
Rolled products for brazed heat exchangers

A white electric car is shown from a rear three-quarter perspective, driving along a winding asphalt road. The road cuts through a rugged, rocky landscape with patches of green vegetation. In the background, a range of mountains is visible under a clear blue sky. Numerous wind turbines are scattered across the hills, their blades turning in the wind. The overall scene conveys a sense of modern, sustainable transportation and energy generation.

Customer driven sustainable aluminium solutions

Our solutions help customers grow and transition to climate neutrality. Sustainability is central in Gränges' business and strategy. We have a strong commitment to minimize the environmental impact of our operations, uphold ethical business practices, and provide a safe and good working environment. The aim is to develop sustainable aluminium solutions with a low-carbon impact, circular and resource efficient, and responsibly sourced and produced.

Aluminium plays an important role in enabling the green transition towards a circular and sustainable economy. Through lighter products, energy, and emission savings can be achieved both operationally and in product usage.

We are committed to creating circular and sustainable aluminium solutions in partnership with our customers and suppliers – for a better future.

Globally powered, locally committed

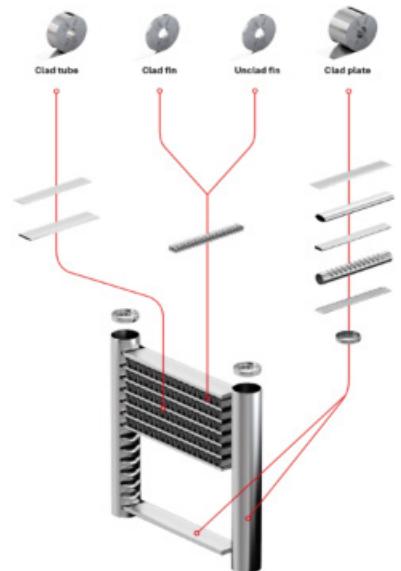
With customized product development, regional production, sales and technical support, we meet customers globally in an efficient and sustainable way.



A global leader in rolled aluminium products

Gränges offers a comprehensive range of clad and unclad rolled aluminium products applications with a high degree of functionality and performance. We offer a full range of rolled aluminium products for manufacturers of heat exchanger, and up to 3,000 product specifications, including 200 active alloy combinations.

Depending on the specific needs of a given application, Gränges offers multi-layer products with up to five layers. This variety provides virtually unlimited possibilities for customised solutions based on carefully selected alloy combinations, delivery conditions, cladding thickness and geometries. Leading-edge technology and true industrial craftsmanship ensure materials with consistent quality.



Clad tube

Tube products for both welded and folded tube designs supporting the continuing trend for downgauging and increasing demands on corrosion resistance, brazeability and strength.

Clad fin

Clad fin developed for excellent brazeability to withstand core dissolution and high-temperature sagging, and to enable downgauging for lighter heat exchangers.

Unclad fin

Unclad fin comprises only one alloy without clad layers and is used for applications such as radiators, heaters, charge air coolers and evaporators.

Clad plate

Consists of a core alloy clad with braze clad on one or two sides. The rolled product is stamped or shaped by the customer depending on the application and used in most kinds of heat exchanger applications, either for coolant plates or manifolds.

Unclad plate

The rolled product is stamped or shaped by the customer. Usually combined with clad plate for brazing of battery cooling plate applications.

Application area Automotive

Gränges rolled products are used in a wide range of applications in the automotive industry. There are suitable material options for all types of vehicles, both with combustion engine and electric. Our high-performance materials increase the efficiency and effectiveness of heattransfer applications; from radiators and condensers to chillers and battery cooling plates.



Battery cooling plates

The batteries of electrical vehicles require cooling. The most common solution is cooling plates of aluminium. It can be several small or one large plate with formed channels.

Oil coolers

Oil coolers come in many different designs. Due to service conditions with high pressure and temperatures, the main material requirements are strength, corrosion resistance, and brazeability.

Evaporators

The typical evaporator design is either a drawn cup plate design or a flat tube design made from extruded micro channel tubes.



Heaters

For heaters, a strong downgauging trend has been ongoing for many years, increasing demands on corrosion performance and brazeability.



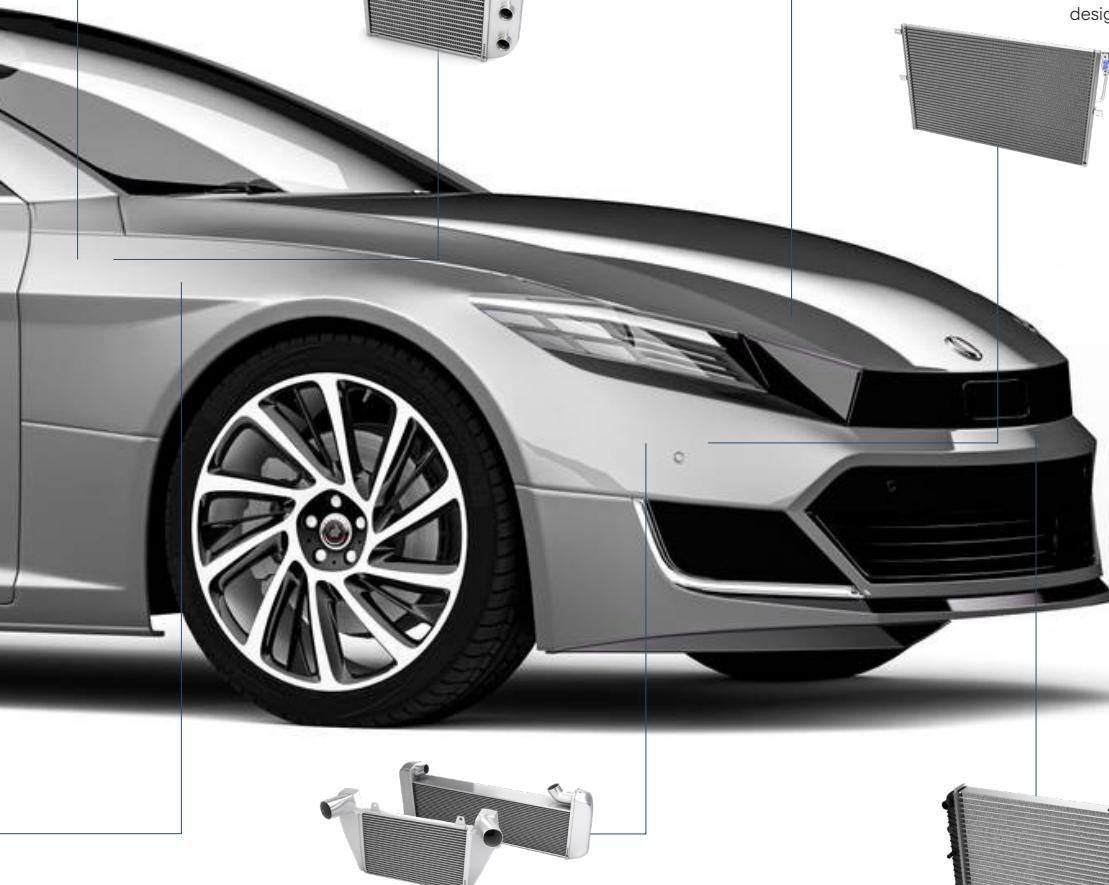
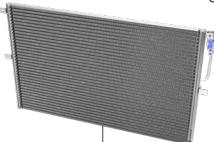
Chillers

The need of chillers have increased with electrification of vehicles. A chiller is typically designed with stacked plates and it requires material with both good formability and brazeability.



Condensers

The most common condenser design is the parallel flow condenser with extruded multiport tubes. Over recent years, alternatives with folded tube design have become common.



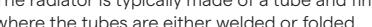
Charge air coolers

Charge air cooler operate under high temperature and pressure conditions, resulting in material requirements for sufficient strength at elevated temperatures.



Radiators

The radiator is typically made of a tube and fin design, where the tubes are either welded or folded.



Your experienced partner

Built on the foundation of 125 years of innovative engineering and materials development, we are a world leader in high-performance aluminium alloys. With a long heritage of supplying the automotive industry, we are an experienced partner delivering consistent, high quality materials to industries with high demands on safety, performance and sustainability.

1580

1580 is considered the start of the first "real" industry in Finspång. The production of cannons and cannonballs started and made **Finspångs Bruk** internationally known.

1896

When **Gränges** was formed in 1896, it had its roots in two activities: railways and mines.

1913

In 1913, **Finspångs Metallverk AB** was founded, the company manufactured, among other things, copper products.

1922

Production of **aluminium products** started in Finspång.

1972

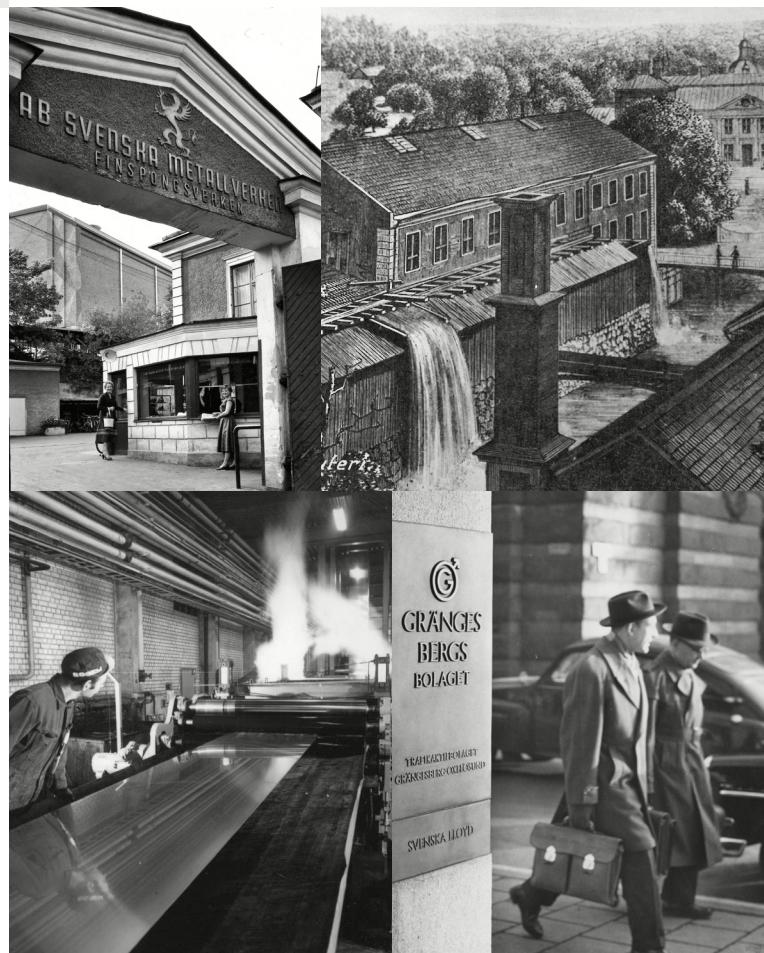
A strategic decision was made to shift the focus to automotive heat exchangers. Production of materials for brazed aluminium **heat exchangers** was started and became the factory's main product.

1996

A milestone as Gränges becomes a global player and established a production plant in **Shanghai**.

2014

The new **Gränges** was listed on Nasdaq Stockholm Stock Exchange.





CEO COMMENT



2016

In 2016, Gränges acquired Noranda's downstream business in the US and the name was changed to **Gränges Americas**.

2020

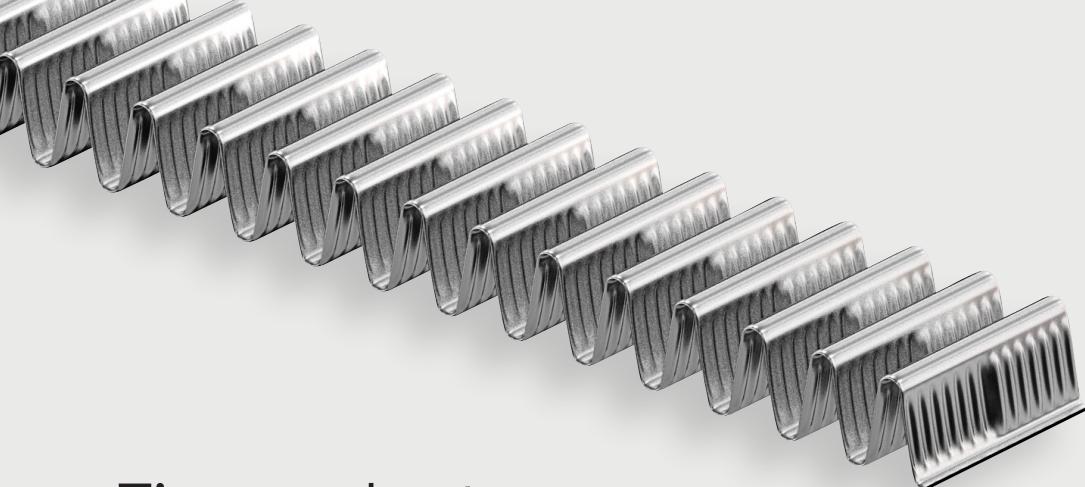
In 2020, Gränges acquired the Polish producer of rolled aluminium, and the business changed its name to **Gränges Konin**. In the same year, Gränges acquires the remaining shares in GETEK and created the new business area Gränges Powder Metallurgy, a French supplier of aluminium products in spray form.

2023

In 2022, Gränges Finspång took a new step in its development by investing in a new production line for cathode foil for batteries. Production of **cathode foil** started in Finspång in 2023.



Going forward, our strategy and approach will remain the same: to stay focused on long-term sustainable growth while flexibly meeting any short-term challenges.



Fin products

Our rolled fin products range offers performance characteristics tailored to each specific application requirement in terms of strength, sustainability and sag resistance.

Alloy		Sustainability		Area of use		Typical mechanical and corrosion properties in post braze condition		
EN AW	Gränges	Carbon footprint* [tCO ₂ e/t]	Ability to absorb recycled and remelted material**	Zn-content [%]	Cladded	Rp0,2 [MPa]	Rm [MPa]	Free corr. pot. [mV vs SCE]
3003	FA5577	5-6	Medium	<0.10	YES/NO	40	110	-715
mod 3003	FA6800	5-6	Medium	0	YES/NO	50	130	-730
	FA6807	5-6	High	0.7	YES/NO	50	130	-750
	FA6815	5-6	High	1.5	YES/NO	50	130	-800
	FA6825	5-6	High	2.5	YES/NO	50	130	-880
	FA7999	4-5	High	1.5	NO	50	140	-760
	FA7041	4-5	High	2.4	NO	50	140	-800
mod 3003 with Zn	FA6809	5-6	High	0.7	YES	65	155	-750
	FA6817	5-6	High	1.5	YES	65	155	-800
	FA6827	5-6	High	2.5	YES	65	155	-880
	3003+Zn	>5	Medium	1.5	YES	50	130	-800
	HF421	>5	Medium	1.5	NO	50	130	-800
	HF422	>5	Medium	0.7	NO	50	130	-760

Values given for standard H14/16 temper. Other tempers available upon request.

* Product carbon footprint data from 2023, third-party verified. Variation on PN level, due to validated slab supplier and added clad layers.

** From internal and external sources. Pre- and post-consumer scrap can be specified.



Tube products

Gränges' MULTICLAD™ material is developed for the most demanding applications, with high requirements on strength and corrosion resistance. It is a multilayer tube concept where a selected core alloy is combined with a tailored interlayer and braze clad in more than 3 layers.

Our rolled tube product range offers distinct benefits in terms of strength, heat treatability and corrosion resistance, depending on the demands of the application.

Alloy		Sustainability			Area of use		Typical mechanical and corrosion properties in post braze condition		
EN AW	Gränges	Carbon footprint* [tCO2e/t]	Ability to absorb recycled and remelted material **	Mg-content	Age hardenable	Improved corrosion resistance	Rp0,2 [MPa]	Rm [MPa]	Free corr. pot. [mV vs SCE]
3003	FA5577	5-6	Medium	None	NO		40	110	-715
mod 3003	FA7929	4-5	High	None	NO	Ti-effect	60	165	-690
	FA7888	5-6	High	None	NO	Ti-effect	60	165	-690
mod 6063	FA7850	4-5	High	High	YES	Ti-effect	75	190	-710
3005	FA7805	5-6	Low	Intermediate	NO	LL	55	145	-695
mod 3005	FA6519	4-5	Low	High	NO	LL	60	170	-695
mod 3003 LL	FA7857	4-5	Low	None	NO	SLL	50	140	-690
	FA7948	>5	Low	Intermediate	NO	SLL	60	165	-675
	FA7031	4-5	Low	High	NO	SLL	60	165	-675
	FA7873	4-5	Low	None	NO	SLL	55	155	-660
	HF435	>5	Low	Intermediate	NO	LL	50	155	-710
	HF436	>5	Low	None	NO	LL	50	145	-700

Values given for standard H24 temper. Other tempers available upon request.

* Product carbon footprint data from 2023, third-party verified. Variation on PN level, due to validated slab supplier and added clad layers.

** From internal and external sources. Pre- and post-consumer scrap can be specified.



Plate products

Gränges' MULTICLAD™ material is developed for the most demanding applications, with high requirements on strength and corrosion resistance. It is a multilayer plate concept where a selected core alloy is combined with a tailored interlayer.

Our rolled plate products offer varying characteristics of strength, enhanced corrosion resistance, hardening and composition to cover the widest range of heat exchanger applications.

Alloy		Sustainability		Area of use			Typical mechanical and corrosion properties in post braze condition		
EN AW	Gränges	Carbon footprint* [tCO ₂ e/t]	Ability to absorb recycled and remelted material **	Mg-content	Age hardenable	Improved corrosion resistance	Rp0,2 [MPa]	Rm [MPa]	Free corr. pot. [mV vs SCE]
3003	FA5577	5-6	Medium	None	NO		40	110	-720
mod 6063	FA7850	4-5	High	High	YES	X	75-90***	190	-700
	FA7915	5-6	High	None	NO	X	55	160	-705
	FA7021	5-6	High	None	NO	X	60	165	-680
mod 3003	FA7975	4-5	High	Intermediate	NO	X	65	170	-680
	LH436	>5	Low	None	NO	X	50	140	-700

Values given for standard O-temper. Other tempers available upon request.

* Product carbon footprint data from 2023, third-party verified. Variation on PN level, due to validated slab supplier and added clad layers.

** From internal and external sources. Pre- and post-consumer scrap can be specified.

*** With controlled cooling rate



Battery cooling plate products

Our material solutions for brazed aluminium battery cooling plates offer low carbon footprint and performance benefits in terms of strength, corrosion resistance, hardening and composition to cover all your needs for the thermal management of Li-ion batteries.

Alloy		Sustainability		Area of use		Typical mechanical and corrosion properties in post braze condition			
EN AW	Gränges	Average carbon footprint [tCO ₂ e/t]	Ability to absorb recycled material **	Mg-content	Age hardenable	Rp _{0,2} [MPa]	R _m [MPa]	Free corr. pot. [mV vs SCE]	
mod 3003	3003	FA5577	5-6	Medium	None	NO	40	110	-720
		FA7915	5-6	High	None	NO	55	160	-705
		FA7021	5-6	High	None	NO	60	165	-680
		FA7975	4-5	High	Intermediate	NO	65	170	-680
		FA7994	5-6	Low	None	NO	50	160	-680
		LH436	>5	Low	None	NO	50	140	-700
		modLH436	>5	Low	None	NO	60	145	-690
	mod 6063	FA7850	4-5	High	High	YES	75-90***	190	-700

Values given for standard O-temper. Other tempers available upon request.

* Product carbon footprint data from 2023, third-party verified, assuming standard braze clad

** From internal and external sources. Pre- and post-consumer scrap can be specified.

*** With controlled cooling rate

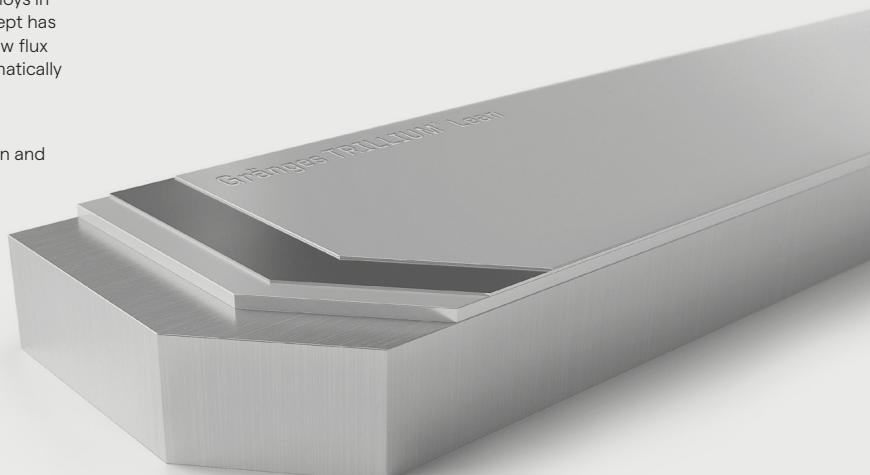
TRILLIUM®: Active brazing technology

TRILLIUM® is an innovative rolled aluminium product that has all the fluxing agents built-in. It enables our customers to reduce costs, create new designs, and achieve better profitability, while reducing their environmental impact.

TRILLIUM® Lean

TRILLIUM® Lean is a multilayer braze clad that can be offered within the chemical composition of all standard 4xxx braze clads on the market. The total clad layer thickness is flexible in the same range (4-18%) as standard braze clads. It can be combined with all Mg-free core alloys in Gränges portfolio and used in all types of applications. The concept has unique properties and proven brazing performance, even at a slow flux load as 100mg/m². It reduces the flux residues in the system dramatically compared to conventional fluxing.

When using TRILLIUM® Lean it is important that application design and material selection are made in close cooperation between application manufacturer and Gränges.



TRILLIUM® Solid

TRILLIUM® Solid was launched in 2010. With its unique formation of uniform flux and silicon particles, TRILLIUM® Solid has numerous advantages built-in and represents a major advancement in brazing technology. It features excellent brazing activity and robustness in sub-optimal atmospheric conditions. This means that it could be the key to solve complicated design and brazing dilemmas.

Selectable clads

Our comprehensive range of selectable clad products spans CAB, vacuum, sacrificial cladding variants and interlayers for MULTICLAD™ concept. The most common alloys per variant are presented on this slide. Customer specific alloys can be created upon request.

BRAZE CLAD - CAB

Alloy		Chemical composition, interval or max [weight-%]							
EN AW	Si	Fe	Cu	Mn	Mg	Zn	Ti	Zr	Others
4343*	6.8-8.2	0.25	0.25	0.10	-	0.20	-	-	0.15
	6.8-8.2	0.8	0.25	0.10	-	0.20	-	-	0.15
4045*	9.0-11.0	0.25	0.3	0.05	0.05	0.10	-	-	0.15
	9.0-11.0	0.8	0.3	0.05	0.05	0.10	-	-	0.15
4047	11.0-13.0	0.8	0.30	0.15	0.10	0.20	-	-	0.15

*Can be modified with Zn-addition

BRAZE CLAD - VACUUM

Alloy		Chemical composition, interval or max [weight-%]							
EN AW	Si	Fe	Cu	Mn	Mg	Zn	B	Zr	Others
4004	9.0-10.5	0.8	0.25	0.10	1.0-2.0	0.20	-	-	0.15
4104	9.0-10.5	0.8	0.25	0.10	1.0-2.0	0.20	0.02-0.20	-	0.15
low Mg - FA7856	9.0-10.5	0.8	0.25	0.10	0.6-0.8	0.20	0.02-0.20	-	0.15

SACRIFICIAL CLAD

Alloy		Chemical composition, interval or max [weight-%]							
EN AW	Si	Fe	Cu	Mn	Mg	Zn	Ti	Zr	V
3003	0.6	0.7	0.05-0.20	1.0-1.5	0.1	0.1	-	-	-
7072	Fe + Si max 0.7		0.10	0.10	0.8-1.3	0.8-1.3	-	0.15	-
FA6815	0.65-1.0	0.7	0.10	1.4-1.8	0.03	1.2-1.8	-	0.05-0.20	-
FA6825	0.65-1.0	0.7	0.10	1.4-1.8	-	2.2-2.8	-	0.05-0.20	-
HF421	0.7-1.1	0.1-0.5	0.05	1.4-1.8	0.05	1.3-1.8	0.05-0.25	-	0.03-0.20

INTERLAYER ALLOYS

Alloy		Chemical composition, interval or max [weight-%]							
Gränges	Si	Fe	Cu	Mn	Mg	Zn	Ti	Zr	V
FA6802	0.40-0.70	0.4	0.04	1.4-1.8	-	0.10	-	0.05-0.20	-

Solutions that enable a sustainable society

With solutions that enable a sustainable society we are committed to mitigating climate change and has set a goal to reach net-zero by 2040. We strives to reduce the climate impact along the value chain – from our own operations and from the materials sourced. The main pathways to reach net-zero include recycling growth, low-carbon primary aluminium sourcing, and renewable energy usage



By managing its business in a sustainable way, Gränges strengthens its long-term competitiveness and creates financial and operational value for the company and its stakeholders. Gränges has an ambition to develop industry-leading aluminium solutions that can help its customers and end-users become more sustainable.

To achieve sustainable growth, Gränges will focus on investing in three areas: sustainable supply and recycling, sustainable operations and sustainable customers and sectors.



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Join us on the path to net-zero 2040



Gränges' five pathways to net-zero and prioritized activities

1	2	3
Net-zero Gränges	Net-zero electricity	Recycling growth
Scope 1	Scope 2	Scope 3
Activities	<ul style="list-style-type: none">• Increase material and energy efficiency• Reduce and phase-out natural gas and non-renewable fuels• Deploy decarbonization technologies	<ul style="list-style-type: none">• Form value chain partnerships• Renewable electricity certificates• Generate own renewable electricity
Ambition	100% net-zero fuels by 2040	100% renewable electricity by 2030
4	5	
Net-zero primary aluminium	Net-zero solutions and sectors	
Scope 3		
Activities	<ul style="list-style-type: none">• Form value chain partnerships• Support suppliers' decarbonization plans	<ul style="list-style-type: none">• Invest in growth from sustainable sectors• Collaborate with customers and OEMs• Develop sustainable and circular alloys
Ambition	100% net-zero primary aluminium by 2040	Enabler for net-zero and sustainable growth

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