

Anatomy of a Gigacasting: How OEMs Design Differently

Every OEM adopting Gigacasting faces the same fundamental question: how much do you integrate into a single casting?

The answer reveals more about an automaker's engineering philosophy than any press release ever could.

Most industry coverage focuses on *who* is adopting Gigacasting and *how many* machines they've ordered and how many kg of weight reduction in % they achieved.

But the real insight lies beneath the surface – in the anatomy of the castings themselves.

Two OEMs can both use a 9,000-ton die casting machine and produce completely different components – one integrating wheel arches for maximum process reduction, the other stripping down to a skeleton structure for minimum weight.

These internal design decisions affect crash safety, repairability, manufacturing complexity, and cost. And they're invisible unless you have access to the actual parts data.

This report dissects the design categories used in Gigacasting today, based entirely on data from [The Gigacasting Database](#). It covers:

- **Machine size distribution** – which tonnage ranges dominate production today, and where new installations are heading
 - **Rear vs. Front Underbody adoption** – why RUB dominates and why FUB remains a safety challenge
 - **Design anatomy** – the three main design types for both RUB and FUB, and what each structural tradeoff means
 - **Future outlook (2026–2031)** – how the next generation of platforms will shift adoption rates
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This document provides an overview of the general characteristics of Gigacastings used in vehicles worldwide, all the data comes from [The Gigacasting Database](#).

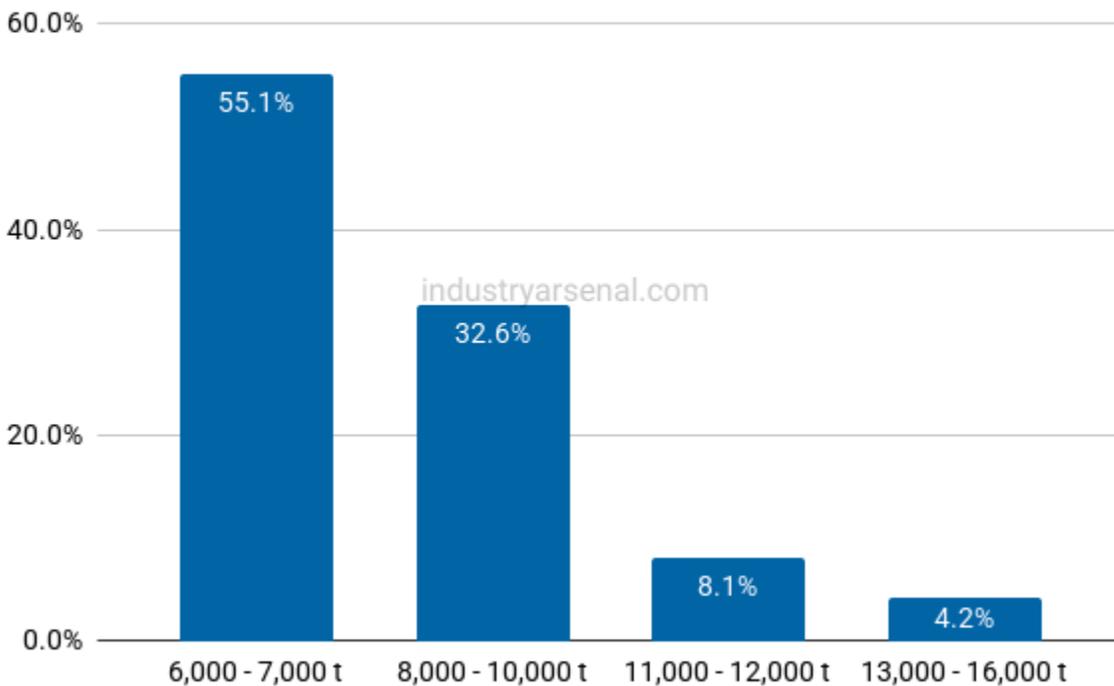


The data is based specifically on vehicles that have been launched on the market, both those currently in production and those that were launched but are no longer available for reasons such as bankruptcy, refreshes with different castings, etc.

A look into the future will also be briefly provided, seeing how OEMs will leverage Gigacasting in their future platforms.

General Overview

Clamping Force in Gigacasting Production



Source: [The Gigacasting Database](#)

Currently, more than 50% of all Gigacastings are produced on machines with clamping forces in the 6,000–7,000 ton range. These machines remain the workhorse for structural components.

However, the majority of new machine installations fall in the 8,500–9,800 ton range, but at present, these higher-tonnage machines account for one-third of Gigacasting production.

Presses exceeding 10,000 tons used for large structural components in passenger vehicles are still relatively rare exceptions.

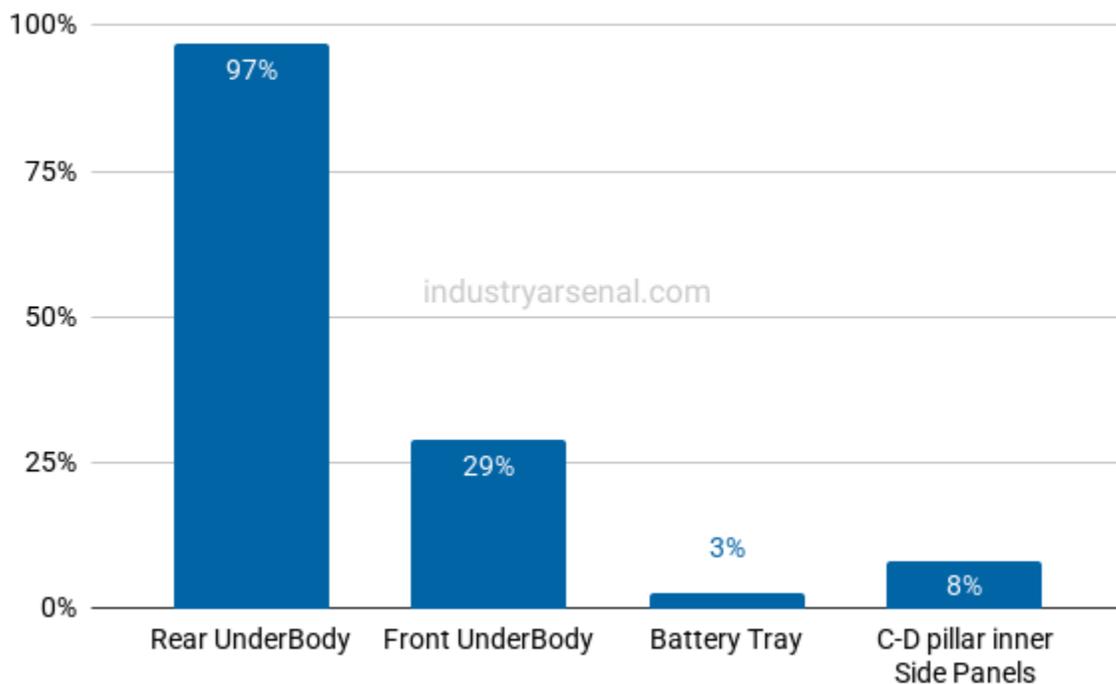
Looking ahead, such ultra-large machines (>10,000 t) are expected to see limited expansion in passenger vehicle structural parts.

Their primary role will focus on demanding components like battery trays, covers, and similar large-scale EV battery enclosures, where size, integration, and structural demands justify the investment.

Now let's see what are the use cases for vehicles released on the market.

The bar chart below shows the share of Gigacasting usage across all vehicles adopting this technology released to the market between 2020 and January 2026.

Gigacasting Use Cases



Source: [The Gigacasting Database](#)

It can be noticed immediately that Rear UnderBody (RUB) Gigacastings dominate the market.

A few key reasons are the simplicity of implementation in the BiW design, increased safety benefits, very high reduction of parts and lightweight benefits.

Compared to RUBs, Front UnderBody (FUB) Gigacastings are a lot harder to implement.

One of the key reasons is safety. It was observed that during simulations, made in the design stage of FUB Gigacastings, that they tend to protrude into the passenger cabin in case of frontal crash.

It is therefore critical to design the FUB with thorough consideration of crash energy management. The primary objectives are to ensure that the casting absorbs and dissipates impact energy effectively, while preventing:

- Intrusion into the passenger cabin, and
- Transfer of excessive crash forces to the occupant cell

thereby minimizing the risk to passenger life and enhancing overall vehicle safety.

Tesla's "progressive crash mode" is an example of how to solve this problem.



In the image above we can see a side by side comparison of the Cybertruck FUB Gigacasting crash simulation and real life crash test.

Progressive crash mode is intentionally designed into the casting to ensure that, during a frontal collision, the forward portions deform, fracture, and absorb energy first, before failure propagates to the sections nearer the passenger cabin.



This controlled, sequential failure is primarily achieved by strategically varying the wall thickness and rib dimensions (size, spacing, and orientation) throughout the load-bearing portion of the casting.

Forward regions incorporate thinner walls and smaller/less reinforced ribs to initiate crushing and fracture early, while progressively thicker and stronger features toward the rear increase resistance and help protect the occupant compartment.

Gigacasting Features

Gigacastings exhibit key observable features that allow categorization.

These characteristics are important aspects in the design of a Gigacasting which can help us understand the choices made by the engineers when they designed the part, like manufacturing complexity, weight tradeoff and reparability.

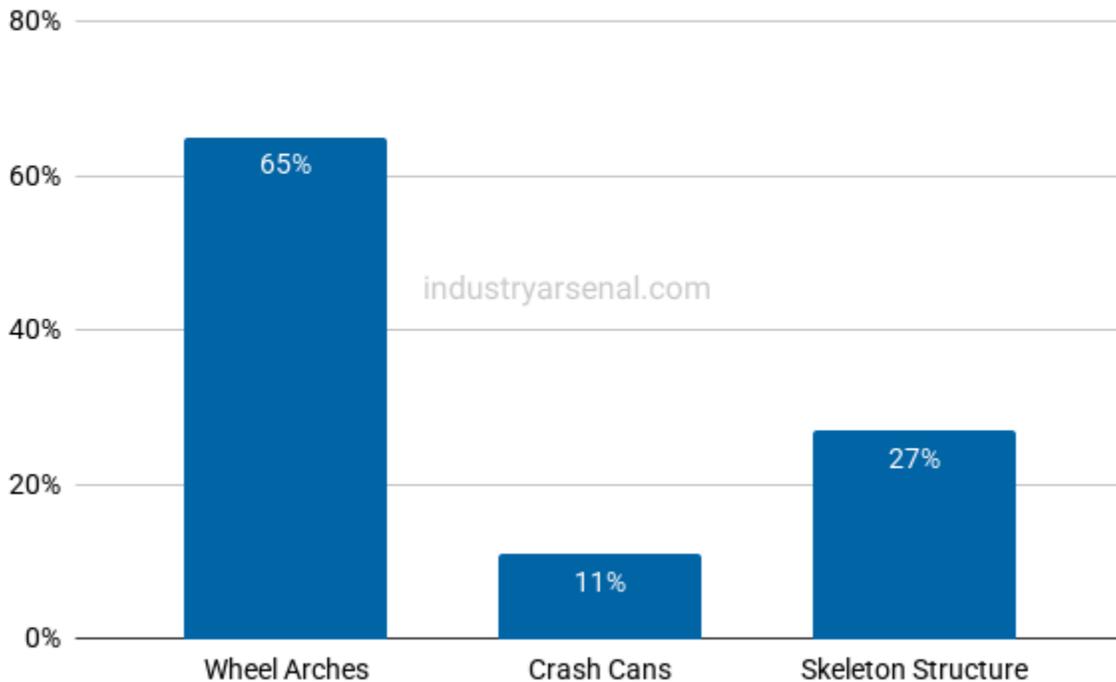
Rear Underbody Gigacastings can be grouped into three main categories:

- With **integrated wheel arches**
Reduces underbody production processes by ~30%
Increases weight by ~10-15%
Requires more complex die-casting process
- With **integrated crash cans**
Minimizes casting involvement in repair procedures
Involves more separate parts and processes overall
- **"Skeleton Structure"**
Only load bearing components

The main features can be visualized in the image below



Rear Underbody Characteristics



Source: [The Gigacasting Database](#)

65% of vehicles with RUB Gigacastings integrate wheel arches in the Gigacasting design.

Integrating the wheel arches reduces underbody manufacturing time by about 30%, according to IDRA General Manager John Stokes¹. This approach delivers the greatest overall cost savings by minimizing part count, assembly steps, and fixtures. However, it comes at the expense of vehicle performance optimization.

Weight reduction is limited because aluminum Gigacastings require a relatively high minimum wall thickness (typically >2 mm in large flat areas) to ensure proper molten metal flow and prevent premature solidification. Large, thin surfaces also risk deformation or damage during handling and transportation.

Excluding the wheel arches from the casting allows them to be replaced with very thin, lightweight stamped metal sheets. This can yield an estimated 10–15% weight savings in the RUB by eliminating these thick, flat cast surfaces.

Only 11% of RUB Gigacastings integrate crash cans (energy absorbers) as an integrated safety feature.



Most rear Gigacastings instead rely on separately attached extruded aluminum crash cans. These protect the main casting during low-speed impacts. While no definitive evidence shows one method clearly outperforms the other in repairability, the integrated “all-in-one” approach shows no major disadvantages compared to traditional body-in-white (BiW) constructions^{2 3}.

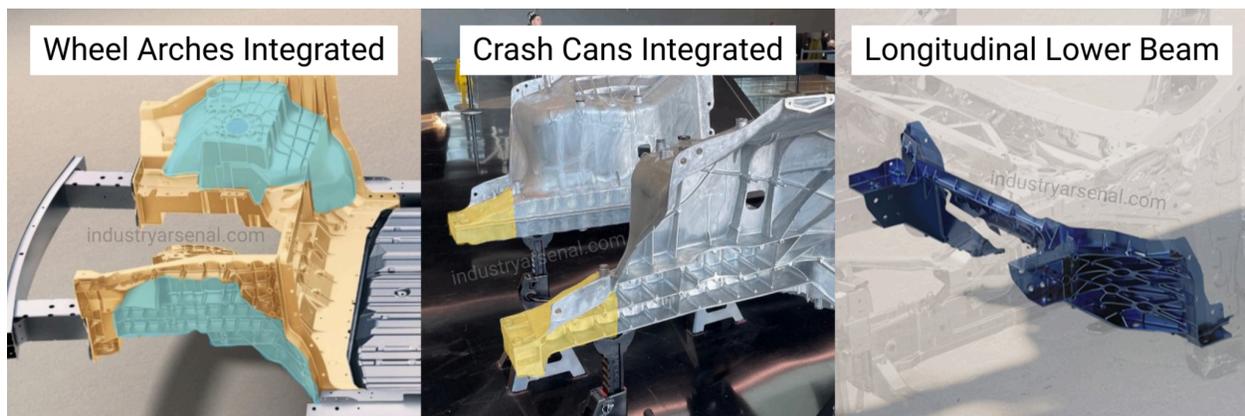
Finally, 27% of RUB Gigacastings eliminate all large flat surfaces; Including wheel arches, the Battery Management System (BMS) cover/anchoring areas, rear floor sections, and inter-wheel spaces.

I refer to these highly optimized designs as “Skeleton Structures”. They consist exclusively of load-bearing elements and attachment points, maximizing torsional stiffness while minimizing weight and enhancing functional utility.

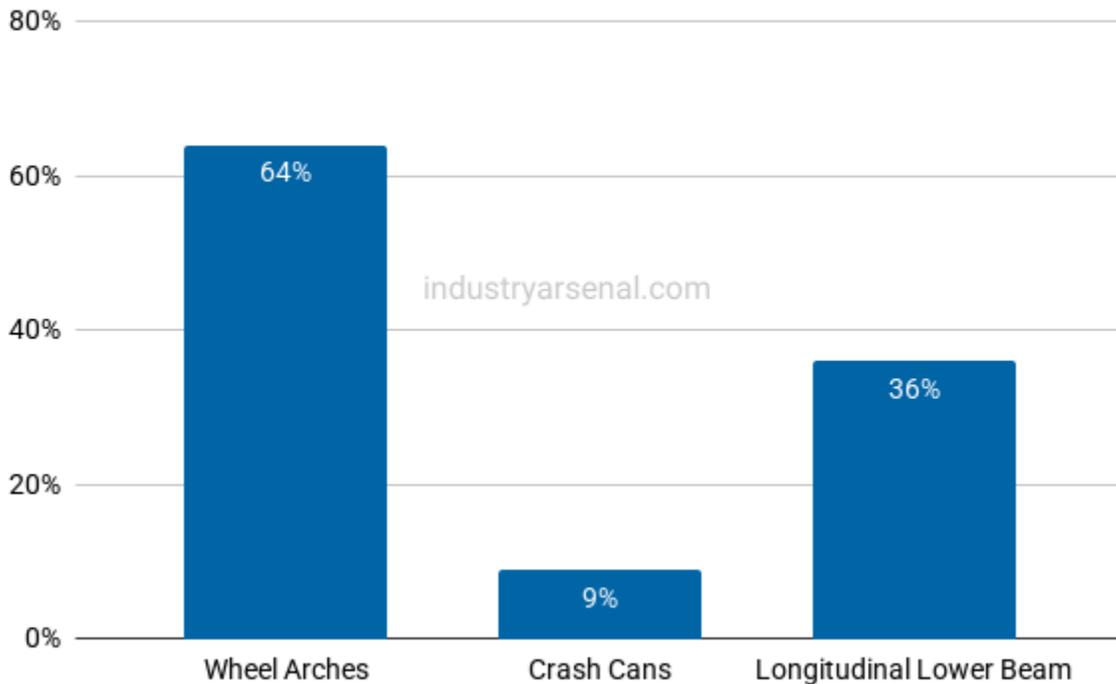
These Skeleton rear castings weigh between 34kg and 40 kg but parts reduction is not as favorable as in a fully integrated underbody casting. They are currently being used mostly for the premium segment when a weight reduction and process addition tradeoff is more favorable.

Front Underbody Gigacastings follow a similar grouping

- With integrated wheel arches and shock towers
- With integrated crash cans
- Longitudinal Lower Beam only



Front Underbody Characteristics



Source: [The Gigacasting Database](#)

Due to safety and repairability concerns associated with FUB Gigacastings, compared to RUB designs (as detailed on pages 3–4), FUB Gigacastings are used in only 29% of vehicles equipped with Gigacastings.

Among these FUB applications:

- Approximately one-third consist solely of the Longitudinal Lower Beam. While this simpler design integrates far fewer components than a full FUB, it is primarily employed to enhance passenger cabin safety and torsional stiffness.
- The remaining 64% of FUB cases feature more comprehensive castings that incorporate wheel arches, shock towers, and attachment points for heat management systems, the front motor, and other critical front-end components.

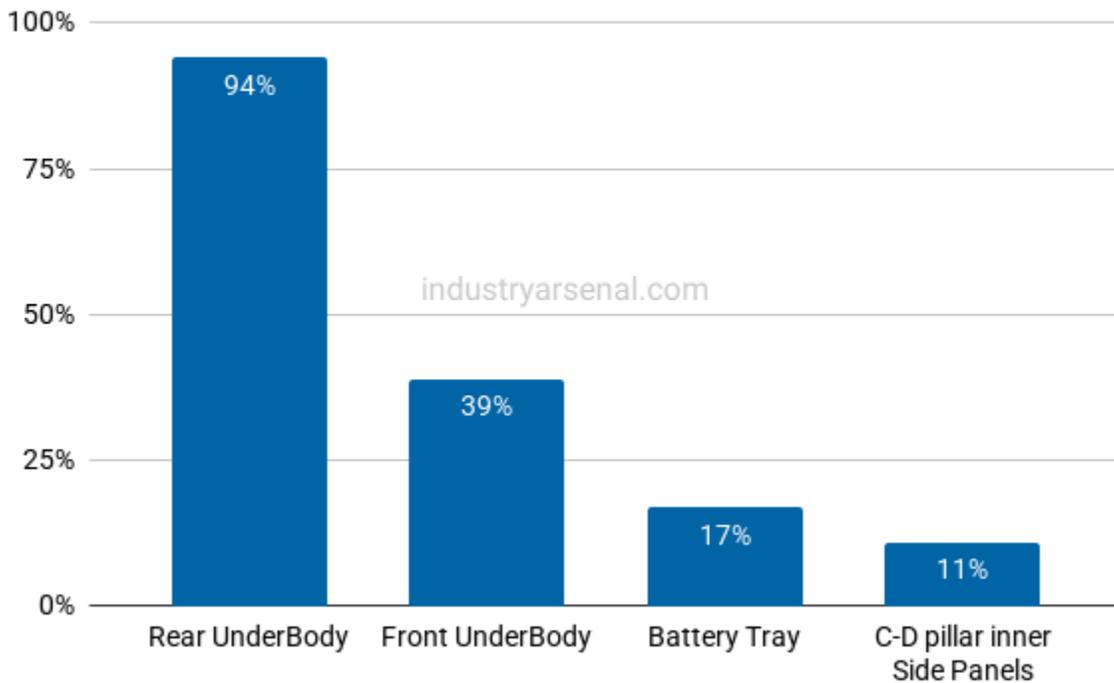
Notably, only a small minority of FUB Gigacastings integrate the front crash cans directly into the casting. These energy-absorbing elements are highly susceptible to damage and typically require replacement even in low-speed collisions (e.g., above ~15 km/h), which poses repair challenges and contributes to the limited adoption of more complex FUB designs



Future Use Cases

The chart below analyzes the future vehicle platforms adopting Gigacastings entering the market between 2026 and 2031.

Future Platforms Adopting Gigacastings



Source: [The Gigacasting Database](#)

Some future platforms will adopt battery trays without the use of front or rear underbody castings.

These exceptions pull down the aggregate adoption rates, resulting in 39% FUB castings and 94% RUB castings overall.

When we filter the analysis to include only vehicles that incorporate at least a rear underbody Gigacasting, front underbody adoption increases markedly - from 29% among existing platforms (Page 3) to almost 50% among platforms planned for launch between now and 2031.

Key Takeaways

- **Rear Underbody Gigacastings dominate the market**, appearing in far more vehicles than Front Underbody designs. The reason: simpler implementation, fewer safety complications, and greater cost savings.
 - **65% of RUB designs integrate wheel arches** – the most popular approach, reducing underbody production time by ~30% at the cost of 10–15% additional weight.
 - **Only 11% integrate crash cans directly** – Tesla's approach remains the exception, not the rule. Most OEMs use bolt-on extruded crash cans instead.
 - **27% use "Skeleton Structures"** – the lightest option (34–40 kg), currently favored for premium vehicles where weight savings justify additional assembly steps.
 - **FUB adoption is set to nearly double** – from 29% among existing platforms to almost 50% among platforms planned through 2031, as OEMs master crash energy management.
 - **Ultra-large machines (>10,000t) will remain niche** for structural parts, finding their primary role in battery trays and EV enclosures.
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What's NOT In This Scorecard

[Gigacasting Machine Database](#)

All the OEMs and suppliers which placed orders for large die casting machines ($\geq 6,000t$) and magnesium Thixomolding machines ($\geq 5,000t$)

[Detailed Capacity Mapping](#)

Description and split for every company by machine size, quantity, location, machine manufacturer, materials used. What size? How many? Where exactly? Who supplied the machines?

[Detailed Order/Installation split](#)

For each machine, it's specified the quantity of machines ordered and installed and specifies whether projects are paused, delayed or cancelled

[Products](#)

What is every machine installed at each location used for?



Vehicle Database

The most comprehensive data for every vehicle model in the world which adopts Gigacasting technology

Future Vehicles and Platforms

Future vehicles and platforms which will use Gigacastings are included with release date and all the details listed below

Granular Production Data

For each model; Where the vehicle is assembled, its start of production, current production status, 2025 total production, 2026 total production, monthly average production and latest monthly production

Gigacasting Analysis

Each Gigacasting in the vehicle (e.g. Rear and/or Front underbody); Described in its most important characteristics, images are also provided

Clamping force used in the process. Where the casting is made. Gigacasting supplier or whether the casting is made by the OEM. Number of machines available and brand of the machine used

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Data compiled by Luca Greco | March 2026

For inquiries: Connect on [LinkedIn](#)

Unaffiliated Sources:

- 1) <https://www.engineering.com/large-format-die-casting-showcases-advanced-italian-technology/>
- 2) <http://youtube.com/watch?si=hbkGtLIYU0U6CFBA&v=abezLmL2j0&feature=youtu.be>



- 3) <https://www.wardsauto.com/news/exclusive-mega-cast-construction-saves-on-vehicle-repairs-study-finds/778512/>

