Quality	**36CrNiMo4**	**Quenching and Tempering Steel**	*Technical card*
According to standards	**ISO 683-2: 2018**		***Lucefin Group***
Number	**1.6511**		*rev. 2018*

Chemical composition

C%	**Si%** [a]	**Mn%**	**P%** max	**S%** max	**Cr%**	**Mo%**	**Ni%**	**Cu%** max	
0,32-0,40	0,10-0,40	0,50-0,80	0,035	0,035	0,90-1,20	0,15-0,30	0,90-1,20	0,40	Product deviations are allowed
± 0.03	± 0.03	± 0.04	+ 0.005	± 0.005	± 0.05	± 0.03	± 0.05	+ 0.05	

[a] Steels may be supplied with a lower silicon content. In this case, alternative means of deoxidation shall be used

Temperature °C

Hot-forming	**Normalizing +N**	**Quenching +Q**	**Quenching +Q**	**Tempering +T**		**Stress-relieving +SR**	
1100-900	860-880 air	850 oil or polymer	820 water	540-680 air		50° under the temperature of tempering	
Soft annealing +A	**Isothermal annealing +I**	**Full annealing**	**End quench hardenability tes**	**Pre-heating welding**		**Stress-relieving after welding**	
650-700 air (HB max 248)	850-900 cooling furnace to 650 then air (HB 180-240)	830-850 cooling furnace to 300 (HB max 235)	850 water	300		550 furnace cooling	
				Ac_1	**Ac_3**	**Ms**	**Mf**
				725	770	340	180

Mechanical properties

36CrNiMo4 Hot-rolled mechanical properties in **quenched and tempered** condition ISO 683-2: 2018

size d / *t* mm		Testing at room temperature (longitudinal)					
		R	**Rp** 0.2	**A**%	**Z**%	**Kv_2**	***HBW***
from	to	N/mm²	N/mm² min.	min.	min.	J min.	*for information*
	16/8	1100-1300	900	10	-	-	*331-380*
16/8	40/20	1000-1200	800	11	-	-	*298-359*
40/20	100/60	900-1100	700	12	-	-	*271-331*
100/60	160/100	800-950	600	13	-	-	*240-286*
160/100	250/160	750-900	550	14	-	-	*225-271*

d = diameter *t* = *thickness*

Table of tempering values obtained at room temperature on rounds of Ø 20 mm after quenching at 850 °C in oil

HB		520	480	442	393	359	331	286	240
HRC		53	50	47	42	38	36	30	23
R	N/mm²	1900	1750	1580	1350	1200	1100	950	800
Rp 0.2	N/mm²	1550	1500	1400	1200	1080	1000	810	700
A	**%**	10	10	10	12	13	16	18	22
Z	**%**	48	50	52	55	56	60	64	66
Kv	J	18	18	16	40	60	90	100	110
Tempering at **°C**		**200**	**300**	**400**	**500**	**550**	**600**	**650**	**700**

LUCEFIN experience: Hot-rolled round

size mm	Testing at room temperature (longitudinal)						
	R	**Rp** 0.2	**A**	**Z**	**Kv** +20 °C	Temperature	
	N/mm²	N/mm²	%	%	J	**°C**	**°C**
250	1108	960	16	62	64-64-68	Quenching at 830 in water	Tempering 600
250	968	820	18	60	88-86-80	Quenching at 830 in water	Tempering 650

36CrNiMo4 1.6511 EN 10277: 2018

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Hot-rolled, annealed and **Cold-drawn** +A+C						Hot-rolled, annealed and **Peeled** +A+SH			
size mm		Testing at room temperature (longitudinal)				Testing at room temperature (longitudinal)			
		R	**Rp** 0.2	**A**%	**HBW**	**R**	**Rp** 0.2	**A**%	**HBW**
from	to	N/mm²	N/mm² min	min		N/mm²	N/mm² min	min	max
5	10	-	-	-	-	-	-	-	-
10	16	-	-	-	-	-	-	-	-
16	40	-	-	-	-	-	-	-	248
40	63	-	-	-	-	-	-	-	248
63	100	-	-	-	-	-	-	-	248

Hot-rolled, quenched and tempered and **Cold-drawn** +QT+C						Hot-rolled, quenched and tempered, **Peeled** +QT+SH			
size mm		Testing at room temperature (longitudinal)				Testing at room temperature (longitudinal) [e]			
		R	**Rp** 0.2	**A**%	**Kv₂** +20 °C	**R**	**Rp** 0.2	**A**%	**Kv₂** +20 °C
from	to	N/mm²	N/mm² min	min	J min	N/mm²	N/mm² min	min	J min
5 [b]	10	-	-	-	-	-	-	-	-
10	16	-	-	-	-	-	-	-	-
16	40	-	-	-	-	1000-1200	800	11	40
40	63	-	-	-	-	900-1100	700	12	45
63	100	-	-	-	-	900-1100	700	12	45

[b] for thickness < 5 mm, mechanical properties should be agreed before order placement

[e] values valid also for +C+QT

36CrNiMo4 1.6511 **Forged** quenched and tempered UNI EN 10250-3: 2001

size d / *t*		Testing at room temperature						
mm		**R**	**Rp** 0.2	**A**% L	**A**% T	**Kv** L	**Kv** T	***HB***
from	to	N/mm² min	N/mm² min	min	min	J min	J min	*min*
	250/*160*	750	550	14	10	45	22	*225*
250/*160*	500/*330*	700	500	15	11	45	22	*213*
500/*330*	990/*660*	650	450	16	12	40	20	*200*

L = longitudinal T = tangential Q = radial d = diameter *t* = *thickness*

ISO 683-2: 2018 **Jominy test HRC** grain size 5 min.

mm distance from quenched end

	1.5	**3**	**5**	**7**	**9**	**11**	**13**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**	
min	51	50	49	49	48	47	46	45	43	41	39	38	36	34	33	**H**
max	59	59	58	58	57	57	57	56	55	54	53	52	51	50	49	
min	54	53	52	52	51	50	50	49	47	45	44	43	41	39	38	**HH**
max	59	59	58	58	57	57	57	56	55	54	53	52	51	50	49	
min	51	50	49	49	48	47	46	45	43	41	39	38	36	34	33	**HL**
max	56	56	55	55	54	54	53	52	51	50	48	47	46	45	44	

Thermal Expansion	$10^{-6} \bullet K^{-1}$	►	11.5	12.2	13.9	14.7
Mod. of Elasticity long.	GPa	210				
Mod. of Elasticity tang.	GPa	80				
Poisson Number	*v*	0.29				
Specific Heat Capacity	J/(Kg•K)	472				
Thermal Conductivity	W/(m•K)	51.9				
Density	Kg/dm³	7.85				
Specific Electric Resist.	Ohm•mm²/m	0.17				
Electrical Conductivity	Siemens•m/mm²	5.59				
°C		**20**	**100**	**250**	**500**	**1000**

The symbol ► indicates temperature between 20 °C and 100 °C, 20 °C and 250 °C …

EUROPE EN	**ITALY** UNI	**CHINA** GB	**GERMANY** DIN	**FRANCE** AFNOR	**U.K.** B.S.	**RUSSIA** GOST	**USA** AISI/SAE
36CrNiMo4	39NiCrMo3		34CrNiMo4	40NCD3 ~	817M37 ~	40ChNMA	9840