

Quality	C35E	Quenching and Tempering Steel	<i>Technical card Lucefin Group rev. 2018</i>
According to standards	ISO 683-1: 2018		
Number	1.1181		

Chemical composition

C%	Si%	Mn%	P% max	S% max	Cr% max	Mo% max	Ni% max	Cu% max	Product deviations are allowed
0,32-0,39	0,10-0,40	0,50-0,80	0,030	0,035	0,40	0,10	0,40	0,30	
± 0.02	± 0.03	± 0.04	+ 0.005	± 0.005	+ 0.05	+ 0.03	+0.03	+ 0.05	

Cr+Mo+Ni max 0.63%

For C35R n° 1.1180, S% 0.020-0.040 product deviations ± 0.005

For C35 n° 1.0501, max P% - S% 0.045. On request, it may be supplied with the addition of lead (C35Pb) Pb 0.15-0.35%

Temperature °C

Hot-forming	Normalizing +N	Quenching +Q	Quenching +Q	Tempering +T	Stress-relieving +SR
1100-850	860-900 air	840 water	880 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
700 air (HB max 210)	840 furnace cooling to 650, then air (HB 140-195)	- (HB max 220)	870	100	slow cooling
				Ac1 Ac3	Ms Mf
				730 795	380 160

Mechanical properties

C35E C35R 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%	Kv₂	HB
from	to	N/mm ² min	N/mm ² min.	min.	min.	J min.	<i>min for information</i>
	16/16	550	300	18	-	-	159
16/16	100/100	520	270	19	-	-	155
100/100	250/250	500	245	19	-	-	152

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

d = diameter t = thickness

C35E C35R 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%	Kv₂	HB
from	to	N/mm ²	N/mm ² min	min.	min.	J min	<i>for information</i>
	16/8	630-780	430	17	40	25	192-232
16/8	40/20	600-750	380	19	45	25	178-225
40/20	100/60	550-700	320	20	50	25	159-213

^{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 Ø 10 mm after quenching at 850 °C in water

HB	467	448	412	343	268	226
HRC	49	47.5	44	37	27.5	20
R N/mm²	1700	1610	1440	1140	890	760
Tempering at °C	100	200	300	400	500	600

C35E 1.1181 - C35R 1.1180 EN 10277: 2018

Lucefina Group

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	for inform.	N/mm ²	N/mm ² min	min	
5 ^{b)}	10	650-1000	510	6	200-298	-	-	-	-
10	16	600-950	420	7	178-286	-	-	-	-
16	40	580-880	320	8	172-263	520-700	-	-	156-204
40	63	550-840	300	9	159-250	520-700	-	-	156-204
63	100	520-800	270	9	155-240	520-700	-	-	156-204

Hot-rolled, quenched and tempered, Peeled +QT+SH						quenched and tempered and Cold-drawn +QT+C			
size mm		Testing at room temperature (longitudinal) ^{a)}				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	-	-	-	-	750-950	525	9	-
10	16	-	-	-	-	700-900	490	9	-
16	40	600-750	370	19	35	650-850	455	10	-
40	63	550-700	320	20	35	570-770	400	11	-
63	100	550-700	320	20	35	550-750	385	12	-

C35E 1.1181 Forged normalized UNI EN 10250-2: 2001

size mm		Testing at room temperature						
from	to	R	Re ^{c)}	A%L	A%	Kv	Kv	HB
		N/mm ² min	N/mm ² min	min (L)	min (T)	J min (L)	J min (T)	min
	100	520	270	19	-	30	-	155
100	250	500	245	19	15	25	15	152
250	500	480	220	19	15	20	12	146
500	1000	470	210	18	14	17	12	141

C35E 1.1181 Forged quenched and tempered EN 10250-2: 2001

size d / t		Testing at room temperature						
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)	min
	100/70	550	320	20	-	35	-	159
100/70	250/160	490	290	22	15	31	20	149
250/160	500/330	470	270	21	14	25	16	141

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

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	H
min	48	40	33	24	22	20	-	-	-	-	-	-	-	-	-	
max	58	57	55	53	49	41	34	31	28	27	26	25	24	23	20	

EUROPE	ITALY	CHINA	GERMANY	FRANCE	U.K.	RUSSIA	USA
EN	UNI	GB	DIN	AFNOR	B.S.	GOST	AISI/SAE
C35E	C35	35	Ck35	XC38H1	080M36	35	1034

C35E*Lucefin Group*

Thermal Expansion	$10^{-6} \cdot K^{-1}$	►	11.1	12.1	12.9	13.5	13.9	14.1
Mod. of Elasticity long.	GPa		210	205	195	185	175	164
Mod. of Elasticity tang.	GPa		80	78	74	71	67	59
Specific Heat Capacity	J/(Kg•K)		460	486	519		586	
Thermal Conductivity	W/(m•K)		50	50.8				
Density	Kg/dm ³		7.85					
Specific Electric Resist.	Ohm•mm ² /m		0.12	0.217				
Electrical Conductivity	Siemens•m/mm ²		8.33	6.25	4.76			
°C			20	100	200	300	400	500

The symbol ► indicates temperature between 20 °C and 100 °C, 20 °C and 200 °C ...

Heat treatment	Temperature (+ ... °C) - min. values							Fatigue data
	20	200	300	350	400	450	500	
+N	275	220	185	165	145			Rp 0.2 N/mm ²
+N				246	187	100	53	Creep rupture, 10.000 h N/mm ² ¹⁾
+N				218	138	70	34	Creep rupture, 100.000 h N/mm ² ¹⁾
+N	334							Cyclic yield strength, σ_y'
+QT	328							N/mm ² low cycle fatigue
+N	0.25							Cyclic strength exponent, n'
+QT	0.23							low cycle fatigue
+N	1599							Cyclic strength coefficient, K'
+QT	1355							N/mm ² low cycle fatigue
+N	1545							Fatigue strength coefficient, σ_f'
+QT	1050							N/mm ² low cycle fatigue
+N	-0.14							Fatigue strength exponent, b
+QT	-0.11							low cycle fatigue
+N	0.90							Fatigue ductility coefficient, g_f'
+QT	0.33							low cycle fatigue
+N	-0.57							Fatigue ductility exponent, c
+QT	-0.47							low cycle fatigue

¹⁾ Creep rupture strength EN 10269: 2001

+N = Normalized +QT = Quenched an Tempered