

Quality	C15E	Case-hardening	<i>Technical card</i>
According to standards	ISO 683-3: 2018	Steel	Lucefin Group
Number	1.1141		<i>rev. 2018</i>

Chemical composition

C%	Si%	Mn%	P% max	S% max	Cr% max	Mo% max	Ni% max	Cu% max	
0,12-0,18	0,15-0,40	0,30-0,60	0,035	0,035	0,40	0,10	0,40	0,30	Product deviations are allowed
± 0.02	± 0.03	± 0.04	+ 0.005	± 0.005	± 0.05	± 0.03	± 0.03	+ 0.05	

C 15R n° 1.1140 S% 0.020-0.040 product deviation ± 0.005%
C15Pb on request, this steel grade can be supplied with addition of lead (Pb) 0.15-0.35%

Temperature °C

Hot-forming	Normalizing +N	Core hardening	Carbonitriding	Carburizing	Hardening carburizing surface	Str-reliev. +SR
1150-850	890-920 air (HB 95 – 150)	880-920 water	750-930 gas	880-980	780-820 water	150 200
Soft annealing +A	Isothermal annealing +I	Intermediate annealing	Natural state +U	Pre-heating welding	Stress-relieving after welding	
690 air (HB max 143)	930 furnace cooling to 650, then air (HB 115-145)	650-700 air	(HB 170)	welding must be carried out on the annealed state and before carburizing	100	slow cooling
				Ac1	Ac3	Ms * core ** carburizing surface
				725	860	460* 220**

Mechanical properties

C15 Hot-rolled values obtained on test blanks after core hardening + stress-relieving UNI 7846: 1978. Use only as reference.

size mm	Testing at room temperature (longitudinal)				
	R	Rp 0.2	A%	Kcu	HB
test blanks	N/mm ²	N/mm ² min.	min.	J min.	
11	740-1180	440	9	22.5	224-354
30	540-780	295	13	30	158-232 for information
63	-	-	-	-	-

Tensile strength after hardening and tempering at +200 °C. **Lucefin** experience

size mm	d ≤ 16	> 16 d ≤ 40
R N/mm ² min.	800	600

Heat treatment	Temperature (+ ... °C) - min. values			Fatigue data
	20	200	300	
+A	249			Cyclic yield strength, σ_y' N/mm ² low cycle fatigue
+N	269			
+A	0.19			Cyclic strength exponent, n' low cycle fatigue
+N	0.18			
+A	824			Cyclic strength coefficient, K' N/mm ² low cycle fatigue
+N	813			
+A	807			Fatigue strength coefficient, σ_f' N/mm ² low cycle fatigue
+N	984			
+A	- 0.12			Fatigue strength exponent, b low cycle fatigue
+N	- 0.13			
+A	0.42			Fatigue ductility coefficient, g_f' low cycle fatigue
+N	0.81			
+A	- 0.53			Fatigue ductility exponent, c low cycle fatigue
+N	- 0.58			
+N	170			Fatigue limit, σ_L' N/mm ² high cycle fatigue

+A = Annealed +N = Normalized

C15E 1.1141 - C15R 1.1140 EN 10277: 2018

Lucefin Group

Cold-drawn +C ^{c)}						Hot-rolled + Peeled +SH			
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 inf.	N/mm ²	N/mm ² min	min	
5 ^{b)}	10	500-800	380	7	152-240	-	-	-	-
10	16	480-780	340	8	146-232	-	-	-	-
16	40	430-730	280	9	128-224	330-600			98-178
40	63	380-670	240	11	110-203	330-600			98-178
63	100	340-600	215	12	100-178	330-600			98-178
size mm		Soft annealing +A+SH Peeled, Ground +G				Soft annealing +A+C Cold-drawn			
from	to	HBW max				HBW max			
5 ^{b)}	10	-				238			
10	16	-				231			
16	40	143				216			
40	63	143				198			
63	100	143				178			

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+G

C15 Forged UNI 8550: 1984. Use only as reference

size mm		Testing at room temperature (longitudinal)					
from	to	R	Rp 0.2	A%	Kcu	HB	
		N/mm ²	N/mm ² min	min (L)	J min (L)	for inform.	
	11	735-1180	440	9	22.5	224-354	
11	25	540-785	345	11	30	158-234	
25	40	490-735	295	14	35	149-224	

Mechanical properties obtained on test blanks after core hardening + stress-relieving

L = longitudinal

Jominy test HRC for information only									Max hardness of the layer casehardened and hardened as a function of carbon content							
distance in mm from quenched end																
	1	2	3	4	5	6	7	8	C%	0.40	0.50	0.60	0.70	0.80	0.90	1.00
min	39	35	31	27	25	22	20		HV1	653	746	800	865	900	865	832
max	45	42	35	33	32	28	26	24								

Thermal Expansion	10 ⁻⁶ • K ⁻¹	▶	11.1	12.1	12.9	13.5	13.9	14.1	
Mod. of Elasticity long.	GPa		210						
Mod. of Elasticity tang.	GPa		80						
Specific Heat Capacity	J/(Kg•K)		460	486	519	599			
Thermal Conductivity	W/(m•K)		58	51	48.9				
Density	Kg/dm ³		7.85						
Specific Electric Resist.	Ohm•mm ² /m		0.11	0.21	0.29				
Electrical Conductivity	Siemens•m/mm ²		9.09						
°C			20	100	200	300	400	500	600

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

EUROPE	ITALY	CHINA	GERMANY	FRANCE	U.K.	RUSSIA	USA
EN	UNI	GB	DIN	AFNOR	B.S.	GOST	AISI/SAE
C15E	C15	15	Ck15	XC12		15	1015