

# Solution Strengthened Ductile Iron (SSDI)

## Description

Solution strengthened ductile iron (SSDI) is a metallurgical term that has been adopted by producers of ductile iron. Shortened from Silicon Solution Strengthened Ferritic Ductile Iron, this material meets the mechanical properties of Spheroidal Graphite Cast Iron - Classification ISO 1083 (GJS-500/10). The new material boasts a tightened Brinell Hardness (BHN) across the material's entirety due to improved microstructural variation from surface to center, as well as enhanced mechanical properties over other similar ductile irons.

One of the greatest benefits is the enhanced machinability due to the addition of silicon. This new alloy has a minimum tensile strength of 75,000 psi, a minimum yield strength of 55,000 psi, and a minimum elongation of 15%. The newest addition to the Dura-Bar family of products, SSDI, is an excellent alternative to 1045 steel, exhibits improved machinability, and is comparable to Dura-Bar 65-45-12 but with elevated tensile and yield strengths.

## Applications

### Oil/Gas:

Plug valve inserts, Crossheads

### Fluid Power:

Compressor rotors, Hydraulic manifolds, cylinders

## Physical Properties

Property	Measurement
Density (lbs/in <sup>3</sup> )	0.255
Poisson's ratio [ν]	0.28
Modulus of elasticity (Tension) (psi) [E]	26 x 10 <sup>6</sup>
Modulus of rigidity (Shearing) (psi) [G]	9.8 x 10 <sup>6</sup>
Thermal conductivity (BTU/Hr/ft <sup>2</sup> /inch/°F), (Range: Room Temp - 212°F)	18.68
Thermal expansion coefficient(/°F) [α], (Range: 70 - 212°F)	6.4 x 10 <sup>6</sup>
Damping capacity	20*
Electrical resistivity (μ Ohm. Cm) [ρ] (Cu =1.67)	75**
Magnetic properties (KiloGauss/Oersteds@100 Oersteds)	14
Heat treat response (Rc)	35-40
Electrical Resistivity (Microhms x Cm)	75

\* Damping = ability of material to quell vibration through elastic hysteresis. Expressed as percentage of total energy/amplitude lost in one complete stress-strain cycle. Damping can be related to chemical analysis/composition and microstructure.

\*\* Specific resistivity of all irons increases with temperature. Chemical composition and microstructure also play roles in determining electrical resistivity. Increasing amounts of carbon/silicon increase ER.

## Mechanical Properties

Mechanical properties are preliminary minimums based on production data from a range of sizes and shapes, both round and square/rectangle. The preliminary minimum values of ultimate tensile strength, yield strength, elongation, and hardness are below:

UTS (min psi)	YS (min psi)	Elongation (%) min	Brinell Hardness (BHN)	Compressive YS (psi)
75,000	55,000	15	167-229	59,200

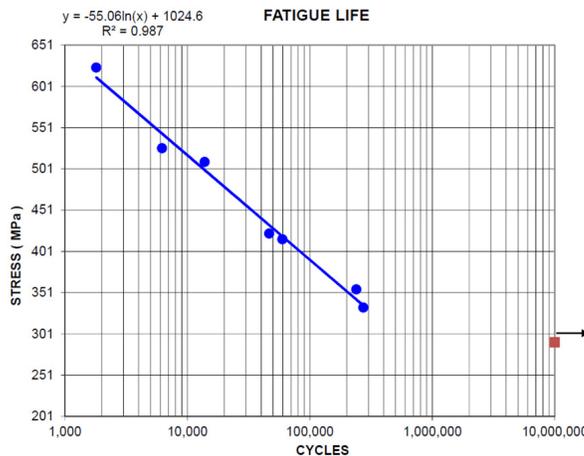
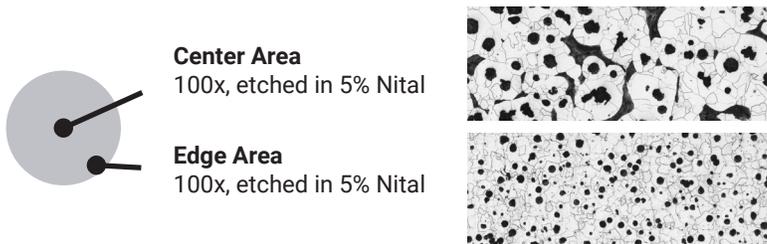


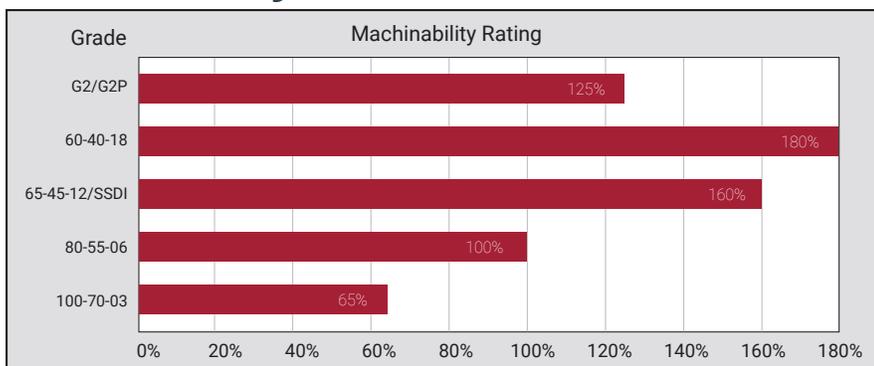
Figure 1

## Microstructure



Microstructure attributes can be summarized as 85% nodularity. Pearlite percentage at the center and edge of the bar is 5-30% and 0-15%, respectively.

## Machinability



\* Based on 1212 steel = 100%

## Chemical Composition

Element	Percentage
Carbon*	3.20% - 3.75%
Silicon*	3.25% - 4.00%
Manganese	0.15 - 0.35%
Sulfur	0.025% Max
Phosphorus	0.05% Max

\*Carbon and silicon targets are specified for each bar size in order to maintain mechanical properties. Magnesium is added as an inoculant to produce nodular graphite.

## Applicable Specifications

ISO 1083 (GJS – 500/10)

## Forms Manufactured

SSDI is available in rounds, squares/rectangles, and custom shapes (available upon request).

## Articles

Fluid Power Technical Conference - [SSDI sneak peak](#)

Fluid Power World - [SSDI](#)

## Disclaimer

All of the above information is for reference only. Actual results are influenced by process variables and actual size of the raw material.

**Machinability:** the above information is recommended as a starting point for machining Dura-Bar SSDI Continuous Cast Iron only. The parameters laid out may be too aggressive for iron castings or foreign material. Results may vary depending on the manufacturer or grade of the tool insert used, the type of equipment used, the geometry (round, square, rectangle, etc.) of the raw material, as well as the desired tool insert life.

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