

WILLMAN INDUSTRIES INC

Casting Facts

DUCTILE IRON

There are many grades of ductile iron, and several specifying bodies within the U.S.A. The most commonly used are those written by A.S.T.M. and frequently these are used as base references by other specifying bodies or casting consumers.

Amongst all the specification written, the two most common for ductile iron are A.S.T.M. 395 and A.S.T.M. 536; and of these two, 536 is referenced the most. Within A.S.T.M. 536 are five grades which are shown in the table below:

Grade	60-40-18	65-45-12	80-55-06	100-70-03	120-90-02
Tensile Min. p.s.i.	60,000	65,000	80,000	100,000	120,000
Yield Min. p.s.i.	40,000	45,000	55,000	70,000	90,000
Elongation % Min.	18%	12%	6%	3%	2%

Of these five grades 60-40-18 and 80-55-06 are overwhelmingly specified the most. Grade A.S.T.M. 395 is in fact a variation of the 60-40-18 grade from A.S.T.M. 535 and it is designed for low temperature service. It is Willman Industries standard practice to meet the requirements of both 395 and 536 at the same time, and so both grades are considered as the same, for the sake of statistical review. The following table shows the typical results achieved by Willman Industries. At the time of writing the "Typical Willman" results were based on the last twelve months test bar results, without exception.

	Tensile	Yield	Elongation	Specification
Specification	60,000	40,000	18%	60-40-18
Typical Willman	69,000	46,000	22%	
Specification	65,000	45,000	12%	65-45-12
Typical Willman	72,400	47,600	19%	
Specification	80,000	55,000	6%	80-55-06
Typical Willman	97,800	60,000	11%	
Specification	120,000	90,000	2%	
Typical Willman	Up to 150,000 p.s.i. Tensile, per Actual Requirements			

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Casting Facts (cont'd)

Apart from the austempered grades which are covered by a separate Willman fact sheet, there are two other grades of ductile which are becoming more popular, and these are A.S.T.M. 874 designed for heavy sections, and the German specification G.G.G. 40.3. designed for low temperature service.

The A.S.T.M. specification places limits on chemical analyses and requires test bars to be taken from the casting. Although not clearly stated, this can also mean cast-on attached bars of unspecified shape and size and location as long as they form a part of the casting. As a result of these restrictions, the minimum required mechanical tensile values are much lower than typically required by the general ductile iron specifications, and are shown below.

Specification	U.T.S p.s.i.	Yield p.s.i.	% Elongation
A.S.T.M. 874	45,000	30,000	12

The German G.G.G. 40.3 specification does not mandate chemical analyses and gives the option of either cast on test bars or separately cast test coupons whose dimensions are specified and related to the casting sections. The mechanical test bar values are shown in the table below. Also, Charpy values at room temperature and -20°C, are called out as well.

G.G.G.40.3	U.T.S.p.s.i.	Yield.p.s.i.	Elongation %	Impact ave.3 specimens	Impact min individual
Separate coupon	58,000	36,250	18%	14 ft.lbs 20° C 10.4ft.lbs-20C	12 ft.lbs20° C 8.2ft.lbs-20°C
Attached 1.5"	56,550	36,250	15%	10.4ft.lbs-20C	8.2ft.lbs-20°C
Attached 2.75"	53,650	34,800	12%	9.0ft.lbs-20°C	6.7ft.lbs-20° C

These more stringent requirements add substantially to the difficulty and cost of processing these grades of ductile and so they are prudently selected only when the castings are to be exposed in critical applications to sub zero temperatures. If you have any questions about these grades or any other grades of ductile, contact your Willman representative or call our engineering staff at the address below.

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