

<b>Quality</b>	<b>C35E</b>	<b>Quenching and Tempering Steel</b>	<i>Technical card</i> <b>Lucefin Group</b> rev. 2024
According to standards	<b>ISO 683-1: 2018</b>		
Number	<b>1.1181</b>		

### 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
				<b>Ac1</b> <b>Ac3</b>	<b>Ms</b> <b>Mf</b>
				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		<b>R</b>	<b>Re<sub>H</sub></b> <sup>a)</sup>	<b>A%</b>	<b>Z%</b>	<b>Kv<sub>2</sub></b>	<b>HB</b>
from	to	N/mm <sup>2</sup> min	N/mm <sup>2</sup> 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

<sup>a)</sup> Re<sub>H</sub> upper yield strength or, if no yield phenomenon occurs, Rp<sub>0.2</sub> 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		<b>R</b>	<b>Re<sub>H</sub></b> <sup>a)</sup>	<b>A%</b>	<b>Z%</b>	<b>Kv<sub>2</sub></b>	<b>HB</b>
from	to	N/mm <sup>2</sup>	N/mm <sup>2</sup> 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

<sup>a)</sup> Re<sub>H</sub> 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 Ø 10 mm after quenching at 850 °C in water

<b>HB</b>	467	448	412	343	268	226
<b>HRC</b>	49	47.5	44	37	27.5	20
<b>R N/mm<sup>2</sup></b>	1700	1610	1440	1140	890	760
<b>Tempering at °C</b>	<b>100</b>	<b>200</b>	<b>300</b>	<b>400</b>	<b>500</b>	<b>600</b>

**C35E 1.1181 - C35R 1.1180 EN ISO 683-7:24**

*Lucefina Group*

<b>Cold-drawn +C <sup>c)</sup></b>						<b>Hot-rolled and Peeled +SH <sup>d)</sup></b>			
size mm		Testing at room temperature (longitudinal)				Testing at room temperature (longitudinal)			
from	to	<b>R</b> <sup>a)</sup>	<b>Rp 0.2</b> <sup>a)</sup>	<b>A%</b>	<b>HBW</b>	<b>R</b>	<b>Rp 0.2</b>	<b>A%</b>	<b>HBW</b>
		N/mm <sup>2</sup>	N/mm <sup>2</sup> min	min	<i>for inform.</i>	N/mm <sup>2</sup>	N/mm <sup>2</sup> min	min	
5 <sup>b)</sup>	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

<b>Hot-rolled, quenched and tempered, Peeled +QT+SH</b>						<b>quenched and tempered and Cold-drawn +QT+C</b>			
size mm		Testing at room temperature (longitudinal) <sup>a)</sup>				Testing at room temperature (longitudinal)			
from	to	<b>R</b>	<b>Rp 0.2</b>	<b>A%</b>	<b>Kv<sub>2</sub> +20°C</b>	<b>R</b>	<b>Rp 0.2</b>	<b>A%</b>	<b>Kv<sub>2</sub> +20°C</b>
		N/mm <sup>2</sup>	N/mm <sup>2</sup> min	min	J min	N/mm <sup>2</sup>	N/mm <sup>2</sup> min	min	J min
5 <sup>b)</sup>	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	<b>R</b>	<b>Re <sup>c)</sup></b>	<b>A%L</b>	<b>A%</b>	<b>Kv</b>	<b>Kv</b>	<b>HB</b>
		N/mm <sup>2</sup> min	N/mm <sup>2</sup> min	min (L)	min (T)	J min (L)	J min (T)	<i>min</i>
	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	<b>R</b>	<b>Re <sup>c)</sup></b>	<b>A%</b>	<b>A%</b>	<b>Kv</b>	<b>Kv</b>	<b>HB</b>
		N/mm <sup>2</sup> min	N/mm <sup>2</sup> min	min (L)	min (T)	J min (L)	J min (T)	<i>min</i>
	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  
<sup>c)</sup> 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
<b>min</b>	48	40	33	24	22	20	-	-	-	-	-	-	-	-	-	
<b>max</b>	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*

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

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 <sup>2</sup>
+N				246	187	100	53	Creep rupture, 10.000 h N/mm <sup>2</sup> <sup>1)</sup>
+N				218	138	70	34	Creep rupture, 100.000 h N/mm <sup>2</sup> <sup>1)</sup>
+N	334							Cyclic yield strength, $\sigma_y'$
+QT	328							N/mm <sup>2</sup> 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 <sup>2</sup> low cycle fatigue
+N	1545							Fatigue strength coefficient, $\sigma_f'$
+QT	1050							N/mm <sup>2</sup> 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

<sup>1)</sup> Creep rupture strength EN 10269: 2001

+N = Normalized +QT = Quenched an Tempered