# 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

SSDI can be used in several applications including (but not limited to):

- Oil and gas applications:
  - Plug valve inserts
  - Crossheads
- Fluid Power
  - Compressor rotors
  - Hydraulic manifolds and cylinders

## Physical Properties

| Property | Measurement |
|---|---|
| Density (lbs/in$^3$) | 0.255 |
| Poisson's ratio [$\nu$] | 0.28 |
| Modulus of elasticity (Tension) (psi) [E] | 26 x $10^6$ |
| Modulus of rigidity (Shearing) (psi) [G] | 9.8 x $10^6$ |
| Thermal conductivity (BTU/Hr/ft$^2$/inch/°F), (Range: Room Temp - 212°F) | 18.68 |
| Thermal expansion coefficient(/°F) [a], (Range: 70 - 212°F) | 6.4 x $10^6$ |
| 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 |

# 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 |

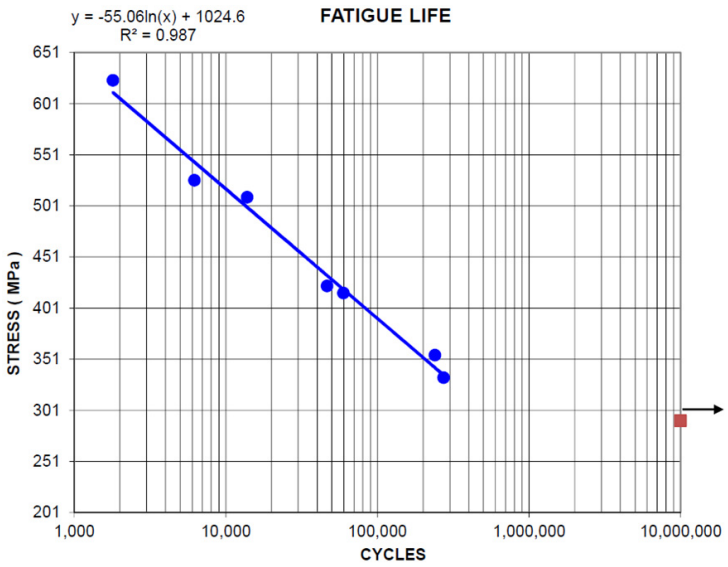
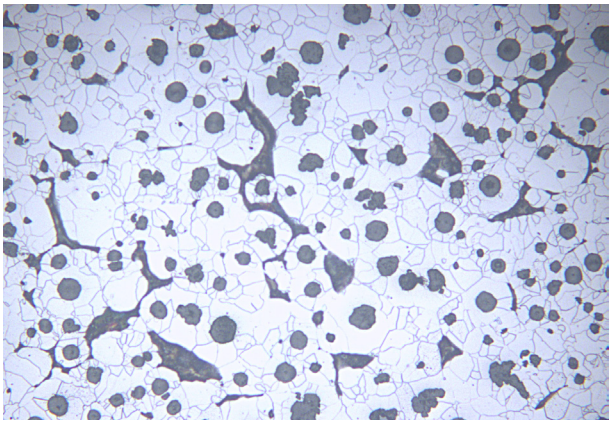


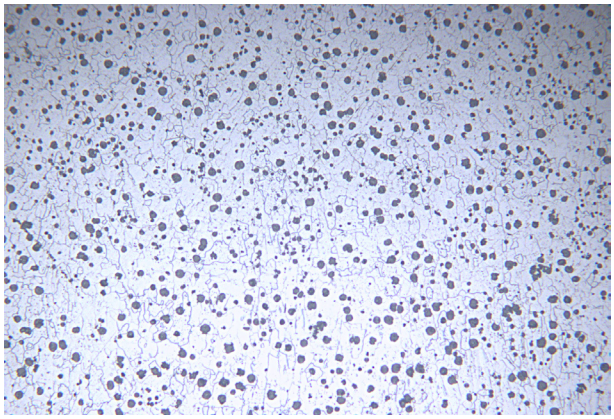

*Figure 1*

# Microstructure

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

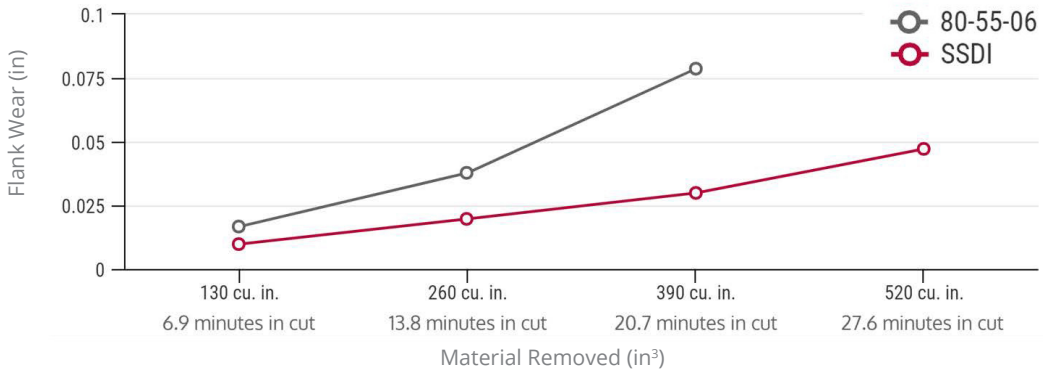


*Center micrograph of SSDI, 6.25" round, etched, 100x*



*Edge micrograph of SSDI, 6.25" round, etched, 100x*

## Machinability




Test Conditions:
*700 surface feet per minute, 0.150" depth of cut, & 0.015" per revolution
**Dura-Bar 80-55-06 test stopped at 390 cu in due to excessive tool wear.

## Chemical Composition

| | | | | | |
|---|---|---|---|---|---|
| Carbon | 3.20% - 3.75% | Manganese | 0.15% - 0.35% | Copper | Trace |
| Phosphorus | 0.05% max. | Sulfur | 0.025% max. | Tin | Trace |
| Silicon | 3.25% - 4.00% | Chromium | Trace | Aluminum | Trace |
| Nickel | Trace | Molybdenum | Trace | Titanium | Trace |

## 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.