



GRÄNGES

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Which KPI's for more growth and more  
value creation with less materials ?

Nancy, 29 June 2017



# Gränges Group



- A global leader in the market for rolled products for aluminium heat exchangers & selected niche applications
- Production in Sweden, China and in the US
- R&D Centre in Sweden and China
- Headquarter in Stockholm
- Gränges is represented all over the world

- ~1,500 employees
- Listed on Nasdaq Stockholm
- Production capacity of 420,000 metric tonnes
- Net sales of more than SEK 10 billion (USD 1.1 billion)

# 20%

We have a global market share of approximately 20% in rolled products for brazed aluminium heat exchangers.

# A global leader in materials for brazed aluminium heat exchangers



About half of the world's cars that are manufactured today have heat exchangers that contain our material and expertise.

Gränges focuses on two market segments in Asia and Europe:

- Automotive heat exchanger
- Stationary heat exchangers

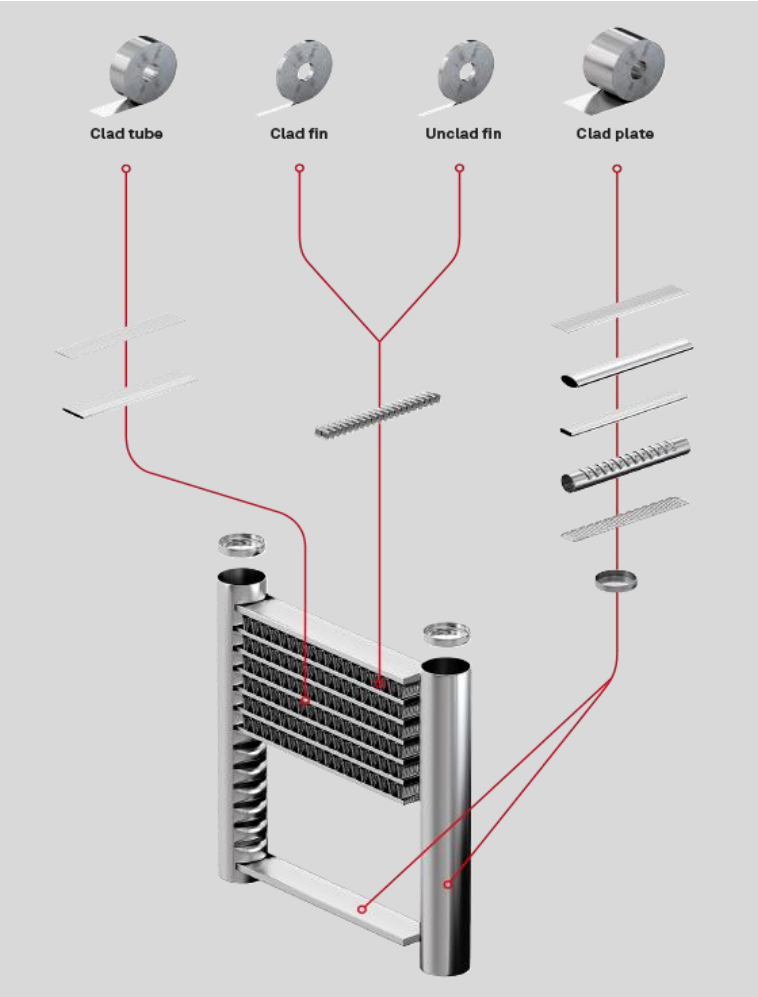
Gränges Group's R&D department consists of around 60 highly educated employees worldwide, including metallurgists, chemists, metallography's, physicists, mechanical engineers and technicians.



# A modern car can have more than ten different heat exchangers



# Multi-layer cladding adds unique properties and enables Gränges to offer tailored solutions



# A global aluminium company specializing on rolled products in the value chain for brazed heat exchangers

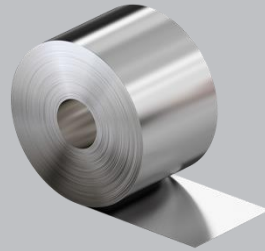
## Value chain for brazed heat exchangers

Aluminium producers

Material producers

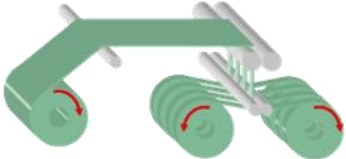
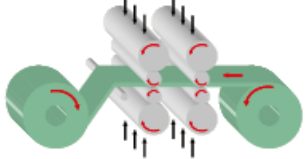
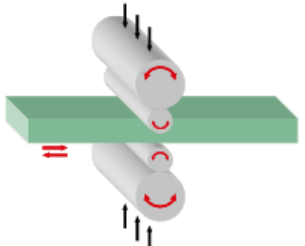
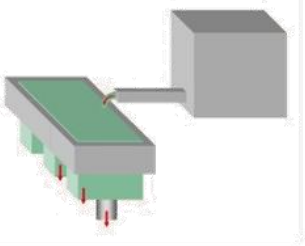
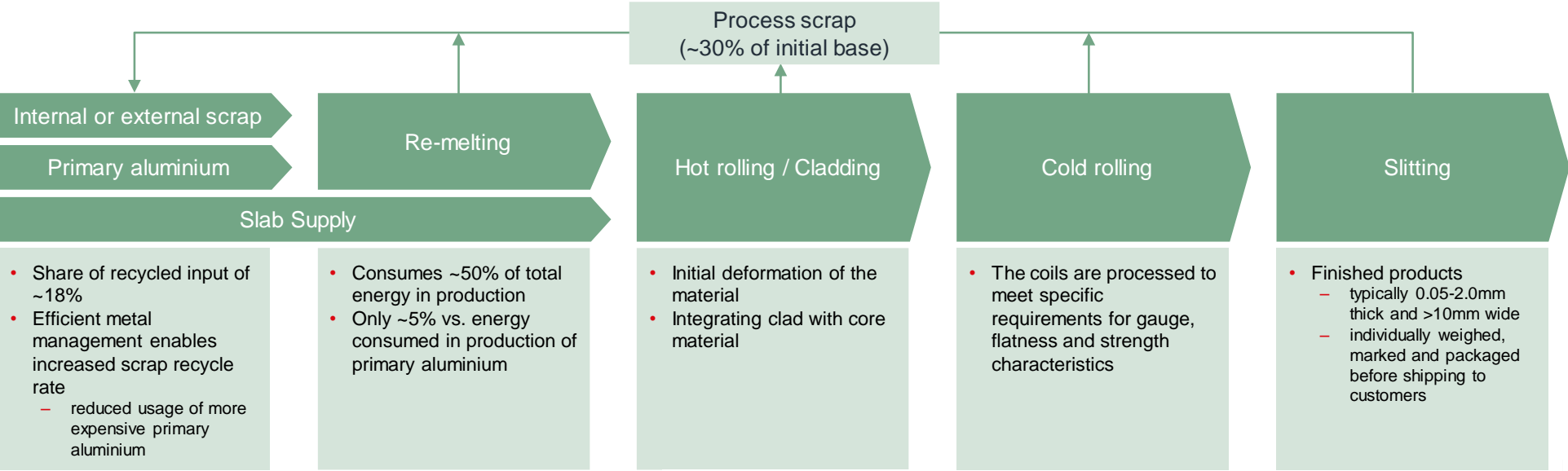
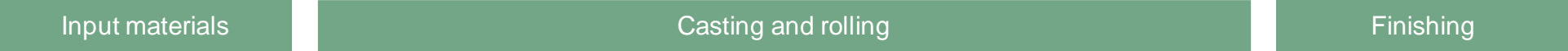
Products

End-markets



# Main stages in production process

## Overview of the production process





# Gränges KPI's for more growth and more value creation with less materials

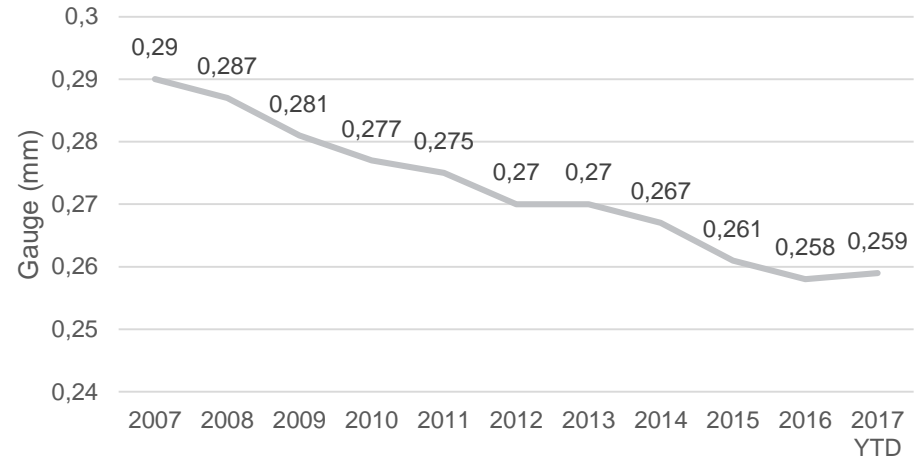
WMF KPI's		Gränges KPI's (drivers for value chain KPI's)
Use Less	Product weight	Down-gauging
	Buy-to-use	Yield
	End-of-life recycling	N/A
Use Longer	Product lifetime	Internal corrosion Material strength
	Resale price	N/A
Use Smart	Product usage	N/A
	New and recycled materials	Sales of new products Use of external scrap
	Product performance	Brazeability External corrosion Product conformity



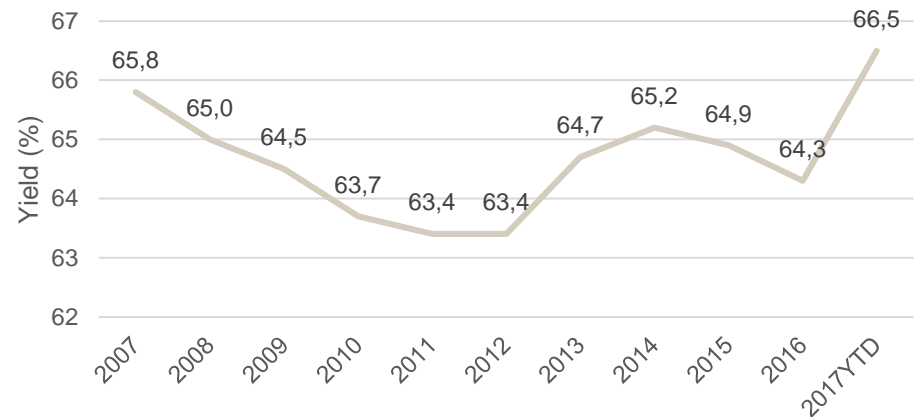
# Use Less: Gränges KPIs

- Product weight
  - Down-gauging
    - Improved material properties to achieve down-gauging
    - Retained heat exchanger performance
- Buy to use
  - Yield
    - KPI affected by more advanced material solutions
    - Increase yield despite more challenging alloys

Gauge development tube material

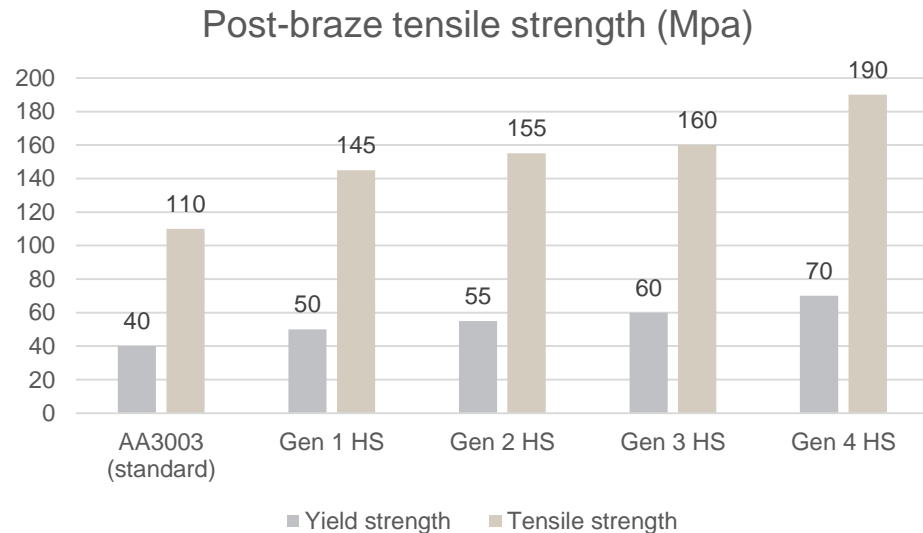


Yield scalp to pack development tube material



# Use Longer: Gränges KPIs

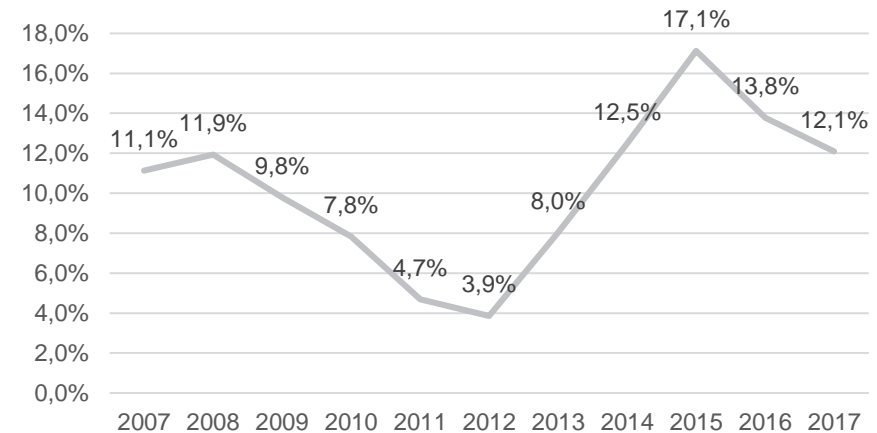
- Product life-time
  - Internal corrosion
    - Improved water side claddings postpone corrosion from coolant
    - No global standard
  - Material strength
    - Improved material strength is increasing product life-time
    - Enables down-gauging



# Use Smart: Gränges KPIs

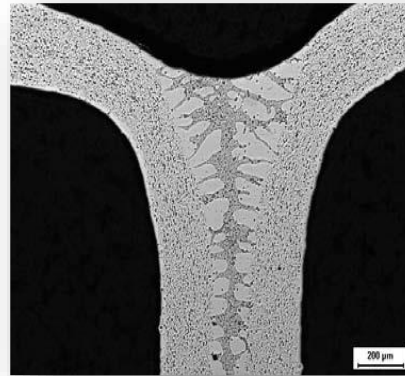
- New and recycled materials
  - Sales of new alloys
    - Long product development and validation cycle
    - Alloys based on recycled material increasingly important
  - Use of external scrap
    - Limited availability of usable scrap
    - End-of-life recycling challenging for heat exchangers

Share of external scrap of total raw material consumption (%)

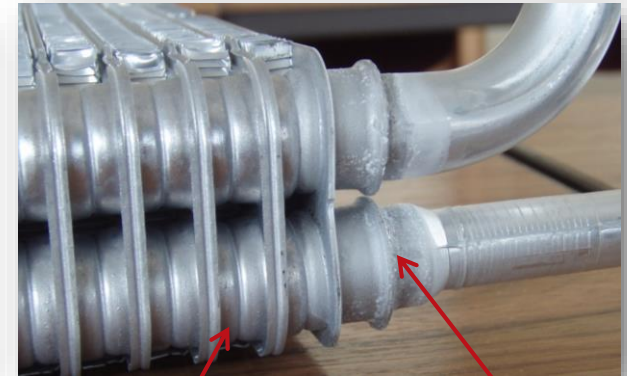


# Use Smart: Gränges KPIs

- Product performance
  - Brazeability
    - Important for design development of heat exchangers
    - Reduces material and energy consumption
    - KPI to be developed
  - External corrosion
    - Improved corrosion resistance is increasing product life-time
    - Enables down-gauging
  - Product conformity
    - Reduced variations improve productivity and yield in value chain
    - Cpk used as KPI



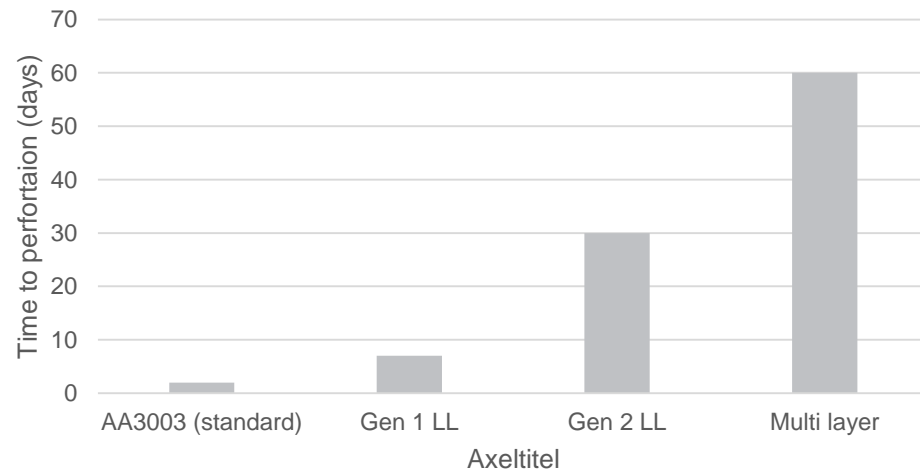
Joint detail



Perfect Joints  
Trillium™ Clad

Flux salt residue  
(non-Trillium)

Time to perforation in SWAAT



# Conclusions – Gränges KPI's for more growth and more value creation with less materials

- Weight and space requirements are key drivers for the development of new materials for automotive applications
  - Use of less material in Gränges part of value chain is driven by increased yield
  - Use of less material in customer's products can be supported by down-gauging
- Thinner material gauge requires better material properties to maintain or increase product life-time
  - Heat exchangers fail from material strength or corrosion
  - Improved life-time in terms of time in use is supported by improved material strength and internal corrosion performance
- Smart and efficient use of the material is driven by development of new sustainable materials with improved product performance
  - Successful introduction of new materials requires development of the right products with special consideration of recycled content
  - Improved product performance drives efficient use of the material when designing, producing and using the heat exchanger



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