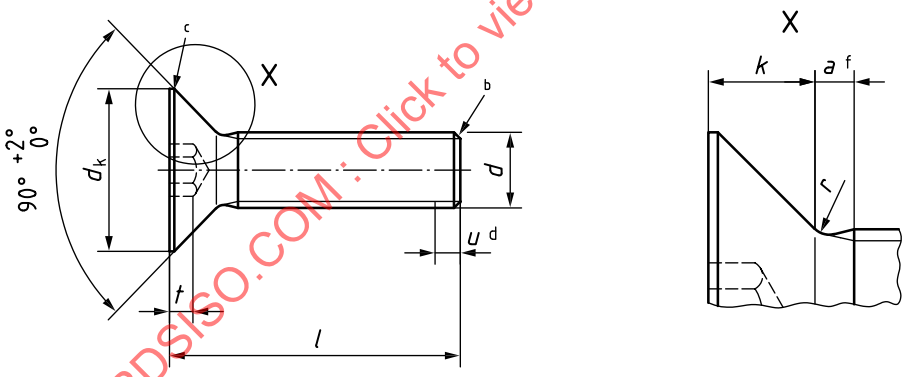
4.1 Dimensions

Dimensions shall be in accordance with Figures 1 to 4 and Tables 1 and 2.

Symbols and descriptions of dimensions are defined in ISO 225.



a) Partially threaded screw



b) Screw threaded to the head

Key

a A slight rounding or countersink at the mouth of the socket is permissible.

b In accordance with ISO 4753, chamfered end or, for sizes ≤M4, as-rolled end.

c Edge of the head flat or rounded.

d Incomplete thread $u \leq 2P$.

e d_s applies when values for $l_{s,min}$ are specified in Tables 1 and 2.

f $a \leq 2P$.

Figure 1 — Hexagon socket countersunk head screws

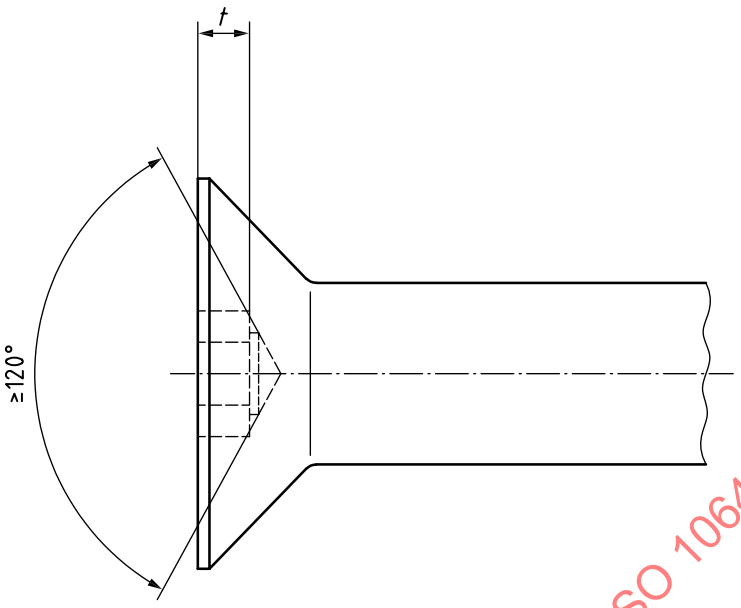


Figure 2 — Permissible alternative form of socket (broached socket)

For broached sockets which are at the maximum limit of size, the overcut resulting from drilling shall not exceed 1/3 of the length of any flat of the socket which is $e/2$ (see Figure 3).

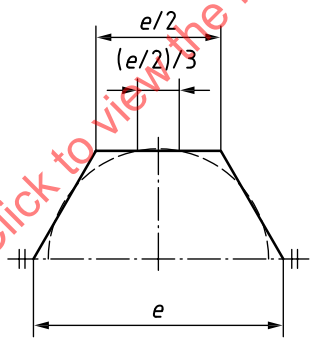


Figure 3 — Detail: Broached socket

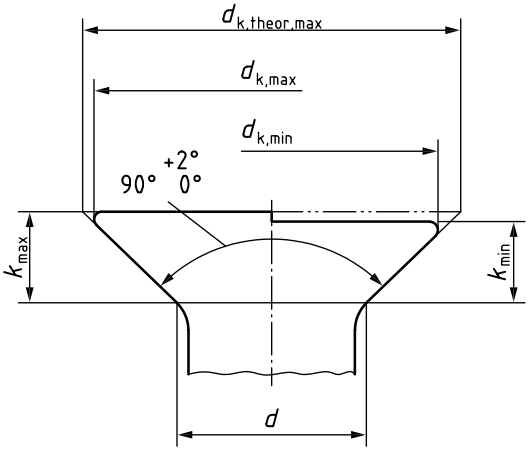


Figure 4 — Countersunk head configuration

Table 1 — Dimensions (M2 to M6)

Dimensions in millimetres

Thread, d			M2	M2,5	M3	M4	M5	M6
P [a]			0,4	0,45	0,5	0,7	0,8	1
b [b]	(ref.)		—	—	18	20	22	24
d_k	theor.	max.	4,70	5,88	6,72	8,96	11,20	13,44
	actual	max.	4,09	5,08	5,81	7,96	10,07	12,16
		min.	3,70	4,80	5,54	7,53	9,43	11,34
d_s		max.	2,00	2,50	3,00	4,00	5,00	6,00
		min.	1,86	2,36	2,86	3,82	4,82	5,82
e [c,d]		min.	1,454	1,733	2,303	2,873	3,443	4,583
k [e]	(ref.)	max.	1,350	1,690	1,860	2,48	3,100	3,720
		min.	1,130	1,408	1,522	2,121	2,669	3,218
r		min.	0,1	0,1	0,1	0,2	0,2	0,25
s [d]		nom.	1,3	1,5	2	2,5	3	4
		max.	1,360	1,560	2,080	2,580	3,080	4,095
		min.	1,320	1,520	2,020	2,520	3,020	4,020
t		max.	0,85	1,15	1,25	1,65	2,00	2,50
		min.	0,75	1,00	1,10	1,40	1,75	2,20

l			Range of standardized lengths between the stepped discontinuous lines [f] Shank length l_s and grip length l_g [g]											
nom.	min.	max.	l_s min.	l_g max.	l_s min.	l_g max.	l_s min.	l_g max.	l_s min.	l_g max.	l_s min.	l_g max.	l_s min.	l_g max.
5	4,76	5,24												
6	5,76	6,24									**Screws with too short lengths**			
8	7,71	8,29												
10	9,71	10,29												
12	11,65	12,35				**Fully threaded screws** [h]								
16	15,65	16,35												
20	19,58	20,42												
25	24,58	25,42												
30	29,58	30,42					9,5	12	6,5	10				
35	34,5	35,5							11,5	15	9	13		
40	39,5	40,5							16,5	20	14	18	11	16
45	44,5	45,5	**Lengths to be agreed between the purchaser and the manufacturer**								19	23	16	21
50	49,5	50,5									24	28	21	26
55	54,4	55,6											26	31
60	59,4	60,6											31	36
65	64,4	65,6												

[a] P is the pitch of the thread.

[b] Thread length for partially threaded screws.

[c] $e_{min} = 1{,}14\ s_{min}$.

[d] For combined gauging of socket dimensions e and s, see ISO 23429.

[e] Values for k are for reference only. Values for k_{min} are in relation to d.

[f] Basically, the minimum lengths of the standardized range are defined as $l \approx 2d + 2P$ up to M5 and $l = 2d$ for M6 and above. The maximum lengths of the standardized range are defined as $l \approx 10d$ up to M10, or chosen from commercially available lengths.

[g] Screws are partially threaded when values for l_g and l_s are specified, in accordance with the following formulae: $l_{g,max} = l_{nom} - b$ and $l_{s,min} = l_{g,max} - 5P$. As an option, fully threaded screws can be agreed between the purchaser and the manufacturer.

[h] Fully threaded screws are threaded to the head within $2P$.

Table 2 — Dimensions (M8 to M20)

Dimensions in millimetres

Thread, d			M8	M10	M12	(M14)	M16	M20
P [a]			1,25	1,5	1,75	2	2	2,5
b [b]	(ref.)		28	32	36	42	48	60
d_k	theor.	max.	17,92	22,40	26,88	30,80	33,60	40,32
	actual	max.	16,43	20,69	24,81	28,31	30,61	36,75
		min.	15,24	19,22	23,12	26,52	29,01	35,40
d_s		max.	8,00	10,00	12,00	14,00	16,00	20,00
		min.	7,78	9,78	11,73	13,73	15,73	19,67
e [c,d]		min.	5,723	6,863	9,149	11,429	11,429	13,716
k [e]	(ref.)	max.	4,960	6,200	7,440	8,400	8,800	10,160
		min.	4,366	5,563	6,711	7,588	7,874	9,037
r		min.	0,4	0,4	0,6	0,6	0,6	0,8
s [d]		nom.	5	6	8	10	10	12
		max.	5,140	6,140	8,175	10,175	10,175	12,212
		min.	5,020	6,020	8,025	10,025	10,025	12,032
t		max.	3,20	3,90	4,90	5,10	5,40	6,40
		min.	2,90	3,50	4,30	4,50	4,80	5,60

l			**Range of standardized lengths between the stepped discontinuous lines** [f] Shank length l_s and grip length l_g [g]											
nom.	min.	max.	l_s min.	l_g max.	l_s min.	l_g max.	l_s min.	l_g max.	l_s min.	l_g max.	l_s min.	l_g max.	l_s min.	l_g max.
16	15,65	16,35												
20	19,58	20,42									**Screws with too short lengths**			
25	24,58	25,42												
30	29,58	30,42												
35	34,5	35,5												
40	39,5	40,5					**Fully threaded screws** [h]							
45	44,5	45,5												
50	49,5	50,5	15,75	22										
55	54,4	55,6	20,75	27	15,5	23								
60	59,4	60,6	25,75	32	20,5	28								
65	64,4	65,6	30,75	37	25,5	33	20,25	29						
70	69,4	70,6	35,75	42	30,5	38	25,25	34	18	28				
80	79,4	80,6	45,75	52	40,5	48	35,25	44	28	38	22	32		
90	89,3	90,7			50,5	58	45,25	54	38	48	32	42		
100	99,3	100,7			60,5	68	55,25	64	48	58	42	52	27,5	40
110	109,3	110,7			**Lengths to be agreed between the purchaser and the manufacturer**									

NOTE Size shown in brackets is a non-preferred diameter.

[a] P is the pitch of the thread.

[b] Thread length for partially threaded screws.

[c] $e_{min} = 1{,}14\ s_{min}$.

[d] For combined gauging of socket dimensions e and s, see ISO 23429.

[e] Values for k are for reference only. Values for k_{min} are in relation to d.

[f] Basically, the minimum lengths of the standardized range are defined as $l \approx 2d + 2P$ up to M5 and $l = 2d$ for M6 and above. The maximum lengths of the standardized range are defined as $l \approx 10d$ up to M10, or chosen from commercially available lengths.

[g] Screws are partially threaded when values for l_g and l_s are specified, in accordance with the following formulae: $l_{g,max} = l_{nom} - b$ and $l_{s,min} = l_{g,max} - 5P$. As an option, fully threaded screws can be agreed between the purchaser and the manufacturer.

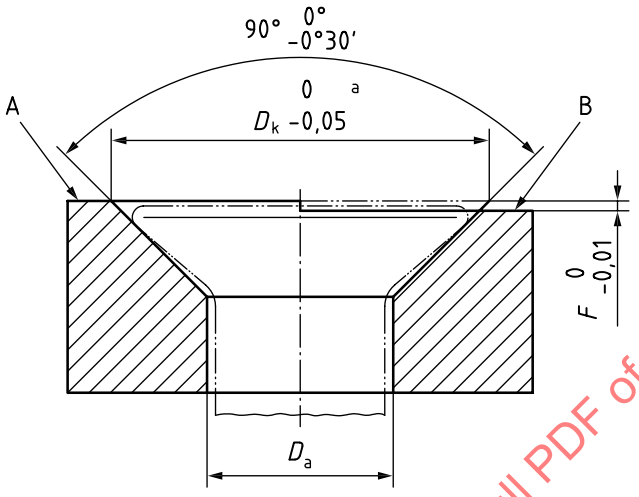
[h] Fully threaded screws are threaded to the head within $2P$.

4.2 Gauging of head

For gauging of the head and for dimensions of the gauge allowing the control of the head dimensions, see Figure 5 and Table 3. The top surface of the screw head shall be located between the gauge surfaces A and B.

NOTE For more information about calculation basis for gauge dimensions, see ISO 7721.

Tolerances in millimetres



Key

D_a gauge inner diameter related to the screw bearing surface
F flushness of the gauge
A gauge maximum dimensional condition
B gauge minimum dimensional condition
a $D_k = d_{k,theor,max}$ (see Table 3).

Figure 5 — Flushness gauge

Table 3 — Gauge dimensions

Thread, d		M2	M2,5	M3	M4	M5	M6
D_a	max.	2,36	2,74	3,30	4,40	5,50	6,60
	min. [a]	2,26	2,64	3,20	4,30	5,40	6,50
D_k	max.	4,70	5,88	6,72	8,96	11,20	13,44
F	max.	0,15	0,20	0,25	0,25	0,30	0,35
Thread, d		**M8**	**M10**	**M12**	**M14**	**M16**	**M20**
D_a	max.	8,54	10,62	13,50	15,50	17,50	22,00
	min. [a]	8,44	10,52	13,40	15,40	17,40	21,90
D_k	max.	17,92	22,40	26,88	30,80	33,60	40,32
F	max.	0,40	0,40	0,45	0,50	0,60	0,75

[a] Values for $D_{a,min}$ are based on a fillet radius $r_{max} = 0{,}25d$.

5 Requirements and reference International Standards

The requirements specified in the International Standards listed in Table 4 shall apply. The minimum ultimate tensile loads of full size fasteners shall meet the minimum values specified in Table 5.

Table 4 — 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	8.8, 10.9, 12.9 [b]	—
	Grade and property class	—	A2-50, A4-50 A2-70, A4-70 A2-80, A4-80
	International Standard	ISO 898-1 [c]	ISO 3506-1 [c]
	Symbol	08.8, 010.9, 012.9	A2-050, A4-050 A2-070, A4-070 A2-080, A4-080 [d]
Tolerances	Product grade	A	
	International Standard	ISO 4759-1	
Finish – Coating		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 Passivated [e]
		Additional requirements or other finishes or coatings shall be agreed between the supplier and the purchaser.	
Surface integrity		Limits for surface discontinuities as specified in ISO 6157-1 and ISO 6157-3	—
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] Fasteners of property class 12.9 are susceptible to hydrogen embrittlement; see ISO 898-1 and ISO/TR 20491.

[c] The minimum ultimate tensile loads for these screws with reduced loadability are specified in Table 5.

[d] 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.

[e] A method for passivation is specified in ISO 16048.

Table 5 — Minimum ultimate tensile loads — Reduced loadability

Thread, *d*	Minimum ultimate tensile load N					
	Property class					
	8.8 [a]	10.9 [a]	12.9 [a]	50 [b]	70 [b]	80 [b]
	Symbol					
	08.8	010.9	012.9	050	070	080
M2	1 330	1 730	2 020	830	1 160	1 330
M2,5	2 180	2 820	3 310	1 360	1 900	2 180
M3	3 220	4 180	4 190	2 010	2 810	3 220
M4	5 620	7 300	8 560	3 510	4 910	5 620
M5	9 080	11 800	13 800	5 680	7 950	9 080
M6	12 900	16 700	19 600	8 060	11 270	12 880
M8	23 400	30 500	35 700	14 600	20 400	23 430
M10	37 100	48 200	56 600	23 200	32 400	37 120
M12	53 900	70 200	82 400	33 710	47 190	53 940
M14	73 600	96 000	112 000	46 180	64 650	73 890
M16	100 000	130 000	154 000	62 670	87 760	100 320
M20	162 000	204 000	239 000	97 920	137 120	156 720

[a] 80 % of the values for $F_{m,min}$ as specified in ISO 898-1.

[b] 80 % of the values for $F_{m,min}$ as specified in ISO 3506-1.

Values of the minimum ultimate tensile load (full loadability) for M2 and M2,5 are given in Annex A.

6 Marking and labelling

6.1 Marking on product

Marking 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 contain at least:

— reference to this document, i.e. ISO 10642;

— thread size *d* and nominal length *l*;

— symbol of the property class for steel fasteners;

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

— type of “Finish – Coating”;

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

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

— quantity of pieces in the package.