



BONAXLE® | product specification

BONAXLE® is our innovative solution to the requirements of increased safety, lifespan and reliability. It also brings significant decrease of life-cycle costs (LCC). **BONAXLE**® is likely to bring paradigmatic change in railways across Europe and beyond. GHH-BONATRANS achieved to improve the technology already well established in Japan by adapting it to the conventional European geometry and steel grades. Innovative technology improves the strength of all types of axles without modification of the axle's geometry or steel grade.

Key features

- Higher safety and lower LCC
- Increased NDT intervals due to higher resistance against crack initiation
- No axle damage during operation thanks to resistance to impact
- No seizure during maintenance - assembly and disassembly of solid wheels, centers, gearbox, brake discs, bearings
- Allows older platforms to comply with current safety requirements



GHH-BONATRANS
Pioneers of wheelset solutions

Damage prevention

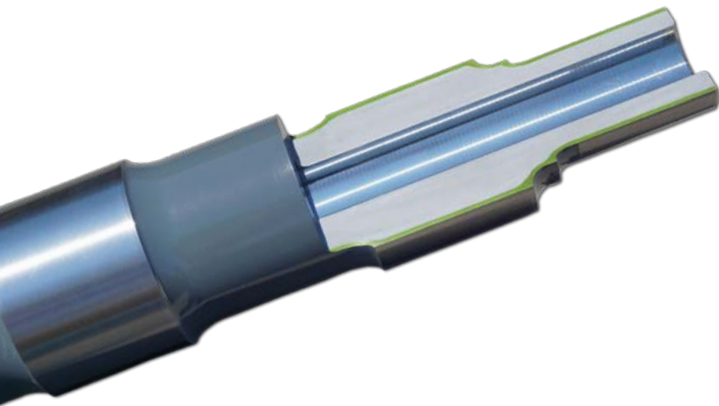
Due to the high hardness, the high yield and tensile strength the wheel seat cannot be seized during wheel dis/assembly (analogically for axle journal with bearing systems). The depth of homogenous hardened layer with hardness of approx. 490 HV 30 reaches up to approx. 6 mm below the axle surface, which enables re-profiling of axle without compromising the hardened layer. The axle body is resistant to impact from track ballast (proved by impact test with energy 90 J).

Endurance against crack propagation

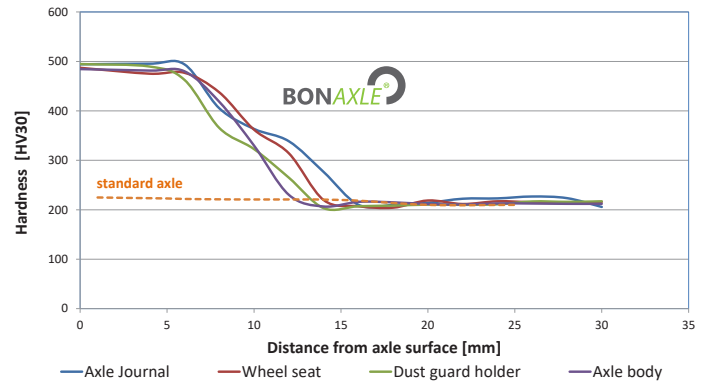
Crack propagation tests demonstrated it is impossible for cracks to propagate. The cracks grow commonly at stress 100 MPa, however, **BONAXLE** is resistant up to 300 MPa. Even with an artificial notch in critical position, the fatigue strength of **BONAXLE** is higher than required level by EN 13261 without notch.

LCC reduction

Thanks to high safety margins the service intervals in particular NDT for crack detection can be prolonged and synchronized with intervals for other wheelset and bogie parts. Therefore, life-cycle costs (LCC) can be reduced significantly. No necessity to repair damaged coating, in principle, no expensive thick-layer coatings are required.



BONAXLE is produced in compliance with EN 13261 and additionally treated by surface induction hardening along the entire length and at all diameters and transitional sections of the axle. It has been fully validated for steel grade EA4T, EA1N, EA1T.



Fatigue and tensile test

The fatigue limit is multiple times higher than that of the standard axle. Even though the surface hardness is higher, the notch sensitivity is not increased and the q parameter meets the requirement of the standard (EA4T).

EN 13261 (steel grade EA4T)	R_{fL} [MPa]	R_{fE} [MPa]	$q=R_{fL}/R_{fE}$ [-]	R_e [MPa]	R_m [MPa]
Required	≥ 350	≥ 215	≤ 1.63	≥ 420	650-800
BONAXLE	660	420	1.57	852	1,563

The fatigue limit of **BONAXLE** has increased from 240 MPa for the standard EA4T axle to the value of 450 MPa and even higher:

EN 13261 (steel grade EA4T)	Local stress [MPa]	Nominal stress – F1 [MPa]	Stress in joint area – F3, F4 [MPa]	Number of cycles
Required	-	≥ 240	$>145 - F3$ $>132 - F4$	10,000,000
BONAXLE	410	352 (+46%)	235 (+78%)	10,000,000
	450	416 (+74%)	274 (+88%)	10,000,000