

Ductile Iron Resource Guide

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The scope of The Resource Guide is intended to be an informational reference to explain the typical characteristics of continuous cast iron bar stock. For more specific information, contact Dura-Bar Sales.

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Ductile Iron Description of Grades

Ductile iron was developed in the 1940s and became widely recognized as an engineering material by 1960. The popularity of using ductile iron continues to increase especially with the concern over leaded steels being an environmental hazard. The nodular graphite provides the same free machining benefits as lead (see Fig. 1 & Fig. 2 below) without creating the machining and waste disposal problems.

Ductile irons contain Type I & II nodular graphite, as defined in ASTM A247, in a matrix of pearlite and ferrite. The spheroidal shaped graphite maximizes the strength in cast iron. The ratio of ferrite to pearlite in the matrix is altered for each of the three grades in order to produce the required values for tensile strength, yield strength, and elongation.

The ductile iron grades will conform to those listed under ASTM A536, with the primary difference being the high nodule count and fine grain size inherent to the Dura-Bar continuous casting process. Mechanical properties for each grade are guaranteed in the actual bar, not a separately cast test sample.

The different grades are produced by controlling the matrix structure around the graphite nodules. Minimum tensile strengths range from 65,000-100,000 psi, with corresponding minimum elongation requirements from 2-12%.

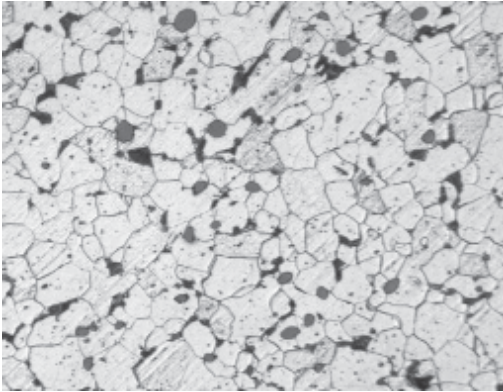


Fig. 1
Photo of 12L14 steel (200x, etched in 5% Nitol). Lead particles can be seen to be spheroidal in shape & uniformly distributed throughout the structures.

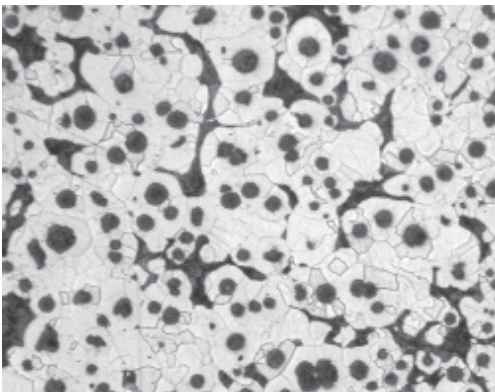


Fig. 2
Photo of Dura-Bar 65-45-12 ductile iron (100x, etched in 5% Nitol). Graphite nodules are uniformly distributed throughout the structure providing the same free machining characteristics inherent to leaded steels.

General Description

Dura-Bar 65-45-12 ductile iron contains nodular graphite in a matrix of ferrite with small amounts of pearlite. The ferritic structure gives excellent machinability with good surface finishes along with optimal impact strengths, fatigue properties, electrical conductivity and high magnetic permeability. This iron has approximately the same tensile and yield strengths as AISI 1020 steel in the as-rolled condition. This specification conforms to ASTM A536 grade 65-45-12.

Microstructure

The microstructure consists of Types I and II nodular graphite as defined in ASTM A247. The matrix is ferrite with approximately 5-25% pearlite. The “rim” will have a higher nodule count and will be mostly ferrite. Chill carbides will be less than 5% in any field at 100x and will be well dispersed.

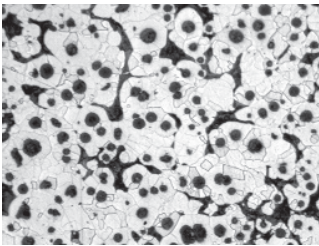


Fig. 3
Typical microstructure in the center area (100x, etched in 5% Nital)

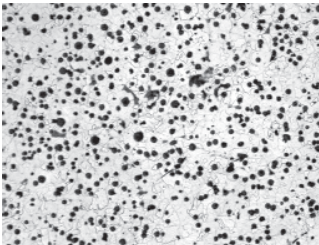


Fig. 4
Typical microstructure in the rim area (100x, etched in 5% Nital)

Chemical Composition

The chemical analysis is subordinate to the mechanical properties. Typical analysis will be as shown in Table 1 below.

Table 1 - 65-45-12 chemical composition.

| Element | Percentage |
|----------------------|--------------|
| Carbon ¹ | 3.50 - 3.90% |
| Silicon ¹ | 2.25 - 3.00% |
| Manganese | 0.15 - 0.35% |
| Sulfur | 0.025% max. |
| Phosphorus | 0.05% max. |

¹Carbon and silicon targets are specified for each bar size in order to maintain mechanical properties..

Mechanical Properties

Hardness properties for various diameters are shown in Table 2 below. Hardness properties listed are minimum, maximum across the bar. For rectangles, squares and shapes, the hardness properties will depend on minimum and maximum section thickness and will be supplied on request.

Table 2 - 65-45-12 hardness properties

| Size Range | | BHN | |
|-----------------|----------|------|------|
| Inches | mm | Min. | Max. |
| 01.000 - 02.000 | 25 - 51 | 156 | 217 |
| 02.001 - 03.000 | 51 - 76 | 153 | 207 |
| 03.001 - 06.000 | 76 - 152 | 143 | 207 |
| 06.001 - 20.000 | 152-508 | 131 | 207 |

Tensile strength is determined from a longitudinal test specimen taken from mid-radius of the as-cast bar. Tensile strength psi (min) 65,000. Yield strength psi (min) 45,000. Elongation (min) 12%. In bars under 2.0" diameter, elongation will be 9% minimum.

Heat Treat Response

Dura-Bar 65-45-12 can be oil quench hardened from 1600°F (870°C) to 50 Rc minimum on the outside of the bar. Hardness in the core will be less than the hardness on the outside surfaces. Typical Jominy end quench test data are shown in the section on Heat Treating (page 5-7).

This grade also responds well to surface hardening methods such as flame or induction heat treating. It is well suited for austempering because of the low residual alloy content, and the highly ferritic matrix provides predictable growth with minimal heat-treat distortion.

Typical Applications

Typical applications for 65-45-12 Dura-Bar ductile iron are listed below. They are classified by industry.

| | |
|-----------------------------|--|
| Fluid Power: | Cylinder blocks, end caps, gear rack housings, gerotors, manifolds, pistons, glands, rotors, & valves |
| Machinery: | Bushings, chuck bodies, die blocks, gears, journals, pulleys, rotary tables, side frames, spindle housings, tie rod nuts, flywheels, pulleys, & rams |
| Transportation: | Rail spacers & sprockets |
| Pump and Compressor: | Gears, housings, pistons, & rotary screws |
| Glass Mold: | Blank molds & plungers |

Availability of Sizes and Shapes

The stock listing for Dura-Bar 65-45-12 follows this section. Sizes and shapes not listed are available by special order.

General Description

Dura-Bar 80-55-06 ductile iron will contain nodular graphite in a matrix of ferrite and pearlite. The pearlite/ferrite structure provides higher wear resistance and strength when compared to a ferritic grade of ductile iron. This material will be readily machinable with good surface finishes. Tensile and yield strengths will be similar to AISI 1040 steel in the as-rolled condition. This grade conforms to ASTM A536 grade 80-55-06.

Microstructure

The microstructure consists of Type I and II nodular graphite as defined in ASTM A247. The matrix is pearlite and ferrite. The “rim” will have a higher nodule count and ferrite content. Chill carbides will be less than 5% in any field at 100x and will be well dispersed.

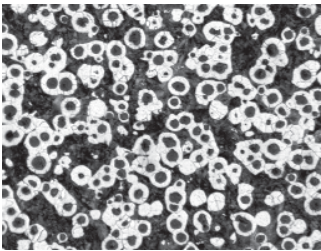


Fig. 5
Typical microstructure in the center area (100x, etched in 5% Nital)

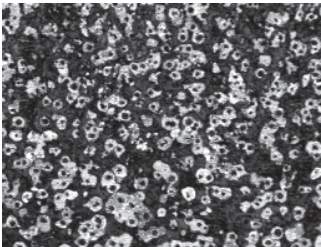


Fig. 6
Typical microstructure in the rim area (100x, etched in 5% Nital)

Chemical Composition

The chemical analysis is subordinate to the mechanical properties. Typical analysis will be as shown in Table 3 below.

Table 3 - 65-45-12 chemical composition

| Element | Percentage |
|----------------------|--------------|
| Carbon ¹ | 3.50 - 3.90% |
| Silicon ¹ | 2.25 - 3.00% |
| Manganese | 0.15 - 0.35% |
| Sulfur | 0.025% max. |
| Phosphorus | 0.05% max. |

¹Carbon and silicon targets are specified for each bar size in order to maintain mechanical properties.
Small amounts of alloying elements are used to stabilize the pearlitic structure.

Mechanical Properties

Hardness properties for various diameters are shown in Table 4 below. Hardness properties listed are minimum, maximum across the bar. For rectangles, squares and shapes, the hardness properties will depend on minimum and maximum section thickness and will be supplied on request.

Table 4 - 80-55-06 hardness properties

| Size Range | | BHN | |
|-----------------|----------|------|------|
| Inches | mm | Min. | Max. |
| 01.000 - 01.500 | 25 - 38 | 187 | 255 |
| 01.501 - 03.000 | 38 - 76 | 187 | 255 |
| 03.001 - 20.000 | 76 - 508 | 187 | 255 |

The tensile strength is determined from a longitudinal test specimen taken from mid-radius of the as-cast bar. Tensile strength psi (min) 80,000. Yield strength psi (min) 55,000. Elongation (min) 6%. In bars under 1.5" diameter, elongation will be a minimum of 4%.

Heat Treat Response

Dura-Bar 80-55-06 can be oil quench hardened from 1600°F (870°C) to a minimum hardness of 50 Rc on the outside of the bar. The inside diameter hardness will be less than 50 Rc. Lower quench hardness on the inside diameters are a result of larger graphite nodules and not a loss of matrix hardness. Typical Jominy end quench test data are shown in the section on Heat Treating (page 5-7).

Typical Applications

Typical applications for 80-55-06 Dura-Bar ductile iron are listed below. They are classified by industry.

| | |
|-----------------------------|--|
| Fluid Power: | Cylinder blocks, gerotors, manifolds, pistons, glands, rotors, & valve bodies |
| Machinery: | Bushings, chain sheave rollers, chuck bodies, die blocks, gears, gear racks, pulleys, press rams, rotary tables, tie rod nuts, guide ways, barrel rollers (cement truck), flywheels, pile drivers, pulleys, & rams |
| Transportation: | Pulleys, gears, & rail spacers |
| Pump and Compressor: | Gears, housings, liners, pistons, & rotary screws |
| Steel Mill: | Guide rolls, pinch rolls, & runout table rolls |
| Miscellaneous: | Disamatic pouring rails, dies, pattern plates, core boxes, grinding rolls, & mill Liners |

Availability of Sizes and Shapes

The stock listing for Dura-Bar 80-55-06 follows this section. Sizes and shapes not listed are available by special order.

General Description

Dura-Bar 100-70-02 ductile iron contains nodular graphite in a matrix of pearlite with small amounts of ferrite. The pearlitic structure maximizes strength and wear characteristics in a non-alloyed as-cast ductile iron. This specification is similar to ASTM A536 grade 100-70-03.

Microstructure

The microstructure consists of Type I and II nodular graphite as defined in ASTM A247. The matrix is highly pearlite with small amounts of ferrite. The rim will have a higher nodule count and contain slightly higher ferrite concentration when compared to the center. Chill carbides will be less than 5% in any field at 100x and will be well dispersed.

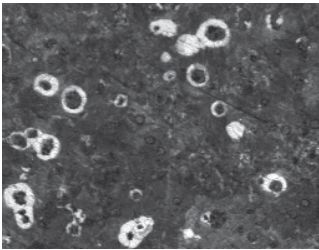


Fig. 7
Typical microstructure in the center area (100x, etched in 5% Nital)

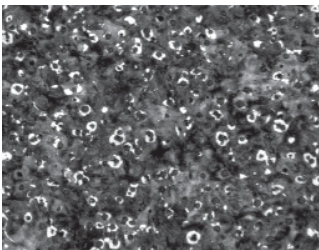


Fig. 8
Typical microstructure in the rim area (100x, etched in 5% Nital)

Chemical Composition

The chemical analysis is subordinate to the mechanical properties. Typical analysis will be as shown in Table 5 below.

Table 5 - 100-70-02 chemical composition

| Element | Percentage |
|----------------------|--------------|
| Carbon ¹ | 3.50 - 3.90% |
| Silicon ¹ | 2.25 - 3.00% |
| Manganese | 0.15 - 0.35% |
| Sulfur | 0.025% max. |
| Phosphorus | 0.05% max. |

¹Carbon and silicon targets are specified for each bar size in order to maintain mechanical properties. Small amounts of alloying elements are used to stabilize the pearlitic structure.

Mechanical Properties

Hardness properties for various diameters are shown in Table 6 below. Hardness properties listed are minimum, maximum across the bar. For rectangles, squares and shapes, the hardness properties will depend on minimum and maximum section thickness and will be supplied on request.

Table 6 - 100-70-02 hardness properties

| Size Range | | BHN | |
|-----------------|----------|------|------|
| Inches | mm | Min. | Max. |
| 01.000 - 20.000 | 25 - 508 | 241 | 329 |

Tensile strength is determined from a longitudinal test specimen taken from mid-radius of the as-cast bar. Tensile strength psi (min) 100,000. Yield strength psi (min) 70,000. Elongation (min) 2%.

Heat Treat Response

Dura-Bar 100-70-02 can be oil quench hardened from 1600°F (870°C) to a minimum hardness of 50 Rc on the outside of the bar. The inside diameter hardness will be less than 50 Rc. Lower quench hardness on the inside diameters are a result of larger graphite nodules and not a loss of matrix hardness. Typical Jominy end quench test data for 80-55-06 ductile iron are shown in the section on Heat Treating (page 5-7). Similar data applies to 100-70-02.

Typical Applications

Typical applications for 100-70-02 Dura-Bar ductile iron are listed below. They are classified by industry.

| | |
|-----------------------------|--|
| Fluid Power: | For higher pressure: cylinder blocks, gerotors, manifolds, pistons, glands, rotors, & valves |
| Machinery: | Bushings, chain sheave rollers, chuck bodies, die blocks, gears, gear racks, pulleys, rams, rotary tables, guide ways, barrel rollers (cement truck), flywheels, pile drivers, pulleys, & rams (<i>also see Fluid Power</i>) |
| Transportation: | Pulleys, gears, rail spacers, hubs, carriers, & camshafts |
| Pump and Compressor: | Gears, housings, liners, & pistons |
| Steel Mill: | Guide rolls, pinch rolls, & runout table rolls |
| Miscellaneous: | Disamatic pouring rails & dies |

Availability of Sizes and Shapes

Dura-Bar 100-70-02 is a non-inventoried item. A wide variety of sizes and shapes is available by special order.

General Description

Dura-Bar 4512 HRDS is a high-silicon ductile iron intended for use at elevated temperatures or when a part is subjected to thermal cycling, such as permanent mold applications. The ferritic structure will remain stable so that no significant transformation takes place, thereby minimizing stresses that lead to cracks and distortion of the finished part.

Microstructure

The microstructure will contain Type I and II nodules as defined in ASTM A247. The matrix will be predominantly ferrite with some pearlite. Chill carbides will be less than 5% in any field at 100x and will be well dispersed.

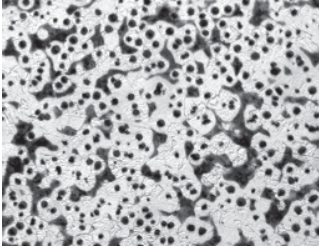


Fig. 9
Typical microstructure in the center area (100x, etched in 5% Nitol)

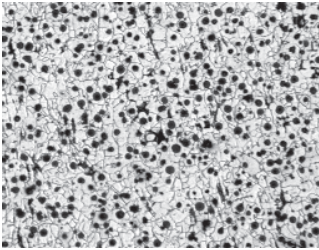


Fig. 10
Typical microstructure in the rim area (100x, etched in 5% Nitol)

Chemical Composition

Typical chemical composition is shown in Table 7 below. Specific targets may be adjusted slightly, although the silicon level is required.

Table 7 - 65-45-12 HRDS chemical composition

| Element | Percentage |
|------------|--------------|
| Carbon | 3.45 - 3.75% |
| Silicon | 3.25 - 4.00% |
| Manganese | 0.15 - 0.35% |
| Sulfur | 0.025% max. |
| Phosphorus | 0.05% max. |

Mechanical Properties

Brinell hardness values for 4512 HRDS will typically be 167-229. Material hardness is subordinate to chemistry, and the silicon level must be maintained in order to achieve elevated temperature properties.

Tensile strength, as determined from a longitudinal test specimen taken from the mid-radius, will have the following properties:

| | |
|----------------------------|--------|
| Tensile strength psi (min) | 65,000 |
| Yield strength psi (min) | 45,000 |
| Elongation (min) | 12% |

In bars under 2.0" diameter, elongation will be 9% minimum.

Table 8 below shows typical mechanical properties at elevated temperatures.

Table 8 - Mechanical properties at elevated temperatures

| Temperature | Tensile Strength (psi) | Yield Strength (psi) | Elongation |
|----------------|------------------------|----------------------|------------|
| 900°F (482°C) | 52,000 | 47,000 | 20% |
| 1100°F (593°C) | 27,000 | 23,000 | 25% |
| 1300°F (704°C) | 10,000 | 7,500 | 45% |
| 1450°F (788°C) | 5,500 | 4,500 | 60% |

Heat Treat Response

4512 HRDS is not intended for hardening. The matrix structure may be softened slightly by heating to 1400°F (760°C) and furnace cooling to 400°F (205°C).

Typical Applications

4512 HRDS is most commonly used in high temperature applications where resistance to growth and oxidation is required. Common applications are listed below:

- Glass molds
- Plate glass furnace rolls
- Steel mill rolls
- Turbocharger bushings
- Sealing knives

Availability of Sizes and Shapes

Dura-Bar 4512 HRDS is a non-inventoried item. A wide variety of sizes and shapes is available by special order.

Sizes and Shapes

Stock listings for rounds, trepanned tubes, rectangles, and squares are listed on the following pages. Dura-Bar ductile 65-45-12 and 80-55-06 are stock grades; 100-70-02 and 65-45-12 HRDS are non-inventory items.

Round bar stock is available in sizes ranging from 1.250" to 20.000" in diameter. Any size round bar in this category can be produced, although stock sizes are made to specific increments.

Round bars are sold to clean up at the nominal size. Additional stock is added to allow for out-of-round and normal imperfections in the as-cast surface. Stock allowance is a function of the bar diameter.

The stock listing for trepanned tubes contains the possible inside diameters for each stock size outside diameter. Any stock size can be trepanned to the inside diameter listed on the chart. Tubes are sold with clean-up stock on the inside and outside diameters.

Rectangles and squares are available in sizes ranging from 0.750" x 1.500" to 18.000" x 22.000". Stock sizes are made to specific increments within this range, although a wide range of height and width combinations can be produced.

Rectangles and squares are sold to the actual size with no allowance for machine stock added.

Custom shapes are special order and are quoted individually.

All custom shapes are special order and are quoted individually.

Ductile Iron Stock Lists - Rounds

| Nominal Diameter (inches) | Stock Allowance (inches) | Nominal Length (inches) | Bundle Quantity | As-Cast | | Cold-Finished* | | | |
|---------------------------|--------------------------|-------------------------|-----------------|-------------------|----------|----------------|-------------------|----------|----------|
| | | | | Weight (lbs./ft.) | 65-45-12 | 80-55-06 | Weight (lbs./ft.) | 65-45-12 | 80-55-06 |
| 1.250 | 0.088 | 72 | 74 | 4.4 | ■ | ■ | 3.9 | ◆ | ◆ |
| 1.375 | 0.095 | 72 | 63 | 5.3 | | ■ | 4.7 | | ◆ |
| 1.500 | 0.095 | 72 | 69 | 6.2 | ■ | ■ | 5.6 | ◆ | ◆ |
| 1.625 | 0.095 | 72 | 63 | 7.2 | | ■ | 6.5 | | ◆ |
| 1.750 | 0.095 | 72 | 53 | 8.3 | ■ | ■ | 7.5 | ◆ | ◆ |
| 1.875 | 0.095 | 72 | 51 | 9.5 | | | 8.7 | | |
| 2.000 | 0.095 | 72 | 42 | 10.8 | ■ | ■ | 9.9 | ■ | ■ |
| 2.125 | 0.118 | 72 | 38 | 12.3 | | ■ | 11.1 | | ◆ |
| 2.250 | 0.118 | 72 | 45 | 13.7 | ■ | ■ | 12.5 | ■ | ◆ |
| 2.375 | 0.118 | 72 | 39 | 15.2 | | ■ | 13.9 | | ■ |
| 2.500 | 0.118 | 72 | 38 | 16.8 | ■ | ■ | 15.4 | ■ | ◆ |
| 2.625 | 0.118 | 72 | 33 | 18.4 | ■ | ■ | 16.9 | ■ | ■ |
| 2.750 | 0.118 | 72 | 30 | 20.2 | ■ | ■ | 18.6 | ◆ | ◆ |
| 3.000 | 0.118 | 72 | 26 | 23.8 | ■ | ■ | 22.1 | ■ | ■ |
| 3.125 | 0.136 | 72 | 23 | 26.1 | ■ | | 24.0 | ◆ | |
| 3.250 | 0.136 | 72 | 22 | 28.1 | ■ | ■ | 26.0 | ◆ | ◆ |
| 3.375 | 0.136 | 72 | 20 | 30.2 | ■ | | 28.0 | ◆ | |
| 3.500 | 0.136 | 72 | 18 | 32.4 | ■ | ■ | 30.1 | ◆ | ◆ |
| 3.625 | 0.136 | 72 | 18 | 34.7 | ■ | ■ | 32.3 | ◆ | |
| 3.750 | 0.136 | 72 | 17 | 37.0 | ■ | ■ | 34.6 | ◆ | ■ |
| 3.875 | 0.136 | 72 | 17 | 39.4 | ■ | | 36.9 | ◆ | |
| 4.000 | 0.136 | 72 | 14 | 41.9 | ■ | ■ | 39.3 | ■ | ◆ |
| 4.125 | 0.154 | 72 | 14 | 44.9 | ■ | | 41.8 | ◆ | |
| 4.250 | 0.154 | 72 | 14 | 47.5 | ■ | ■ | 44.4 | ◆ | ◆ |
| 4.375 | 0.154 | 72 | 11 | 50.3 | ■ | | 47.0 | ◆ | |
| 4.500 | 0.154 | 72 | 11 | 53.1 | ■ | ■ | 49.7 | ◆ | ◆ |
| 4.625 | 0.154 | 72 | 11 | 56.0 | ■ | ■ | 52.5 | ◆ | ◆ |
| 47.50 | 0.154 | 72 | 11 | 58.9 | ■ | ■ | 55.4 | ◆ | ◆ |
| 5.00 | 0.154 | 72 | 9 | 65.1 | ■ | ■ | 61.4 | ◆ | ◆ |
| 5.250 | 0.172 | 72 | 9 | 72.0 | ■ | ■ | 67.7 | ◆ | ◆ |
| 5.500 | 0.172 | 72 | 7 | 78.8 | ■ | ■ | 74.3 | ◆ | ◆ |
| 5.750 | 0.172 | 72 | 7 | 85.9 | ■ | ■ | 81.2 | ◆ | ◆ |

■ Available as stock item

◆ Available upon request

* Cold-finished bars in sizes 1.250" through 5.000" are centerless turned. All others available are centerless ground.

Ductile Iron Stock Lists - Rounds

| Nominal Diameter (inches) | Stock Allowance (inches) | Nominal Length (inches) | Bundle Quantity | As-Cast | | | Cold-Finished* | | |
|---------------------------|--------------------------|-------------------------|-----------------|-------------------|----------|----------|-------------------|----------|----------|
| | | | | Weight (lbs./ft.) | 65-45-12 | 80-55-06 | Weight (lbs./ft.) | 65-45-12 | 80-55-06 |
| 6.000 | 0.172 | 72 | 7 | 93.3 | ■ | ■ | 88.4 | ◆ | ◆ |
| 6.250 | 0.190 | 72 | 4 | 101.6 | ■ | ■ | | | |
| 6.500 | 0.190 | 72 | 4 | 109.7 | ■ | ■ | | | |
| 6.750 | 0.190 | 72 | 4 | 118.0 | ■ | ■ | | | |
| 7.000 | 0.190 | 72 | 3 | 126.7 | ■ | ■ | | | |
| 7.250 | 0.213 | 72 | 3 | 136.5 | ■ | ■ | | | |
| 7.500 | 0.213 | 72 | 3 | 145.8 | ■ | ■ | | | |
| 7.750 | 0.213 | 72 | 3 | 155.4 | ■ | ■ | | | |
| 8.000 | 0.213 | 72 | 3 | 165.3 | ■ | ■ | | | |
| 8.250 | 0.242 | 72 | 3 | 176.7 | | ■ | | | |
| 8.500 | 0.242 | 72 | 3 | 187.3 | ■ | ■ | | | |
| 9.000 | 0.242 | 72 | 2 | 209.3 | ■ | ■ | | | |
| 9.250 | 0.283 | 72 | 2 | 222.7 | | ■ | | | |
| 9.500 | 0.283 | 72 | 2 | 234.5 | ■ | ■ | | | |
| 10.000 | 0.283 | 72 | 2 | 259.1 | ■ | ■ | | | |
| 10.500 | 0.432 | 72 | 2 | 292.8 | ■ | ■ | | | |
| 11.000 | 0.432 | 72 | 2 | 320.2 | ■ | ■ | | | |
| 11.500 | 0.623 | 72 | 2 | 360.1 | | ■ | | | |
| 12.000 | 0.623 | 72 | 2 | 390.5 | ■ | ■ | | | |
| 13.000 | 0.623 | 72 | 1 | 454.8 | ■ | ■ | | | |
| 14.000 | 0.623 | 72 | 1 | 524.0 | ■ | ■ | | | |
| 15.000 | 0.623 | 72 | 1 | 598.1 | ■ | ■ | | | |
| 16.000 | 0.623 | 72 | 1 | 677.1 | ■ | ■ | | | |
| 17.000 | 0.815 | 72 | 1 | 777.7 | | ■ | | | |
| 18.000 | 0.815 | 72 | 1 | 867.5 | ■ | ■ | | | |
| 20.000 | 0.819 | 54 | 1 | 1062.0 | ■ | ■ | | | |

■ Available as stock item

◆ Available upon request

* Cold-finished bars in sizes 1.000" through 5.000" are centerless turned. All others available are centerless ground.

Ductile Iron Trepanned Tube Weights

| Outside Diameter (inches) | Inside Diameter (inches) | | | | | | | | |
|---------------------------|--------------------------|-------|-------|-------|-------|------|-------|-------|-------|
| | 1.500 | 2.000 | 2.250 | 2.500 | 2.750 | 3.00 | 3.250 | 3.500 | 3.750 |
| 2.250 | 10 | | | | | | | | |
| 2.375 | 11 | | | | | | | | |
| 2.500 | 13 | | | | | | | | |
| 2.625 | 15 | | | | | | | | |
| 2.750 | 16 | 13 | | | | | | | |
| 2.875 | 18 | 14 | | | | | | | |
| 3.000 | 20 | 16 | 14 | | | | | | |
| 3.125 | 22 | 18 | 16 | | | | | | |
| 3.250 | 24 | 20 | 18 | 16 | | | | | |
| 3.375 | 26 | 23 | 20 | 18 | | | | | |
| 3.500 | 28 | 25 | 22 | 20 | 17 | | | | |
| 3.625 | 31 | 27 | 25 | 22 | 19 | | | | |
| 3.750 | 33 | 29 | 27 | 24 | 21 | 18 | | | |
| 3.875 | 35 | 32 | 29 | 27 | 24 | 21 | | | |
| 4.000 | 38 | 34 | 32 | 29 | 26 | 23 | 20 | | |
| 4.125 | 41 | 37 | 35 | 32 | 29 | 26 | 23 | 19 | |
| 4.250 | 43 | 40 | 37 | 35 | 32 | 29 | 25 | 21 | |
| 4.375 | 46 | 42 | 40 | 38 | 35 | 31 | 28 | 24 | |
| 4.500 | 49 | 45 | 43 | 40 | 37 | 34 | 31 | 27 | 23 |
| 4.625 | 52 | 48 | 46 | 43 | 40 | 37 | 34 | 30 | 26 |
| 4.750 | 55 | 51 | 49 | 46 | 43 | 40 | 37 | 33 | 29 |
| 5.000 | 61 | 57 | 55 | 52 | 49 | 46 | 43 | 39 | 35 |
| 5.250 | 68 | 64 | 62 | 59 | 56 | 53 | 50 | 46 | 42 |
| 5.500 | 75 | 71 | 69 | 66 | 63 | 60 | 56 | 52 | 48 |
| 5.750 | 82 | 78 | 76 | 73 | 70 | 67 | 63 | 60 | 55 |
| 6.000 | 89 | 85 | 83 | 80 | 77 | 74 | 71 | 67 | 63 |
| 6.250 | | | | 89 | 86 | 82 | 79 | 75 | 71 |
| 6.500 | | | | 97 | 94 | 90 | 87 | 83 | 79 |
| 6.750 | | | | 105 | 102 | 99 | 95 | 91 | 87 |
| 7.000 | | | | 114 | 111 | 107 | 104 | 100 | 96 |
| 7.250 | | | | 123 | 120 | 117 | 114 | 110 | 106 |
| 7.500 | | | | 133 | 130 | 126 | 123 | 119 | 115 |
| 7.750 | | | | 142 | 139 | 136 | 132 | 129 | 124 |
| 8.000 | | | | 152 | 149 | 146 | 142 | 138 | 134 |
| 8.250 | | | | 163 | 160 | 157 | 154 | 150 | 146 |
| 8.500 | | | | 174 | 171 | 168 | 164 | 160 | 156 |
| 8.750 | | | | 185 | 182 | 178 | 175 | 171 | 167 |
| 9.000 | | | | 196 | 193 | 190 | 186 | 182 | 178 |

All weights expressed in lbs./ft.
0.250" concentricity tolerance between the inside diameter and average outside diameter

Ductile Iron Trepanned Tube Weights

| Inside Diameter (inches) | | | | | | | | | | Outside Diameter (inches) |
|--------------------------|-------|-------|-------|-------|-------|------|-------|-------|--|---------------------------|
| 4.000 | 4.250 | 4.500 | 4.750 | 5.000 | 5.500 | 6.00 | 6.500 | 7.000 | | |
| | | | | | | | | | | 2.250 |
| | | | | | | | | | | 2.375 |
| | | | | | | | | | | 2.500 |
| | | | | | | | | | | 2.625 |
| | | | | | | | | | | 2.750 |
| | | | | | | | | | | 2.875 |
| | | | | | | | | | | 3.000 |
| | | | | | | | | | | 3.125 |
| | | | | | | | | | | 3.250 |
| | | | | | | | | | | 3.375 |
| | | | | | | | | | | 3.500 |
| | | | | | | | | | | 3.625 |
| | | | | | | | | | | 3.750 |
| | | | | | | | | | | 3.875 |
| | | | | | | | | | | 4.000 |
| | | | | | | | | | | 4.125 |
| | | | | | | | | | | 4.250 |
| | | | | | | | | | | 4.375 |
| | | | | | | | | | | 4.500 |
| | | | | | | | | | | 4.625 |
| | | | | | | | | | | 4.750 |
| 24 | | | | | | | | | | 5.000 |
| 30 | 26 | | | | | | | | | 5.250 |
| 37 | 32 | 27 | | | | | | | | 5.500 |
| 44 | 39 | 34 | 29 | | | | | | | 5.750 |
| 51 | 46 | 41 | 36 | 30 | | | | | | 6.000 |
| 58 | 54 | 49 | 43 | 38 | | | | | | 6.250 |
| 67 | 62 | 57 | 51 | 46 | | | | | | 6.500 |
| 75 | 70 | 65 | 59 | 54 | 41 | | | | | 6.750 |
| 83 | 78 | 73 | 68 | 62 | 50 | | | | | 7.000 |
| 92 | 87 | 82 | 76 | 71 | 58 | 45 | | | | 7.250 |
| 101 | 96 | 91 | 86 | 80 | 68 | 55 | | | | 7.500 |
| 110 | 106 | 101 | 95 | 90 | 77 | 64 | 49 | | | 7.750 |
| 120 | 115 | 110 | 105 | 99 | 87 | 73 | 59 | | | 8.000 |
| 130 | 125 | 120 | 115 | 109 | 97 | 83 | 69 | 53 | | 8.250 |
| 141 | 136 | 131 | 126 | 120 | 109 | 95 | 80 | 64 | | 8.500 |
| 152 | 147 | 142 | 137 | 131 | 119 | 105 | 90 | 75 | | 8.750 |
| 163 | 158 | 153 | 147 | 142 | 129 | 116 | 101 | 85 | | 9.000 |
| 174 | 169 | 164 | 159 | 153 | 141 | 127 | 112 | 96 | | |

All weights expressed in lbs./ft.
0.250" concentricity tolerance between the inside diameter and average outside diameter

65-45-12 Ductile Iron Rectange Stock List/Weights

| As-Cast Size (Inches) | Length (Inches) | Weight (lbs./ft.) | Finish Size (Inches) | Bundle Quantity |
|-----------------------|-----------------|-------------------|----------------------|-----------------|
| 2.150 x 2.930 | 74 | 19.7 | 1.970 x 2.750 | 18 |
| 2.250 x 3.250 | 72 | 22.8 | 2.070 x 3.070 | 24 |
| 2.250 x 4.250 | 72 | 29.8 | 2.070 x 4.070 | 20 |
| 2.550 x 2.930 | 74 | 23.3 | 2.350 x 2.730 | 15 |
| 2.750 x 3.000 | 72 | 25.7 | 2.550 x 2.800 | 20 |
| 3.250 x 4.250 | 72 | 43.1 | 3.050 x 4.050 | 12 |
| 3.250 x 4.750 | 72 | 48.2 | 3.050 x 4.550 | 12 |
| 3.250 x 5.250 | 72 | 53.2 | 3.050 x 5.050 | 9 |
| 3.250 x 5.750 | 72 | 58.3 | 3.050 x 5.550 | 9 |
| 3.250 x 6.250 | 72 | 63.4 | 3.050 x 6.050 | 9 |
| 3.500 x 4.550 | 73 | 49.7 | 3.300 x 4.350 | 12 |
| 4.250 x 5.250 | 72 | 69.6 | 4.026 x 5.026 | 8 |
| 4.250 x 5.500 | 72 | 72.9 | 4.026 x 5.276 | 8 |
| 4.250 x 5.750 | 72 | 76.2 | 4.026 x 5.526 | 8 |
| 4.250 x 6.250 | 72 | 82.9 | 4.026 x 6.026 | 6 |
| 4.250 x 6.750 | 72 | 89.5 | 4.026 x 6.526 | 6 |
| 4.250 x 7.250 | 72 | 96.1 | 4.026 x 7.026 | 6 |
| 4.750 x 6.250 | 72 | 92.6 | 4.526 x 6.026 | 6 |
| 5.000 x 6.500 | 72 | 101.4 | 4.776 x 6.276 | 6 |
| 5.250 x 6.250 | 72 | 102.4 | 5.026 x 6.026 | 6 |
| 5.250 x 7.250 | 72 | 118.8 | 5.026 x 7.026 | 6 |
| 5.250 x 8.250 | 72 | 135.1 | 5.026 x 8.026 | 4 |
| 6.080 x 9.040 | 77 | 171.5 | 5.830 x 8.790 | 4 |
| 7.250 x 11.875 | 72 | 268.6 | 7.000 x 11.625 | 2 |
| 7.680 x 9.180 | 79 | 220.0 | 7.430 x 8.930 | 2 |
| 8.000 x 21.000* | 72 | 524.2 | 7.500 x 20.500 | 1 |
| 8.190 x 11.190 | 75 | 285.9 | 7.940 x 10.940 | 2 |
| 8.250 x 12.250 | 72 | 315.3 | 8.000 x 12.000 | 2 |
| 8.750 x 9.250 | 72 | 252.5 | 8.374 x 8.874 | 2 |
| 8.750 x 10.750 | 73 | 293.5 | 8.374 x 10.374 | 2 |
| 8.770 x 13.500 | 83 | 369.4 | 8.394 x 13.124 | 1 |
| 9.300 x 11.500 | 79 | 333.7 | 8.924 x 11.124 | 2 |
| 10.250 x 12.250 | 72 | 391.8 | 9.874 x 11.874 | 2 |
| 10.340 x 13.540 | 79 | 436.8 | 9.964 x 13.164 | 1 |
| 11.340 x 12.700 | 74 | 449.3 | 10.964 x 12.324 | 1 |
| 12.100 x 12.400 | 74 | 468.1 | 11.600 x 11.900 | 1 |
| 12.540 x 14.540 | 72 | 568.9 | 12.040 x 14.040 | 1 |
| 14.000 x 21.000 | 54 | 917.3 | 13.500 x 20.500 | 1 |
| 18.500 x 22.000 | 54 | 1269.8 | 18.000 x 21.500 | 1 |

*8.000" x 21.000" also available in 80-55-06

65-45-12 Ductile Iron Square Stock List/Weights

| As-Cast Size (Inches) | Length (Inches) | Weight (lbs./ft.) | Finish Size (Inches) | Bundle Quantity |
|-----------------------|-----------------|-------------------|----------------------|-----------------|
| 3.250 x 3.250 | 72 | 33.0 | 3.050 x 3.050 | 20 |
| 4.250 x 4.250 | 72 | 56.4 | 4.026 x 4.026 | 9 |
| 5.250 x 5.250 | 72 | 86.0 | 5.026 x 5.026 | 8 |
| 6.180 x 6.180 | 74 | 119.2 | 5.930 x 5.930 | 4 |
| 6.250 x 6.250 | 72 | 121.9 | 6.000 x 6.000 | 4 |
| 6.680 x 6.680 | 74 | 139.2 | 6.430 x 6.430 | 4 |
| 7.250 x 7.250 | 72 | 164.0 | 7.000 x 7.000 | 4 |
| 8.250 x 8.250 | 72 | 212.4 | 8.000 x 8.000 | 2 |
| 9.375 x 9.375 | 72 | 274.2 | 9.000 x 9.000 | 2 |
| 10.375 x 10.375 | 72 | 335.8 | 10.000 x 10.000 | 2 |

65-45-12 Ductile Iron Milled Bar List/Weights

| Milled Size (Inches) | | | | Weight (lbs./ft.) |
|----------------------|---|-------|------|-------------------|
| *2.530 | x | 2.530 | x 72 | 19.6 |
| *3.030 | x | 3.030 | x 72 | 28.1 |
| *3.030 | x | 3.530 | x 72 | 32.7 |
| *3.030 | x | 4.030 | x 72 | 37.4 |
| *3.030 | x | 4.530 | x 72 | 42.0 |
| *3.030 | x | 5.030 | x 72 | 46.6 |
| *3.030 | x | 5.530 | x 72 | 51.2 |
| *3.030 | x | 6.030 | x 72 | 55.9 |
| *3.530 | x | 3.530 | x 72 | 38.1 |
| *4.030 | x | 4.030 | x 72 | 49.7 |
| *4.030 | x | 5.030 | x 72 | 62.0 |
| *4.030 | x | 5.530 | x 72 | 68.2 |
| *4.030 | x | 6.030 | x 72 | 74.4 |
| **4.030 | x | 7.030 | x 72 | 86.7 |
| *4.530 | x | 6.030 | x 72 | 83.6 |
| *5.030 | x | 5.030 | x 72 | 77.4 |
| *5.030 | x | 6.030 | x 72 | 92.8 |
| **5.030 | x | 7.030 | x 72 | 108.2 |
| **5.030 | x | 8.030 | x 72 | 123.6 |
| *6.030 | x | 6.030 | x 72 | 111.3 |
| **6.030 | x | 7.030 | x 72 | 129.7 |
| **6.030 | x | 8.030 | x 72 | 148.2 |
| **6.530 | x | 6.530 | x 72 | 130.5 |
| **7.000 | x | 9.000 | x 72 | 192.8 |
| **7.000 | x | 10.00 | x 72 | 214.2 |
| **7.030 | x | 7.030 | x 72 | 151.2 |
| **7.030 | x | 8.030 | x 72 | 172.7 |
| **7.530 | x | 7.530 | x 72 | 173.5 |
| **8.000 | x | 8.000 | x 72 | 195.8 |
| **8.030 | x | 10.03 | x 73 | 246.5 |
| **11.03 | x | 11.03 | x 74 | 372.3 |

Dimensional Tolerances:

* +/- .005"

** +.030"/-.000"

(Square, parallel, flat within .010" in any 6" section)