

Quality	C40E	Quenching and Tempering Steel	<i>Technical card Lucefin Group rev. 2024</i>
According to standards	ISO 683-1: 2018		
Number	1.1186		

Chemical composition

C%	Si%	Mn%	P% max	S% max	Cr% max	Mo max	Ni% max	Cu% max	Product deviations are allowed
0,37-0,44 ± 0.02	0,10-0,40 ± 0.03	0,50-0,80 ± 0.04	0,030 + 0.005	0,035 ± 0.005	0,40 +0.05	0,10 +0.03	0,40 +0.03	0,30 +0.05	

Cr+Mo+Ni max 0.63%
For C40R n° 1.1189, S% 0.020-0.040 product deviations ± 0.005

Temperature °C

Hot-forming	Normalizing +N	Quenching +Q	Quenching +Q	Tempering +T	Stress-relieving +SR
1100-850	850-890 air	830 water	870 oil or polymer	550-660 air	50° under the temperature of tempering
Soft annealing +A	Isothermal annealing +I	Natural state +U	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 Ac1 730	Ac3 790 Ms 360 Mf 140

Mechanical properties

C40E – C40R Hot-rolled mechanical properties in **normalized** condition ISO 683-1: 2018

size d / t		Testing at room temperature (longitudinal)					
mm		R	Re _H ^{a)}	A%	Z%	Kv ₂	HB
from	to	N/mm ² min	N/mm ² min.	min.	min.	J min.	min for information
	16/16	580	320	16	-	-	172
16/16	100/100	550	290	17	-	-	159
100/100	250/250	530	260	17	-	-	156

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

C40E – C40R Hot-rolled mechanical properties in **quenched and tempered** condition ISO 683-1: 2018

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

^{a)} Re_H 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 840 °C in water

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

C40E 1.1186 - C40R 1.1189 EN ISO 683-7:24
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Cold-drawn +C ^{c)}						Hot-rolled and Peeled +SH ^{d)}			
size mm		Testing at room temperature (longitudinal)				Testing at room temperature (longitudinal)			
from	to	R ^{a)}	Rp ^{0.2 a)}	A%	HBW	R	Rp ^{0.2}	A%	HBW
		N/mm ²	N/mm ² min	min	<i>for inform.</i>	N/mm ²	N/mm ² min	min	
5 ^{b)}	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	-	-	164-207
40	63	590-840	330	9	176-250	550-710	-	-	164-207
63	100	550-820	290	9	159-246	550-710	-	-	164-207

^{a)} 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
^{c)} values valid also for +C+G
^{d)} values valid also for +SH+G

Hot-rolled, quenched and tempered and Peeled +QT+SH ^{c)}						Quenched and tempered and Cold-drawn +QT+C			
size mm		Testing at room temperature (longitudinal)				Testing at room temperature (longitudinal)			
from	to	R	Rp ^{0.2}	A%	Kv₂ +20 °C	R	Rp ^{0.2}	A%	Kv₂ +20 °C
		N/mm ²	N/mm ² min	min	J min	N/mm ²	N/mm ² min	min	J min
5 ^{b)}	10	-	-	-	-	800-1000	560	8	-
10	16	-	-	-	-	750-950	525	8	-
16	40	630-780	400	18	30	680-880	490	9	-
40	63	600-750	350	19	30	620-820	435	10	-
63	100	600-750	350	19	30	600-800	420	11	-

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

 Work-hardening by **cold-drawing** table (Hot-rolled +N+C)

R N/mm ²	680	780	800	840	870	910
Rp ^{0.2} N/mm ²	440	630	650	660	740	840
A%	24	16	14	14	102	8
Reduction %	0	10	20	30	40	50

C40 1.0511 Forged normalized UNI EN 10250-2: 2001

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

^{c)} Re upper yield strength or, if no yield phenomenon occurs, the 0.2% proof strength Rp _{0.2}

 ISO 683-1: 2018 **Jominy test HRC** grain size 5 min.

mm distance from quenched end																	
	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	-	-	-	-	-	-	
max	60	60	59	57	53	47	39	34	31	30	29	28	27	-	-	-	

Thermal Expansion	10 ⁻⁶ • K ⁻¹	▶	11.3	12.0	12.5	13.3	13.9	14.4	14.8	
Mod. of Elasticity long.	GPa		220							
Mod. of Elasticity tang.	GPa		88							
Specific Heat Capacity	J/(Kg•K)		460	486	519	586				
Thermal Conductivity	W/(m•K)			50.7						
Density	Kg/dm ³		7.84							
Specific Electric Resistivity	Ohm•mm ² /m		0.142	0.16	0.22					
Electrical Conductivity	Siemens•m/mm ²		7.0	6.2	4.5					
°C			20	100	200	300	400	500	600	700

The symbol ▶ indicates temperature between 20 °C and 100 °C

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