

QT450-10 Fully Ferritic Ductile Iron

QT450-10 is a fully ferritic spheroidal graphite ductile iron widely used across mechanical manufacturing. Uniform spherical graphite sits within a pure ferrite matrix, delivering good tensile strength, excellent ductility and reliable low-temperature impact resistance with low brittleness.

We supply two production grades to match different working conditions:

1. As-cast high-toughness QT450-10: No extra heat treatment required, best for low-temperature impact scenarios
2. Standard general QT450-10: Can be fully ferritized via annealing, balanced raw material cost for regular ambient-temperature use

This grade features strong vibration damping, easy machining and stable performance under alternating and impact loads. It is commonly cast into structural parts for automotive, hydraulic, pipeline, mining and agricultural machinery.

Chemical Composition (Mass Fraction, %)

Element	Content Range
Carbon (C)	3.5 ~ 3.9
Silicon (Si)	2.2 ~ 2.9
Manganese (Mn)	≤ 0.60
Sulfur (S)	≤ 0.025
Phosphorus (P)	≤ 0.045
Residual Magnesium (Mg residual)	0.03 ~ 0.06
Rare Earth (RE)	0.015 ~ 0.04

Notes for Chemical Composition:

1. Carbon-silicon equivalent is controlled to promote spherical graphite formation and eliminate cementite.
2. S and P are strictly limited to avoid grain boundary brittleness and reduce low-temperature impact performance.
3. Residual Mg & RE are nodulizing elements to guarantee complete spherical graphite morphology.

Mandatory Mechanical Properties (National Standard Requirement)

Performance Item	Standard Minimum Index
Tensile Strength (Rm)	≥ 450 MPa
Yield Strength (Rp0.2)	≥ 310 MPa
Elongation Rate (A)	≥ 10%
Brinell Hardness (HBW)	160 ~ 210 HB
Metallographic Matrix Structure	Fully Ferritic Matrix



Supplementary Physical & Metallurgical Performance

1. Metallographic Structure: 100% ferrite matrix, graphite spheroidization grade ≥ 3 , graphite size grade 5~7; no massive cementite or pearlite allowed for standard QT450-10.
2. Impact Toughness: As-cast high toughness grade maintains stable impact value at $-20^{\circ}\text{C} \sim -40^{\circ}\text{C}$, suitable for cold region equipment.
3. Density: $7.20 \sim 7.30 \text{ g/cm}^3$
4. Modulus of Elasticity: 162 GPa
5. Linear Expansion Coefficient ($20\sim 400^{\circ}\text{C}$): $11.8 \times 10^{-6} /^{\circ}\text{C}$
6. Thermal Conductivity: $36 \sim 42 \text{ W/(m}\cdot\text{K)}$

Core Product Advantages

1. Excellent Low-temperature Toughness: As-cast version requires no annealing heat treatment, retains high impact resistance under sub-zero working environments without brittle fracture risk.
2. Ultra-high Ductility: Minimum elongation reaches 10%, far superior to pearlitic ductile iron QT600-3, capable of bearing large deformation and alternating impact load.
3. Two Grade Options for Cost Optimization: High-purity low-Mn as-cast formula for cold & heavy impact conditions; wide-range general formula reduces raw material cost for normal temperature working scenarios.
4. Outstanding Machinability: Soft full-ferrite matrix with HBW below 210, cutting, drilling and tapping processes achieve high efficiency and long tool life.
5. Good Vibration Absorption & Fatigue Resistance: Spherical graphite effectively absorbs mechanical vibration, extends service life for rotating and reciprocating structural parts.
6. Reliable Casting Performance: High carbon equivalent delivers good fluidity, suitable for complex thin-wall castings, low shrinkage and cold shut defects.

Reference Heat Treatment Specification

1. As-cast High Toughness QT450-10: Delivered in as-cast state, no annealing required; directly meet standard mechanical indicators after casting cooling.
2. Conventional General QT450-10 (Full Ferritizing Annealing Process):
 - ◇ Heating stage: Heat casting to $900 \sim 930^{\circ}\text{C}$, hold for 2 ~ 4h based on wall thickness
 - ◇ Slow cooling stage: Cool slowly to $700 \sim 750^{\circ}\text{C}$ inside furnace, hold for 3 ~ 5h
 - ◇ Final cooling: Furnace cool to below 500°C then air cool to room temperature
 - ◇ Function: Eliminate trace pearlite and cementite, obtain pure ferrite matrix to reach 10% elongation standard.



Typical Industrial Application Fields & Components

Automobile Industry

Truck axle housing, suspension brackets, engine crankcases, brake caliper housings, wheel hubs, exhaust pipe flanges, cold-region vehicle chassis parts.

General Machinery & Hydraulic Equipment

Hydraulic valve bodies, pump housings, gearbox casings, cylinder blocks, connecting brackets, rotating bearing seats under alternating impact.

Pipeline & Valve Industry

Low-temperature fluid valve bodies, pipe fittings, flange joints, water pump casings for outdoor cold environment pipelines.

Mining & Construction Machinery

Light load crusher supports, conveyor roller supports, excavator small structural castings, low-temperature construction equipment brackets.

Agricultural Machinery

Tractor chassis parts, harvesting machine connecting castings, cold-resistant agricultural tool holders working in northern low-temperature areas.

Quality Inspection Standards & Test Items

All QT450-10 castings implement full inspection per GB/T 1348-2019 before factory delivery:

1. Spectroscopic chemical composition analysis for each melting batch to control C, Si, Mn, S, P, Mg, RE content.
2. Tensile test specimen inspection to verify tensile strength, yield strength and elongation rate.
3. Brinell hardness test to confirm HBW range 160~210.
4. Metallographic microscope inspection: Graphite spheroidization rate, matrix ferrite proportion, forbidden cementite detection.
5. Low-temperature impact test (custom required for as-cast high toughness grade at -20°C / -40°C).
6. Visual & penetrant flaw detection to eliminate surface cracks, shrinkage porosity and cold shut defects.

