



Thin Wall STEEL CASTING Solutions



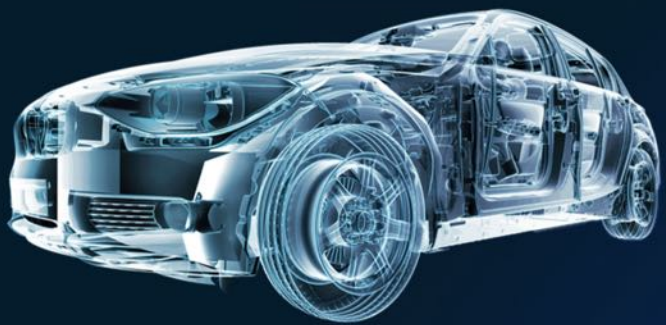
Introduction

Automotive Megatrends

Digitalization



Value of Time



Sustainability

Utilization



Why thin wall steel casting?

Important future requirements	General
(1) Lightweight Constructions (2) Durability (3) Safety (4) Sustainability & Recycling	<ul style="list-style-type: none"> - Vehicle structure is undergoing an important transition that will change the general boundary conditions - New Technologies, Designs and Materials will be required to overcome new challenges due to increased weight of vehicles, passenger protection, protection of batteries and e-engines, etc

(1) Lightweight Constructions

General weight increase of vehicles due to electrification and digitalization requires counter measures to maintain driving experience and increase driving range.

➔ Higher Strength for Lightweight Applications

(2) Durability

Changed Utilization of vehicles will result in increasing number of passengers that will require durable solutions.

➔ Increasing Durability

(3) Safety

Changing vehicle architecture, weight increase, weight distribution as well as potentially hazardous components require new safety concepts for passenger protection.

➔ Improving Passenger Safety

(4) Sustainability & Recycling

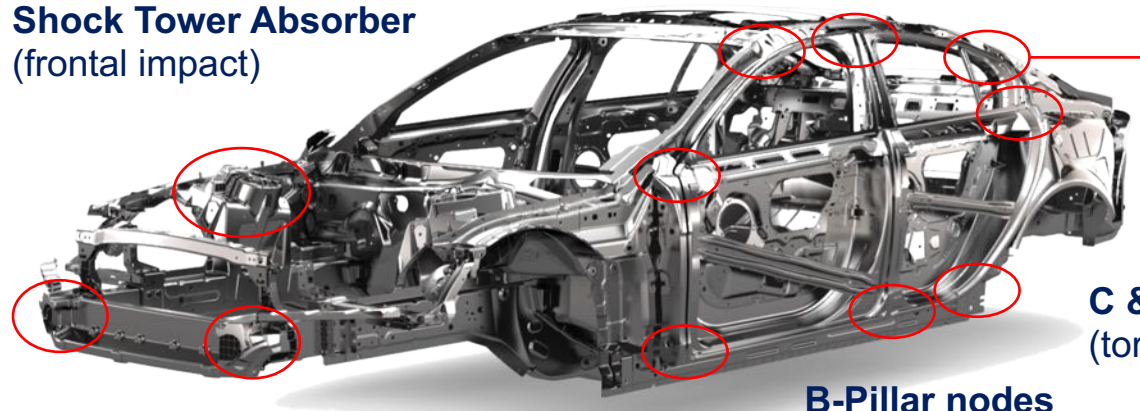
Sustainable materials, reasonable carbon footprint and recycling of materials will become a major focus in the global automotive industry.

➔ Extraordinary Sustainability & Recycling on entire process and supply chain.

Thin Wall Steel Casting is a key solution to overcome multiple challenges with the future automotive vehicle architecture!

Areas of Application

Shock Tower Absorber
(frontal impact)

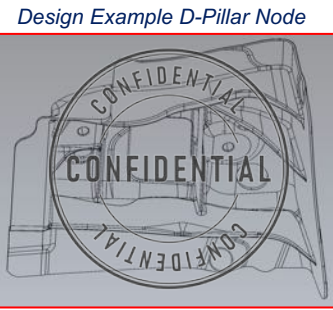


Front Side Rails
(frontal impact)

A-Pillar nodes
(frontal, roof impact & torsional stiffness)

B-Pillar nodes
(side, roof impact & torsional stiffness)

C & D-Pillar nodes
(torsional stiffness)



(1) Lightweight Constructions

- Possibility for weight reduction by replacement of multiple other parts (sheet metal or aluminium parts)
- Increased rigidity by design optimizations and variable wall thickness
- General freedom in terms of design

(2) Durability

- Drastically improved durability in combination with lower weight achievable

(3) Safety

- Better absorption and dispersion of crash loads by thin wall casting steel nodes to preserve structural integrity
- Possibility to re-direct load path and secure body interior in combination with potential weight saving

(4) Sustainability & Recycling

- Steel has an outstanding sustainability compared e.g. to Aluminium with established scrap recycling cycles globally available.

(5) Integrity of Assembly at OEM

- Possibility to maintain integrity of assembly process at car manufacturer in consideration of existing ways of manufacturing the body in white / vehicle architecture

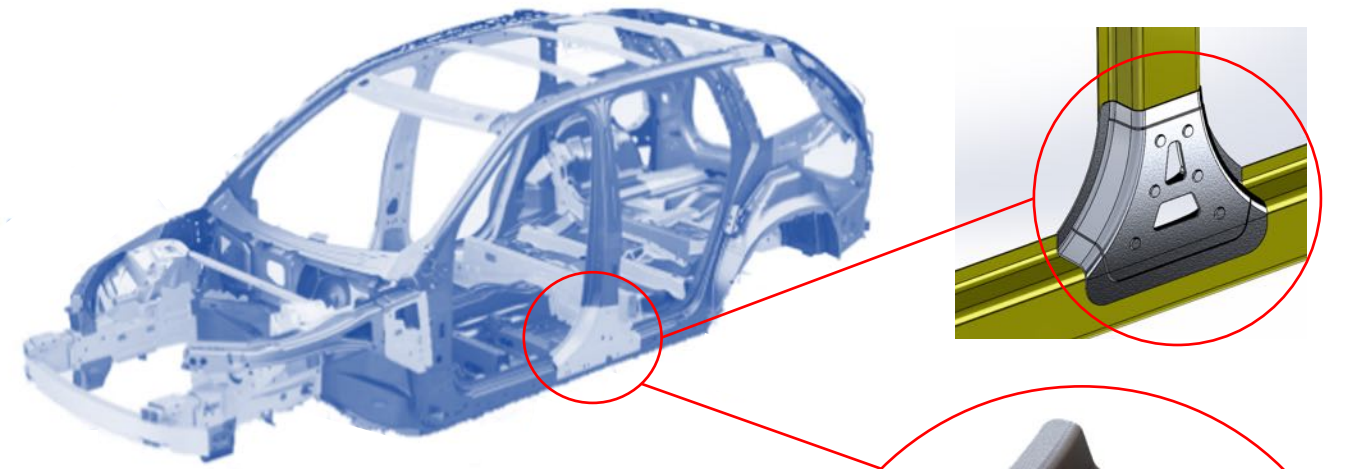
Advantages of Thin Wall Steel Casting



- Freedom of design
- Possibility of integration of multiple parts and functions into one single component
- Flexibility during development cycles
- weight reduction
- Improved safety for passengers and battery system
- Integrity of assembly with existing equipment at OEM
- Sustainable material
- Adaptability from prototypes to big volumes in serial production

Design Example – Connecting Node B-Pillar

- Incorporated into the design are variable wall thickness zones; Thin walls (2mm) for welding assembly with B-pillar & chassis frame combined with thicker walls to improve strength and rigidity
- Ribbing for reinforcement and apertures for weight reduction are incorporated to optimize the strength/weight ratio.



Flexible design elements integration:

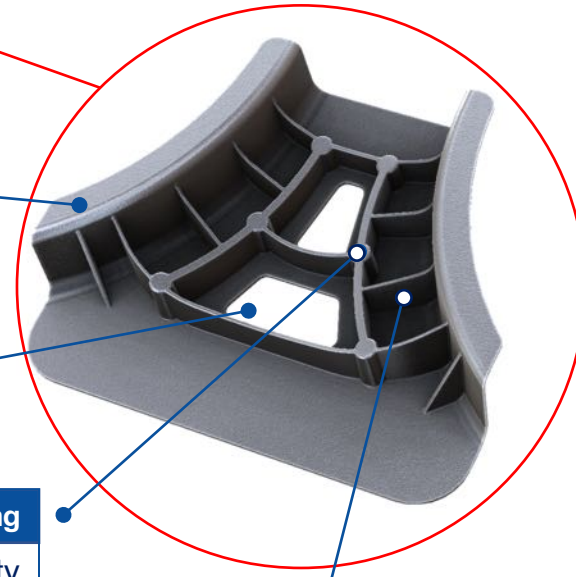
1. Variable wall thickness from thin to thick as required in the structure design
2. Variable rib and node dimensions to improve structural rigidity
3. Freedom for ribbing direction and orientation
4. Hollow structure for future weight reduction
5. Implementation of features not feasible with conventional processes

Reduced Wall Thickness In Welding Zones
 Wall thickness can vary from thin to thick for function requirements

Weight Reduction Features
 Unnecessary material can be eliminated

Nodal Positioning
 Optimization of structural rigidity

Variable Rib Thickness
 Optimized rib thickness tailored to strength requirement



Manufacturing

Investment Casting

Pictures and flow are only examples, real process might vary slightly

Advantages Investment-Casting

- Better surface quality than sand-casting potentially avoiding further after treatments
- Better dimensional accuracy
- Lower tooling cost
- Short Industrialization time compared to stamping or deep drawing processes
- Flexibility for late design changes during development phase compared to stamping or deep drawing processes

Sand-Casting


Pictures and flow are only examples, real process might vary slightly

Advantages Sand-Casting

- Commercially beneficial for large quantities
- Better process sustainability than investment casting
- Short Industrialization time compared to stamping or deep drawing processes
- Flexibility for late design changes during development phase compared to stamping or deep drawing processes

Technical Functions & Advantages


Parts Functions for Chassis and Body-In-White



Key components (such as nodes) capable of:


- Absorbing much of the energy in case of impact (shock or crash)
- Deformation without breaking
- Retaining sufficient rigidity to guarantee integrity and safety of the people / critical components located inside the car

Parts Requirements



- Material with high mechanical properties suitable to absorb high energy with thin wall thicknesses and to fulfil assembly and coating treatment conditions.
- Optimized design to integrate assembly line constraints allowing maximized rigidity combined with efficient absorption/distribution of energy peaks.

Casting Process Advantages compared to Stamping Process



- Reasonable manufacturing cost
- Reasonable tooling cost investment / number of parts produced
- Flexibility during development cycle permitting last minute changes
- Acceleration of the development process by reducing tooling manufacturing time
- Adaptability from prototypes to big volumes in serial production

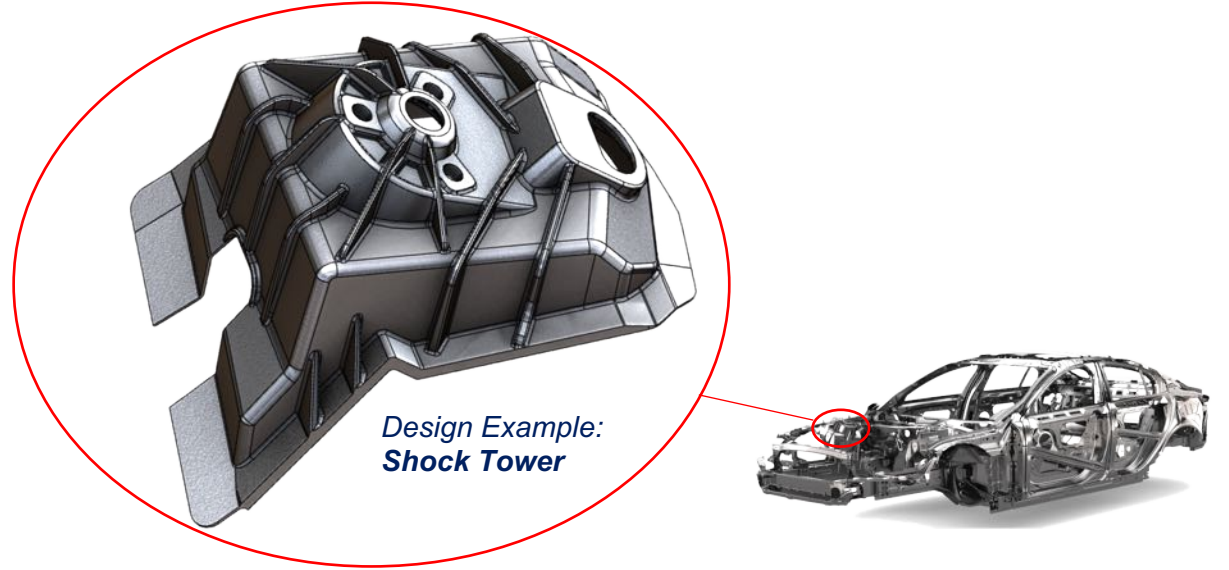
Parts Additional Advantages

Possibility to integrate various parts and functions in a single part

→ *Global potential cost reduction of the function.*

Possibility to implement material where it is necessary only and to merge multiple parts in a single component

→ *Global potential weight reduction whilst maintaining functionality.*





Conclusion

Why thin wall steel casting?

Safety 	Rigidity & Stiffness 	Commercials
Sustainability 	Integrity at OEM 	Replacing Multiple Parts
Lightweight 	Flexible Design 	Fast Development
Recycling 	Industrialization 	Functionality

Final Statement

Thin Wall Steel Casting components represent a promising solution to overcome multiple challenges of future vehicle development and production.

The outstanding material properties of steel, great carbon footprint, existing supply chains and global material availability in combination with the flexibility in design, fast development cycles and integrity of available structures at the OEMs make this technology advanced to comparable sheet metal or Aluminium casting products.

For gaining the maximum profit in terms of commercials and functionality a close development collaboration between the customer and manufacturer are required.

We are looking forward to work with you to create the future!

Business Philosophy / 經營理念

Customer is top priority
客戶至上

Honesty comes first
誠信第一

Care for each other
相互關懷

Learn actively
積極學習

Quality Philosophy / 品質政策

Excellent quality
質量第一

On-time-delivery
交期準確

Reasonable price
價格合理

Thoughtful service
服務周到

Thank You

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