

## Materials, heat treatment and chemical composition

according to ISO 898, part 5: 2012 table 2

Hardness class	Material	Heat treatment <sup>a)</sup>	Chemical composition limit (cast analysis, %) <sup>b)</sup>			
			C		P	S
			max.	min.	max.	max.
14 H	Carbon steel <sup>c)</sup>	–	0,50	–	0,11	0,15
22 H	Carbon steel <sup>c)</sup>	quenched and tempered	0,50	0,19	0,05	0,05
33 H	Carbon steel <sup>c)</sup>	quenched and tempered	0,50	0,19	0,05	0,05
45 H	Carbon steel <sup>d) e)</sup>	quenched and tempered	0,50	0,45	0,05	0,05
	Carbon steel with additives <sup>d)</sup> (e.g. Boron or Mn or Cr)	quenched and tempered	0,50	0,28	0,05	0,05
	Alloy steel <sup>d)</sup>	quenched and tempered	0,50	0,30	0,05	0,05

<sup>a)</sup> Case hardening is not allowed.

<sup>b)</sup> In case of dispute, the product analysis applies.

<sup>c)</sup> Free-cutting steel may be used, with maximum lead content 0,35 %, maximum phosphorus content 0,11 % and maximum sulfur content 0,34 %.

<sup>d)</sup> Steel with a maximum lead content of 0,35 % may be used.

<sup>e)</sup> For d ≤ M16 only.

<sup>f)</sup> This alloy steel shall contain at least one of the following elements in the minimum quantity given: chromium 0,30 %, nickel 0,30 %, molybdenum 0,20 %, vanadium 0,10 %. Where elements are specified in combinations of two, three or four and have lower alloy contents than those given above in this footnote, the limit value to be applied for steel class determination is 70 % of the sum of the individual limit values shown above in this footnote for the two, three or four elements concerned.

## Mechanical and physical properties

according to ISO 898, part 5: 2012 table 3

The mechanical properties apply to set screws and similar, which are **not subject to tension** and which have threads of diameter from 1,6 to 39 mm, made from unalloyed or alloyed steel.

For further details of the mechanical properties of set screws please refer to ISO 898, part 5.

No.	Mechanical and physical properties			Hardness class				
				14 H	22 H	33 H	45 H	
1	Performance hardness							
	1.1	Vickers hardness HV 10	min.	140	220	330	450	
			max.	290	300	440	560	
	1.2	Brinell hardness HBW, F = 30 D <sup>2</sup>	min.	133	209	314	428	
			max.	276	285	418	532	
	1.3	Rockwell hardness	HRB	min.	75	95	–	–
				max.	105	<sup>a)</sup>	–	–
HRC			min.	–	<sup>a)</sup>	33	45	
			max.	–	30	44	53	
2	Torsional strength			–	–	–	see table 5	
3	Height of non-decarburized thread zone, E, mm			min.	–	1/2H <sub>1</sub>	2/3H <sub>1</sub>	
4	Depth of complete decarburization, G, mm			max.	–	0,015	0,015 <sup>b)</sup>	
5	Surface hardness HV 0,3			max.	–	320	450	
6	Non-carburization HV 0,3			max.	–	<sup>c)</sup>	<sup>c)</sup>	
7	Surface integrity in accordance with			ISO 6157-1				

<sup>a)</sup> For hardness class 22H: if hardness is tested in Rockwell, it is necessary to test the minimum value in HRB and the maximum value in HRC.

<sup>b)</sup> No complete decarburization permitted in hardness class 45H.

<sup>c)</sup> Surface hardness shall not be more than 30 Vickers points above the measured base metal hardness of the fastener when determination of both the surface hardness and base metal hardness are carried out with HV 0,3.