Comparison - Equivalent Grades of Grey Iron, Ductile Iron, SG Iron & Nodular Graphite Iron

This is a comparison table for the grey iron and ductile iron grades of various standards showing equivalents, including AS, EN, BS, ISO, ASTM, DIN, JIS, UNI, NF, IS, UNF, NBN, AS, SS, NS.

Country	Standard	Comparison - Equivalent Grades of Grey Iron (Grey Cast Iron)								
ISO (2004)	ISO 185/JL/	100	150	200	225	250	275	300	350	-
Australia (2007)	AS 1830	100	150	200	225	250	275	300	350	400
USA[a]	ASTM A48[a]	-	150 (No. 20/25)	200 (No. 30)		250 (No. 35)		300 (No. 45)	350 (No. 50)	400 (No. 55/60)
	ASTM A126[a]	-	CLASS A	CLASS B				CLASS C		
Germany Austria	DIN 1691	GG10	GG15	GG20		GG25		GG30	GG35	GG40
European	EN 1561	EN-GJL-100	EN-GJL-150	EN-GJL-200/225		EN-GJL-250		EN-GJL-300	EN-GJL-350	
China	GB 9439	HT100	HT150	HT200		HT250		HT300	HT350	-
Japan	JIS G5501	FC100	FC150	FC200		FC250		FC300	FC350	-
Italy	UNI 5007	G10	G15	G20		G25		G30	G35	-
France	NG A32-101	-	FGL150	FGL200		FGL250		FGL300	FGL350	FGL400
UK[b]	BS 1452[b]	100	150	200		250		300	350	-
India	IS 210	-	FG150	FG200		FG260		FG300	FG350	FG400
Spain	UNF	-	FG15	FG20		FG25		FG30	FG35	-
Belgium	NBN 830-01	FGG10	FGG15	FGG20		FGG25		FGG30	FGG35	FGG40
Sweden	SS 14 01	O110	O115	O120		O125		O130	O135	O140
Norway	NS11 100	SJG100	SJG150	SJG200		SJG250		SJG300	SJG350	-
SAE[c]	J431[c]	-	G9H12	G10H18	G10H21 G11H18	G11H20	G12H21 G13H19	G13H22	G13H24	-

[a] ASTM A126 is used for valves, flanges & fittings. ASTM A48 is for general engineering use.
[b] Superseded by BS EN 1561 see EN 1561 above.
[c] Because SAE specified grey cast-iron grades by a combination of minimum test-bar tensile-strength-to-hardness ratio and minimum casting hardness, SAE J431 grades, in addition to those shown, may also be produced to meet a grade specified only by tensile strength. Because SAE hardness grades specify minimum casting hardness, a direct correlation between SAE J431 and ISO 185 hardness grades is not possible; the table above shows SAE grades which have minimum hardness values approximately the same as ISO grades. Because ISO 185:1988 hardness grades did not differentiate between expected values for different relevant wall thickness, it is possible that more than one of the previous ISO hardness grades may satisfy the requirements of the current grades.

Country	Standard	Comparison - Equivalent Grades of Ductile Iron (SG Iron, Nodular Graphite Iron)								
ISO	ISO 1083/JS/	400-15/S	400-18/S	450-10/S	500-7/S	500-10/S	600-3/S	700-2/S	800-2/S	900-2/S
Australia (2007)	AS 1831	400-15	400-18	450-10	500-7		600-3	700-2	800-2	900-2
USA	ASTM A395		60-40-18							
	ASTM A536			60-42-10/ 65-45-12	70-50-05		80-60-03/ 80-55-06	100-70-03	120-90-02	-
Germany Austria	DIN 1693	GGG40		-	GGG50		GGG60	GGG70	GGG80	-
European	EN 1563	EN-GJS-400-15	EN-GJS-400-18	EN-GJS-450-10	EN-GJS-500-7		EN-GJS-600-3	EN-GJS-700-2	EN-GJS-800-2	EN-GJS-900-2
China	GB 1348		QT400-18	QT450-10	QT500-7		QT600-3	QT700-2	QT800-2	QT900-2
Japan	JIS G5502	FCD400		FCD450	FCD500		FCD600	FCD700	FCD800	-
Italy	UNI 4544	GS370-17		GS400-12	GS500-7		GS600-2	GS700-2	GS800-2	-
France	NF A32-201	FGS370-17		FGS400-12	FGS500-7		FGS600-2	FGS700-2	FGS800-2	-
UK	BS 2789[d]	400/17		420/12	500/7		600/7	700/2	800/2	900/2
India	IS 1865	SG370/17		SG400/12	SG500/7		SG600/3	SG700/2	SG800/2	-
Spain	UNF	FGE38-17		FGE42-12	FGE50-7		FGE60-2	FGE70-2	FGE80-2	-
Belgium	NBN 830-02	FNG38-17		FNG42-12	FNG50-7		FNG60-2	FNG70-2	FNG80-2	-
Sweden	SS 14 07	0717-02		-	0727-02	SS 140725	0732-03	0737-01	0864-03	-
Norway	NS11 301	SJK-400.3 SJK-400		-	SJK-500		SJK-600	SJK-700	SJK-800	

[d] Superceded by BS EN 1563 see EN 1563 above.

AS 1831/ISO 1083 Ductile Iron Typical Properties

Material designation	Tensile strength R_m N/mm² min.	0,2 % proof stress $R_{p0,2}$ N/mm² min.	Elongation A % min.
ISO1083/JS/350-22-LT/S[a]	350	220	22
ISO1083/JS/350-22-RT/S[b]	350	220	22
ISO1083/JS/350-22/S	350	220	22
ISO1083/JS/400-18-LT/S[a]	400	240	18
ISO1083/JS/400-18-RT/S[b]	400	250	18
ISO1083/JS/400-18/S	400	250	18
ISO1083/JS/400-15/S	400	250	15
ISO1083/JS/450-10/S	450	310	10
ISO1083/JS/500-7/S	500	320	7
ISO1083/JS/550-5/S	550	350	5
ISO1083/JS/600-3/S	600	370	3
ISO1083/JS/700-2/S	700	420	2
ISO1083/JS/800-2/S	800	480	2
ISO1083/JS/900-2/S	900	600	2

NOTE 1 The values for these materials apply to castings cast in sand moulds of comparable thermal behaviour. Subject to amendments to be agreed upon in the order, they can apply to castings obtained by alternative methods.

NOTE 2 Whatever the method used for obtaining the castings, the grades are based on the mechanical properties measured on test pieces machined from samples separately cast in a sand mould or a mould of comparable thermal behaviour.

NOTE 3 The mechanical properties of the materials refer to separately cast samples produced in accordance with Figures 1, 2 or 3.

NOTE 4 Elongation values are determined from $L_0 = 5\,d$. For other gauge lengths, see 9.1 and Annex B.

NOTE 5 1 N/mm² = 1 MPa.

[a] LT for low temperature (– 20 °C or – 40 °C).

[b] RT for room temperature (23 °C).

AS 1831/ISO 1083 Ductile Iron Typical Properties

Characteristic	Unit	Material designation									
		ISO1083/ JS/350-22	ISO1083/ JS/400-18	ISO1083/ JS/450-10	ISO1083/ JS/500-7	ISO1083/ JS/550-5	ISO1083/ JS/600-3	ISO1083/ JS/700-2	ISO1083 /JS/800-2	ISO1083/ JS/900-2	ISO1083/ JS/500-10
Shear strength	N/mm²	315	360	405	450	500	540	630	720	810	nd[b]
Torsional strength	N/mm²	315	360	405	450	500	540	630	720	810	nd[b]
Modulus of elasticity E (tension and compression)	GN/m²	169	169	169	169	172	174	176	176	176	170
Poisson's ratio ν	—	0,275	0,275	0,275	0,275	0,275	0,275	0,275	0,275	0,275	0,28 to 0,29
Fatigue limit (Wöhler)[c] (rotating bending) unnotched[d] (ϕ 10,6 mm)	N/mm²	180	195	210	224	236	248	280	304	304	225
Fatigue limit (Wöhler)[c] (rotating bending) notched[e] (ϕ 10,6 mm)	N/mm²	114	122	128	134	142	149	168	182	182	140
Compression strength	N/mm²	—	700	700	800	840	870	1 000	1 150	—	nd[b]
Fracture toughness K_{IC}	MPa·$\sqrt{m}$	31	30	28	25	22	20	15	14	14	28
Thermal conductivity at 300 °C	W/(K·m)	36,2	36,2	36,2	35,2	34	32,5	31,1	31,1	31,1	nd[b]
Specific heat capacity 20 °C to 500 °C	J/(kg·K)	515	515	515	515	515	515	515	515	515	nd[b]
Linear expansion coefficient 20 °C to 400 °C	µm/(m·K)	12,5	12,5	12,5	12,5	12,5	12,5	12,5	12,5	12,5	nd[b]
Density	kg/dm³	7,1	7,1	7,1	7,1	7,1	7,2	7,2	7,2	7,2	7,1
Maximum permeability	µH/m	2 136	2 136	2 136	1 596	1 200	866	501	501	501	nd[b]
Hysteresis loss (B = 1T)	J/m³	600	600	600	1 345	1 800	2 248	2 700	2 700	2 700	nd[b]
Resistivity	µΩ·m	0,50	0,50	0,50	0,51	0,52	0,53	0,54	0,54	0,54	nd[b]
Predominant structure		ferrite	ferrite	ferrite	ferrite-pearlite	ferrite-pearlite	pearlite-ferrite	pearlite	pearlite or tempered martensite	tempered martensite[f, g]	ferrite

NOTE 1 The notched test pieces are illustrated in [6] and [7], see bibliography.

NOTE 2 1 N/mm² = 1 MPa.

NOTE 3 Unless otherwise specified, the values given in this Table come from measurements at room temperature.

[a] For details, see [5].

[b] Not determined.

[c] Fatigue limit test pieces.

[d] Unnotched – In annealed ferritic spheroidal graphite cast iron the fatigue limit is about 0,5 × tensile strength in spheroidal graphite cast iron with a tensile strength of 370 N/mm². The ratio decreases with increase in tensile strength until, in pearlitic and quenched and tempered spheroidal graphite cast iron, the fatigue limit is approximately 0,4 × tensile strength. The ratio decreases further when tensile strength exceeds 740 N/mm².

[e] Notched – For a test piece of 10,6 mm diameter at notch with a circumferential 45° V-notch having a radius of 0,25 mm, the fatigue limit of annealed spheroidal graphite cast iron decreases to a value of about 0,63 × fatigue limit of unnotched test pieces in spheroidal graphite cast iron with a tensile strength of 370 N/mm². This figure decreases as the tensile strength of a ferritic spheroidal graphite cast iron increases. In spheroidal graphite cast iron with intermediate strengths and in pearlitic spheroidal graphite cast iron and quenched and tempered spheroidal graphite cast iron, the fatigue limit of notched test pieces is approximately 0,6 × the fatigue limit of unnotched test pieces.

[f] For large castings, it can also be pearlite.

[g] Or bainite-ausferrite

Global Supply Line stocks a large range of cast iron & ductile iron valves including: -

- Ball valves - soft seat
- Swing check valves - metal & soft seat
- Gate valves - metal seat
- Globe valves - metal seat
- Style N & NX Check valves - NBR/Buna seat
- Style KB & A straight through and Weir Diaphragm valves
- Dual flap wafer check valves - metal & soft seat

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Design

MSS SP-701-1, MSS SP-128, MSS SP-85, API 594, AS 3574, AS 2038, AS 2638.1, BSEN 1171 (BS5163), BSEN 13789 (BS5152).

Types

Gate: - Inside screw & yoke, solid wedge, bolted bonnet, non-rising stem, rising stem outside screw, Swing check, Globe.

Flanging/Pressure Class

ANSI B16.1 125LB, 150LB, 250LB
ANSI B16.42, 150LB, 250LB
AS 2129 Table D, E, F, H
AS 4087 PN14, PN16, PN21, PN35
AS 4331.1 PN10, PN16
EN 1092-2, PN10, PN16
ISO 7005-1, PN10, PN16

Face to Face Dimensions

EN 1171 (BS 5163), ASME B16.10, AS 2638.1, EN 558-1, MSS SP-70

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