

## ASTM A48 Gray Iron Grades

Cast iron properties are controlled by four major foundry variables:

- Base chemistry
- Inoculation
- Rate of solidification
- Rate of cooling

Any one of the four variables can significantly affect mechanical properties, especially tensile strength in gray or ductile iron castings. Castings that solidify and cool at different rates will have different mechanical properties even if the base chemistry and inoculation are the same. Large section castings have longer solidification rates than small section castings therefore the base chemistry and inoculation practices require adjustment by the foundry to control mechanical properties in different size castings. Individual castings with different section thickness will have variations in mechanical properties within the same part.

## ASTM A48

ASTM A48 is the most popular gray iron casting specification and classifies castings to various grades by their tensile strength. In order to standardize solidification and cooling rate, standard test specimen sizes are used to ensure conformance to the specification. The minimum required tensile strength in a separate cast test bar is established for each of the grades. The tensile strength in the separate cast test bar is intended to provide some degree of measure of consistency between different production lots or between different foundries pouring the same part. It is not intended to represent the tensile strength in the casting poured from the same iron. Specific wording to this effect is in the ASTM A48 standard.

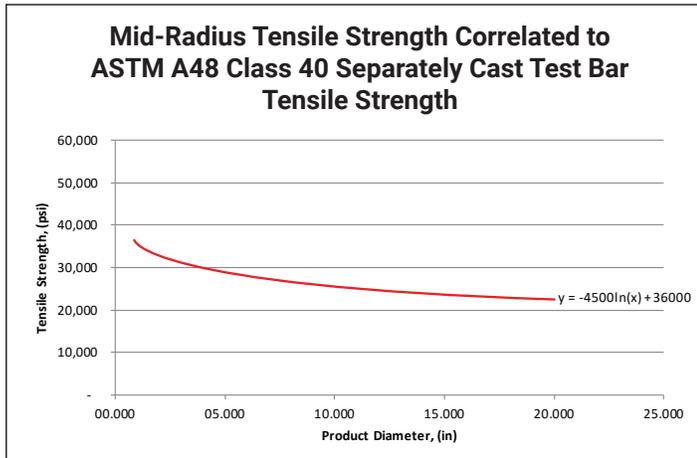
The specification also states that when the relationship between tensile strength in the separate cast test coupon and the actual casting is important, it can be established through experimentation.

## Dura-Bar G2

Dura-Bar G2 microstructure in the center area will contain Type VII, A, size 4-6 graphite as defined in ASTM A247. It is developed to correspond with ASTM A48 class 40 castings. Continuous cast bar size ranges from 0.750" to 20.00" in diameter. Tensile strength decreases with increasing bar diameters because of the difference in solidification and cooling rates. The graphite flake size in the center of a 20.00" diameter bar will be larger than the flakes in a 2.00" diameter bar. Because of this the tensile strength in the 20.0" diameter bar is lower than the strength in the 2.0" bar, however if a separate cast test specimen was poured from the iron used to produce the 20.00" diameter bar, the graphite flake size would be considerably smaller by comparison with a test specimen poured from the iron used in the 2.00" continuous cast bar.

The same is true for foundries that cast large-section castings. For this reason, separate cast test bars are not useful in predicting the strength in castings or in Dura-Bar continuous cast bar stock.

The correlation between separate cast test bars and continuous cast bars made from the same iron has been established by Dura-Bar and illustrated in the graph below.



Continuous cast bars made from Dura-Bar G2 can be certified to ASTM A48, class 40 when the separate cast test coupon has a minimum tensile strength of 40,000 psi. As mentioned previously, separate cast test bar tensile strengths will be much higher when poured from iron used to produce 20.0" diameter continuous cast bars than with iron used to make 2.0" diameter bars.

The minimum tensile strength required for ASTM A48, Class 40b is 40,000 psi in the separate cast test coupon. Tensile tests taken from the continuous cast bars must meet the minimum strength of 40,000 psi in a test coupon. Using the formula in the chart on the right, minimum strengths are required for continuous cast bars ranging in diameters from 1.0" to 20.0":

Unless otherwise required by the customer, minimum tensile strengths as shown in the table above, are used to specify conformance to ASTM A48 class 40.

Contact us today to discuss your application and how you can start saving with Dura-Bar.

| Diameter (in) | Minimum Requirement for Mid-Radius Tensile Strength (PSI) to Conform to ASTM A48 Class 40 |
|---------------|---|
| 1             | 36000   |
| 2             | 32881   |
| 3             | 31056   |
| 4             | 29762   |
| 5             | 28758   |
| 6             | 27937   |
| 7             | 27243   |
| 8             | 26643   |
| 9             | 26112   |
| 10            | 25638   |
| 11            | 25209   |
| 12            | 24818   |
| 13            | 24458   |
| 14            | 24124   |
| 15            | 23814   |
| 16            | 23523   |
| 17            | 23251   |
| 18            | 22993   |
| 19            | 22750   |
| 20            | 22519   |