

## Cast iron

**vonRoll**casting

editor:  
vonRoll casting (emmenbrücke) ltd  
rüeggisingerstrasse 2  
ch-6020 emmenbrücke

date of issue: september 2012

## Contents

Ductile cast iron with nodular graphite	4 – 7
Grey cast iron with lamellar graphite	8

# Ductile cast iron with nodular graphite

## Designation according to DIN EN 1563

### Nominal analysis

for moderate wall thickness

C  
Si  
Mn  
Mo  
Ni

### EN-GJS-350-22-LT

3,50 – 3,70  
1,80 – 2,00  
max. 0,2  
–  
–

### EN-GJS-400-18-LT

3,50 – 3,70  
2,30 – 2,60  
max. 0,25  
–  
–

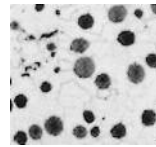
### EN-GJS-400-15

3,50 – 3,70  
2,30 – 2,60  
max. 0,25  
–  
–

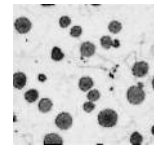
### EN-GJS-450-10

3,20 – 3,50  
2,80 – 3,20  
max. 0,40  
–  
–

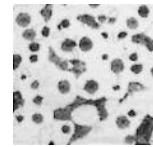
### Microstructure



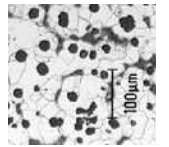
Ferrite 100:1



Ferrite 100:1



Ferrite and pearlite 100:1



Ferrite and pearlite 100:1

### Mechanical properties<sup>1)</sup>

Tensile strength	R <sub>m</sub>	MPa
0,2 % yield strength	R <sub>p0,2</sub>	MPa
Elongation	A <sub>5</sub>	%
Modulus of elasticity	E	GPa
Impact energy <sup>2)</sup>	at +23 °C (RT)	Joule
	at –20 °C (LT)	Joule
	at –40 °C (LT)	Joule
Brinell hardness	HBW	
Unnotched fatigue limit <sup>3)</sup>		MPa
Notched fatigue limit <sup>4)</sup>		MPa

350	400	400	450
220	240	250	310
22	18	15	10
169	169	169	169
17	14	–	–
–	12	–	–
12	–	–	–
< 160	130–175	135–180	160–210
180	195	–	210
114	122	–	128

### Technological properties

Service temperature <sup>5)</sup>	°C
Machinability	
Wear resistance	
Inductive or flame-hardening capacity	
Nitride hardening capacity	
Weldability	

< 500	< 500	< 500	< 500
very good	very good	very good	good
low	low	low	low
low	low	low	low
good	good	good	good
limited weldability, use of special electrodes required			

### Physical properties

Density	ρ	kg/dm <sup>3</sup>
Thermal conductivity	λ at 300 °C	W/(K·m)
Thermal expansion	α up to 400 °C	10 <sup>-6</sup> /K

7,10	7,10	7,10	7,10
36,2	36,2	36,2	36,2
12,5	12,5	12,5	12,5

<sup>1)</sup> Mechanical properties of cast-on test samples (minimum values)

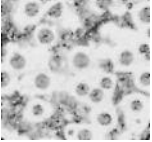
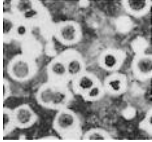
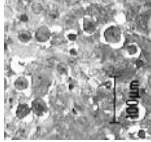
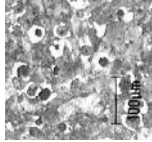
<sup>2)</sup> Mean value resulting from 3 tests with ISO-V-samples (DIN 50115)

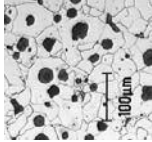
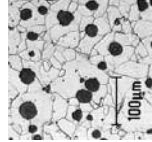
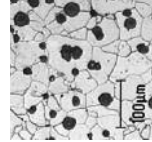
<sup>3)</sup> Wöhler fatigue test with unnotched samples

<sup>4)</sup> Wöhler fatigue test with notched samples

<sup>5)</sup> Data according to technical literature

## Ductile cast iron with nodular graphite

EN-GJS-500-7	EN-GJS-600-3	EN-GJS-700-2	EN-GJS-800-2
3,50 – 3,70	3,50 – 3,70	3,50 – 3,70	3,50 – 3,70
2,30 – 2,60	2,30 – 2,60	2,30 – 2,60	2,30 – 2,60
max. 0,40	max. 0,40	max. 0,40	max. 0,40
–	–	–	–
–	–	–	–
			
Ferrite and pearlite 100:1	Pearlite and Ferrite 100:1	Pearlite and Ferrite 100:1	Pearlite 100:1
500	600	700	800
320	370	420	480
7	3	2	2
169	174	176	176
–	–	–	–
–	–	–	–
–	–	–	–
170 – 230	190 – 270	225 – 305	245 – 335
224	248	280	304
134	149	168	182
< 500	< 500	< 500	< 500
good	good	moderate	moderate
good	good	very good	very good
low	good	very good	very good
good	good	very good	very good
limited weldability, use of special electrodes required			
7,10	7,20	7,20	7,20
35,2	32,5	31,1	31,1
12,5	12,5	12,5	12,5

EN-GJS-450-18	EN-GJS-500-14	EN-GJS-600-10
3,20 – 3,50	3,00 – 3,30	2,80 – 3,10
2,80 – 3,20	3,40 – 3,80	3,90 – 4,30
max. 0,50	max. 0,50	max. 0,50
–	–	–
–	–	–
		
Ferrite 100:1 (Solid solution hardening)	Ferrite 100:1 (Solid solution hardening)	Ferrite 100:1 (Solid solution hardening)
450	500	600
350	400	470
18	14	10
170	170	170
8	3	–
4	3	–
3	2	–
170 – 200	185 – 215	200 – 230
210	225	275
130	140	165
< 500	< 500	< 500
good	good	good
low	low	low
low	low	low
good	good	good
limited weldability, use of special electrodes required		
7,1	7,0	7,0
–	–	–
–	–	–

special materials or not listed grades on request

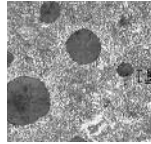
# Ductile cast iron with nodular graphite – high-strength grades

## Designation according to DIN EN 1564

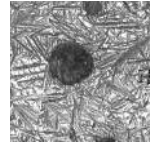
### Nominal analysis

		EN-GJS-800-10	EN-GJS-1050-6	EN-GJS-1200-3
C		3,50 – 3,70	3,50 – 3,70	3,50 – 3,70
for moderate wall thickness	Si	2,30 – 2,60	2,30 – 2,60	2,30 – 2,60
	Mn	max. 0,40	max. 0,40	max. 0,40
	Mo	–	–	–
	Ni	max. 1,0	max. 1,0	max. 1,0

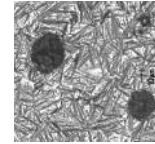
### Microstructure



Austenite and ferrite (ausferrite) 500:1



Austenite and ferrite (ausferrite) 500:1



Austenite and ferrite (ausferrite) 500:1

### Mechanical properties<sup>1)</sup>

			EN-GJS-800-10	EN-GJS-1050-6	EN-GJS-1200-3
Tensile strength	R <sub>m</sub>	MPa	800	1050	1200
0,2 % yield strength	R <sub>p0,2</sub>	MPa	500	700	850
Elongation	A <sub>5</sub>	%	10	6	3
Modulus of elasticity	E	GPa	170	168	167
Impact energy <sup>2)</sup>	at +23 °C (RT)	Joule	10	–	–
Brinell hardness	HBW		250 – 310	320 – 380	340 – 420
Unnotched fatigue limit <sup>3)</sup>		MPa	375	430	450
Notched fatigue limit <sup>4)</sup>		MPa	225	265	280

### Technological properties

		EN-GJS-800-10	EN-GJS-1050-6	EN-GJS-1200-3
Service temperature	°C	< 200	< 200	< 200
Machinability		moderate	moderate	difficult
Wear resistance		very good	very good	very good
Inductive or flame-hardening capacity		neither hardenable nor weldable		
Nitride hardening capacity		neither hardenable nor weldable		
Weldability		neither hardenable nor weldable		

### Physical properties

			EN-GJS-800-10	EN-GJS-1050-6	EN-GJS-1200-3
Density	ρ	kg/dm <sup>3</sup>	7,1	7,1	7,0
Thermal conductivity	λ at 200 °C	W/(K·m)	20 – 23	20 – 23	20 – 23
Thermal expansion	α up to 200 °C	10 <sup>-6</sup> /K	14 – 18	14 – 18	14 – 18

<sup>1)</sup> Mechanical properties of cast-on test samples (minimum values)

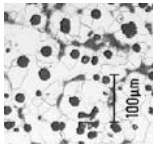
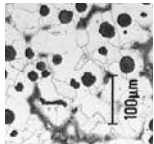
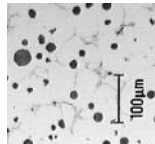
<sup>2)</sup> Mean value resulting from 3 tests with ISO-V-samples (DIN 50115)

<sup>3)</sup> Wöhler fatigue test with unnotched samples

<sup>4)</sup> Wöhler fatigue test with notched samples

special materials or not listed grades on request

## Ductile cast iron with nodular graphite – alloyed grades

Designation according to DIN EN 16124/DIN EN 13835			EN-GJS-SiMo40-6	EN-GJS-SiMo45-10	EN-GJSA-XNiSiCr35-5-2
<b>Nominal analysis</b>					
for moderate wall thickness	C		3,00 – 3,40	3,00 – 3,40	max. 2,00
	Si		3,80 – 4,20	4,30 – 4,70	4,00 – 6,00
	Mn		max. 0,30	max. 0,30	0,50 – 1,50
	Mo		0,5 – 0,70	0,80 – 1,10	–
	Cr		–	–	1,5 – 2,5
	Ni		–	–	34,0 – 36,0
<b>Microstructure</b>					
			Ferrite 100:1	Ferrite 100:1	Austenite 100:1
<b>Mechanical properties<sup>1)</sup></b>					
Tensile strength	R <sub>m</sub>	MPa	480	550	380
0,2 % yield strength	R <sub>p0,2</sub>	MPa	380	460	210
Elongation	A <sub>5</sub>	%	8	5	10
Modulus of elasticity	E	GPa	160 – 180	160 – 180	130 – 150
Brinell hardness	HBW		190 – 240	200 – 250	130 – 170
<b>at 780 °C<sup>2)</sup></b>					
Tensile strength	R <sub>m</sub>	MPa	70	70	130
0,2 % yield strength	R <sub>p0,2</sub>	MPa	35	35	90
Modulus of elasticity	E	GPa	30	30	100
<b>Technological properties</b>					
Service temperature		°C	< 700	< 700	< 900
Machinability			moderate	moderate	good
Wear resistance			good	good	moderate
Inductive or flame-hardening capacity			–	–	–
Nitride hardening capacity			–	–	–
Weldability			limited weldability, use of special electrodes required		
<b>Physical properties</b>					
Density	ρ	kg/dm <sup>3</sup>	6,8 – 7,0	6,8 – 7,0	7,45
Thermal conductivity	λ	W/(K·m)	22 – 26 (at 100 °C) 25 – 30 (at 400 °C)	22 – 26 (at 100 °C) 25 – 30 (at 400 °C)	12,6 (at 100 °C) –
Thermal expansion	α up to 200 °C	10 <sup>-6</sup> /K	11 – 13	11 – 13	12,9

<sup>1)</sup> Mechanical properties of cast-on test samples (minimum values)

<sup>2)</sup> Data according to technical literature

**special materials or not listed grades on request**

# Grey iron with lamellar graphite

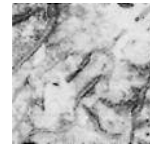
## Designation according to DIN EN 1561

<b>Nominal analysis</b>	C
for moderate wall thickness	Si
	Mn

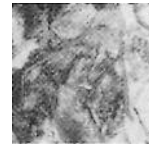
## Microstructure

EN-GJL-150	EN-GJL-200	EN-GJL-250	EN-GJL-300
------------	------------	------------	------------

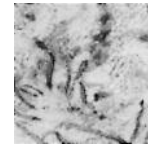
3,40 – 3,60	3,20 – 3,40	2,90 – 3,10	2,90 – 3,10
2,30 – 2,60	2,00 – 2,40	1,80 – 2,10	1,60 – 1,90
0,60 – 0,90	0,70 – 1,00	0,80 – 1,10	0,80 – 1,10



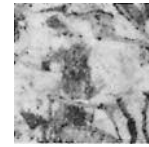
Coarse pearlite  
100:1



Coarse pearlite  
100:1



Fine pearlite  
100:1



Fine pearlite  
100:1

## Mechanical properties<sup>1)</sup>

Tensile strength	R <sub>m</sub>	MPa		150 – 250	200 – 300	250 – 350	300 – 400
– dependent on wall thickness	R <sub>m</sub>	MPa	2,5 – 50 mm	150	200	–	–
			5 – 50 mm	–	–	250	–
			10 – 50 mm	–	–	–	300
			50 – 100 mm	130	180	220	260
			100 – 200 mm	110	160	200	240
0,1 % yield strength	R <sub>p0,1</sub>	MPa		98 – 165	130 – 195	165 – 228	195 – 260
Elongation	A	%		0,8 – 0,3	0,8 – 0,3	0,8 – 0,3	0,8 – 0,3
Modulus of elasticity	E	GPa		78 – 103	88 – 113	103 – 118	108 – 137
Bending fatigue strength		MPa		0,46 × R <sub>m</sub>	0,46 × R <sub>m</sub>	0,46 × R <sub>m</sub>	0,46 × R <sub>m</sub>
Tension-compression fatigue strength		MPa		0,34 × R <sub>m</sub>	0,34 × R <sub>m</sub>	0,34 × R <sub>m</sub>	0,34 × R <sub>m</sub>
Hardness/material designation				EN-GJL-HB175	EN-GJL-HB195	EN-GJL-HB215	EN-GJL-HB235
– dependent on wall thickness	HBW		2,5 – 50 mm	115 – 175	–	–	–
			5 – 50 mm	–	135 – 195	155 – 215	–
			10 – 50 mm	–	–	–	175 – 235
			50 – 100 mm	105 – 165	125 – 185	145 – 205	160 – 220

## Technological properties

Machinability	very good	very good	very good	very good
Wear resistance	moderate	good	very good	very good
Inductive or flame-hardening capacity	poor	low	good	very good
Nitride hardening capacity	good	good	good	very good
Damping capacity	very good	very good	very good	very good
Weldability	limited weldability, use of special electrodes required			

## Physical properties

Density	ρ	kg/dm <sup>3</sup>	7,10	7,15	7,20	7,25
Thermal conductivity	λ at 300 °C	W/(K·m)	50,0	48,0	46,5	45,0
Thermal expansion	α up to 400 °C	10 <sup>-6</sup> /K	13,0	13,0	13,0	13,0

<sup>1)</sup> Mechanical properties of cast-on test samples with diameter 30 mm (minimum values)

special materials or not listed grades on request





Visit us at  
www.vonroll-casting.ch

or contact us at

vonRoll casting (emmenbrücke) ltd  
rüeggisingerstrasse 2  
ch-6020 emmenbrücke  
info@vonroll-casting.ch  
phone +41 41 269 34 19  
fax +41 41 269 31 39

vonRoll casting (rondez) ltd  
rondez 17  
ch-2800 delémont  
info-rondez@vonroll-casting.ch  
phone +41 32 421 78 10  
fax +41 32 421 77 75

## Our business units



Certifications:  
ISO 9001  
ISO/TS 16949  
ISO 14001  
TÜV DGR 97/23/EG  
TÜV AD-2000  
Deutsche Bahn AG  
Germanischer Lloyd

We will be happy to welcome you in one of our foundries and are looking forward to working together with you.  
vonRoll casting – engineered casting solutions

# **vonRoll**casting

**vonRoll casting (emmenbrücke) ltd**  
rüeggisingerstrasse 2  
ch-6020 emmenbrücke  
tel. +41 41 269 34 19  
fax +41 41 269 31 39  
www.vonroll-casting.ch