

Quality	C22E	Quenching and Tempering Steel	<i>Technical card</i> Lucefin Group rev. 2018
According to standards	EN 10083-2: 2006		
Number	1.1151		

Chemical composition

C%	Si%	Mn%	P%	S%	Cr%	Mo%	Ni%	Product deviation are allowed
	max		max	max	max	max	max	
0,17-0,24 ± 0.02	0,40 + 0.03	0,40-0,70 ± 0.04	0,030 + 0.005	0,035 + 0.005	0,40 + 0.5	0,10 + 0.3	0,40 + 0.5	

Cr+Mo+Ni max 0.63%
C22R n° 1.1149 S% 0.020-0.040 product deviation ± 0.005

Temperature °C

Hot-forming	Normalizing +N	Quenching +Q	Quenching +Q	Tempering +T	Stress-relieving +SR
1150-850	890-920 air	880 water	900 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 170)	880 furnace cooling to 650, then air (HB max 160)	- (HB max 185)	-	not demanded	slow cooling
				AC1 730	AC3 840
				Ms 440	Mf 220

Mechanical properties

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

size d / t		Testing at room temperature (longitudinal)					
mm		R	Re ^{a)}	A%	Z%	Kv	HB
from	to	N/mm ² min	N/mm ² min.	min.	min.	J min.	min
	16/16	430	240	24	-	-	128
16/16	100/100	410	210	25	-	-	122

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 ^{a)}	A%	Z%	Kv	HB
from	to	N/mm ²	N/mm ² min	min.	min.	J min	for information
	16/8	500-650	340	20	50	-	152-200
16/8	40/20	470-620	290	22	50	50	141-190

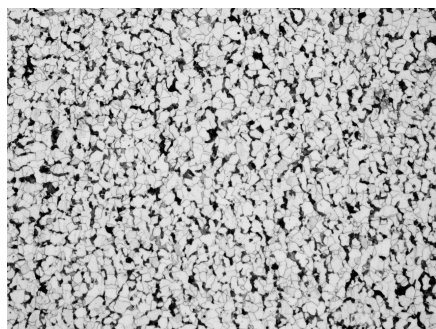
^{a)} Re upper yield strength or, if no yield phenomenon occurs, Rp 0.2 has to be considered

d = diameter t = thickness

Table of tempering values obtained at room temperature on rounds of Ø 30 mm after quenching at 880 °C in water

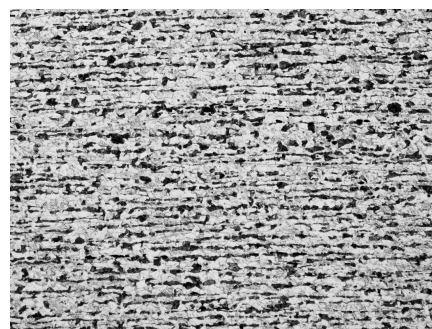
HB		198	178	172	159	154
R	N/mm ²	640	600	580	550	510
Rp 0.2	N/mm ²	390	370	350	320	300
A	%	18	20	20	20	20
Z	%	45	50	52	58	60
Tempering at °C		450	500	550	600	650

Hot-rolled in its natural state **HB 180**



X100 ferrite – pearlite

Cold-drawn in its natural state **HB 210**



X100 ferrite – pearlite

Cold-drawn +C Values valid also for +C+G. 070M20 BS 970 pt.3: 1991. Use only as reference

size mm		Testing at room temperature (longitudinal)			
from	to	R	Rp 0.2	A%	HB
		N/mm ² min	N/mm ² min	min	min
6	13	560	420	10	162
13	16	530	390	12	156
16	40	490	340	12	149
40	63	480	290	13	146
63	76	450	280	14	135

C22 1.0402 Forged normalized UNI EN 10250-2: 2001

size mm		Testing at room temperature (longitudinal)				
from	to	R	Re ^{a)}	A%	Kv	HB
		N/mm ² min	N/mm ² min	min (L)	J min (L)	min
	100	410	210	25	-	122

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

Hardness test HRC Use only as reference; only reference

mm distance from quenched end

	1	2	3	4	5	6	7	8	9	10	11	13	15	20
min	-	-	-	-	-									
max	35	35	34	30	27									

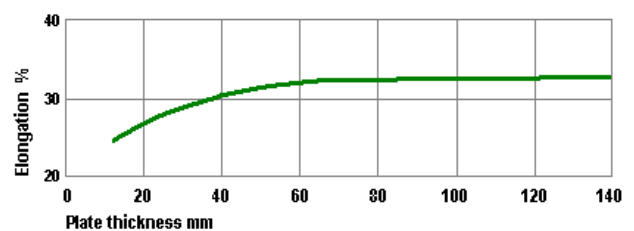
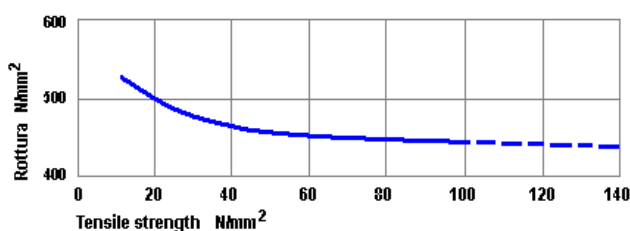
Thermal Expansion	10 ⁻⁶ · K ⁻¹	►	12.25	13.10	13.73	14.28	14.79	15.06	15.37		
Mod. of Elasticity long.	GPa		210								
Mod. of Elasticity tang.	GPa		80								
Electrical resistivity	Ω · mm ² /m			0.219	0.293						
Density	Kg/dm ³		7.85								
Thermal conductivity	W/(m·K)			51.1	49.0	46.1	42.7	39.4	35.6	31.8	
°C				20	100	200	300	400	500	600	700

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

Heat treatment	Temperature (+ ... °C) - min. values			Data under fatigue
	20	200	300	
+U	267			Cyclic yield strength, σ_y'
+QT	279			N/mm ² low cycle fatigue
+U	0.13			Cyclic strength exponent, n'
+QT	0.13			low cycle fatigue
+U	580			Cyclic strength coefficient, K'
+QT	613			N/mm ² low cycle fatigue
+U	561			Fatigue strength coefficient, σ_f'
+QT	700			N/mm ² low cycle fatigue
+U	- 0.08			Fatigue strength exponent, b
+QT	- 0.09			low cycle fatigue
+U	1.30			Fatigue ductility coefficient, g_f'
+QT	0.49			low cycle fatigue
+U	- 0.65			Fatigue ductility exponent, c
+QT	- 0.69			low cycle fatigue

+U = natural +QT = quenched and tempered

EUROPE	EN	ITALY	UNI	CHINA	GB	GERMANY	DIN	FRANCE	AFNOR	U.K. B.S.	RUSSIA	GOST	USA	AISI/SAE
C22E		C20		20		Ck22		XC18		070M20	20		1020	



Effect of thickness on tensile properties, steel plate after rolling