



Rolled products for brazed heat exchangers





Customer driven sustainable aluminium solutions

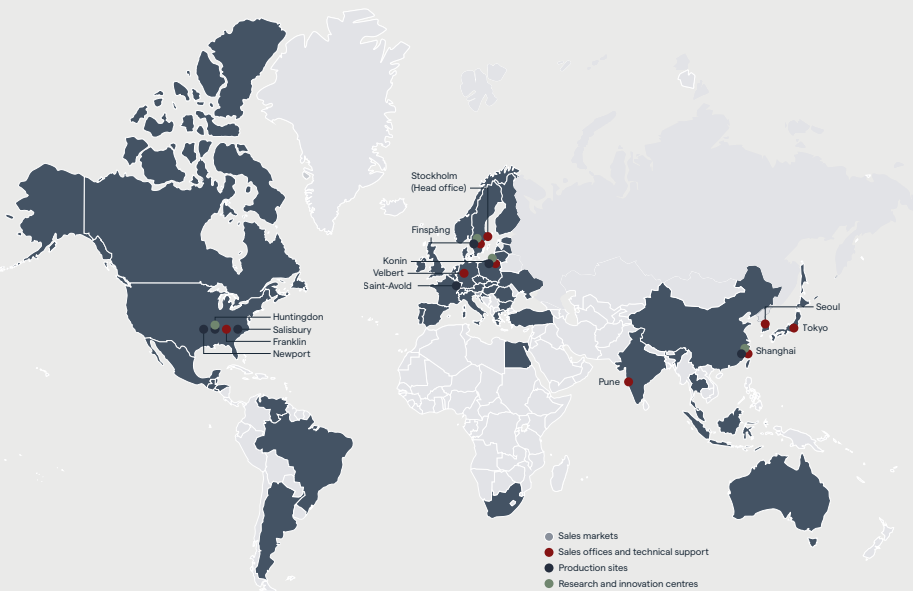
Our solutions help customers grow and transition to climate neutrality. Sustainability is central in Gränges' business and strategy. We have a strong commitment to minimize the environmental impact of our operations, uphold ethical business practices, and provide a safe and good working environment. 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

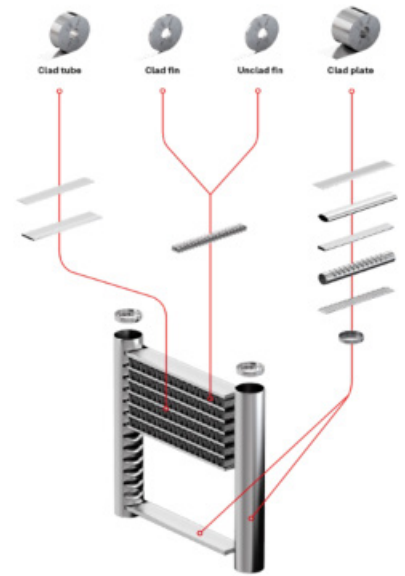
With customized product development, regional production, sales and technical support, we meet customers globally in an efficient and sustainable way.



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 aluminum 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 brazability.

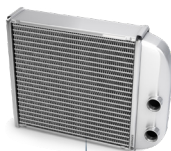
Evaporators

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.



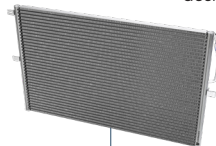
Chillers

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.



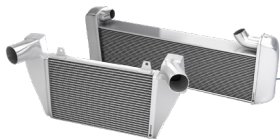
Condensers

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.



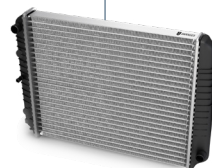
Charge air coolers

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 **Finspongs Bruk** internationally known.

1896

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

1913

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

1922

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

1972

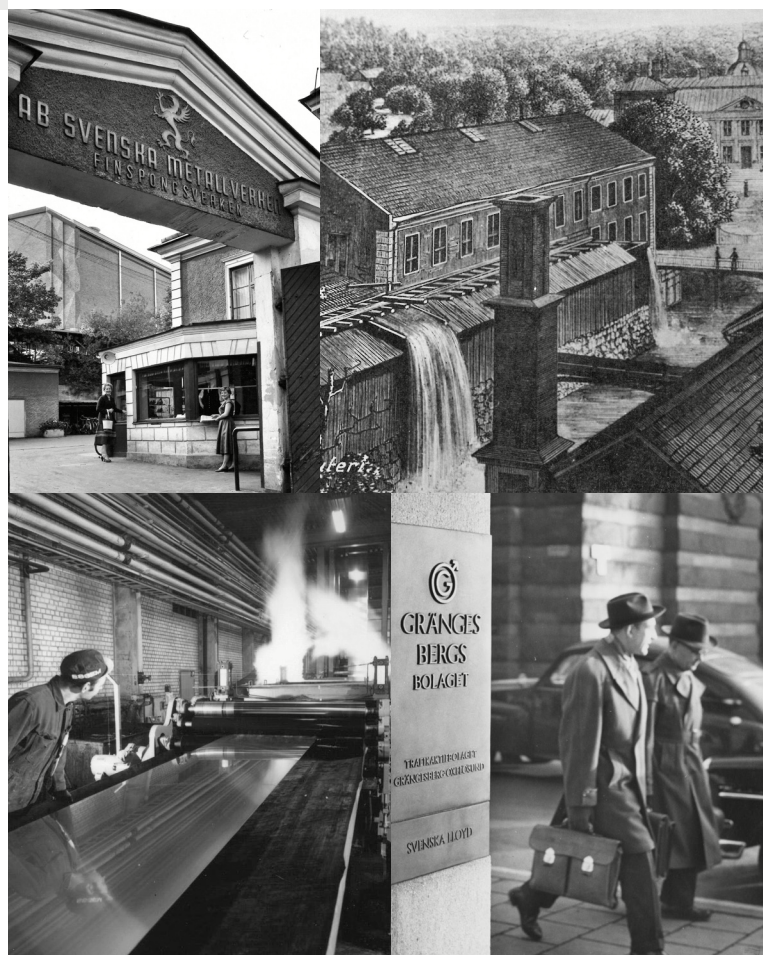
A strategic decision was made to shift the focus to automotive heat exchangers. Production of materials for brazed aluminium **heat exchangers** was started and became the factory's main product.

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

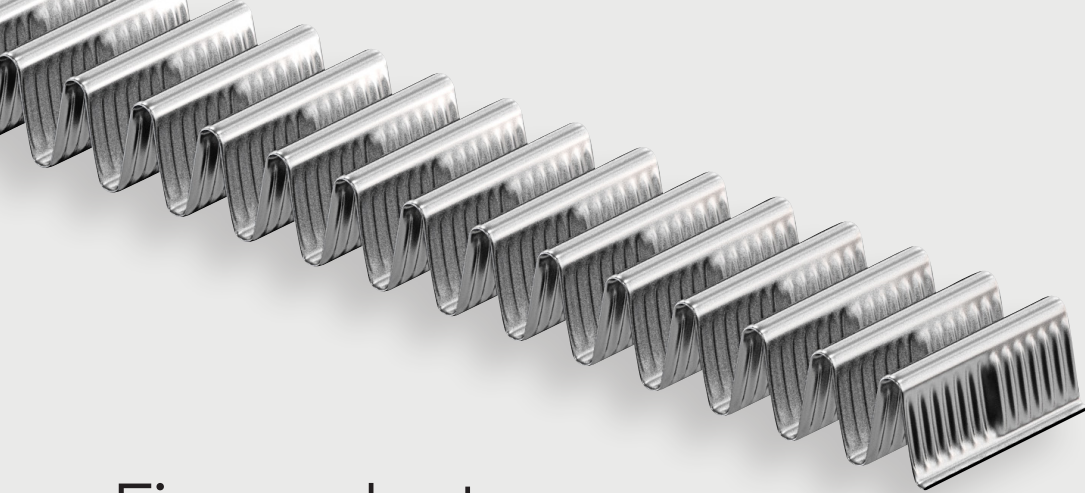
In 2020, Gränges acquired the Polish producer of rolled aluminium, and the business changed its name to Gränges **Konin**. In the same year, Gränges acquires the remaining shares in GETEK and created the new business area Gränges Powder Metallurgy, a French supplier of aluminium products in spray form.

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

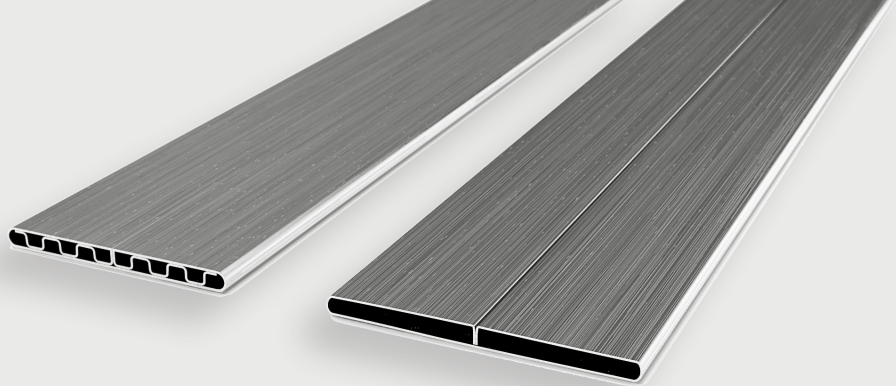
Our rolled fin products range offers performance characteristics tailored to each specific application requirement in terms of strength, sustainability and sag resistance.

| 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 re-melted 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 with Zn | 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 |
| | 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 re-cycled 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.

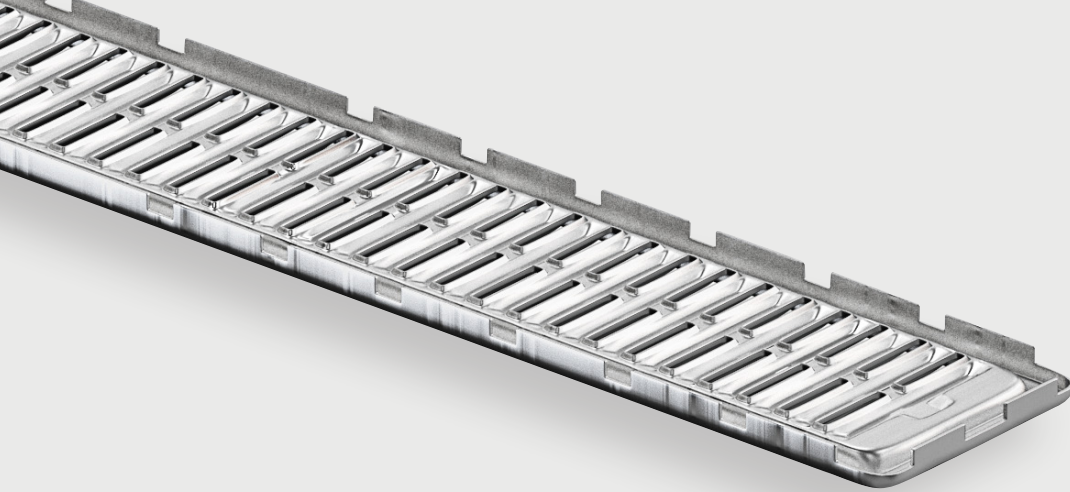


Plate products

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 re-cycled 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 |
| mod 3003 | FA7915 | 5-6 | High | None | NO | X | 55 | 160 | -705 |
| | FA7021 | 5-6 | High | None | NO | X | 60 | 165 | -680 |
| | FA7975 | 4-5 | High | Inter-mediate | 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 [tCO2e/t] | Ability to absorb recycled material ** | Mg-content | Age hardenable | Rp0.2 [MPa] | Rm [MPa] | Free corr. pot. [mV vs SCE] |
| mod 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®:

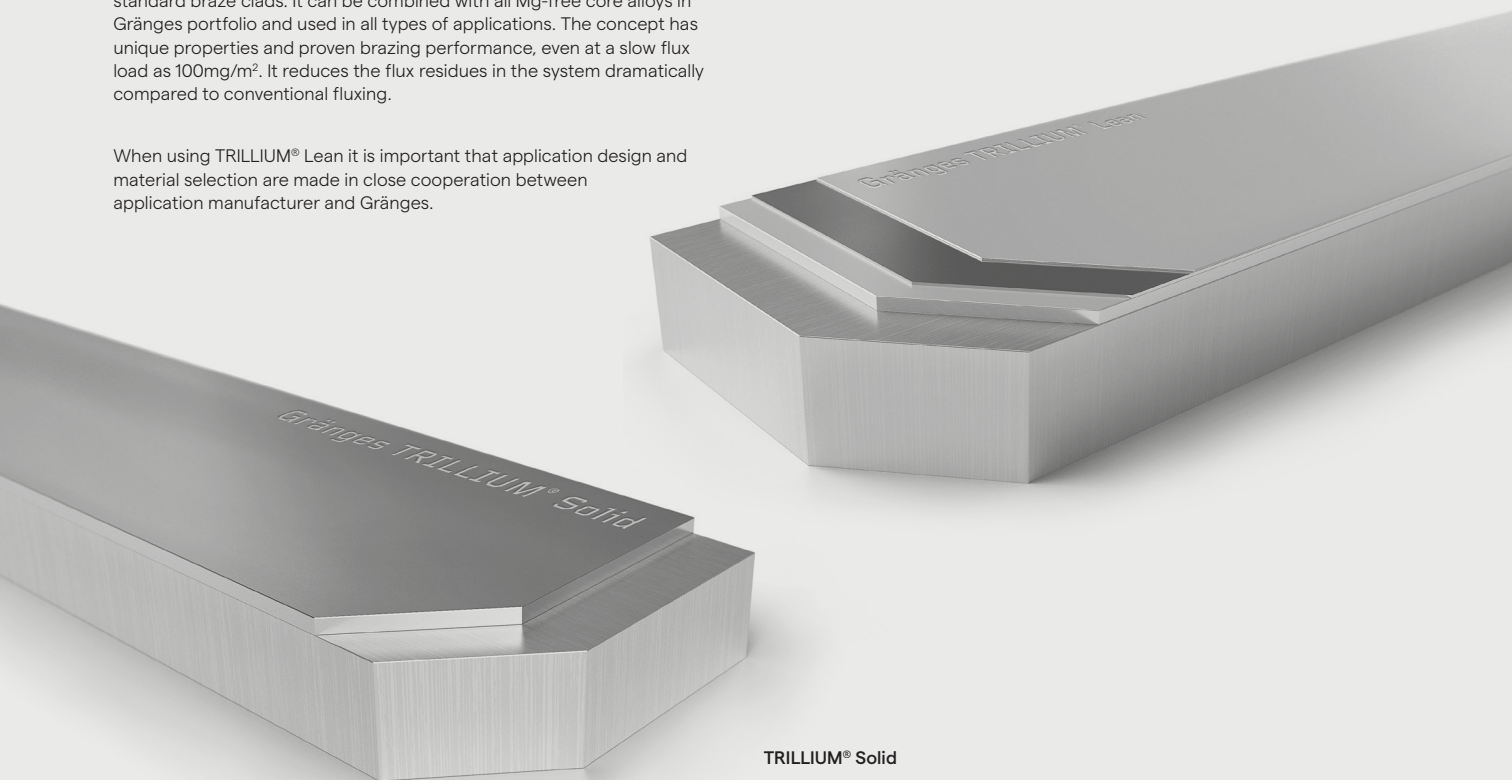
Active brazing technology

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



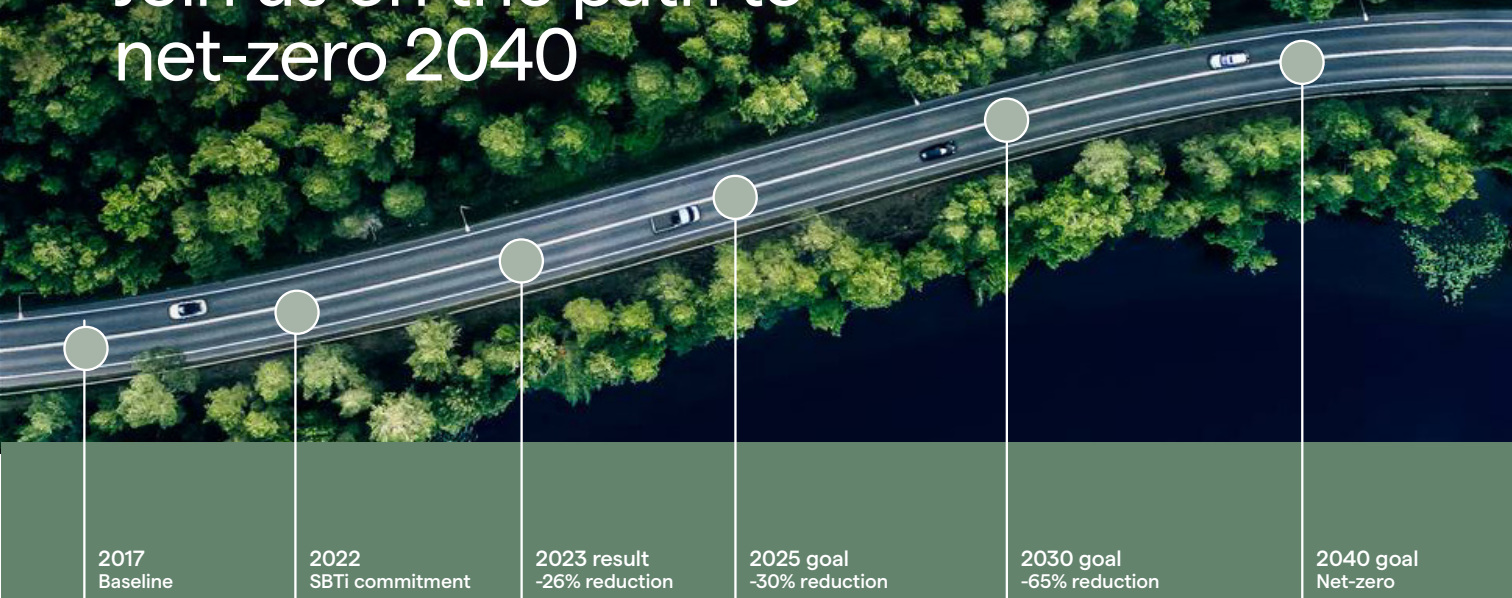
By managing its business in a sustainable way, Gränges strengthens its long-term competitiveness and creates financial and operational value for the company and its stakeholders. Gränges has an ambition to develop industry-leading aluminium solutions that can help its customers and end-users become more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

| | | |
|--|---|---|
| <p>1</p> <p>Net-zero Gränges</p> <p>Scope 1</p> <p>Activities</p> <ul style="list-style-type: none"> • Increase material and energy efficiency • Reduce and phase-out natural gas and non-renewable fuels • Deploy decarbonization technologies | <p>2</p> <p>Net-zero electricity</p> <p>Scope 2</p> <p>Activities</p> <ul style="list-style-type: none"> • Form value chain partnerships • Renewable electricity certificates • Generate own renewable electricity | <p>3</p> <p>Recycling growth</p> <p>Scope 3</p> <p>Activities</p> <ul style="list-style-type: none"> • Form value chain partnerships • Invest in recycling capabilities and capacity • Develop circular alloys |
| <p>Ambition</p> <p>100% net-zero fuels by 2040</p> | <p>Ambition</p> <p>100% renewable electricity by 2030</p> | <p>Ambition</p> <p>500 ktonnes recycling by 2030</p> |
| <p>4</p> <p>Net-zero primary aluminium</p> <p>Scope 3</p> <p>Activities</p> <ul style="list-style-type: none"> • Form value chain partnerships • Support suppliers' decarbonization plans | <p>5</p> <p>Net-zero solutions and sectors</p> <p>Activities</p> <ul style="list-style-type: none"> • Invest in growth from sustainable sectors • Collaborate with customers and OEMs • Develop sustainable and circular alloys | |
| <p>Ambition</p> <p>100% net-zero primary aluminium by 2040</p> | <p>Ambition</p> <p>Enabler for net-zero and sustainable growth</p> | |

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