

Vermicular Irons														
chemical analysis										mechanical analysis				
	C	Si	Mn	P	S	Mo	Ni	Ti	Mg	Fe	tensile strength (N/mm <sup>2</sup> ) minimum	0.2% proof stress (N/mm <sup>2</sup> ) minimum	elongation (%)	hardness (HBW) 10/3000
GJV-SiMo4.1	3 to 3.6	4.3 to 4.7	max 0.3	max 0.05	max 0.02	0.5 to 0.7	max 0.6	max 0.2	(0.05*)	balance	min 520	min 450	min 2	200 to 250
GJV-SiMoNi5-1-1	2.8 to 3.4	4.6 to 5.0	max 0.3	max 0.07	max 0.02	0.6 to 0.08	0.5 to 0.7	max 0.2	(0.05*)	balance	min 520	min 420	min 1	210 to 260

\* may deviate if microstructure is according to standard

BS EN 1564: 1997 Austempered Ductile Iron (ADI)					
Material Designation		Tensile Strength (N/mm <sup>2</sup> ) minimum	0.2% Proof Stress (N/mm <sup>2</sup> ) minimum	Elongation (%)	Brinell Hardness (HB)
symbol	number				
EN-GJS-800-8	EN-JS-1100	800	500	8	260 to 320
EN-GJS-1000-5	EN-JS-1110	1000	700	5	300 to 360
EN-GJS-1200-2	EN-JS-1120	1200	850	2	340 to 440
EN-GJS-1400-1	EN-JS-1130	1400	1100	1	380 to 480

International Specifications Equivalent to EN 1563:1997								
Mechanical properties as measured on separately cast test bars.								
Material Designation EN 1563								
symbol	number	UK BS 2789 1985	Germany DIN 1693 1973	Netherlands NEN 6002-D 1966	Italy UNI 4544 1979	Sweden SS 1407 1981	USA ASTM A536 1993	international ISO 1083 1987
EN-GJS 350-22	EN JS1010	350-22						350-22
EN-GJS 350-22LT	EN JS1015	350-22L40	GGG 35.3	GN 38	GS 370-17	17-15		350-22L
EN-GJS 400-18	EN JS1020	400-18		GN 42			60-40-18	400-18
EN-GJS 400-18LT	EN JS1025	100-18L20	GGG 40.3			17-Feb		400-18L
EN-GJS 400-15	EN JS1030	420-12	GGG 40		GS 400-12	17-00	65-45-12	400-15
EN-GJS 450-10	EN JS1040	450-10					70-50-05	450-10
EN-GJS 500-7	EN JS1050	500-7	GGG 50	GN50	GS 500-7	27-Feb	80-55-06	500-7
EN-GJS 600-3	EN JS1060	600-3	GGG 60	GN60	GS 600-3	32-03	100-70-03	600-3
EN-GJS 700-2	EN JS1070	700-2	GGG 70	GN70	GS 700-2	37-01		700-2
EN-GJS 800-2	EN JS1080	800-2	GGG 80	GN80	GS 800-2		120-90-02	800-2
EN-GJS 900-2	EN JS1090	900-2						900-2

High Silicon Molybdenum Irons									
Vanguard designation	chemical analysis						mechanical analysis		
	C %	Si %	Mn %	S %	Mo %	Mg %	tensile strength (N/mm <sup>2</sup> ) minimum	0.2% proof stress (N/mm <sup>2</sup> ) minimum	elongation (%)
0.5 to 0.7 Si-Mo	3 to 3.4	3.8 to 4.2	0.4 max	0.15 max	0.5 to 0.7	0.03 to 0.08	460	310	8
0.7 to 1.25 Si-Mo	3.2 to 3.8	4.0 to 5.0	0.4 max	0.15 max	0.7 to 1.25	0.03 to 0.08	550	480	5

notes:

- The above internal specifications were created to accommodate the slight variations in customer to customer requirements.
- On the very infrequent occasions that the customer's specification falls outside this range Vanguard's versatility means that most variations can be produced.
- Typically these materials will be subject to a ferritising heat-treatment (anneal).

BS 3468 1986 Austenitic Iron Specifications														
Chemical and mechanical properties.														
Type	Grade	C (max) %	Si %	Mn %	Ni %	Cu %	Cr %	Nb %	P %	Mg %	Tensile Strength (N/mm <sup>2</sup> ) minimum	0.2% Proof Stress (N/mm <sup>2</sup> ) minimum	Elongation (%)	Charpy impact strength (min) J at 20±5°C
Spheroidal Graphite	S2	3	1.5 to 2.8	0.5 to 1.5	18.0 to 22.0	0.5 max	1.5 to 2.5		0.8		370	210	7	
	S2W	3	1.5 to 2.2	0.5 to 1.5	18.0 to 22.0	0.5 max	1.5 to 2.5	0.2 to 1.2	0.8	0.06 max	370	210	7	
	S2B	3	1.5 to 2.8	0.5 to 1.5	18.0 to 22.0	0.5 max	2.5 to 3.5		0.8		370	210	7	4
	S2C	3	1.5 to 2.8	0.5 to 2.5	21.0 to 24.0	0.5 max	0.5 max		0.8		370	170	20	20
	S2M	3	1.5 to 2.5	4.0 to 4.5	21.0 to 24.0	0.5 max	0.2 max		0.8		420	200	25	15
	S3	2.5	1.5 to 2.8	0.5 to 1.5	28.0 to 32.0	0.5 max	2.5 to 3.5		0.8		370	210	7	
	S5S	2.2	4.8 to 5.4	1.0 max	34.0 to 36.0	0.5 max	1.5 to 2.5		0.8		370	210	7	
	S6	3	1.5 to 2.8	6.0 to 7.0	12.0 to 14.0	0.5 max	0.2 max		0.8		390	200	15	

notes:  
1 N/mm<sup>2</sup> = 1 Mpa  
Flake graphite specifications are shown for interest only. Vanguard Foundry only produce the spheroidal graphite grades.

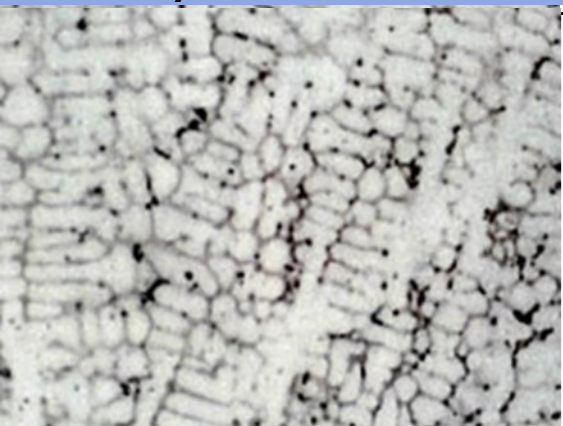
EN 1563 Ductile Iron Specifications				
Mechanical properties as measured on separately cast test bars.				
Material Designation		Tensile Strength (N/mm <sup>2</sup> ) minimum	0.2% Proof Stress (N/mm <sup>2</sup> ) minimum	Elongation (%)
symbol	number			
EN-GJS 350-22	EN JS1010	350	220	22
EN-GJS 350-22LT	EN JS1015	350	220	22
EN-GJS 400-18	EN JS1020	400	250	18
EN-GJS 400-18LT	EN JS1025	400	240	18
EN-GJS 400-15	EN JS1030	400	250	15
EN-GJS 450-10	EN JS1040	450	310	10
EN-GJS 500-7	EN JS1050	500	320	7
EN-GJS 600-3	EN JS1060	600	370	3
EN-GJS 700-2	EN JS1070	700	420	2
EN-GJS 800-2	EN JS1080	800	480	2
EN-GJS 900-2	EN JS1090	900	600	2

notes:  
LT = low temperature  
1 N/mm<sup>2</sup> = 1 Mpa

ASTM 897M-03 Austempered Ductile Iron (ADI)				
grade	Tensile Strength (N/mm <sup>2</sup> ) minimum	0.2% Proof Stress (N/mm <sup>2</sup> ) minimum	Elongation (%)	Brinell Hardness (HB)
1	900	650	9	269 to 341
2	1050	750	7	302 to 375
3	1200	850	4	341 to 444
4	1400	1100	2	388 to 477
5	1600	1300	1	402 to 512

Vanguard Stainless Steel Chemical Specification													
	C	Cr	Ni	Si	Mn	Co	Nb	W	Mo	Cu	V	P	S
CrNiSiNb 22-10	0.3-0.5	21-23	9.5-10.5	1-2.5	2 max	1 max	0.5-0.7	0.6 max	0.5 max	0.25 max	0.12 max	0.04 max	0.03 max
<b>1</b>	0.45	21.5	10	1.5			0.55						
CrNiSiNb 25-13	0.3-0.5	24-27	12-14.0	0.8-1.5	2 max	1 max	0.5-1.7	0.6 max	0.5 max	0.25 max	0.12 max	0.04 max	0.03 max
<b>2</b>	0.45	25	12.5	1.3			0.55						
CrNiSi 25-20 1.4848	0.3-0.5	24-27	19-22	1-2.5	2 max	1 max	0	0.6 max	0.5 max	0.25 max	0.12 max	0.04 max	0.03 max
<b>3</b>	0.45	25	19.5	1.5									
NiCrSiNb 38-19 1.4849	0.3-0.5	18-22	36-39	1-2.5	2 max	1 max	1.5 to 2.5	0.6 max	0.5 max	0.25 max	0.12 max	0.04 max	0.03 max
<b>4</b>	0.45	19	36.5	1.5			1.4						

Tensile Strengths				
	Tensile Strengths (Mpa)	Yield Strengths (Mpa)	Elongation %	BHN
CrNiSiNb 22-10				
<b>1</b>	470	240	4	170-230
CrNiSiNb 25-13				
<b>2</b>	460	230	2	150-220
CrNiSi 25-20 1.4848				
<b>3</b>	450	220	8	150-220
NiCrSiNb 38-19 1.4849				
<b>4</b>	450	220	4	150-220

Micro Analysis	
	Essentially austenitic basic matrix with interdentritic complex carbides
	Max % carbides 20%, finely distributed
	Constant structure over all areas
	Sigma phases < 2.5%
	Grain size 3 to 6 according to ISO 643
