



RAILWAY
SYSTEMS

PERFORMANCE ON TRACK®

HSH® RAILS FOR TRAMWAYS

Track performance as design-criterion

voestalpine

ONE STEP AHEAD.

voestalpine Rail Technology
www.voestalpine.com/railway-systems



HSH® RAILS FOR TRAMWAYS

TRACK PERFORMANCE AS DESIGN-CRITERION

Tramway operation is the backbone of urban transportation in many metropolitan areas. The ability to combine high transportation capacity at competitive cost represents the attractiveness of the system and defines the key requirements on tracks and rails: track availability, economic efficiency and social responsibility.

Offering optimized and sustainable solutions to our customers is voestalpine's philosophy, reverting to more than 100 years of experience in rail production, an exceptional expertise of engineers and unique portfolio of profiles and steel grades for tramways.

Modern steel design is a core competence of voestalpine aiming for longest service lives and lowest maintenance efforts. The HSH® grooved rail concepts are developed particularly to master the increasing demands like

- » 24/7 tram operation
- » increased noise sensitivity
- » economic efficiency requirements

The significantly increased resistance against wear and corrugation, the two main degradation mechanisms, enables longest lifetime of HSH® grooved rails.

We offer a broad range of different grooved rail steels ranging from 200BHN up to 400BHN hardness.

HSH® rails – Customer benefits

- » Longest service life
- » Low maintenance concept
- » Slow corrugation development – low vibration
- » Fast amortization

400GHT – HSH® QUALITY FOR THE ENTIRE SERVICE LIFE

Despite the lower axle loads, tight tramway curves are the most aggressive areas of all railway applications making them to critical areas. Among tramway operators, two maintenance strategies have established, to master the increased wear and corrugation in these areas:

- » **HSH® rails for “easy-to-maintain” strategy:**
 - Side wear is restored by gauge corner repair welding
 - Reduced level of corrugation
- » **HSH® rails for “put-in-&-forget” strategy:**
 - Side wear and vertical wear are countered by highest wear resistance of rails
 - Grinding interval can be stretched due to minimal corrugation development

While the “easy-to-maintain” concept is well established in central European countries, a trend towards the “put-in-&-forget” strategies is being observed for tramway operators who

- » are aiming for highest availability of the track and a minimum of maintenance (minimized down time),
- » want to avoid noise emissions from the grinding process and corrugation,
- » assure highest economic efficiency (lowest LCC),
- » have limited access to maintenance providers or technologies,
- » want to eliminate potential failures from Gauge Corner Repair Welding – the best weld is no weld
- » want to rely on a 100% quality controlled product with no need for Gauge Corner Repair Welding throughout the entire rail service life

The rail steel 400GHT is the most modern product that follows the “put-in-&-forget” strategy and worldwide installations in curves have shown that the rail service lives of rail steels following the “easy-to-maintain” concept will be reached or exceeded, without Gauge Corner Repair Welding.

400GHT – FACTS



Innovative UHC® steel design



400BHN hardness for highest material resistance



Joint and repair weldable with commercially available welding materials



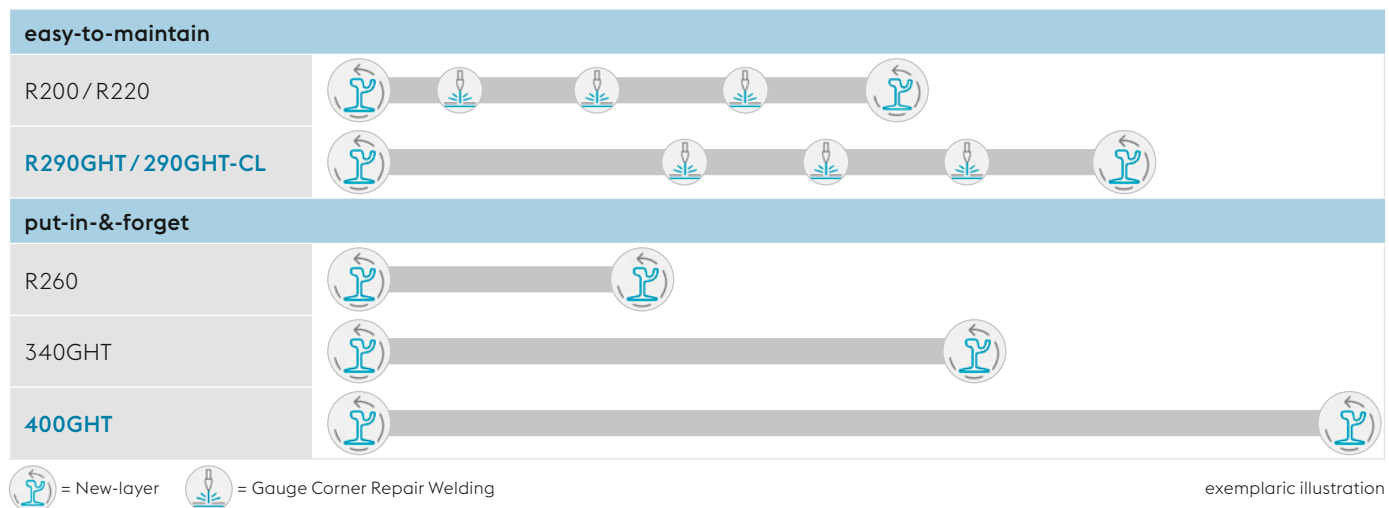
20 years of experience in other railway applications

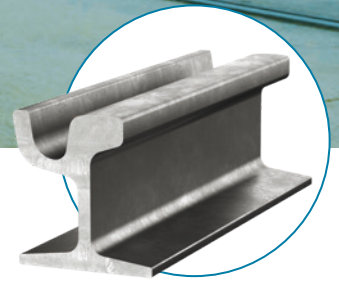


Bent down to min. radius of 14 m



Gauge Corner Repair Welding no longer necessary





CHOICE OF RAIL STEEL

voestalpine offers a wide range of grooved rail steels suiting all maintenance concepts by combining our HSH heat treatment with a specially adjusted material concepts. The application of HSH® heat treatment technology to all our GHT-steels leads to a microstructure refinement and thus significantly increased wear resistance without negatively affecting weldability. Besides carbon content adjustment, HSH® heat treatment has been proven being the most efficient methodology to significantly increase wear resistance.

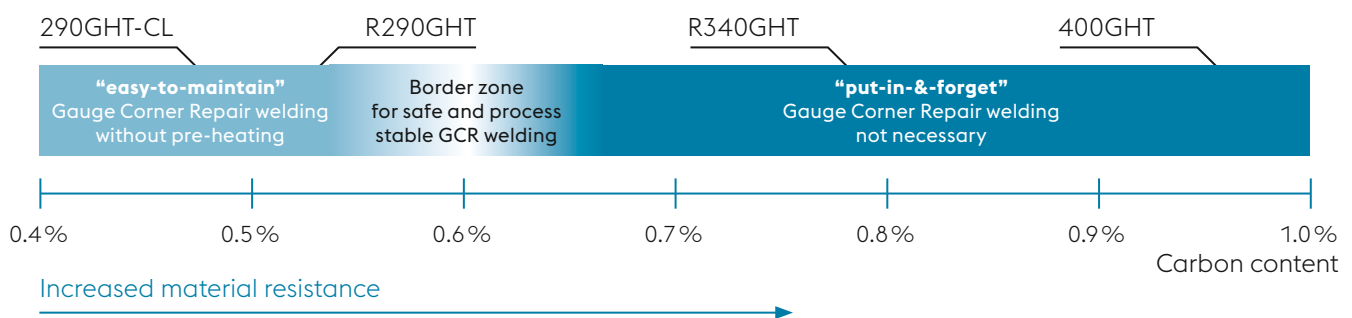
Based on the respective maintenance strategy, the suitable material concept is selected to meet our customer's demands. As other relevant alloying elements like Cr and Mn are usually on the same level for most grooved rails, the Carbon content (as stated in the inspection certificate) is the main influence parameter for the suitability for Gauge Corner Repair Welding. This is of high importance as the limit for a safe and process stable Gauge Corner Repair Welding without pre-heating was observed to be in a range of 0.6 % Carbon.

“easy-to-maintain”:

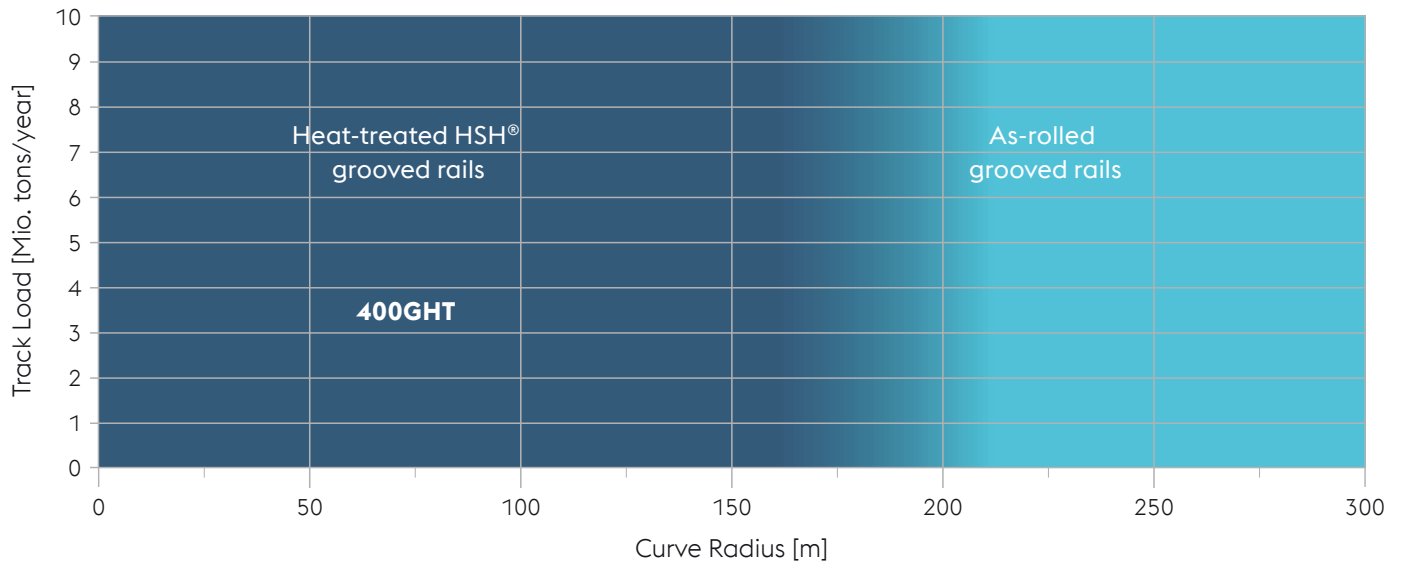
- » The low carbon content of the 290GHT-CL especially facilitates gauge corner repair welding and makes welding as easy as for R200 rail steel.

“put-in-&-forget”:

- » The higher carbon content of the 400GHT ultimately leads to highest wear resistance available and makes gauge corner repair welding no longer necessary.



Recommendation: put-in-&-forget strategy



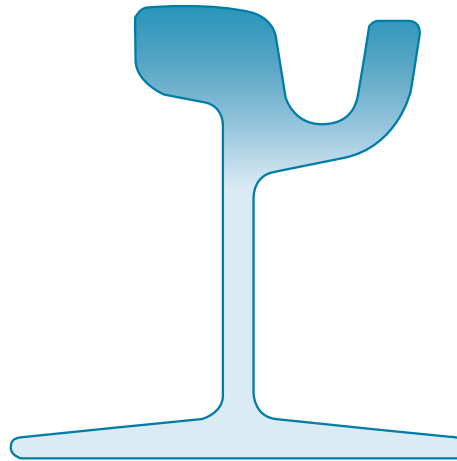
We recommend our HSH® grooved rails to be used in areas of increased wear and corrugation. Meaningful areas of application might vary from operator to operator as they depend on various factors such as running behavior of trams, track geometry and others. According to track experience, curves below $R = 150$ m radius are usually affected by higher wear and corrugation and thus we recommend the use of HSH® grooved rails for these areas. Latest track experiences have shown, that the 400GHT rail steel leads to the longest service lives and due to the reduced maintenance ultimately to the lowest Life Cycle Costs.



PRODUCT DESCRIPTION

Heat treated HSH® grooved rails are available in all EN profiles as well as in special profiles according to customer specifications. Furthermore, these rails are also available pre-bent based on bending plans done by voestalpine, and drilled for the application with tie bars.

Our rails excel by having tightest tolerances for profile, straightness and flatness as well as by their outstanding surface quality. All these are essential requirements for excellent bending results and a high track laying quality.



HSH® heat treatment

- » For running and guiding head
- » maximum resistance against wear
- » highest resistance against corrugation

Untreated rail foot and web

- » high service strength
- » low notch sensitivity

Mechanical Properties

Product name	Description	Hardness of running surface [HBW]	Tensile strength R_m [MPa]	Elongation A_5 [%]	Branding
290GHT-CL	» Non-alloy (C-Mn) HSH® heat-treated	300 ± 20	≥ 960	≥ 11	
R290GHT	» Non-alloy (C-Mn) HSH® heat-treated	310 ± 20	≥ 960	≥ 10	
R340GHT	» Non-alloy (C-Mn) HSH® heat-treated	360 ± 20	≥ 1.175	≥ 9	
400GHT	» Non-alloy (C-Mn) HSH® heat-treated	400 ± 20	≥ 1.280	≥ 8	

Chemical composition

Product name	C [%]	Si [%]	Mn [%]	Cr [%]	P [%]	S [%]	H [ppm]
290GHT-CL	0.40 - 0.50*	0.15 - 0.58	0.70 - 1.20	≤ 0.15	max. 0.02	max. 0.025	max. 2.00
R290GHT	0.50 - 0.55	0.15 - 0.58	1.00 - 1.25	≤ 0.15	max. 0.02	max. 0.025	max. 2.00
R340GHT	0.62 - 0.80	0.15 - 0.58	0.70 - 1.20	≤ 0.15	max. 0.02	max. 0.025	max. 2.00
400GHT	0.90 - 1.05	0.20 - 0.60	1.00 - 1.30	max. 0.30	max. 0.02	max. 0.020	max. 1.50

*Extra low C-content for best weldability (deposit welding)

Detailed information such as rail steel data sheets, rail profile drawings and technical descriptions are available upon request. The experts of Product Management and Technical Customer Service will be happy to assist.

Contact – Productmanagement: product_management@voestalpine.com

voestalpine PREMIUM SERVICES

voestalpine offers a unique portfolio of additional customer services including



LOGISTICS

» Our logistics team guarantees smooth rail delivery to its destination by optimization of the entire logistics chain. Our specialties are just-in-time deliveries to any construction site in Europe, as well as oversea deliveries.



WELDING

» Our experts from voestalpine Competence Center Welding (CCW) are constantly working jointly with renowned welding material suppliers to develop and improve rail welding technology.

» Beside trainings in our plant as well as on site, CCW offers also welding inspection to ensure high initial quality of rail welds



TECHNICAL SUPPORT TEAM

Our customer service team assists you in questions of:

- In-track performance evaluation
- Whole track system optimization
- Wheel – Rail interface optimization
- RAMS & LCC consulting



ISO 9001 Quality



ISO 14001 Environment
in accordance with EMAS II



ISO 45001 Safety



ISO 50001 Energy



AT-000183
Verified Environmental
Management

