

<b>Quality</b>	<b>51CrV4</b> (50CrV4 †)	<b>Spring Steel</b>	<i>Technical card</i> <b>Lucefin Group</b> rev. 2018
According to standards	<b>EN 10083-3: 2006</b>		
Number	<b>1.8159</b>		

### Chemical composition

C%	Si% max	Mn%	P% max	S% max	Cr%	V%	Product deviations are allowed
0,47-0,55 ± 0.02	0,40 ± 0.03	0,70-1,10 ± 0.05	0,025 + 0.005	0,025 + 0.005	0,90-1,20 ± 0.05	0,10-0,25 ± 0.02	

Other elements non mentioned above should not be added to the steel, except for those necessary to casting  
Cu + 10Sn ≤ 0,60

### Temperature °C

Hot-forming	Normalizing +N	Quenching +Q on spring	Tempering +T	Hot moulding of springs			
1050-850	870 air	850-880 oil or polymer	400-450 air	920-830			
Soft annealing +A	Spheroidized annealing +AC	Natural state +U	End quench hardenableity test	Pre-heating welding	Stress-relieving after welding		
700 air (HB max 248)	820 furnace cooling to 650, then air (HB max 230)	- (HB max 310)	850 water	not allowed			
				<b>Ac1</b> 740	<b>Ac3</b> 790	<b>Ms</b> 280	<b>Mf</b> 60

### Mechanical properties

Hot-rolled mechanical properties after QT EN 10083-3: 2006							Values for <b>springs</b> according to Stahlschlüssel 2007 standard				
size d / t mm		Testing at room temperature (longitudinal)					<b>R</b>	<b>Rp 0.2</b>	<b>A%</b>	<b>DVM</b>	
from	to	N/mm <sup>2</sup>	N/mm <sup>2</sup> min.	min.	min.	J min.	N/mm <sup>2</sup>	N/mm <sup>2</sup> min	min	J min	
16/8	16/8	1100-1300	900	9	40		1400-1700	1200	6	21	
16/8	40/20	1000-1200	800	10	45	30					
40/20	100/60	900-1100	700	12	50	30					
100/60	160/100	850-1000	650	13	50	30					
160/100	250/160	800-950	600	13	50	30					

d = diameter t = thickness

**Table of tempering** values obtained at room temperature on round of Ø 10 mm after quenching at 850 °C in oil

<b>HB</b>	615	595	577	577	550	525	504	455	421	390	371	344	297	253
<b>HRC</b>	58	57	56	56	54.5	53	51.5	48	45	42	40	37	31.5	25
<b>R</b> N/mm <sup>2</sup>	-	-	-	2170	2050	1960	1840	1650	1490	1340	1250	1140	990	850
<b>Rp 0.2</b> N/mm <sup>2</sup>	1500	1590	1700	1750	1750	1720	1650	1530	1400	1270	1170	1130	900	700
<b>A</b> %	-	-	-	6.8	7.6	7.8	8.0	8.5	9.8	11.2	12.5	14.6	19.0	22.5
<b>Kv</b> J	-	8	10	16	16	15	16	26	28	31	38	46	94	135
Tempering at °C	<b>50</b>	<b>100</b>	<b>150</b>	<b>200</b>	<b>250</b>	<b>300</b>	<b>350</b>	<b>400</b>	<b>450</b>	<b>500</b>	<b>550</b>	<b>600</b>	<b>650</b>	<b>700</b>

Max thickness and diameter recommended for the spring to obtain, after quenching, internal hardness of <b>52 HRC</b>	Flat products thickness mm	Round products Ø mm
	25	38

<b>Thermal Expansion</b>	10 <sup>-6</sup> • K <sup>-1</sup>	►	12.2	12.8	13.3	13.7	14.2	14.5	14.7	
<b>Mod. of Elasticity</b> long.	GPa		210							
<b>Mod. of Elasticity</b> tang.	GPa		80							
<b>Specific Heat Capacity</b>	J/(Kg•K)									
<b>Thermal Conductivity</b>	W/(m•K)		44.9							
<b>Density</b>	Kg/dm <sup>3</sup>		7.85							
<b>Specific Electric Resistivity</b>	Ohm•mm <sup>2</sup> /m									
<b>Electrical Conductivity</b>	Siemens•m/mm <sup>2</sup>									
°C			<b>20</b>	<b>100</b>	<b>200</b>	<b>300</b>	<b>400</b>	<b>500</b>	<b>600</b>	<b>700</b>

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

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Cold-drawn + quenched and tempered +C+QT EN 10277-5: 2008					Hot-rolled annealed + Peeled +A+SH				
size		Testing at room temperature (longitudinal)				Testing at room temperature (longitudinal)			
mm		R	Rp 0.2	A%	HB	R	Rp 0.2	A%	HB
from	to	N/mm <sup>2</sup>	N/mm <sup>2</sup> min	min	for inf.	N/mm <sup>2</sup>	N/mm <sup>2</sup> min	min	max
b)	16	1100-1300	900	9	331-380	-	-	-	248
	16	1000-1200	800	10	298-359	-	-	-	248
	40	900-1100	700	12	271-331	-	-	-	248

b) for thickness &lt; 5 mm, mechanical properties can be agreed before order placement

Hot-rolled, quenched and tempered, cold-drawn +QT+C					Hot-rolled annealed + cold-drawn +A+C				
size		Testing at room temperature (longitudinal)				Testing at room temperature (longitudinal)			
mm		R	Rp 0.2	A%	HB	R	Rp 0.2	A%	HB
from	to	N/mm <sup>2</sup>	N/mm <sup>2</sup> min	min		N/mm <sup>2</sup> min	N/mm <sup>2</sup> min	min	max
b)	16	-	-	-	-	-	-	-	311
	16	-	-	-	-	-	-	-	293
	40	-	-	-	-	-	-	-	287

b) for thickness &lt; 5 mm, mechanical properties can be agreed before order placement

**51CrV4 1.8159 Forged quenched and tempered UNI EN 10250-3: 2001**

size		Testing at room temperature						
mm		R	Rp 0.2	A%	A%	Kv +20 °C	Kv +20 °C	HB
from	to	N/mm <sup>2</sup> min	N/mm <sup>2</sup> min	min (L)	min (T)	J min (L)	J min (T)	min
	250/160	800	600	13	9	30	16	240
	250/160 500/330	-	-	-	-	-	-	-

L = longitudinal T = tangential

**EN 10083-3: 2006 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	Symbol
<b>min</b>	57	56	56	55	53	52	50	48	44	41	37	35	34	33	32	<b>H</b>
<b>max</b>	65	65	64	64	63	63	63	62	62	62	61	60	60	59	58	
<b>min</b>	60	59	59	58	56	56	54	53	50	48	45	43	43	42	41	<b>HH</b>
<b>max</b>	65	65	64	64	63	63	63	62	62	62	61	60	60	59	58	
<b>min</b>	57	56	56	55	53	52	50	48	44	41	37	35	34	33	32	<b>HL</b>
<b>max</b>	62	62	61	61	60	59	59	57	56	55	53	52	51	50	49	

EUROPE	ITALY	CHINA	GERMANY	FRANCE	U.K.	RUSSIA	USA
EN	UNI	GB	DIN	AFNOR	B.S.	GOST	AISI/SAE
51CrV4	50CrV4	50CrVA	50CrV4	50CV4	735A50	50HGF	6150