RAILWAY SYSTEMS
by voestalpine

PERFORMANCE ON TRACK®

400 UHC® HSH® AND 340 DOBAIN® HSH®

Combining the best.

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

voestalpine
ONE STEP AHEAD.

400 UHC® HSH® AND 340 Dobain® HSH®

COMBINING THE BEST

To master the increasing demands of modern rail traffic, voestalpine Rail Technology GmbH has developed innovative rail solutions using state-of-the-art production technologies. With our premium rail steels, we optimize the track where conventional rail steels reach their limits, particularly in curves. It is our goal to minimize and even completely prevent typical rail damage, such as wear, rolling contact fatigue (RCF) or corrugation. Taking into account the entire railway system, a contribution can be made to the remaining components of the superstructure. Furthermore, voestalpine steel designs present solutions that minimize maintenance effort and ensure long service lives to optimize life cycle costs and maximize safety.

voestalpine has always developed high quality steels adapted to the needs of our customers and their specific railway network.

On this basis, the best material concept is identified and a proper solution is offered.

Rail deterioration for mixed and high-speed traffic follows the predominant wear mechanism in track. Our customer-based solution – driven by safety concerns and short maintenance windows – consists of two different steel designs:

the well-established **400 UHC® HSH®** (EN13674-1) and
the all-new **340 Dobain® HSH®**.

The goal of both rail steels is similar – preventing rail deterioration – but their material design is very different.

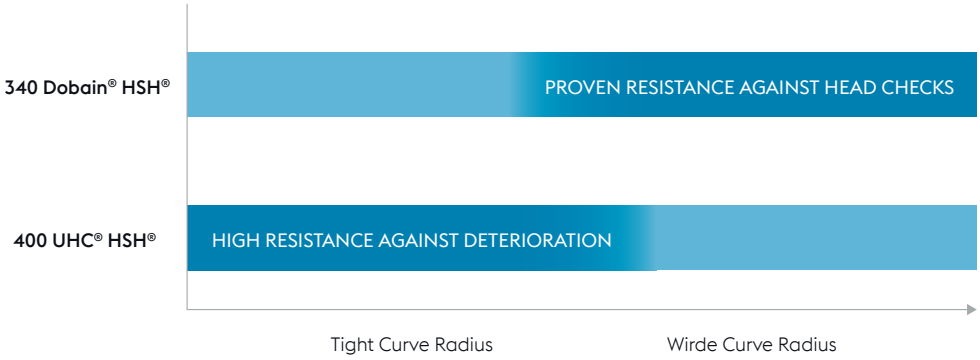
Applying their specific advantages, maintenance needs are minimized to reach maximum service life. Therefore, we offer the safest and most economical solution for our customers and their clients.

Customer benefits

- Significant reduction of rail maintenance costs due to excellent resistance against rail deterioration
- Significant increase of the operational rail service lifespan
- Lowest life cycle costs
- Best weldability due to the non- and low alloy steel design

STEEL DESIGN
AGAINST RAIL DETERIORATION

Rails in track usually suffer from severe loading that is transmitted through the wheels of the passing trains. High stresses in the contact area between rail and wheel deform the rail and can cause defects, such as corrugation, wear and head-checks.



THE voestalpine SOLUTION

Using the rail steel grade that is needed in track.
voestalpine offers two different premium rail grades for the predominant rail defect mechanism(s).

APPROVED IN TRACK

INCREASED SAFETY

JOINT AND REPAIR WELDING WITH STANDARD WELDING EQUIPMENT

400 UHC® HSH®

- 100% pearlitic rail steel, non-alloy
- Microstructure refinement and reinforcement
- High resistance against all types of rail deterioration

340 Dobain® HSH®

- Innovative multiphase steel design
- Microstructure-related polishing
- Head-Checks free

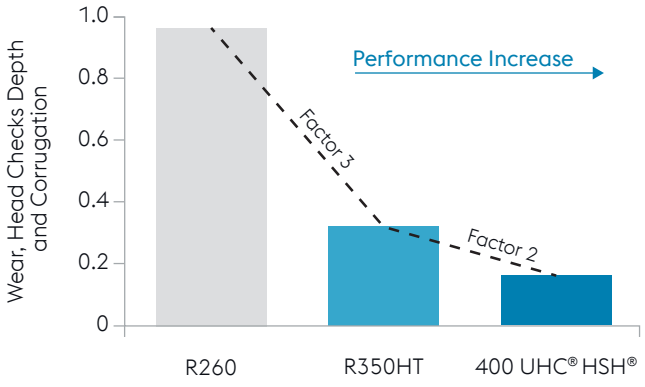
400 UHC® HSH®
HIGH RESISTANCE AGAINST DETERIORATION

The smart material concept of the 400 UHC® HSH® rail grade is based on the idea to boost the strengths of the long-term proven pearlitic steel designs.
The superior performance of 400 UHC® HSH® against all kinds of rail deterioration mechanisms leads to the longest service life and thus lowest life cycle costs compared to other common steel grades. Due to the easy-to-weld material design (just apply standard procedures) it is easy for our customers to replace R350HT and gain the benefits of 400 UHC® HSH® in dedicated track sections.

PERFORMANCE

The performance factors are based on long-term experience in various tracks of our customers. They confirm the steel grade's resistance against wear, corrugation and head checks – especially in curved tracks.

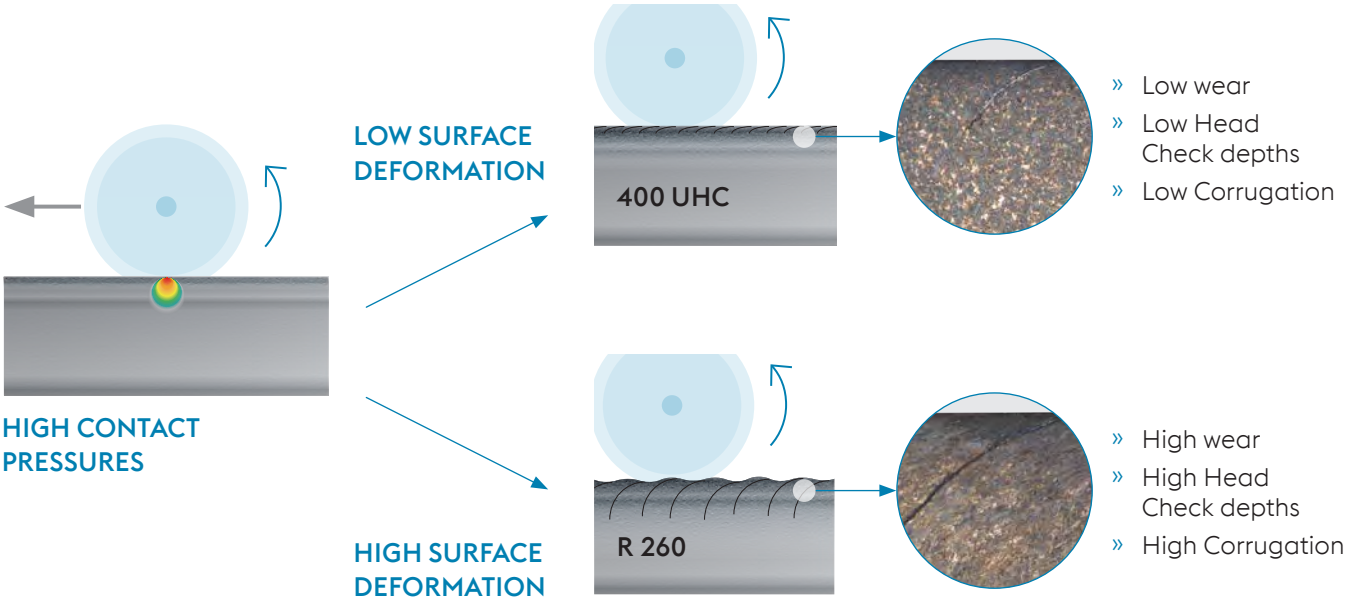
PERFORMANCE INDICATORS IN TERMS OF HEAD CHECKS DEPTH, WEAR AND CORRUGATION DEPTH.



REDUCING DEFORMATION

High forces are transmitted over a small area between wheel and rail, which causes high stresses in the rail. This cyclical process permanently deforms the rail material near the surface: The original rail properties deteriorate, resulting in head checks and corrugation.

The 400 UHC® HSH® rail grade changes the underlying damage mechanism by reducing its deformation. As a result, the resistance against rail deterioration is increased when using the 400 UHC® HSH®.



340 Dobain® HSH®
PROVEN RESISTANCE AGAINST HEAD CHECKS

To ensure the highest safety in track, we performed comprehensive laboratory testing, including various tests on a full-scale wheel-rail test rig and numerous performance tests in track together with our customers. As a result, we developed the 340 Dobain® HSH®.

RESULT OF INTENSIVE RESEARCH

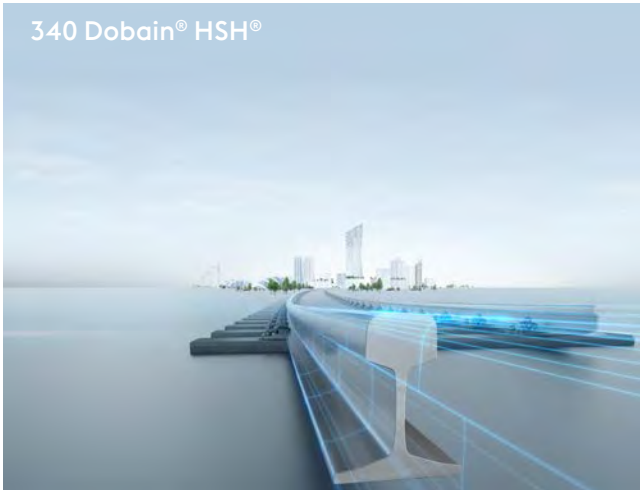
EXTENSIVE FULL-SIZE LABORATORY TESTING

APPROVED IN TRACK

A SIMPLE MECHANISM

Nature knows many ways to adapt to harsh environments. One well known mechanism is self-cleaning or polishing – a feature some plants take advantage of to protect their surface and ensure their functionality.

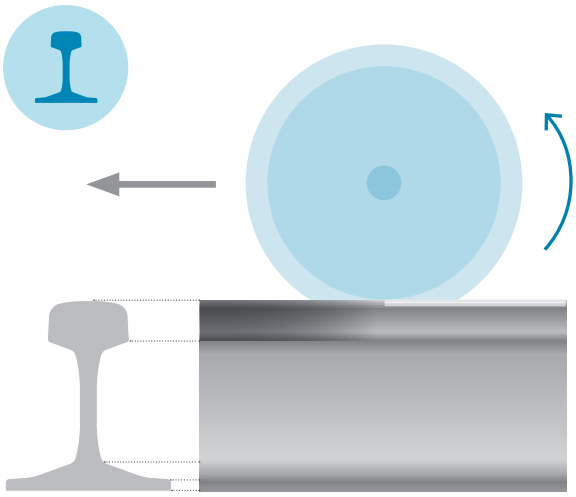
The so-called Lotus effect. voestalpine's highly experienced R&D team managed to apply this simple concept of nature to the rail development and launched a new dimension in rail steel.

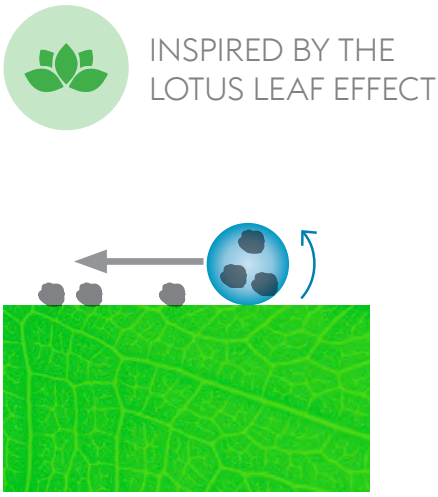


INSPIRED BY NATURE

PREVENTING HEAD CHECKS INITIATION ON A PHYSICAL LEVEL

The new multiphase steel design of 340 Dobain® HSH® uses its microstructural features and prevents the formation of Head Checks. A self-polishing effect responds to the severe loading situation and reduces the deformation on the surface to a minimum. The Lotus effect applied to rails. As a result we are able to produce a rail with lowest maintenance needs.





STATE-OF-THE-ART RAIL PRODUCTION

voestalpine produces metallurgically ultra clean rails up to a length of 120 m. More than one hundred profiles according to EN13674, AREMA and other standards are available – having the tightest profile and straightness tolerances. State-of-the-art non-destructive testing methods ensure the quality of our rail steels and guarantee a smooth installation and extraordinary performance in track. Furthermore, our modern production techniques offer the highest flexibility for all lot sizes.

SUSTAINABLE RAIL PRODUCTION FOR CLEAN STEELS

HIGHEST PROFILE AND STRAIGHTNESS TOLERANCES

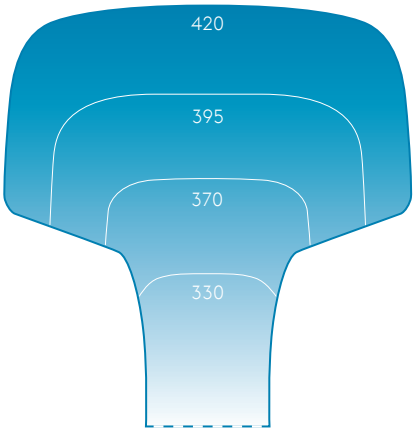
HIGHEST QUALITY STANDARDS AND STATE-OF-THE-ART TESTING

HSH® TECHNOLOGY

voestalpine developed a rail fining process with the highest homogeneity: With the “Head Special Hardened” – HSH® process the as-rolled hot rail is dipped is dipped in the heat-treatment bath over the whole length of rail – immediately after the final rolling pass. This process results in a fine pearlitic microstructure that exhibits superior mechanical properties such as strength, hardness, elongation and fracture toughness.

To significantly increase the resistance against wear and rolling contact fatigue (RCF) but maintain a high ductility and low notch sensitivity, only the rail head is heat treated. For our pearlitic rail steels a higher hardness due to microstructure refinement can be achieved in the head and a lower hardness in the web and foot: **resistance where it is needed.**

400 UHC® HSH®



RAIL STEELS FOR MODERN RAILWAYS

With our state-of-the-art production and steel grades, we can cover the various requirements for rails in modern railways: from the use in straight track to tight curves. For heat treated rail grades the well-established HSH® technology is used, ensuring the highest homogeneity along the whole length and the highest in-depth treatment.

The following table provides an excerpt of vignol rail steels standardized and/or produced according to European standards EN13674-1.

Rail grades according to EN 13674-1:2017:

Steel Grade		Chemical Composition [mass %]				Mechanical properties		
		C	Si	Mn	Cr	R_m [MPa]	A^5 [%]	Hardness [BHN]
"As rolled" rail grades	**R200**	0.40 - 0.60	0.15 - 0.58	0.70 - 1.20	≤ 0.15	≥ 680	≥ 14	200 - 240
	R260	0.62 - 0.80	0.15 - 0.58	0.70 - 1.20	≤ 0.15	≥ 880	≥ 10	260 - 300
	R260Mn	0.55 - 0.75	0.15 - 0.60	1.30 - 1.70	≤ 0.15	≥ 880	≥ 10	260 - 300
Heat treated rail grades	**350HT** (350HT HSH®)	0.72 - 0.80	0.15 - 0.58	0.70 - 1.20	≤ 0.15	≥ 1,175	≥ 9	350 - 390
	R350LHT (350LHT HSH®)	0.72 - 0.80	0.15 - 0.58	0.70 - 1.20	≤ 0.30	≥ 1,175	≥ 9	350 - 390
	R370CrHT (370LHT HSH®)	0.70 - 0.82	0.40 - 1.00	0.70 - 1.10	0.40 - 0.60	≥ 1,280	≥ 9	370 - 410
	R400HT (400UHC® HSH®)	0.90 - 1.05	0.20 - 0.60	1.00 - 1.30	≤ 0.30	≥ 1,280	≥ 9	400 – 440
	340 Dobain® HSH®*	0.20 - 0.50	0.80 - 1.20	1.20 - 1.80	≤0.40	≥ 1,050	≥ 14	300 - 340

*not standardized in EN13674-1.

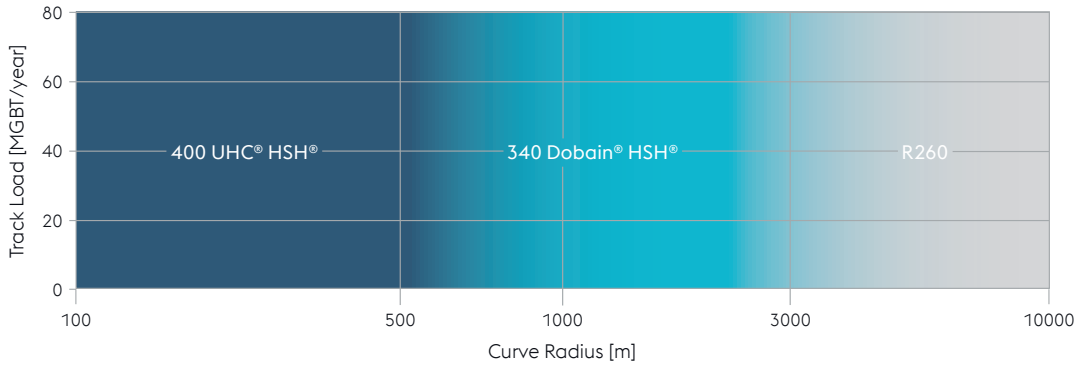
CHOICE OF RAIL STEEL

As a full-range rail supplier, voestalpine offers the widest range of rail profiles and rail steels suiting all fields of application and maintenance concepts by combining our HSH® heat treatment with adjusted and new material concepts.

RECOMMENDATION

Depending on the predominant rail defect mechanism, we define suitable areas of application for our rail grades. For tracks susceptible to head checks the solution is our 340 Dobain® HSH®. In areas of increased wear and corrugation we recommend our 400 UHC® HSH® rails. Latest track experiences show that this rail grade strategy leads to the longest service life and due to the reduced maintenance, ultimately to the lowest life cycle costs.

Following this rail grade recommendation leads to a technically, economically and ecologically optimized track.



STEEL TECHNOLOGY

For all premium rail steels, the HSH® technology allows for highest weldabilty and toughness by minimizing the amount of alloying elements.

- **HSH® TECHNOLOGY**
- **NO HEAD CHECKS (340 Dobain® HSH®)**
- **LOWEST LIFE CYCLE COSTS**
- **EASY TO WELD**
- **LOWEST MAINTENANCE NEEDS**
- **HIGH WEAR RESISTANCE (400 UHC® HSH®)**

340 Dobain® HSH®

The Dobain® material concept combined with the well-established HSH® technology creates a unique microstructure that is able to solve the mechanism of head checks initiation on a physical level.

400 UHC® HSH®

The UHC® steel design combined with the HSH® technology leads to a microstructure strengthening and refinement. The rail steel features the highest resistance to degradation such as wear, corrugation and RCF.

voestalpine PREMIUM SERVICES

voestalpine offers a unique portfolio of additional customer services, including

TECHNICAL SUPPORT TEAM

Our customer service team assists you in questions of:

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

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 also offers welding inspection to ensure high initial quality of rail welds

LOGISTICS

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

ISO 9001 Quality

ISO 14001 Environment in accordance with EMAS II

ISO 45001 Safety

ISO 50001 Energy

AT-000183 Verified Environmental Management

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