

Quality	C45E
According to standards	EN 10083-2: 2006
Number	1.1191

Chemical composition

C%	Si%	Mn%	P%	S%	Cr%	Mo%	Ni%	Deviations allowed for analysis product
	max		max	max	max	max	max	
0,42-0,50	0,40	0,50-0,80	0,030	0,035	0,40	0,10	0,40	
± 0.02	+ 0.03	± 0.04	+ 0.005	+ 0.005				

Cr+Mo+Ni max 0.63%
 For C45R n° 1.1201, S% 0.020-0.040 product deviation ± 0.005
 For C45 n° 1.0503, P% - S% max 0.045
 On request, it may be supplied (Ca) treated

Temperature °C

Hot-forming	Normalizing	Quenching	Quenching	Tempering	Stress-relieving		
1100-850	870 air	840 water	860 oil or polymer	540-660 air	50° under the temperature of tempering		
Soft annealing	Isothermal annealing	Natural state	End quench hardenability test	Pre-heating welding		Stress-relieving after welding	
690 cooling 10 °C/h to 600, then air (HB max 207)	810 furnace cooling to 660, then air (HB 160-216)	(~ HB 169-245)	850 water	250		550 furnace cooling	
				Ac1	Ac3	Ms	Mf
				735	780	350	120

Mechanical and physical properties

C45E C45R Hot-rolled mechanical properties in normalized condition EN 10083-2: 2006

size d / t		Testing at room temperature (longitudinal)					
from	to	R	Re ^{a)}	A%	C%	Kv	HB
mm		N/mm ² min	N/mm ² min.	min.	min.	J min.	min
16/16		620	340	14			190
16/16	100/100	580	305	16			172
100/100	250/250	560	275	16			162

d = diameter t = thickness

C45E C45R Hot-rolled mechanical properties in quenched an tempered condition EN 10083-2: 2006

size d / t		Testing at room temperature (longitudinal)					
from	to	R	Re ^{a)}	A%	C%	Kv	HB
mm		N/mm ²	N/mm ² min	min.	min.	J min	for information
16/8		700-850	490	14	35		213-253
16/8	40/20	650-800	430	16	40	25	200-240
40/20	100/60	630-780	370	17	45	25	192-232

^{a)} Re upper yield strength or, if no yield phenomenon occurs, Rp_{0.2} has to be considered
 d = diameter t = thickness

Table of tempering values obtained at room temperature on rounds of Ø 10 mm after quenching at 850 °C in water

°C	HB	HRC	R N/mm ²
100	615	58	2330
200	597	57	2240
300	510	52	1880
400	401	43	1390
500	311	33	1030
600	242	23	810

°C	R N/mm ²	R _{p 0.2} N/mm ²	A %
620	740	480	22
650	600	400	23
700	540	320	24

Hardness condition on bars quenched in water

A = diameter 13 mm

B = diameter 25 mm

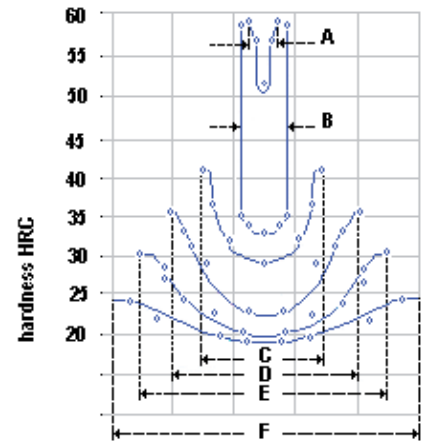
C = diameter 50 mm

D = diameter 75 mm

E = diameter 100 mm

F = diameter 130 mm

• hardness check points



C45E 1.1191 C45R 1.1201 EN 10277-5: 2008

Cold-drawn +C ^{c)}						Hot-rolled + Peeled-Reeled +SH ^{c)}			
size mm		Testing at room temperature (longitudinal)				Testing at room temperature (longitudinal)			
from	to	R ^{a)}	Rp 0.2 ^{a)}	A%	HB	R	Rp 0.2	A%	HB
		N/mm ²	N/mm ² min	min	for inform.	N/mm ²	N/mm ² min	min	
5 ^{b)}	10	750-1050	565	5	225-319				
10	16	710-1030	500	6	218-311				
16	40	650-1000	410	7	200-298	580-820			172-242
40	63	630-900	360	8	192-271	580-820			172-242
63	100	580-850	310	8	172-253	580-820			172-242

^{a)} for flats and special sections, yield point can be -10% and tensile strength can be ± 10%

^{b)} for thickness < 5 mm, mechanical properties should be agreed before order placement

^{c)} values valid also for +C+SL and +SH+SL

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Hot-rolled, quenched and tempered, cold-drawn +QT +C ^{c)}						Cold-drawn + quenching and tempering +C +QT ^{c)}			
size mm		Testing at room temperature (longitudinal)				Testing at room temperature (longitudinal)			
from	to	R	Rp 0.2	A%	HB	R	Rp 0.2	A%	HB
		N/mm ²	N/mm ² min	min	for inform.	N/mm ²	N/mm ² min	min	for inform.
5 ^{b)}	10	850-1050	595	8	253-319				
10	16	810-1010	565	8	243-300				
16	40	750-950	525	9	225-286	650-800	430	16	200-240
40	63	650-850	455	10	200-253	630-780	370	17	192-232
63	100	650-850	455	11	200-253	630-780	370	17	192-232

^{b)} for thickness < 5 mm, mechanical properties should be agreed before order placement

^{c)} values valid also for +QT+C+SL and +C+QT+SL

Testing at room temperature (longitudinal)

Cold-drawn +QT					Cold-drawn + QT + Cold-drawn			
diameter mm	R	Rp 0.2	A%	Kv + 20 °C	R	Rp 0.2	A%	Kv + 20 °C
	N/mm ²	N/mm ² min	min	J	N/mm ²	N/mm ² min	min	J
56	675	429	22,6	60-50-60	704	570	23,6	45-36-58

C45E 1.1191 Forged normalized EN 10250-2: 2001

size mm		Testing at room temperature							
from	to	R	Re ^{c)}	A%	A%	A%	Kv +20 °C	Kv +20 °C	HB
		N/mm ² min	N/mm ² min	min L	min T	min Q	J min L	J min T	min
	100	580	305	16					172
100	250	560	275	16	12		18	10	162
250	500	540	240	16	12		15	10	158
500	1000	530	230	15	11		12	10	156

C45E 1.1191 Forged quenched and tempered EN 10250-2: 2001

size d / t mm		Testing at room temperature							
from	to	R	Re ^{c)}	A%	A%	A%	Kv +20 °C	Kv +20 °C	HB
		N/mm ² min	N/mm ² min	min L	min T	min Q	J min L	J min T	min
	100/70	630	370	17			25		192
100/70	250/160	590	340	18	12		22	15	176
250/160	500/330	540	320	17	11		20	12	158

L = longitudinal T = tangential Q = radial

^{c)} Re upper yield strength or, if no yield phenomenon occurs, Rp 0.2 has to be considered

d = diameter t = thickness

+N	190	Fatigue limit, σ_L ' N/mm ² high cycle fatigue
+QT	265	

¹⁾ creep rupture strength

+U natural +N normalized +QT quenched and tempered +SR stress-relieved

Kv values obtained on hot-rolled 130 mm rounds;					
+QT induction for R 743 N/mm² - Rp 421 N/mm² A% 26 C% 58					
J	50 - 57 - 60	36 - 33 - 40	32 - 41 - 28	14 - 24 - 24	16 - 26 - 14
°C	+20	0	-20	-40	-60