Clarksville Foundry, Inc.

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Summary of Technical Specifications

This document presents a non-exhaustive summary of some materials that Clarksville Foundry commonly produces. We can cross-reference the listed ASTM specifications to other specifying bodies such as DIN, JIS, SAE, etc. upon request. Clarksville Foundry also specializes in producing materials to custom and/or proprietary specifications. All summaries of different types of iron presented are general rules of thumb, but not universally true. Physical properties can be altered dramatically by various heat treatments and/or the addition of selected alloying elements. For more information, contact us today.

Gray Iron Specifications

	Grade G2000	Grade G2500	Grade G3000	Grade G3500	Grade G4000
Tensile Strength Minimum (PSI)	20,000	25,000	30,000	35,000	40,000
Brinell Hardness Range	187 Max	170-229	187-241	207-255	217-269
Micro-Structure	Large randomly oriented carbon flakes in ferritic matrix	Large randomly oriented carbon flakes in ferritic matrix	Medium length randomly oriented carbon flakes in ferritic/pearlitic matrix	Short to medium length randomly oriented carbon flakes in mostly pearlitic matrix	Short to medium length carbon flakes in pearlitic matrix. Some carbides in thin sections
ASTM Specifications	A48, A126, A159	A48, A159, A319	A48, A126, A159, A319	A48, A159, A319	A48, A126, A159, A278

Gray irons tend to be brittle, and depending on the grade can offer superior vibration-dampening properties, easy machinibility and resistance to thermal shock. Many grades of gray iron respond readily to heat treatment to produce a wide range of physical properties. Some typical applications of various grades of gray iron include: municipal castings, high-temperature pressure-containing vessels, machine parts, gear cases, pumps, valves and pistons.

Ductile Iron Specifications

	Grade 60-40-18	Grade 65-45-12	Grade 80-55-06	Grade 100-70-03	Grade 120-90-02
Tensile Strength Minimum (PSI)	60,000	65,000	80,000	100,000	120,000
Yield Strength Minimum (PSI)	40,000	45,000	55,000	70,000	90,000
Elongation in 2", Minimum (%)	18	12	6	3	2
Brinell Hardness Range	143-187	156-217	187-255	241-302	As specified
Micro-Structure	Graphite spheroids in ferritic matrix	Graphite spheroids in mostly ferritic matrix	Graphite spheroids in mostly pearlitic matrix	Graphite spheroids in pearlitic matrix	Tempered martensite
ASTM Specifications	A395, A536	A536	A536	A536	A536

Ductile irons, depending on the grade, can offer the following properties: easy machinibility, resistance to catastrophic impact failure and crack propagation, good lubricity, wear resistance and substantial elongation. Some typical applications of various grades of ductile iron include: machine parts, gear and pump cases, impellers and transmission components.

Austenitic Gray and Ductile Iron (Ni-Resist) Specifications

	Grade N4361	Grade N4362b	Grade N4392D	Grade N4393D	Grade N4395D
Tensile Strength Minimum (PSI)	25,000	30,000	58,000	55,000	58,000
Yield Strength Minimum (PSI)	N/A	N/A	30,000	30,000	30,000
Elongation in 2", Minimum (%)	N/A	N/A	8	6	8
Brinell Hardness Range	131-212	171-248	139-202	139-202	139-202
Micro-Structure	Uniformly distributed graphite flakes with some carbides in austenitic matrix	Uniformly distributed graphite flakes with some carbides in austenitic matrix	Uniformly distributed graphite spheroids in austenitic matrix	Uniformly distributed graphite spheroids in austenitic matrix	Uniformly distributed graphite spheroids in austenitic matrix
ASTM Specifications	A436 Type 1	A436 Type 2b	A439 Type D-2	A439 Type D-3	A439 Type D-5

Depending on the grade, Ni-Resist irons can be resistant to corrosion, heat or wear. Some grades are readily machinable, and all are non-magnetic. Some common applications of various grades of Ni-Resist irons are valves, pump cases and impellers for corrosive applications.

White Iron Specifications

	Grade W5321	Grade W5321b	Grade W5321d	Grade W5322b	Grade W5322d	Grade W5323
Brinell Hardness (approximate)	600	600	550	450	450	450
Micro-Structure	"White" iron, essentially carbidic	"White" iron, essentially carbidic	"White" iron, essentially carbidic	"White" iron, essentially carbidic	"White" iron, essentially carbidic	"White" iron, essentially carbidic
ASTM Specifications	A532 Class I Type A (Ni-Cr-Hc)	A532 Class I Type B (Ni-Cr-Lc)	A532 Class I Type D (Ni-HiCr)	A532 Class II Type B (15% Cr-Mo)	A532 Class II Type D (20% Cr-Mo)	A532 Class III Type A (25% Cr)

White iron, also known as "hard iron" or "Ni-Hard," is an abrasion-resistant iron. White irons are typically specified by their hardness, and as such, tensile strength is not usually a limiting factor in their industrial use. White irons are virtually non-machinable, brittle on impact, and do not tolerate rapid thermal cycling well. They are commonly used in high-wear applications, such as: crusher parts, wear plates, mining machinery, milling machinery and earth-handling equipment.

Austempered Ductile Iron (ADI) Specifications

We can produce the base material for any grade of ADI under ASTM specification A897. While we do not do any austempering in-house, we work closely with a number of heat treating facilities to ensure that the requested end-product reaches the customer. The physical properties of ADI are determined both by the chemistry of the base material and by carefully controlled variations of the two-part austempering heat treatment required to produce ADI. Those properties include high strength, wear resistance, work-hardenability, and depending on the grade specified, substantial elongation. ADI can offer many of the advantages of steel castings or fabrications, such as high tensile and yield strength, while still maintaining the high elongation and ease of castability characteristic of ductile iron. ADI can also offer superior wear-resistance as compared to other materials of equivalent hardness.

For more information on gray vs. ductile irons, visit http://clarksvillefoundry.com/links/technical/ for technical resources.

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