

<b>Quality</b>	<b>C40E</b>
According to standards	<b>EN 10083-2: 2006</b>
Number	<b>1.1186</b>

## Chemical composition

C%	Si%	Mn%	P%	S%	Cr%	Mo	Ni%	Scostamenti ammessi per analisi di prodotto
	max		max	max	max	max	max	
0,37-0,44	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 C40R n° 1.1189, S% 0.020-0.040 product deviations ± 0.005

For C40 n° 1.0511, P% - S% max 0.045

## Temperature °C

Hot-forming	Normalizing	Quenching	Quenching	Tempering	Stress-relieving	
1100-850	870 air	840 water	860 oil or polymer	550-650 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 air (HB max 210)	820 furnace cooling to 660, then air (HB 160-210)	(HB max 235)	870 water	250 <b>Ac1</b> <b>Ac3</b> 730        780		550 furnace cooling <b>Ms</b> <b>Mf</b> 360      140

## Mechanical and physical properties

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

size d / t		Testing at room temperature (longitudinal)					
mm		R	Re <sup>a)</sup>	A%	C%	Kv	HB
from	to	N/mm <sup>2</sup> min	N/mm <sup>2</sup> min.	min.	min.	J min.	min
	16/16	580	320	16			172
16/16	100/100	550	290	17			159
100/100	250/250	530	260	17			156

d = diameter t = thickness

Hot-rolled mechanical properties in **quenched and tempered** condition EN 10083-2: 2006

size d / t		Testing at room temperature (longitudinal)					
mm		R	Re <sup>a)</sup>	A%	C%	Kv	HB
from	to	N/mm <sup>2</sup>	N/mm <sup>2</sup> min	min.	min.	J min	for information
	16/8	650-800	460	16	35		200-240
16/8	40/20	630-780	400	18	40	30	192-232
40/20	100/60	600-750	350	19	45	30	178-225

<sup>a)</sup> Re upper yield strength or, if no yield phenomenon occurs, Rp<sub>0.2</sub> 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 840 °C in water

<b>HB</b>		560	550	525	496	461	426	390	357	319	275	243	213	202
<b>HRC</b>		55	54.5	53	51	48.5	45.5	42	38.5	34	28.5	23		
<b>R</b>	N/mm <sup>2</sup>	2070	2050	1950	1820	1670	1500	1350	1200	1050	920	800	700	660
<b>Rp<sub>0.2</sub></b>	N/mm <sup>2</sup>	1600	1650	1640	1590	1500	1380	1240	1100	950	800	700	620	550
<b>A</b>	%			6.0	8.4	10.2	11.0	12.0	13.0	14.2	16.0	19.0	24.0	26.2
<b>C</b>	%			30	40	47	52	53	54	57	58	63	66	67
<b>Kv</b>	J	10	12	14	14	18	24	38	38	45	66	94	124	126
<b>Tempering at °C</b>		<b>100</b>	<b>150</b>	<b>200</b>	<b>250</b>	<b>300</b>	<b>350</b>	<b>400</b>	<b>450</b>	<b>500</b>	<b>550</b>	<b>600</b>	<b>650</b>	<b>700</b>

## C40E 1.1186 C40R 1.1189 EN 10277-5: 2008

Cold-drawn +C <sup>c)</sup>						Hot-rolled + peeled-reeled +SH <sup>c)</sup>			
size mm		Testing at room temperature (longitudinal)				Testing at room temperature (longitudinal)			
from	to	R <sup>a)</sup>	R <sub>p</sub> 0.2 <sup>a)</sup>	A%	HB	R	R <sub>p</sub> 0.2	A%	HB
		N/mm <sup>2</sup>	N/mm <sup>2</sup> min	min	for inform.	N/mm <sup>2</sup>	N/mm <sup>2</sup> min	min	
5 <sup>b)</sup>	10	700-1000	540	6	213-298				
10	16	650-980	460	7	200-295				
16	40	620-920	365	8	190-275	550-710			163-211
40	63	590-840	330	9	176-250	550-710			163-211
63	100	550-820	290	9	159-246	550-710			163-211

<sup>a)</sup> for flats and special sections, yield point can be – 10% and tensile strength can be ± 10%

<sup>b)</sup> for thickness < 5 mm, mechanical properties should be agreed before order placement

<sup>c)</sup> values valid also for +C+SL and +SH+SL

## C40E 1.1186 C40R 1.1189 EN 10277-5: 2008

Hot-rolled, quenched and tempered, cold-drawn +QT +C <sup>c)</sup>						Cold-drawn + quenching and tempering +C +QT <sup>c)</sup>			
size mm		Testing at room temperature (longitudinal)				Testing at room temperature (longitudinal)			
from	to	R	R <sub>p</sub> 0.2	A%	HB	R	R <sub>p</sub> 0.2	A%	HB
		N/mm <sup>2</sup>	N/mm <sup>2</sup> min	min	for inform.	N/mm <sup>2</sup>	N/mm <sup>2</sup> min	min	for inform.
5 <sup>b)</sup>	10	800-1000	560	8	240-298				
10	16	750-950	525	8	225-286				
16	40	700-900	490	9	213-271	630-780	400	18	192-232
40	63	620-820	435	10	190-246	600-750	350	19	178-225
63	100	600-800	420	11	178-240	600-750	350	19	178-225

<sup>b)</sup> for thickness < 5 mm, mechanical properties should be agreed before order placement

<sup>c)</sup> values valid also for +QT+C+SL and +C+QT+SL

## Forged normalized EN 10250-2: 2001

size mm		Testing at room temperature (longitudinal)							
from	to	R	Re <sup>c)</sup>	A% L	A% T	A% Q	Kv L	Kv T	HB
		N/mm <sup>2</sup> min	N/mm <sup>2</sup> min	min	min	min	J min	J min	min
	100	550	290	17					159
100	250	530	260	17					156

<sup>c)</sup> Re upper yield strength or, if no yield phenomenon occurs, the 0.2% proof strength R<sub>p</sub> 0.2

d = diameter t = thickness

## EN 10083-2: 2006 Jominy test HRC grain size 5 min.

mm distance from quenched extremity																	
	1	2	3	4	5	6	7	8	9	10	11	13	15	20	25	30	H
min	51	46	35	27	25	24	23	22	21	20							normal
max	60	60	59	57	53	47	39	34	31	30	29	28	27				

Temperature	Mod. of elasticity GPa		Thermal expansion	
Testing at °C	E long.	G tang.	10 <sup>-6</sup> · K <sup>-1</sup>	
20	220	88		

EUROPE EN	ITALY UNI	CHINA GB	GERMANY DIN	FRANCE AFNOR	U.K. B.S.	RUSSIA GOST	USA AISI/SAE
C40E	C40	40	Ck40	XC42H1	080M40	40	1040