



Activating Your Ideas

Stainless steel for railway vehicles

**OUTO
KUMPU**



Right on track

The applications of stainless steel in railway vehicles are as diverse as their applications in the transport domain. Different stainless steel grades and surface finishes provide the full choice for manufacturers to make the most of this versatile material. Whatever the rail transport in question, whether passenger, freight, metro or light rail transit system, can all benefit from key benefits, which Outokumpu's comprehensive range of stainless steels can offer.

Our expertise at your service

Outokumpu is one of the largest producers of stainless steel and is widely recognised as a world leader in technical support, research and development. We service our customers from our main production facilities, supported by extensive operations in 30 countries globally.

Outokumpu's stainless steel can be found on many of the world's leading train manufacturers, for example, Alstom,

AnsaldoBreda, Bombardier, CAF and Vossloh products today. Customer for customer we strive to know your business better and offer the right solution for your needs.

Outokumpu supplies a wide range of grades, dimensions and finishes. Working together we can provide designers and engineers with exceptional possibilities to create innovative, lightweight railway vehicles of the future.



For Passenger Vehicles

Reflecting the growing trend by railcar operators to favour austenitic stainless steel over carbon steels in the design and construction of rolling stock, Outokumpu has a range of advanced alternatives. The benefits are clear: high-strength giving reduced weight, high energy absorption at impact and greater corrosion and fire-resistance all in the same package.

Significant benefits, a range of possibilities

These qualities enable weight reduction through the creation of thinner sections, profiles and panels, particularly so when using temper rolled 1.4318 / 301LN or duplex

stainless steels with their even greater corrosion resistance. Temper rolled 301LN / 1.4318 with its high strength and duplex stainless steels combine low nickel content with high mechanical strength making them an efficient alternative to standard strength grades. This offers cost-saving benefits: thinner also means lighter, which for railcars, especially on commuter and metro routes, means significant energy savings over their entire life cycle.

Outokumpu is able to provide outstanding high strength stainless steel grades in addition to many high-strength offerings for passenger rail car bodies in high-strength temper rolled 301, 301LN, 201 (1.4310, 1.4318, 1.4372) stainless steel.

For Freight Vehicles

The performance demands on freight vehicles are greater than ever: reduced maintenance, higher wear resistance and reduced tare weight are all key factors in their evolution. For example Outokumpu's lean ferritic 12% Chromium type 1.4003, which is used for coal and ore freight wagons competes directly with carbon steels but with greater corrosion resistance. The benefits are clear: longer vehicle life, higher load carrying ability, reduced maintenance and overall better performance when transporting heavy commodities.

What's your requirement?

Many applications within the railway industry can benefit from Outokumpu's wide range of grades suited to your particular demands. We actively develop unique materials, finishes and treatments to meet these demands and offer the ability to test them under exacting conditions. By so doing we ensure they will meet your customer's requirements long before they ever go into service.

Customer reference: Bombardier

Bombardier Transportation is a global leader in the rail industry. Headquartered in Berlin, Germany, the company has 59 production and engineering sites in 23 countries. Additionally, Bombardier operates over 40 service centres at its customers' premises across the world. The company places environmental sustainability firmly at the top of the agenda. Its products and services combine energy conserving technology with optimal safety, reliability and cost efficiency and are designed for sustainable mobility throughout their lifecycle.

Bombardier Transportation offers the broadest portfolio of products and services in the rail industry, encompassing passenger vehicles for urban and mainline operations, locomotives, bogies, rail control solutions, propulsion

and complete transportation systems, as well as vehicle modernization and maintenance. Over 100,000 vehicles in operation worldwide attest the company's unique strengths in project management and innovation, design and technology.

Bombardier use Outokumpu as a supplier of stainless steel due to weight saving possibilities offered by temper rolled stainless steel products in the construction of carbodies.



Image courtesy of Bombardier

Customer references:

CAF

Construcciones y Auxiliar de Ferrocarriles (CAF), S.A. is one of the international market leaders in the design, manufacture, maintenance and supply of equipment and components for railway systems. Their product range extends to complete transportation systems including high speed locomotives, regional trains, commuter trains/ electric motorcars, metro unit trains, streetcars and light rail trains.

CAF has worked with Outokumpu to provide clear weight saving potential and all the high strength benefits that come from the use of temper rolled stainless steel grades in its products.



Alstom

A promoter of sustainable mobility, Alstom Transport develops and markets the most complete range of systems, equipment and services in the railway sector. Alstom Transport manages entire transport systems, taking in rolling stock, signalling and infrastructure, and offers "turnkey" solutions. The company is no. 1 in the high and very high speed train sector. Alstom Transport is present in over 60 countries and employs some 27,000 people.

Alstom chose to partner with Outokumpu as a supplier of stainless steel that will be used in high strength carbodies, which also have good corrosion resistance.



Customer reference: Vossloh Group España

The Vossloh Group, which is made up of over 70 companies operating in more than 30 countries is a global player in selected rail infrastructure and rail technology markets. Vossloh commands a strong position in certain niche markets such as rail fasteners or switch systems and in the manufacture of diesel locomotives and key electrical components for trams, streetcars, metros, and trolleybuses.

Vossloh Group España chose to work with Outokumpu steel to render clear benefits in the production of rolling stock to its customers including increased strength and greater corrosion resistance.

"We chose duplex LDX 2101® because of its strength and corrosion resistance. First, the duplex grade's yield strength is 60% and tensile strength 45% higher than the values presented by the ferritic grade. Second, duplex LDX 2101® has corrosion resistance similar to that of the austenitic stainless steel grade EN 1.4404 (ASTM 316L)."

– Vossloh Group España's engineering department



What's your specification?

Stainless is the perfect fit for rail transportation vehicles combining high strength weight saving possibilities with fire resistant properties and ease of fabrication. It also offers excellent recyclability. Under impact, high strength stainless also offers excellent energy absorption in relation to strain rate. Outokumpu offers a broad range of alternatives – what's your specification?



Right grades

At Outokumpu we recognize the need to be close to our customers as well as finding the right match for their design and production needs. Each stainless steel application is unique and we work hard to help them choose the optimal match for their needs. We not only help our customers with our expertise and advice but we also give them the possibility to test candidate materials on their own premises.

Right delivery

We also believe in making the purchase of stainless steel as effortless as possible. We do this through a responsive supply chain. This is further supported by our global network of local sales offices, all of which are dedicated to providing the personal level of service to which our clients have become accustomed.

Right development

At Outokumpu, R&D is an essential part of our customer offering. From product and applications development to process development and improving the quality of production processes, all contribute to greater cost efficiency and environmental sustainability.

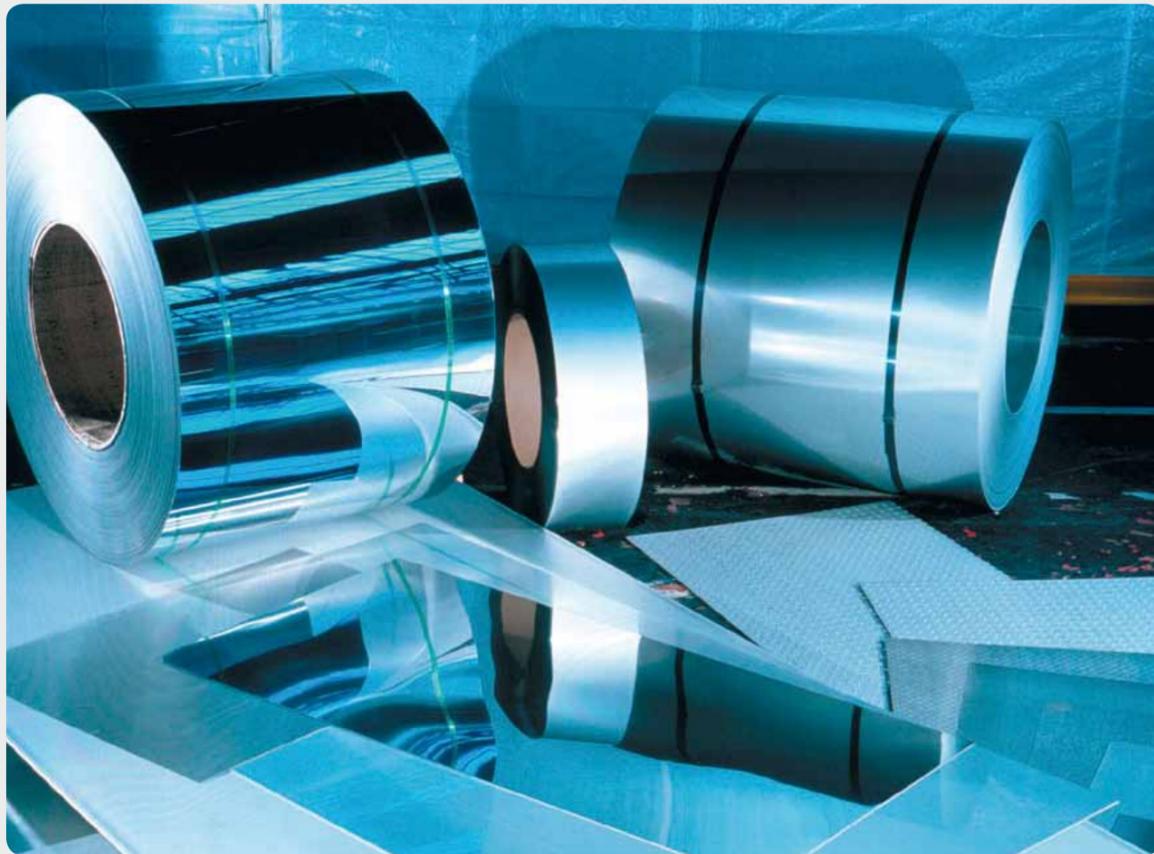
Right approach

It's our goal to minimize environmental impact – a goal, which encompasses both the recyclable materials we offer to our customers and the processes that govern our operations. Placing an order with us ties in the whole supply chain from production to final installation with the minimum environmental impact and maximum attention to health and safety.

Our complete offering

Outokumpu's offering includes temper, cold and hot rolled stainless steel coil, sheet and plate, which are available in a number of grades. We also make billet, wire rod and bar, as well as tubes, fittings and suction roll shells. In addition, we offer tailor-made solutions for our customers. These products find their application in process industries, oil & gas, household, transport and construction industries.

We also produce speciality stainless products for e.g. the electronics and IT industries as well as having the most up-to-date downstream processing centres in the main markets.



Technical specifications:

Temper Rolled High Strength Stainless Steel

Outokumpu can provide weight reduction solutions using high strength stainless steel products. In grade 301LN / 1.4318 Outokumpu provides many different strengths, up to a tensile strength of 1300 MPa, available in a wide range of thicknesses and widths. Temper rolled products are also available in other austenitic grades, including 304L / 1.4307 and 316L / 1.4404, by request. Temper rolled material is available as sheets or coils form and even with a polished / brushed surface finish.

Replacing Carbon Steel

As a superior substitute to carbon steel, Outokumpu's ferritic UNS40977 / 1.4003 has been used for coal and ore freight wagons, metro and tram cars. It offers improved corrosion resistance when compared to carbon steels, often not requiring coatings to be applied. This can give substantial overall cost savings to the finished product.

Duplex stainless steels

With higher corrosion resistance combined with high strength, duplex grades LDX2101, 2304 and 2205 have been the preferred choices in a number of projects.

Brake Pipes

Outokumpu can provide stainless steel tubing for use in brake pipes.

Value added services

- Edge preparation
- Cut to shape
- Bending
- Surface finishing: 2B, 2E, 1D and more
- Polishing
- Construction kits
- Prefabrication
- Modified chemical analysis
- Slit coils
- Package solutions
- Welding advice
- Technical support

Outokumpu – Activating Your Ideas

Our technical leadership allows us to offer stainless steels for all needs across the transport industry, and also to tailor solutions to meet your specific needs.

We are full committed to sustaining value by continuously developing our people and putting the customer at the heart of everything we do.

Total customer commitment defines all that we do. You have the idea. We make it a reality with our world-class stainless steels and professional support.

Our global network supports you all the way from assessing your needs on the ground, to providing full back-up in quality and production planning.

We are committed to excellence everywhere. Not just in product development and customer service, but also in logistics and the development of new technologies for the environment.



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Outokumpu is a global leader in stainless steel. Our vision is to be the undisputed number one in stainless, with success based on operational excellence. Customers in a wide range of industries use our stainless steel and services worldwide. Being fully recyclable, maintenance-free, as well as very strong and durable material, stainless steel is one of the key building blocks for sustainable future.

What makes Outokumpu special is total customer focus – all the way, from R&D to delivery. You have the idea. We offer the world's best stainless steel, technical know-how and support. We activate your ideas.

