

# DUCTILE IRON PILES

## PRODUCT GUIDE

**FAST.  
SIMPLE.  
SAFE.®**



The Ductile Iron Pile system is a low-vibration, modular driven piling system that is well-suited for many site challenges including constrained and tight access sites, limited overhead clearances, and vibration-sensitive projects. Each modular section is manufactured in 5-meter (16.4-ft) lengths and includes the innovative Plug and Drive (bell-spigot) rigid, moment-resisting connection mechanism for fast, simple and safe field connections. A variety of pile diameters and wall thicknesses are available to deliver allowable structural compression capacities

ranging from 25 tons to 125 tons. The system also resists tension loads with the insertion of a high-strength center bar in the pile. Lateral loads are resisted through either bending of the pile shaft or by battering during installation.

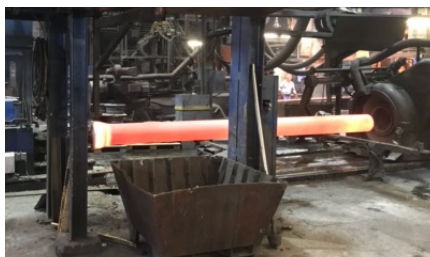
## MECHANICAL PROPERTIES OF DUCTILE IRON PILES

| MATERIAL PROPERTY            | KSI [MPA]        |
|------------------------------|------------------|
| Tensile Strength             | 60.9 [420]       |
| Compressive Strength         | 130.5 [900]      |
| Yield Strength (0.2% offset) | 46.4 [320]       |
| Modulus of Elasticity        | 24,656 [170,000] |

Ductile Iron Piles are manufactured by Tiroler Rohre GmbH (TRM) in Austria. TRM has more than 70 years of high-quality ductile iron manufacturing experience. The manufacturing process employs a strict quality assurance system that is certified in compliance with standard BS EN ISO 9001. Further, European ONCERT certification (ONORM 2567 regulation) and technical approval (ETA-07/0169) provide regular control of the product and prefabrication process. Quality control methods are deployed at key stages throughout the manufacturing process to ensure compliance with the manufacturing standards to deliver the highest quality product.



100% recycled material



State of the art production equipment







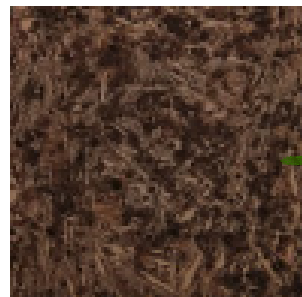
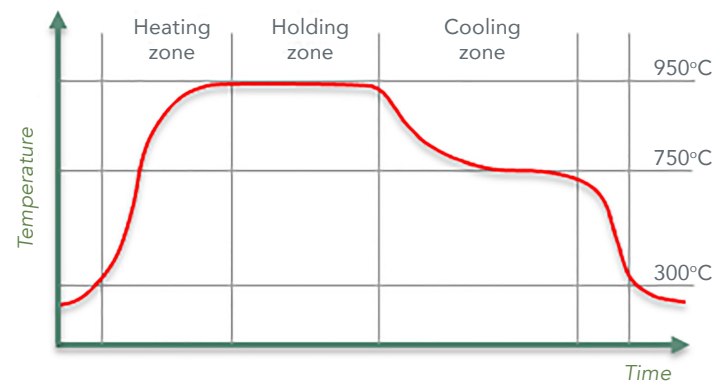
## MANUFACTURING

Ductile Iron Piles are manufactured from grey cast iron. Ordinary grey or lamellar graphite cast iron is transformed into spheroidal graphite or ductile cast iron by adding magnesium to the iron melt to increase the surface tension of the iron. During the subsequent centrifugal or spin casting process followed by controlled temperature annealing, the grey cast iron is converted to ductile iron. This drastically improves the cast iron's impact resistance, ductility, tensile strength, and flexural stiffness.

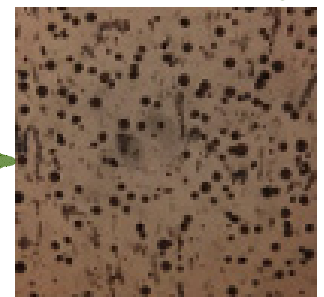
Ductile cast iron is comprised of 100% recycled materials and includes: 90-95% scrap metal iron, approximately 3.7% carbon, and approximately 2.7% silicon. Sources of material include raw materials such as laminated cores, sorted steel scrap and recycled materials certified from European sources. Sustainability and care for the environment is at the core of TRM's operations. TRM embarked on the extensive process of receiving an Environmental Product Declaration (EPD) of the piling system. The awarding of the EPDs and the content are regulated by ISO 14025 and EN 15804. Field studies showed the TRM piling system reduced Global Warming Potential (GWP) by 30% and CO2 emissions by 60% compared with concrete bored piles.



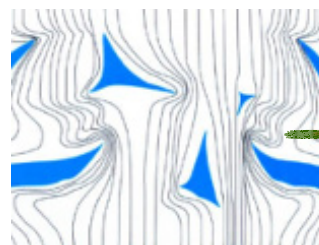
## DUCTILE BY ANNEALING



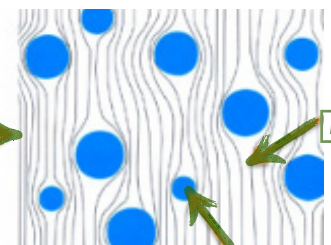
Laminar (brittle)



Ductile



Grey cast iron



Ductile cast iron

Iron  
Carbon



Laminar (brittle)



Ductile



MATERIALS

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DRIVE COMPONENTS

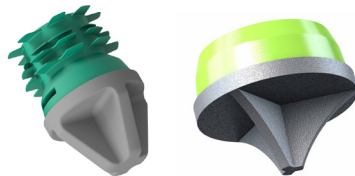
Flat Shoe



Flat Heavy Duty (HD) Shoe



Rock Point



Conical Grouting Shoe



SERIES

98



118



170



# PILE SPECIFICATIONS

| DIP Series | Outer Diameter<br>mm<br>in | Wall Thickness<br>mm<br>in | Cross-Sectional Area<br>in <sup>2</sup> | Moment of Inertia<br>in <sup>4</sup> | Section Modulus<br>in <sup>3</sup> | Bending Moment<br>(k-ft) | Weight<br>lb/ft | Internal Volume <sup>5</sup><br>ft <sup>3</sup> /ft | Allowable Structural Compression Capacity <sup>1,2,3,4</sup> |                   |
|------------|----------------------------|----------------------------|-----------------------------------------|--------------------------------------|------------------------------------|--------------------------|-----------------|-----------------------------------------------------|--------------------------------------------------------------|-------------------|
|            |                            |                            |                                         |                                      |                                    |                          |                 |                                                     | μ = 0.4<br>(kips)                                            | μ = 0.5<br>(kips) |
| 98 / 6.0   | 98                         | 6.0                        | 2.69                                    | 4.43                                 | 2.29                               | 8.8                      | 9.7             | 0.063                                               | 54                                                           | 65                |
|            | 3.86                       | 0.24                       |                                         |                                      |                                    |                          |                 |                                                     |                                                              |                   |
| 98 / 7.5   | 98                         | 7.5                        | 3.31                                    | 5.28                                 | 2.74                               | 10.6                     | 11.6            | 0.058                                               | 65                                                           | 79                |
|            | 3.86                       | 0.30                       |                                         |                                      |                                    |                          |                 |                                                     |                                                              |                   |
| 118 / 7.5  | 118                        | 7.5                        | 4.04                                    | 9.59                                 | 4.13                               | 15.8                     | 14.1            | 0.090                                               | 83                                                           | 101               |
|            | 4.65                       | 0.30                       |                                         |                                      |                                    |                          |                 |                                                     |                                                              |                   |
| 118 / 9.0  | 118                        | 9.0                        | 4.78                                    | 11.07                                | 4.77                               | 18.3                     | 16.4            | 0.085                                               | 96                                                           | 118               |
|            | 4.65                       | 0.35                       |                                         |                                      |                                    |                          |                 |                                                     |                                                              |                   |
| 118 / 10.6 | 118                        | 10.6                       | 5.54                                    | 12.51                                | 5.39                               | 20.6                     | 18.8            | 0.079                                               | 109                                                          | 134               |
|            | 4.65                       | 0.42                       |                                         |                                      |                                    |                          |                 |                                                     |                                                              |                   |
| 170 / 7.5  | 170                        | 7.5                        | 5.93                                    | 30.43                                | 9.09                               | 35.2                     | 22.7            | 0.203                                               | 136                                                          | 163               |
|            | 6.69                       | 0.30                       |                                         |                                      |                                    |                          |                 |                                                     |                                                              |                   |
| 170 / 9.0  | 170                        | 9.0                        | 7.06                                    | 35.55                                | 10.62                              | 40.7                     | 25.0            | 0.195                                               | 155                                                          | 188               |
|            | 6.69                       | 0.35                       |                                         |                                      |                                    |                          |                 |                                                     |                                                              |                   |
| 170 / 10.6 | 170                        | 10.6                       | 8.23                                    | 40.68                                | 12.16                              | 46.6                     | 28.6            | 0.187                                               | 176                                                          | 212               |
|            | 6.69                       | 0.42                       |                                         |                                      |                                    |                          |                 |                                                     |                                                              |                   |
| 170 / 13.0 | 170                        | 13.0                       | 9.94                                    | 47.79                                | 14.28                              | 55.2                     | 33.9            | 0.175                                               | 205                                                          | 252               |
|            | 6.69                       | 0.51                       |                                         |                                      |                                    |                          |                 |                                                     |                                                              |                   |

<sup>1</sup> Maximum structural capacity for pile and interior grout only. Does not consider geotechnical capacity for end-bearing or friction.

<sup>2</sup> Calculations include "low" corrosion rate applied to exterior only. Exterior corrosion applied at 1/32 inch per exposed face.

<sup>3</sup> Uses allowable stress factor (μ) of 0.4 and 0.5 per IBC Table 1810.3.2.6 (w/o or w/ load testing) for evaluation of structural capacity.

<sup>4</sup> Incorporates a 4,000 psi cement grout used to fill center of pile.

<sup>5</sup> Calculation of interior pile volume to estimate post-installation grout volume.

# DRIVE SHOES

| DIP Series | Dry Installation Method |            |         |            |            |         |            | Wet (Grouting) Installation Method                                                           |      |      |      |      |      |
|------------|-------------------------|------------|---------|------------|------------|---------|------------|----------------------------------------------------------------------------------------------|------|------|------|------|------|
|            | Series 98               | Series 118 |         |            | Series 170 |         |            | Conical Grouting Shoe (mm / in)<br>Neat Line Grout Volume <sup>6</sup> (ft <sup>3</sup> /ft) |      |      |      |      |      |
|            | Flat                    | Flat       | Flat HD | Rock Point | Flat       | Flat HD | Rock Point | 150                                                                                          | 180  | 220  | 270  | 320  | 370  |
|            |                         |            |         |            |            |         |            | 5.9                                                                                          | 7.1  | 8.7  | 10.6 | 12.6 | 14.6 |
| 98 / 6.0   | X                       |            |         |            |            |         |            | 0.17                                                                                         | 0.26 | 0.39 | 0.60 | 0.85 | 1.14 |
| 98 / 7.5   | X                       |            |         |            |            |         |            | 0.17                                                                                         | 0.25 | 0.39 | 0.59 | 0.84 | 1.13 |
| 118 / 7.5  |                         | X          | X       | X          |            |         |            |                                                                                              |      | 0.38 | 0.59 | 0.84 | 1.13 |
| 118 / 9.0  |                         | X          | X       | X          |            |         |            |                                                                                              |      | 0.38 | 0.58 | 0.83 | 1.12 |
| 118 / 10.6 |                         | X          | X       | X          |            |         |            |                                                                                              |      | 0.37 | 0.58 | 0.83 | 1.12 |
| 170 / 7.5  |                         |            |         |            | X          | X       | X          |                                                                                              |      |      | 0.58 | 0.82 | 1.12 |
| 170 / 9.0  |                         |            |         |            | X          | X       | X          |                                                                                              |      |      | 0.57 | 0.82 | 1.11 |
| 170 / 10.6 |                         |            |         |            | X          | X       | X          |                                                                                              |      |      | 0.56 | 0.81 | 1.10 |
| 170 / 13.0 |                         |            |         |            | X          | X       | X          |                                                                                              |      |      | 0.55 | 0.80 | 1.09 |

<sup>6</sup> Estimate of interior and exterior grout volume based on drive shoe diameter. Waste factors should be added to grout estimate.