



# FerryNod<sup>®</sup>

Ferry Captain's reference  
for girth gears



# FerryNod®

FerryNod® is a ferrous alloy grade that covers a hardness range from 250 BHN (FerryNod®250) to 340 BHN (FerryNod®340).

It allows guaranteed minimum mechanical properties and hardness in thick cross-sections (>100 mm).

FerryNod® material grades do not have direct equivalents in published standards.

FerryNod® Grades 320 to 340 are the subject of technical patents.

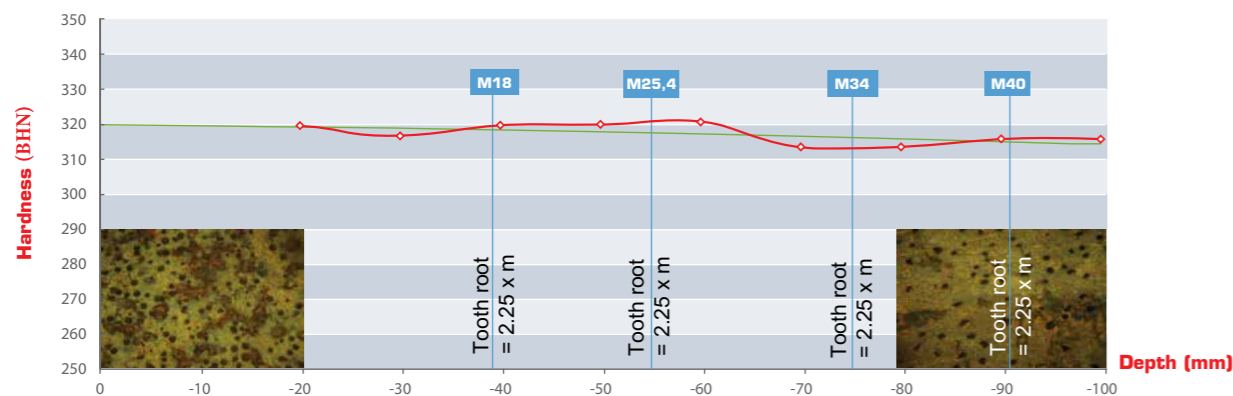


## 1 Physical properties guaranteed

### ■ Hardness

- Range : from 250 to 340 BHN (minimum guaranteed on casting)
- FerryNod® is a very homogenous material: on a 200 mm thickness cross-section, the maximum hardness loss is 5 BHN.

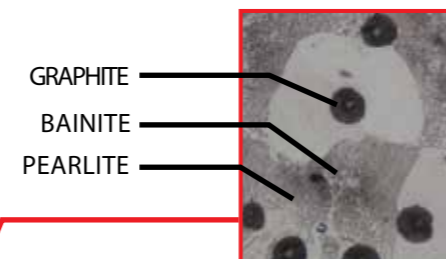
### Hardness gradient along tooth root



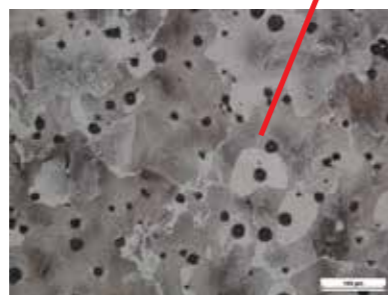
### ■ Microstructure

The matrix evolves as a function of hardness as follows :

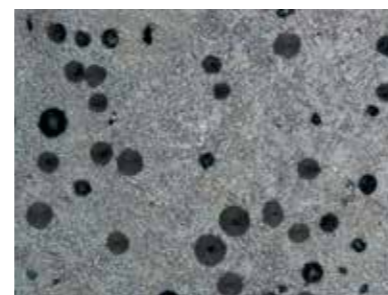
- FerryNod® 250 to 270 : pearlitic
- FerryNod® 280 to 300 : pearlito-bainitic
- FerryNod® 310 to 340 : bainitic



Pearlitic



Pearlito-Bainitic



Bainitic

## 2

## Minimum mechanical properties guaranteed beyond material standard limits

Material standard EN 1563 does not specify minimum mechanical properties for high hardness material, having thick cross-sections (see table below).

Material Grade		Section thickness	Yield strength 0,2%	Tensile Strength	Elongation
Designation	Number	t mm	Rp 0,2 MPa min.	Rm MPa min.	A % min.
EN-GJS-800-2	5.3301	t ≤ 30	480	800	2
		30 < t ≤ 60	* To be specified and agreed upon by supplier and purchaser		
		60 < t ≤ 200	* To be specified and agreed upon by supplier and purchaser		
EN-GJS-900-2	5.3302	t ≤ 30	600	900	2
		30 < t ≤ 60	* To be specified and agreed upon by supplier and purchaser		
		60 < t ≤ 200	* To be specified and agreed upon by supplier and purchaser		

FerryNod® bridges the gaps in the specification by guaranteeing mechanical properties on thick cross-sections.

Minimum mechanical properties values guaranteed by FERRY CAPITAIN for FerryNod® grades

Grade	Tensile testing			Fatigue testing	
	Tensile Strength (Rm)	Yield Strength 0,2% (Rp0,2)	A%	Fatigue Limit tooth root $\sigma_{rim}$ min. (N/mm <sup>2</sup> )	Fatigue Limit tooth flank $\sigma_{rim}$ min. (N/mm <sup>2</sup> )
	min. (MPa)	min. (MPa)			
FerryNod® 250	750	540	3	229	625
FerryNod® 270	790	550	3	237	655
FerryNod® 280	800	550	2	240	670
FerryNod® 285	810	560	2	242	678
FerryNod® 290	820	560	2	244	685
FerryNod® 300	850	570	1	248	700
FerryNod® 310	870	570	1	252	715
FerryNod® 320	890	580	1	256	730
FerryNod® 330	910	590	1	259	745
FerryNod® 340	930	600	1	263	760

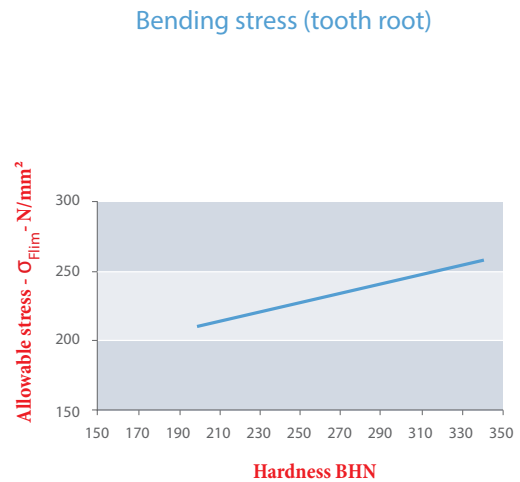
- Tensile properties obtained from test bars machined, with integrally-cast test blocks.
- Fatigue limits specific to gearing are as specified by ISO 6336 Grade ME and AGMA 6014 grade M2.
- The same standard, non destructive, test methods (e.g., UT, MP, ...) applicable for steel are used to verify the soundness of the castings, even for cross-section thicknesses exceeding 1000 mm.

### 3

## A material dedicated to open gearing applications

Gear design standard ISO6336, Section 5, specifies the maximum allowable contact (tooth flank  $\sigma_{Hlim}$ ) and bending (tooth root  $\sigma_{Flim}$ ) stresses as a function of material hardness (see graphs below). FerryNod® grades meet or exceed the specified stress values of this standard.

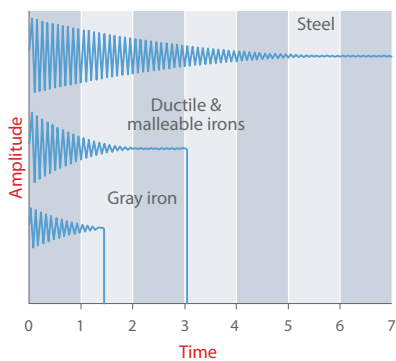
ISO6336 does not specify allowable stress values for hardness above 300 BHN. FerryNod® 310 to 340 material grades allow the limitations of the standard to be exceeded, and to achieve higher allowable contact and bending stresses.



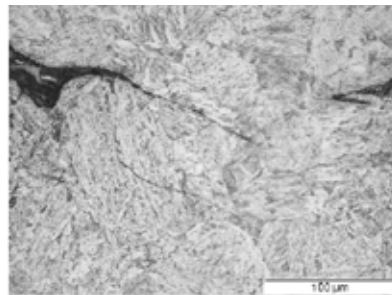
#### ■ Specific advantages

The presence of graphite nodules provides inherent lubricity and enhances a better vibration damping properties

... and provides higher resistance to crack propagation (see photos)



STEEL - crack propagates freely



FerryNod® : crack is arrested/absorbed by graphite nodules



### 4

## Field Repair

Welding trials and mechanical testing conducted specifically on SGI gear teeth have shown that a serviceable repair on an installed gear is possible, with only minor losses in fatigue strength. As such, any production stoppages due to damaged gearing should be minimized. Ferry Captain has established a formal repair procedure (PR2/89).

## FERRY CAPITAIN

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