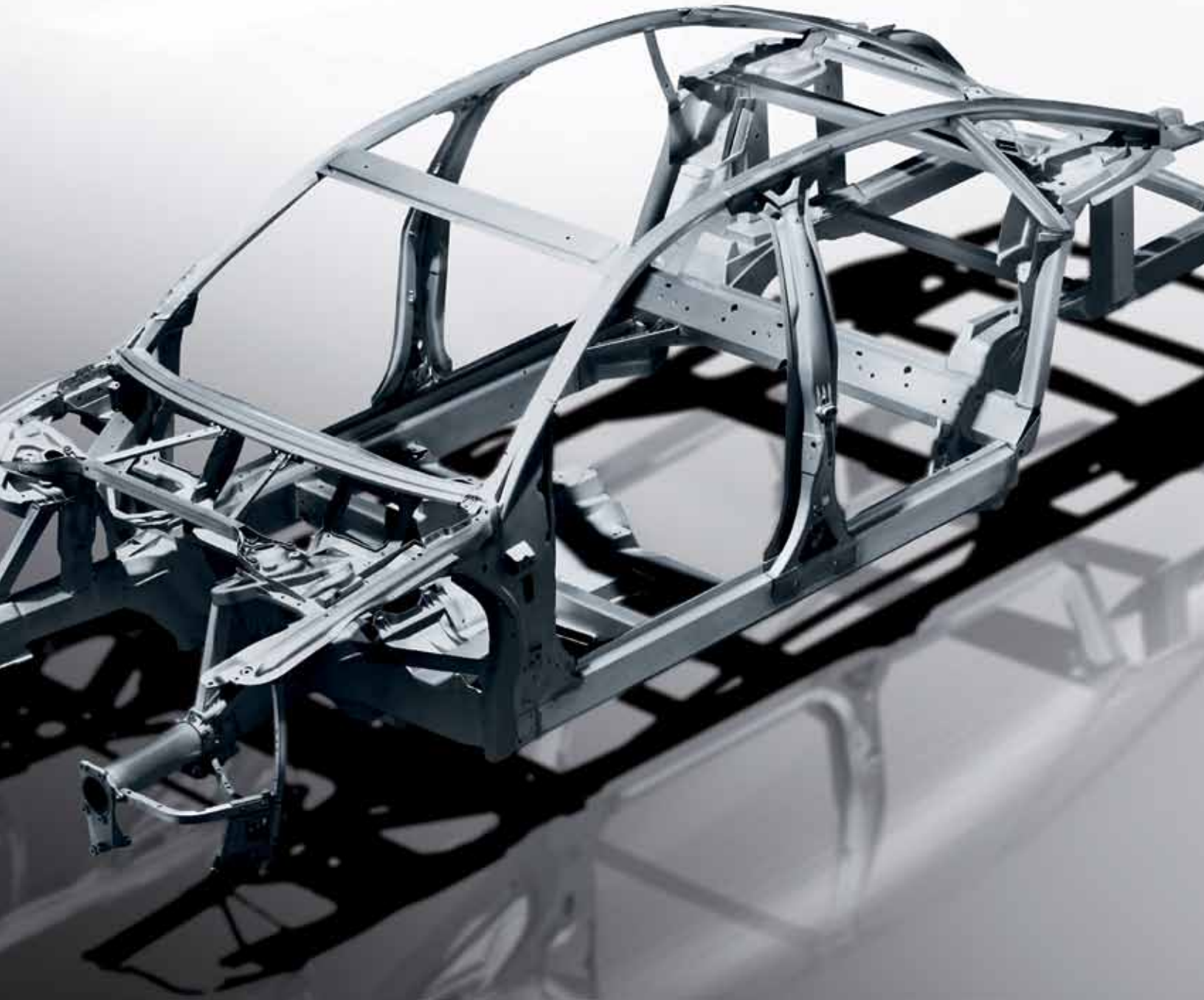
Audi
Truth in Engineering

Audi Collision Frame Technology Guide

Note: This communication is for internal use only.



Introduction

The *Audi Collision Frame Technology Guide* is designed to serve the following reference needs:

Audi Authorized Collision Repair Facilities will use the guide to identify the components and procedures required for each repair. This information is critical to ordering the correct parts and repair materials, using the correct equipment (welders, bench systems, etc.) and making accurate estimates based on this criteria.

Insurance estimators will find the guide invaluable for verifying the accuracy of estimates and recognizing the unique qualifications of Audi Authorized Collision Repair Facilities in effecting safe, structurally sound and aesthetically satisfying repairs.

NOTE:
This guide is NOT a repair manual and is intended for informational purposes only.

Contents

Topic	00 Structural body damage or body dimensions differ from Repair Manual specifications
Market area	United States 444 Volkswagen of America, Inc. (6444), Canada 999 Volkswagen Canada Inc (6999)
Brand	Audi
Transaction No.	2022005/1
Level	EH
Status	Approval
Release date	

Customer codes

ID	Component group	Damage group	Broad code	General code	Detail code
041012	Body	excessive wear/consumption/ damage	Interior - pillars	*	*

New customer code

Object of complaint	Complaint type	Position
Body -> Structure	Dimensional accuracy	

Vehicle data

All Audi

Sales types

Type	MY	Brand	Designation	Engine code	Gearbox code	Final drive code
*	2005	A		*	*	*
*	2006	A		*	*	*
*	2007	A		*	*	*
*	2008	A		*	*	*
*	2009	A		*	*	*
*	2010	A		*	*	*
*	2011	A		*	*	*
*	2012	A		*	*	*
*	2013	A		*	*	*
*	2014	A		*	*	*
*	2015	A		*	*	*

Documents

*True technical bulletin

Document name
master.xml

Condition
Structural body damage or deviations from the body dimensions specified in the Repair Manuals are suspected and/or there is visible damage to structural components.

Technical Background
AUDI AG has defined structural damage as follows:

Damage (dent, crack, buckling) and/or change in the position of a structural component of the vehicle body. Structural components refer to all components of the body except body shell components or components that are bolted on. However, bolted longitudinal members in aluminum vehicles are structural components.

Repair Information
Use the contacts below to access information that can aid you in the estimating and repair processes.

Online Resources
- ElsaWeb is the online resource for Audi Dealers
- Collision repair centers must use ErWin

Service
The vehicle must be placed on a repair bench system approved by AUDI AG and measured. For a list of approved frame benches, refer to the *Audi Authorized Collision Repair Facilities Required Tools and Equipment Guide*.

Warranty
This TSB is informational only and not applicable to any Audi warranty.

Additional Information
All parts and service references provided in this TSB are subject to change and/or removal. Always check with your Parts Department and Repair Manuals for the latest information.

Elektron	Tim Morgan	tmorgansr@att.net	(248) 909-0963
RAE	David Gruskos	gruskos1@comcast.net	
TECNA	Bill Berman		(386) 255-7090
SBS	Larry Nichol	larry.a.nichol@snapon.com	(262) 656-5631
I-Car	Steve Marks	steve.marks@i-car.com	(920) 749-0444 x131
Celette	Bastien Dias Da Costa		(630) 369-6100
Car-O-liner	Jeff Kern	jkern@car-o-liner.com	(248) 624-5900
DuPont	Rich Katko	rich.katko@usa.dupont.com	(248) 583-5005
CarFax	Sonya Halseth	sonyahalseth@carfax.com	(703) 934-2664 x4755
Sherwin Williams	Rodes Brown	rodes.brown@sherwin.com	(804) 433-9690
Collision Advice	Mike Anderson	mike@collisionadvice.com	

Service Information

Special Tools and Equipment **Number:** ATE-09-40

Subject: Audi Approved Spot Welders **Date:** Nov. 6, 2009

This is for U.S. Dealers only

Audi has approved three new spot welders for non-aluminum body repairs. These spot welders are the only factory-approved spot welders which carry the new Audi spot welding software programs and that meet Audi spot repair safety standards on MY 2009 and newer vehicles.

It is a **safety requirement** that this tool standard be used when spot welding ultra-high-strength/advanced-high-strength steel during collision repair as outlined in the Body Collision Repair Manuals.

It is critical to note that only the spot welders carrying the VAS 6530, 6535 or 6545 designations contain Audi approved software and are upgradable for future programming changes as required.

To verify that the shop you are referring collision repairs to uses the approved spot welders, access the lists of Audi Authorized Collision Repair Facilities. Refer to the Audi Top Service Process Guide (AccessAudi.com > Service tab > Audi Top Service Process Guide > Collision link > Body Collision link). Above the photo at the center of the page are two links. For all TT, A6, A7, A8, S8 and R8 models, click “Audi Authorized Aluminum Collision Network.” For all other models, click “Audi Authorized Collision Repair Facility Program.” Under the “Resources” menu at the right of the web page, the Audi Authorized Collision Repair Facility Program Manual 2010 and Audi Authorized Collision Repair Facility Program Manual list the approved spot welders (examples follow).

Installation

Note

When using different types of steel and materials of different strengths, one of the resistance spot welders listed and approved by Audi is required to service them correctly under ***> Chapter “Special Tools.”***

The following pages provide details on each approved spot welder.

Resistance Spot Welder VAS 6530

The VAS6530 Resistance Spot Welder is recommended for general body repairs on vehicles with high- and ultra-high-tensile-strength steel panels, especially for workshops with a critical mains power supply. The inverter technology in conjunction with adaptive smart control makes quality spot weld joints possible. Variations in joint structure are detected and compensated for if possible. If a weld is not possible, a text warning message will be issued by the unit. Operation is by touch screen via three different welding modes: manual, smart/automatic or manufacturer-specific programs. With a USB interface, new welding programs can be uploaded or recorded; welding results can be copied for further processing on a PC. The water-cooled C-transgun delivers equal electrode contact force with electrode arms up to 635mm in length.

Specifications:

- Mains connection: 230V 3-Phase 60 Hz
- Breaker protection: 60A delayed
- Mains connection lead: 17 KVA
- Welding current max.: 14,000 A DC
- Electrode contact force max.: 450 daN (1,011 lbs.)
- Dimensions:
  600 mm (24") x 680 mm (27.2") x 1,220 mm (48.8")
- Weight: 130 kg (286 lbs.)

Includes:

- Main unit with inverter and touch screen
- Inverter C-transgun, pneumatic with short electrode
- C-arm, length 85 mm with electrode, water-cooled
- Cart with large wheels at rear and braked casters at front
- C-Transgun holder and swivel arm with adjustable balancer
- Water-cooler module for transformer, transgun, arms and electrodes
- Rubber mains power cord, 8 m on retractable stowage facility on cart
- Electrode cap key for electrodes up to DN 21

VAS 6530/1 Accessory Package

- C-arm, long, 505 mm with angled electrodes, short (water-cooled)
- C-arm, small, air-cooled for wheel housings with ball-head electrode
- Ball-head electrode, water-cooled with mushroom head insert
- Long, angled electrode, water-cooled

VAS 6530/2 Accessory Package

- C-arm, medium, 355 mm with angled electrodes, short (water-cooled)
- Support, long for offset electrodes
- Offset electrode, water-cooled
- Long, straight electrode, water-cooled on arm side

Warranty: 24 Months

Manufactured by:
TECNA S.p.A.

Supplied by:
Equipment Solutions
800-892-9650

Resistance Spot Welder VAS 6535

The resistance spot welder VAS 6535 features a central connection and a tool-detection function. An impedance measurement is used to regulate the welding parameters automatically. In this way, a constant level of quality of the weld points is assured. With VAS 6535, it is possible to store the weld processes and to document them. Disturbance variables such as dirt, adhesive, etc., are detected and compensated for. A compact flash memory card allows the unit's software to be updated at any time.

Mobile resistance spot welder with inverter technology. Features impedance, measurement and welding parameter regulation.

Specifications:

- Mains connection: 208 – 240V 3-Phase
- Mains connection lead ø/length: 6 mm2 / 10 m
- Fuse protection at least: 60 A delay
- Mains frequency: 60 Hz
- Mains connection output: 42 kVA
- Rated output at 50% ED: 60 KVA
- Idle voltage max.: 23 V DC
- Welding current regulated: max. 12,000 A DC
- Water tank volume: approx. 32 l/4.5 gal.
- Ambient temperature: 40 C°
- Type pf protection: IP21
- Dimensions:
  661 mm (26") x 661 mm (26") x 1,372 mm (54")
- Weight: 171 kg (376 lbs.)

X Tongs:

- Cable length: 2.5 m
- Welding current: max. 12,000 A DC
- Weight of tongs without cables: 8 kg

Includes:

- Mobile mains unit
- X Tongs
- Welding gun

VAS 6535

- Quick dent removal hammer
- Linear balancer
- Cooling unit
- Heat exchanger
- Special VAS Welding Programs

VAS 6535/1

VAS 6535/1 Accessory Package

- Electrode set 02/06/415 MX coded
- Electrode set 05 MX coded
- Electrode set 11/280 MX coded
- Abrasive sponge, fine
- Multi-purpose electrode SB8 for planishing work
- Electrode caps A 13 R 25 (6 pcs.)
- Electrode caps A 13 R 15 (6 pcs.)

Warranty: 24 Months

Manufactured by:
Elektron, Bremen, Germany

Supplied by:
Equipment Solutions
800-892-9650

Resistance Spot Welder VAS 6545

Setting the welding parameters is carried out using simple, self-explanatory symbols. The welding programs are for high- and higher-tensile panels, for spot weld-bonded connections and for galvanized panels. Individual storage of welding parameters is possible. In addition, the system is suitable for documentation and administration of work order details on A4 paper. Software updates can be carried out using an SD card (upload). The material recognition function is performed with a material test program. Current control and pressure monitoring is provided. The welding process is monitored and the actual values are shown in the display.

The C-arms can be exchanged by means of a quick-positioning feature. The C-arms can be opened via a folding catch, thereby enabling access to the body, for example, behind profile sections.

VAS 6545

VAS 6545/1

VAS 6545/2

VAS 6545/3

Specifications:

- Power supply 3 x 190-240 Volt 50-60 Hz
- Setting range 0-13 kA
- Welding current: DC
- Continuous duty 100 %ED 2,8 kA
- Open circuit voltage: 12 V DC
- Max.Power with 5% ED: 156 KVA
- Fuse (slow blow): 63 A
- Connector cable (Cu): 5m / 4 x 0,157sq inch)
- Air pressure: 90 psi +/- 5%
- Refrigerant: water + anti corr.
- Water tank volume: 85 l / 22.5 gallon
- Dimensions:
  810 mm (32") x 560 mm (22") x 750 mm (30")
- Welding lead length: 3,000 mm
- Weight: 119 kg (262 lbs.)

Includes:

- Current source
- 1 CS transformer tongs
- 1 control unit with water tank 80 l
- 1 CS transformer tongs with integrated C-arm size 1
- 1 balancer with spring-loaded cable
- 1 mounting set for C-arms

Accessory Packs:

VAS 6545/1 Transformer x-gun with water-cooling up to the tips. 3 x 200-240 Volt / 50-60Hz ≤ 13.000 A / 65 A breakers.

VAS 6545/2 Single-sided gun for c-trafo air-cooled, with earth cable and accessory box on arm side

VAS 6545/3 Single-sided gun for x-trafo air-cooled, with earth cable and accessory box.

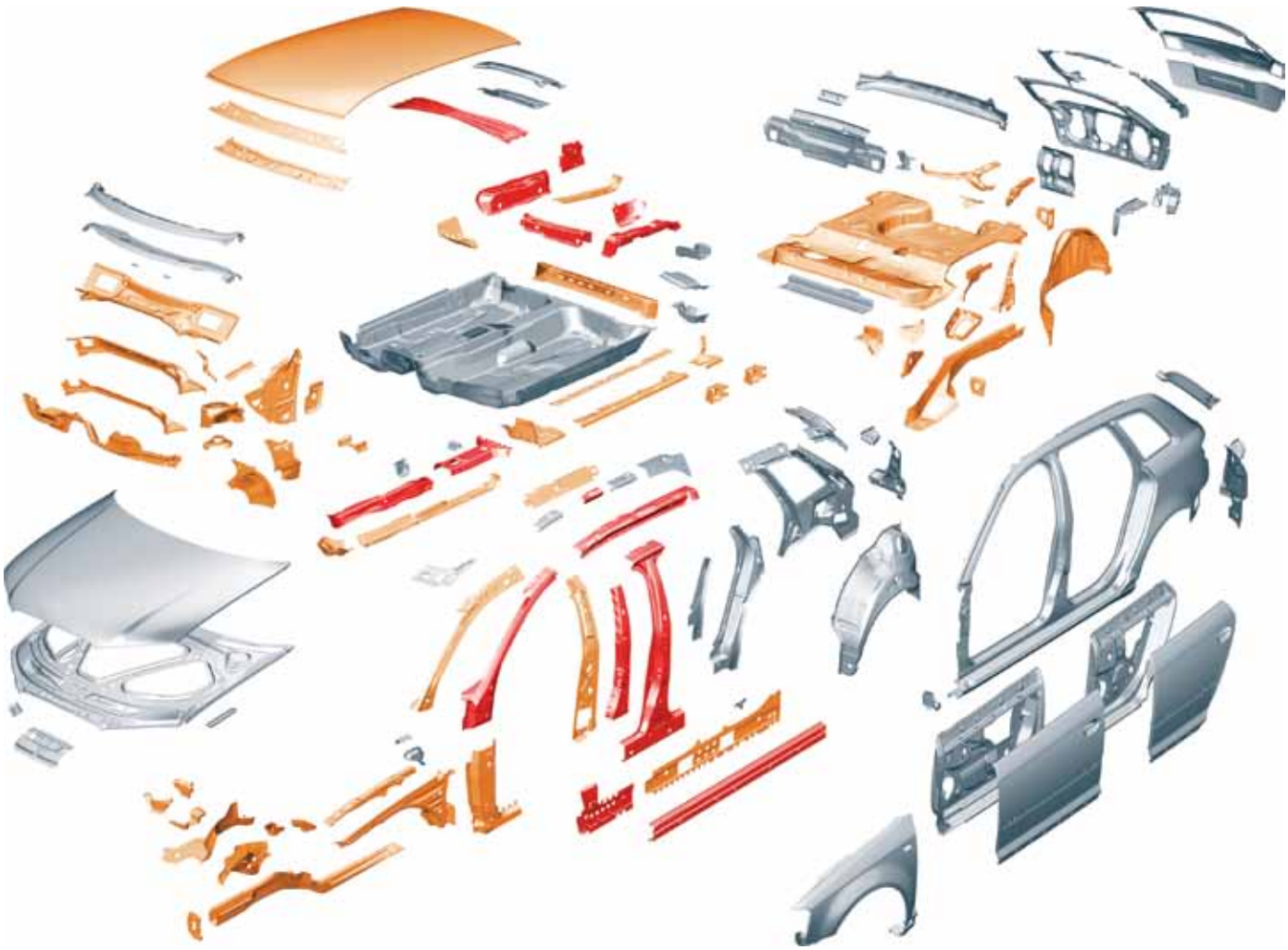
Warranty: 24 Months

Manufactured by:
Wielander & Schill

Supplied by:
Equipment Solutions
800-892-9650

Optimized Body

High-strength steel
Ultra-high-strength steel



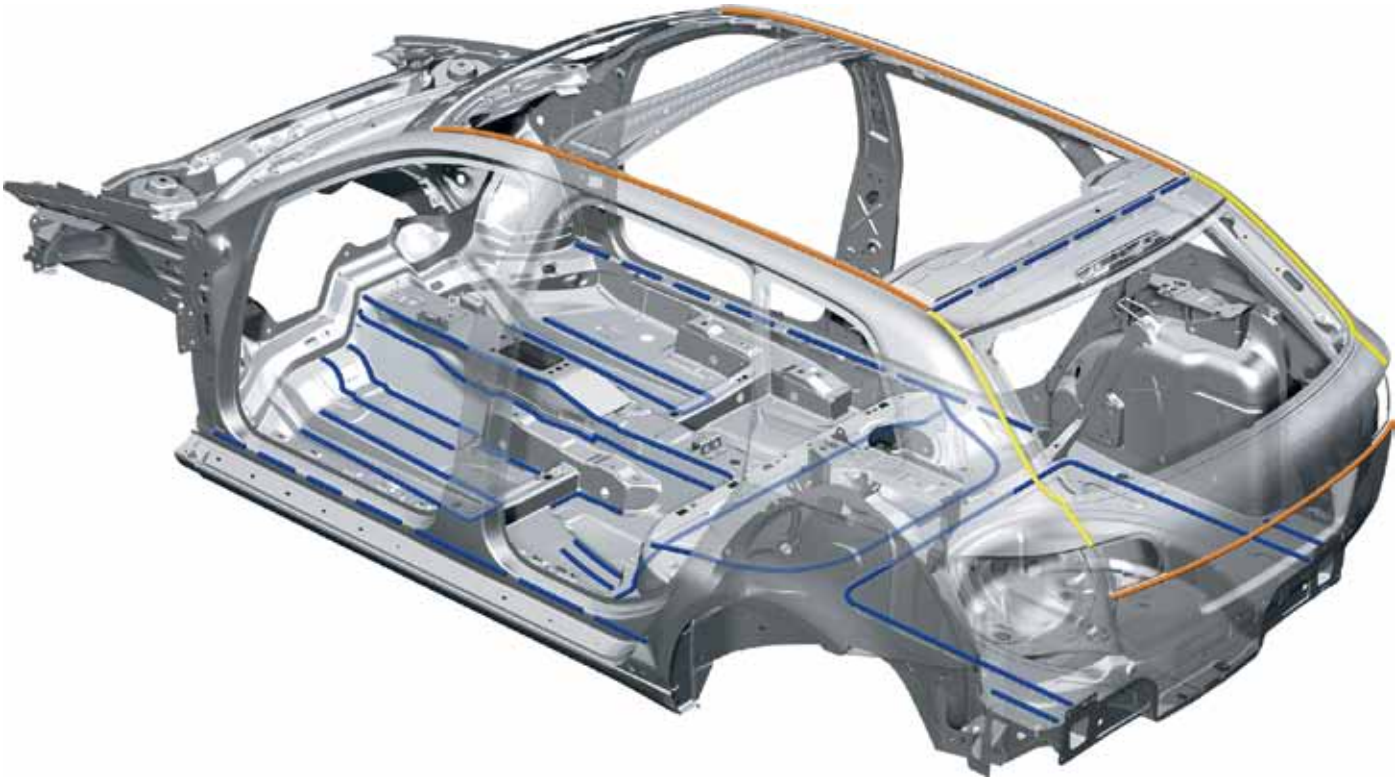
Joining Techniques

Spot Welding
Crash-relevant and rigidity-defining joints are spot weld-bonded using a high-strength structural adhesive.

Laser Welding
Laser welding is used in areas which are not easily accessible. It increases chassis strength and rigidity while reducing deformation of the sheet metal.

Laser Soldering
Laser-solder joining achieves a better design and higher rigidity in the area of the invisible joint and trunk lid.

Plasma Soldering
To ensure high rigidity and optimal design for the water channel, materials are joined by plasma soldering.

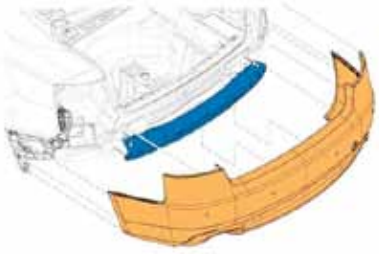


Materials

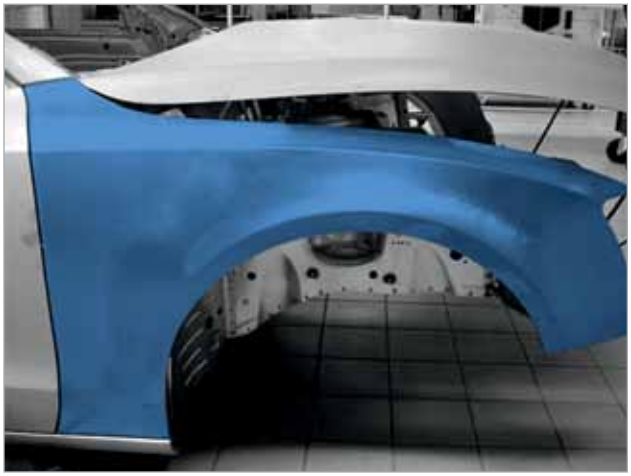
- Mild steel
- High-strength steel
- Higher-strength steel
- Ultra-high-strength steel
- Hot-formed (die-quenched) steel
- Aluminum

Materials

- Mild steel
- High-strength steel
- Higher-strength steel
- Ultra-high-strength steel
- Ultra-high-strength hot-formed steel
- Aluminum



Repair



A5/S5 repair considerations
New techniques are required for the repair of ultra-high-strength hot-formed steel. Straightening and reshaping of even minor deformations are not possible due to the high-tensile yield strength and the rebound effect of hot-formed steel. A damaged component must be completely cut out and/or partially replaced in accordance with the manufacturer's specifications.

The use of butt welding to repair ultra-high-strength hot-formed steel can cause weakness in the repair because of micro-structural changes arising from heating the steel during the welding process. To help ensure optimum repair integrity, suitable service solutions were incorporated during the development of the body structure that allow affected components to be replaced wholly or partially in special parting sections (depending on energy flow).

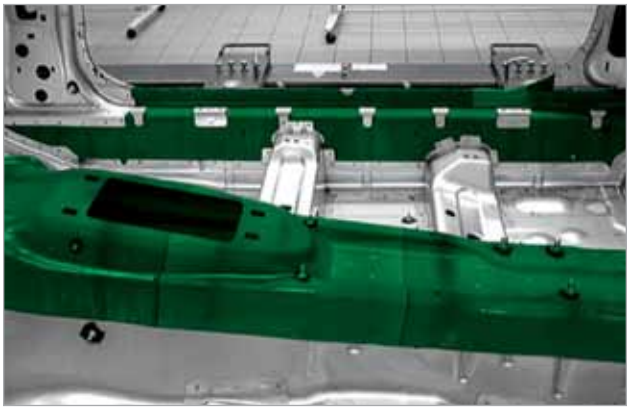
Ultra-high-strength hot-formed steel
This innovative material addresses the lightweight build and structural rigidity requirements of the new Audi line. It is used for the first time in multiple applications on the Audi A5/S5. Existing joining techniques have been modified to easily integrate the material into the vehicle production and repair processes. You will see it used even more extensively in future Audi vehicles.

The A5/S5 body construction is a testimony to the experience of Audi in lightweight design and its knowledge of innovative welding and joining techniques. The benefits of these technologies is evident:

- 38.8-lb. weight savings by using hot-formed steel
- Component-specific joining techniques were developed
- Tailored blanks of various wall thicknesses help increase overall body rigidity
- Aluminum wings

Rewarding results
These efforts have produced very high rigidity in addition to low body weight and a well-balanced axle load distribution.

For the occupants of the Audi A5/S5, this means a marked improvement in safety, agility and driving dynamics. Body vibration has also been reduced, bringing a further noticeable improvement in driving comfort.



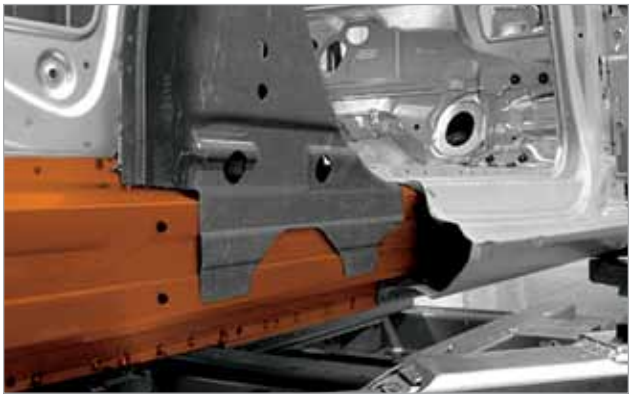
Repair concept of hot-formed steel

Hot-formed steel is used in the following areas:

- B-pillar
- Rear inner sill
- Rear longitudinal beam
- Tunnel reinforcement
- Tunnel bridge
- Longitudinal beam reinforcement

Upper B-pillar
If the upper B-pillar (green) is damaged, the entire B-pillar must be replaced. Dealers should consult ElsaWeb, and collision repair centers should consult the ErWin Workshop Manual for replacement procedures. Special tools and workshop equipment are required.

Lower B-pillar
Repair is possible using a service part. The parting cut (circled) must be made as described for dealers on ElsaWeb and for collision repair centers in the ErWin Body Repair Manual.



Lower area of B-pillar and rear inner sill panel
Dealers should review repair procedures on ElsaWeb, and collision repair centers should consult the ErWin Workshop Manual. The extensive use of high-strength hot-formed steel requires special welding equipment as well as welding accuracy. Material overheated in the welding process could fail in a future collision.

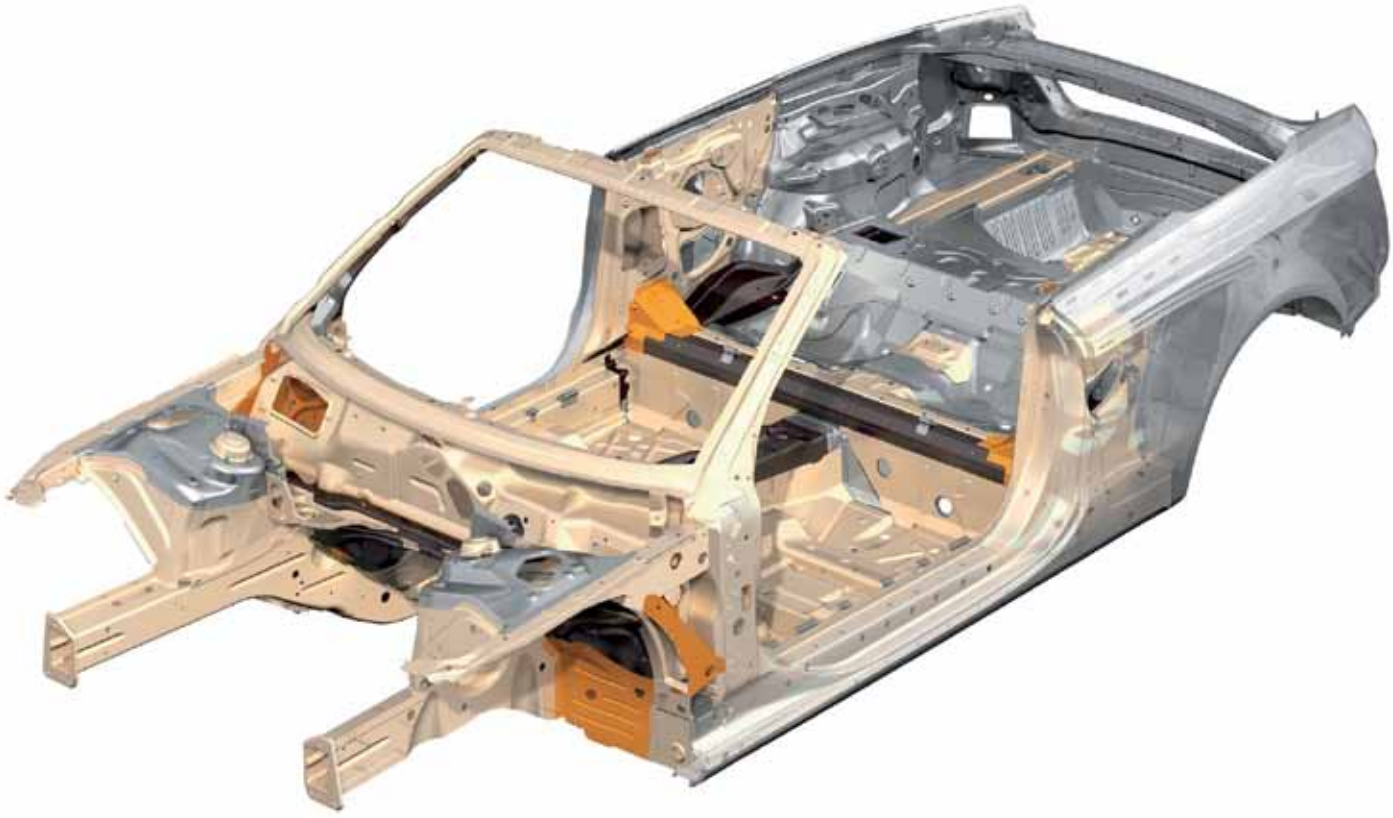
Rear longitudinal beam
"Tailored blanks" are panels manufactured to size with different material thicknesses. As a tailored blank component, the rear longitudinal member was designed so that the ultra-high-strength section will only deform if major damage occurs to the surrounding body structure and straightening and reshaping are no longer possible.

High-strength steel
Ultra-high-strength hot-formed steel

Partial replacement of the rear longitudinal beam is possible. The parting cut must be made as described in the Workshop Manual on General Body Repairs.

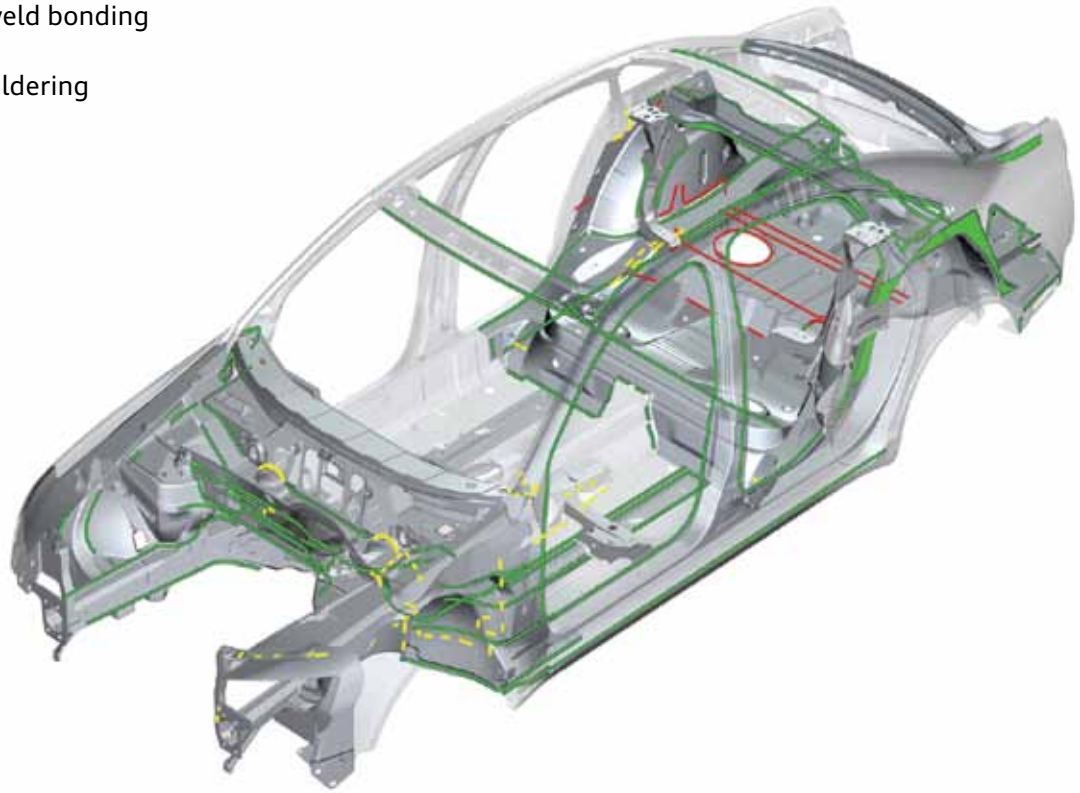
Materials

- Mild steel
- High-strength steel
- Advanced high-strength steel
- Ultra-high-strength hot-formed steel



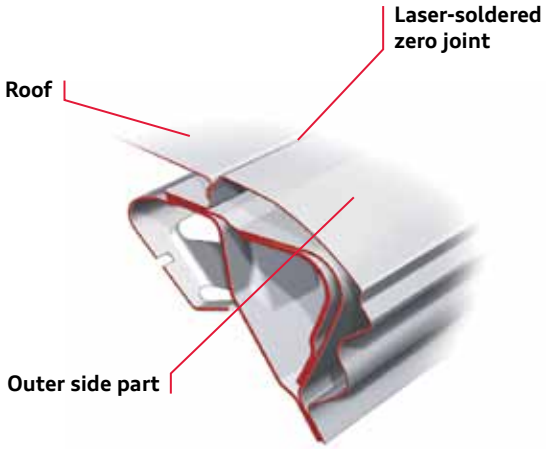
Body

Spot-weld bonding
Laser
MIG soldering



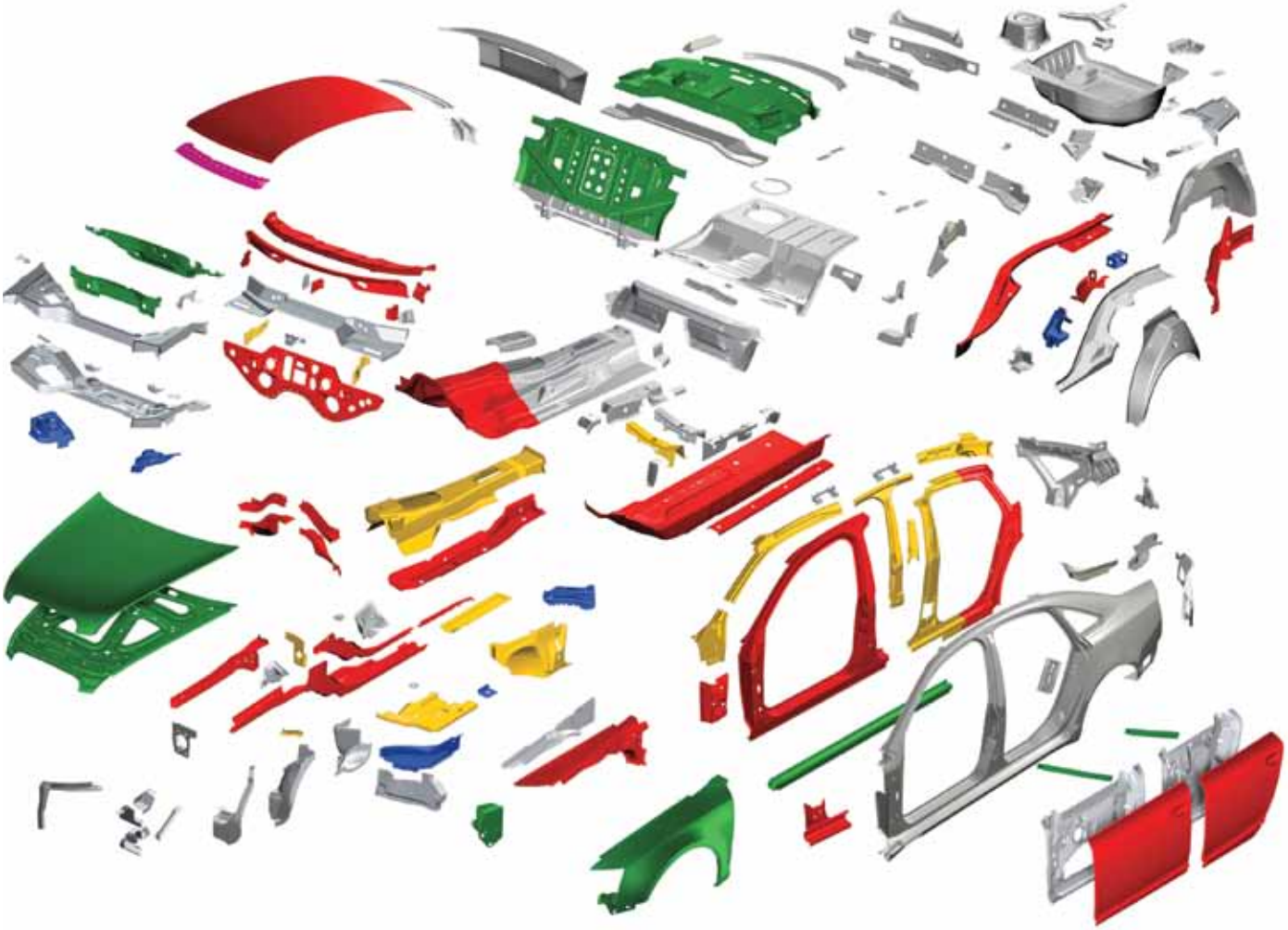
In addition to classic resistance spot welding, the following connecting techniques are used on the 2005 Audi A6 body shell:

- Spot-weld bonding
- Punch riveting
- Clinching (hood and trunk openings)
- Laser soldering
- Laser welding
- MIG soldering



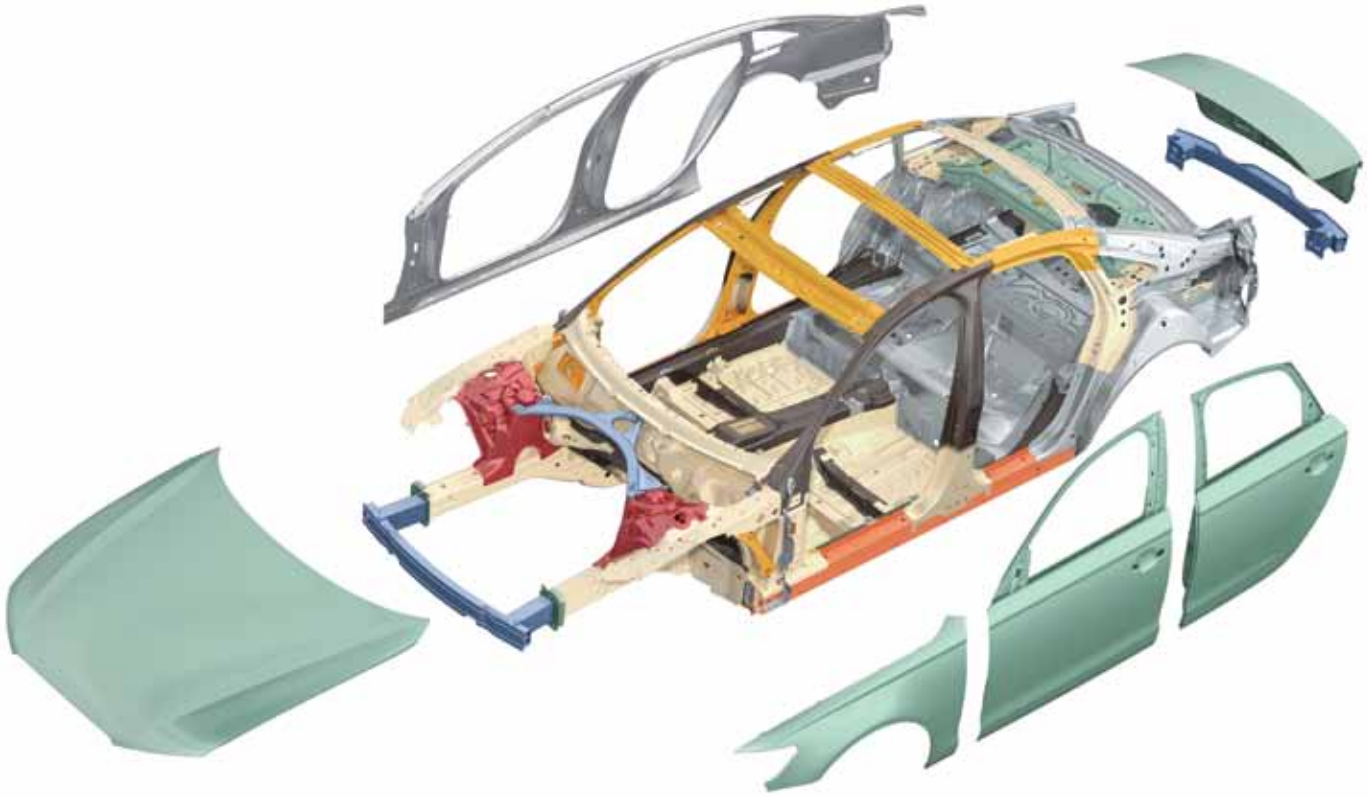
Body

- High-tensile steel (180 - 300 N/mm2)
- Dual-phase steel (340 - 500 N/mm2)
- Special steel (600 - 900 N/mm2)
- Aluminum
- Hybrid component



Body

- Mild steel
- High-strength steel
- Modern high-strength steel
- Ultra-high-strength steel
- Ultra-high-strength hot-formed steel
- Aluminum sheet
- Aluminum casting
- Aluminum extrusion

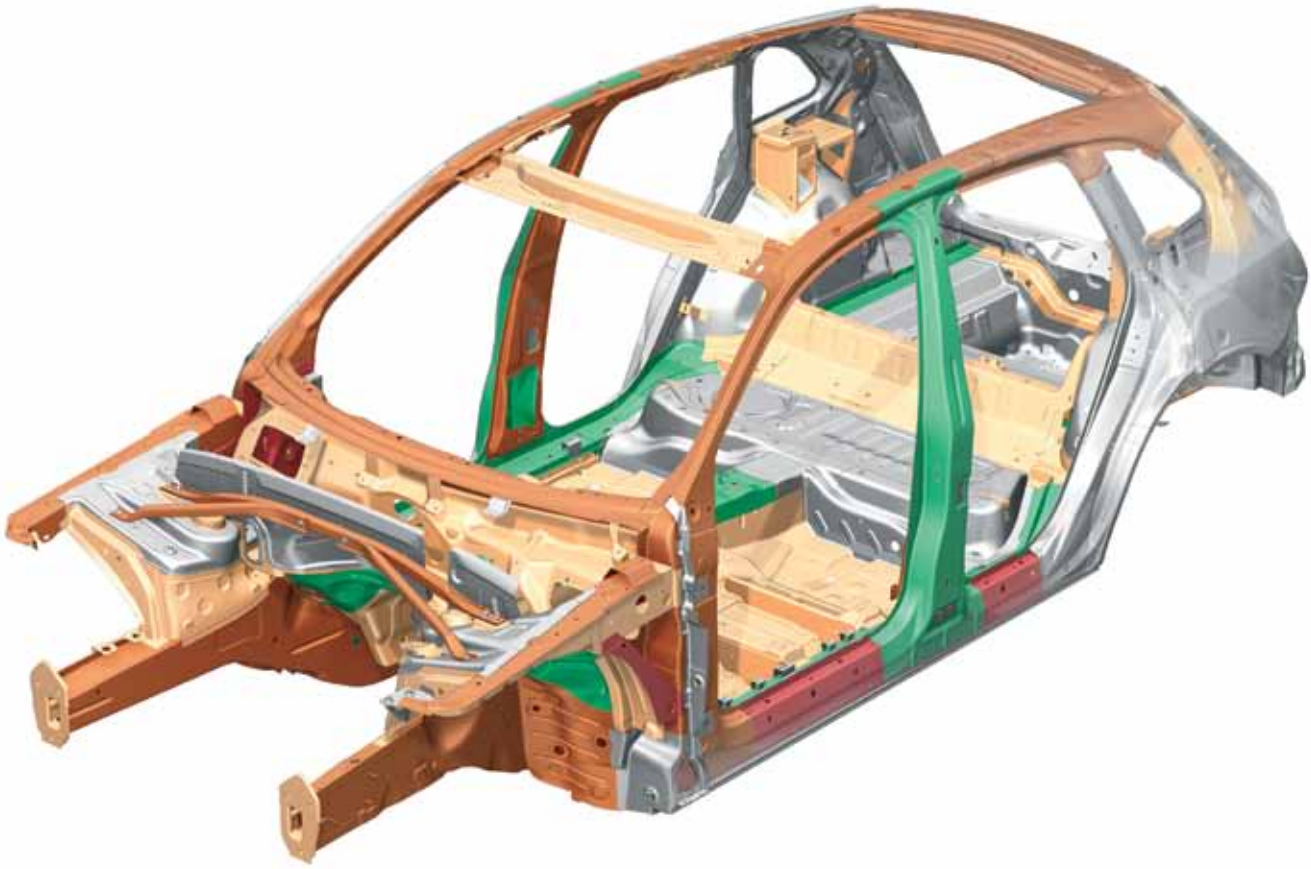


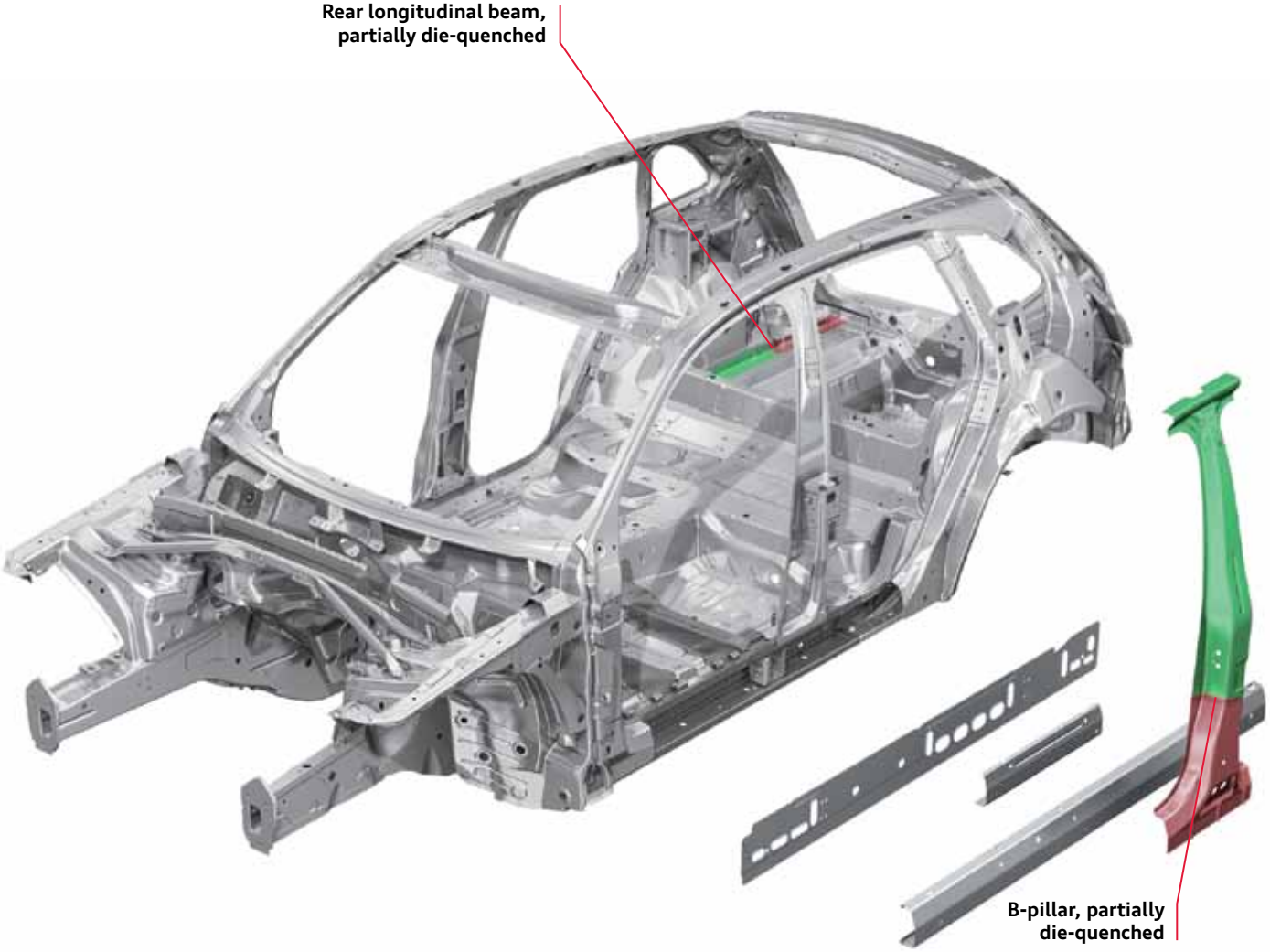
The body of the 2011 Audi A6 shares the same platform as the Audi A7, which is of hybrid construction. The sheet-steel parts are of high-strength steel and ultra-high-strength steel. The die-cast-aluminum strut mountings previously featured on the Audi A7 are used at the front end of the vehicle.

Like in the 2005 Audi A6, the parcel shelf in the 2011 Audi A6 is made of sheet aluminum. On the 2011 Audi A6, attachments such as the hood, wings, doors and trunk lid are also made of sheet aluminum.

Materials

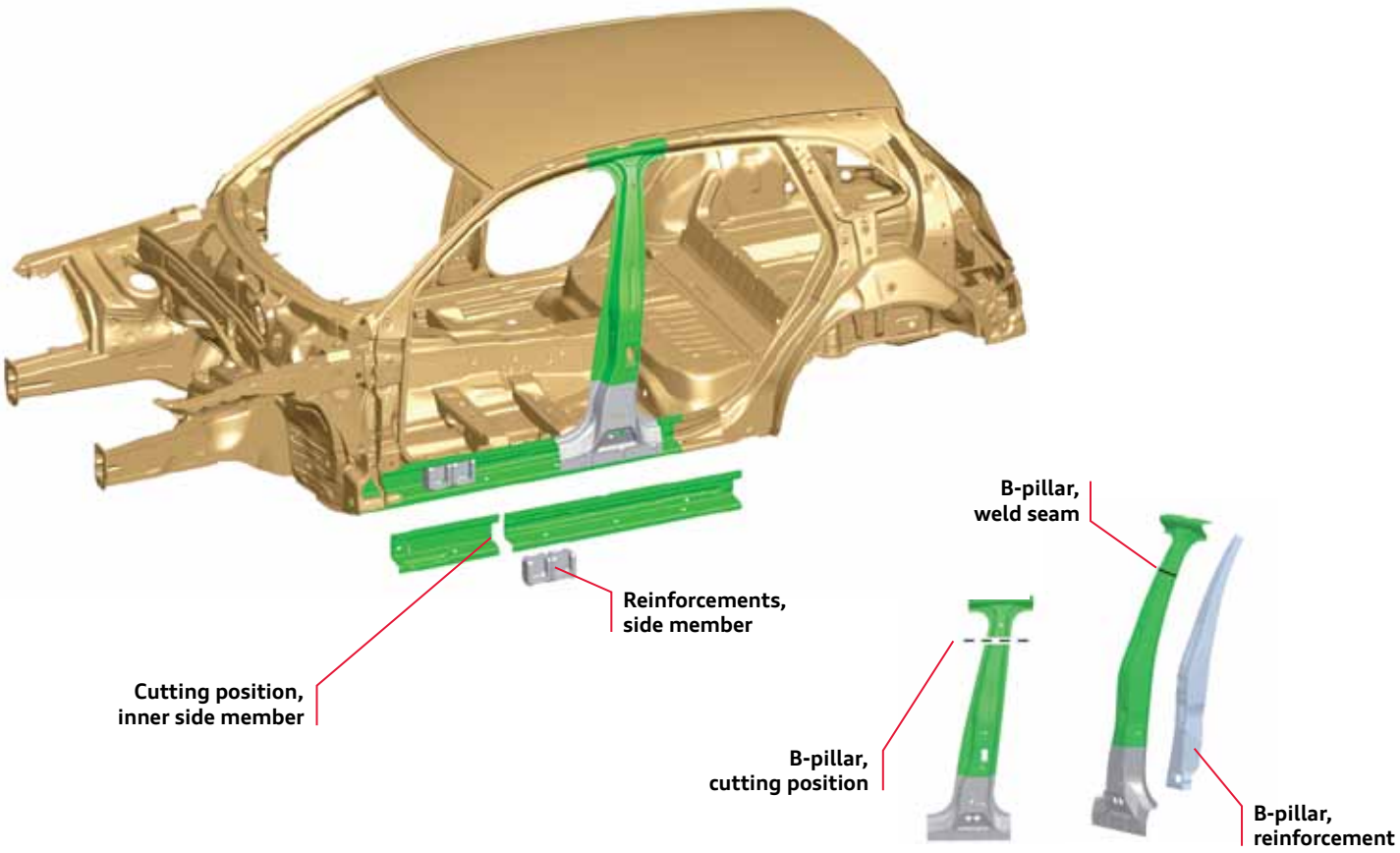
- 30.8% Mild steel
- 44.5% High-strength steel
- 12.3% Advanced high-strength steel
- 3.3% Ultra-high-strength steel
- 9.1% Ultra-high-strength die-quenched steel





To optimize the performance of the B-pillar in a side-impact collision, it is important that the lower section be able to absorb more deformation energy than the upper section – which, ideally, should have a very rigid construction. This was made possible, for example, in the 2009 Audi A4, through the use of tailored blanks. The B-pillar in the Audi Q5 is partially heated and then reshaped, as a result, the upper section of the pillar has properties of an ultra-high-strength die-quenched steel and the lower section those of an ultra-high-strength steel. This process is also applied to the rear longitudinal beams. Here, the rearmost section is able to absorb more deformation energy than the more rigid front section of this component.

Partial replacement of side member/sill at inner front (defined cutting position, reinforcing required)

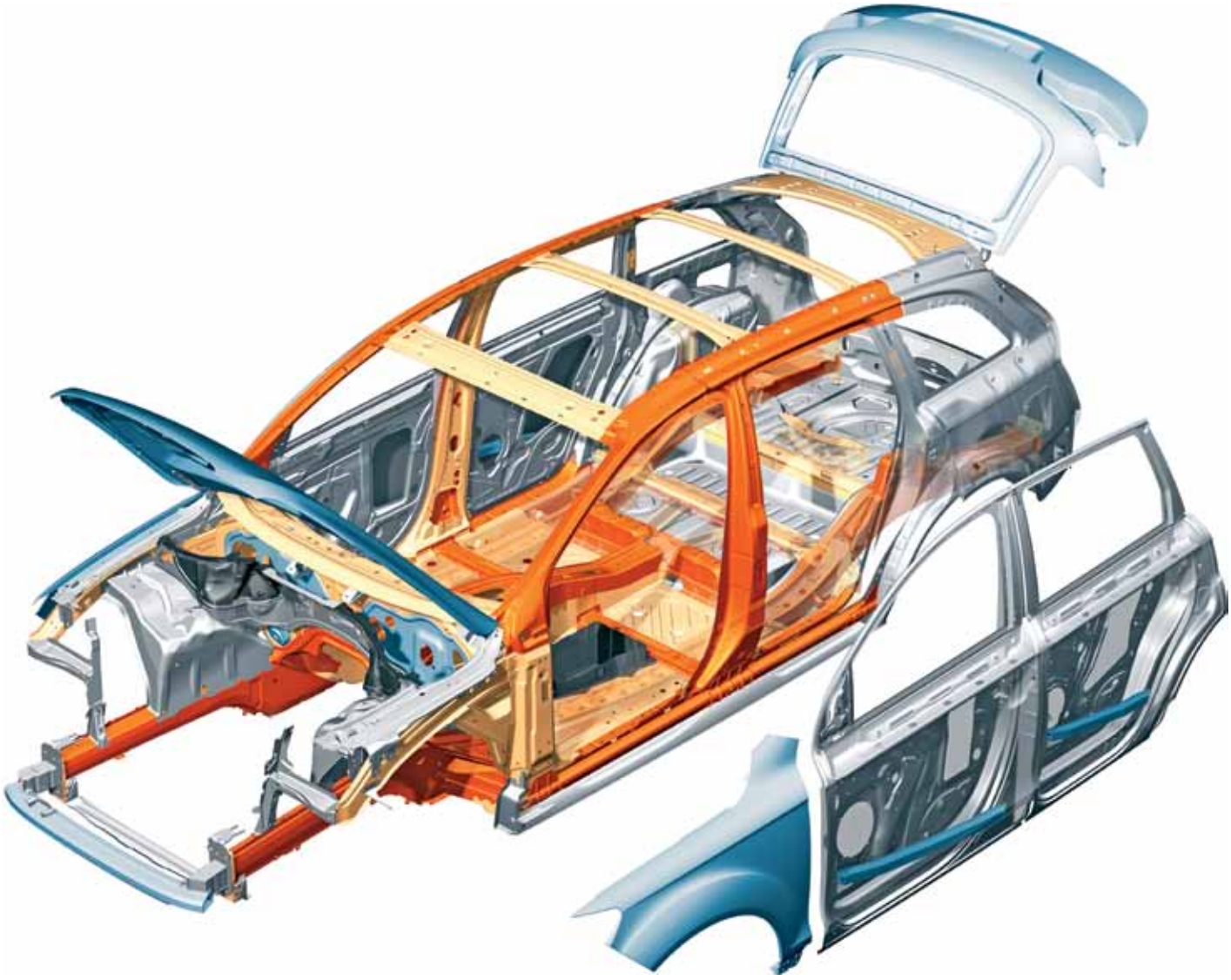


The increased use of ultra-high-strength steels necessitates the use of body repair methods adapted specially to suit the properties of the materials. High-heat-input welding will irreversibly compromise the strength and structure of the component due to microstructural changes in the material. A body structure thus welded cannot, therefore, reliably meet the requirements. It is important to apply a very high contact pressure and a precision-controlled electrical current during spot welding work on ultra-high-strength die-quenched steels.

Following extensive tests, modern spot-welding machines that meet precisely these requirements are now available through Workshop Equipment. MAG gas-shielded arc welding may only be performed on these high-grade steels in specific areas, on a case-by-case basis. They are described in the workshop literature. After miscellaneous tests and crash simulations on repaired ultra-high-strength die-quenched steel body parts of the Audi Q5, Audi has approved two repair points at which MAG welding is permissible.

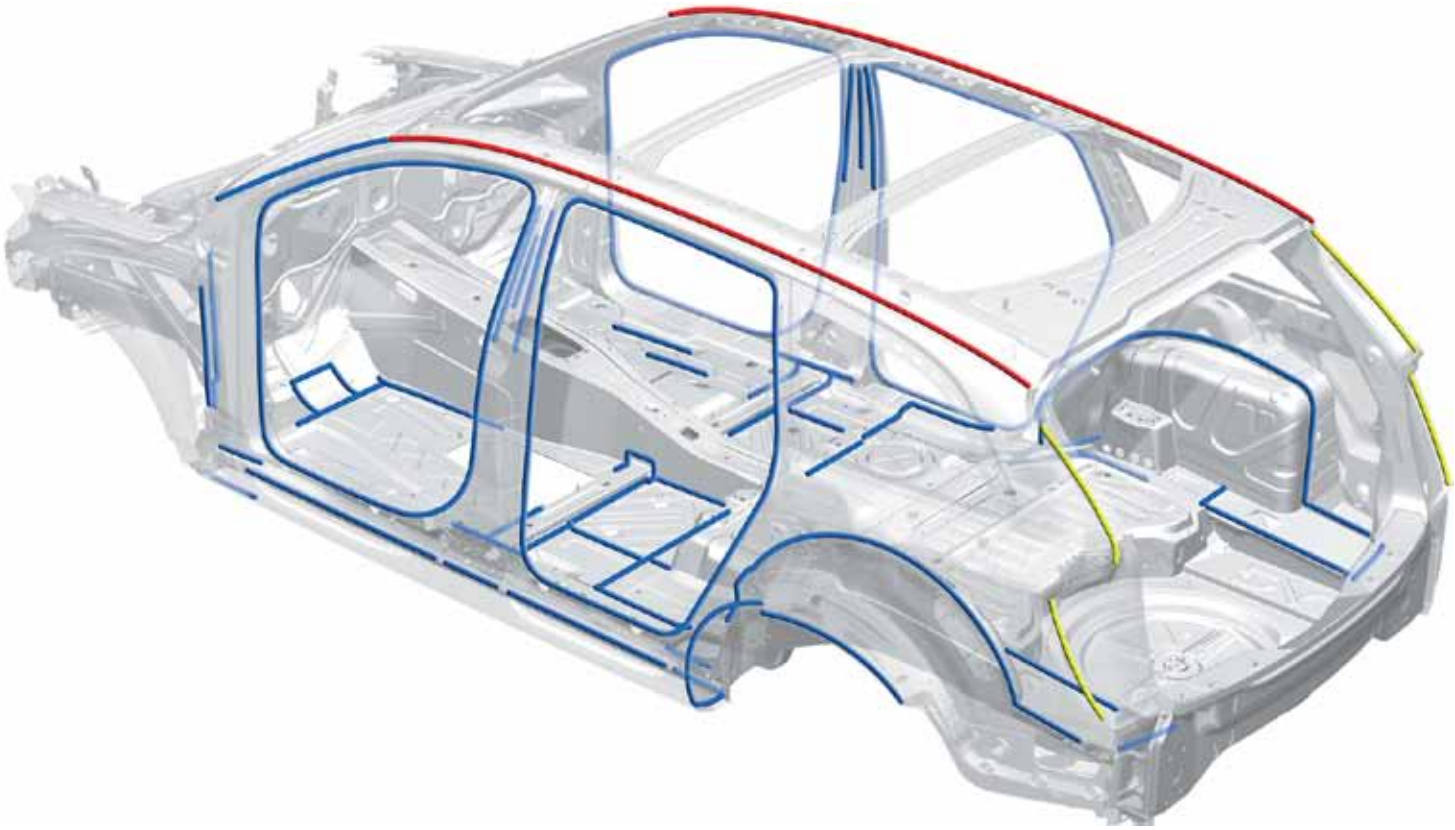
Materials

- 36% Mild steel
- 26% High-strength steel
- 32% Higher-strength/ultra-high-strength steel
- 6% Aluminum



Joining Techniques

- Spot-Weld Bonding
- Plasma Soldering
- Laser Soldering



Body Shell
The high-strength body shell is made up of numerous materials joined together with ultramodern joining processes. NOTE: Some joining processes cannot be duplicated during collision repair or panel replacement. Always reference the body repair manual whenever collision repair or panel replacement is required.

Squeeze-Type Resistance Spot Welding
The most common type of panel attachment method is used throughout the vehicle. (Not shown.)

Spot-Weld Bonding
Joining parts by spot welding through a layer of high-strength, electrically conductive structural adhesive. These areas are generally identified by a blue adhesive that can be seen behind the panel.

Laser Welds
Used to make tailor-welded blanks on the front lower longitudinal members. NOTE: A laser weld cannot be duplicated during the repair process and should not be used as a sectioning location. (Not shown.)

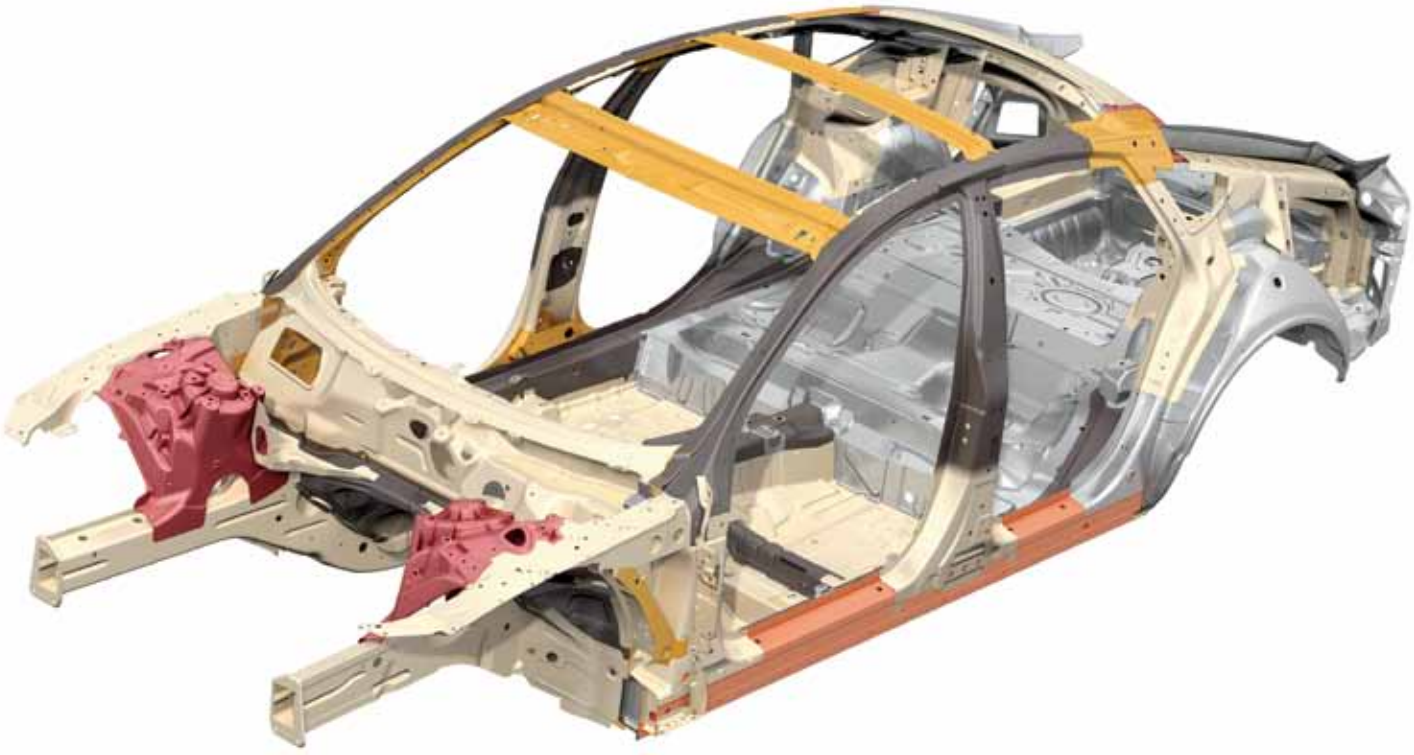
Laser Soldering
A low-heat panel-joining process that does not melt the base metal, only the filler material, which is distributed between the surfaces of the joint. Creates a smooth joint and avoids melting the zinc corrosion protection. Laser soldering can be found at the roof-panel-to-side-panel joint.

Plasma Soldering
Uses silicon bronze as filler wire to create a high-quality joint. Like laser soldering, this is not a fusion process. It is more similar to adhesive bonding. Plasma soldering is used between the rain run channel and side panel.

Gas Metal Arc (GMA) or
Metal Inert Gas (MIG) Welding
GMA (MIG) welding is used quite extensively on the Audi Q7 body shell. There are several locations where GMA (MIG) stitch welds are used to join structural parts together. (Not shown.)

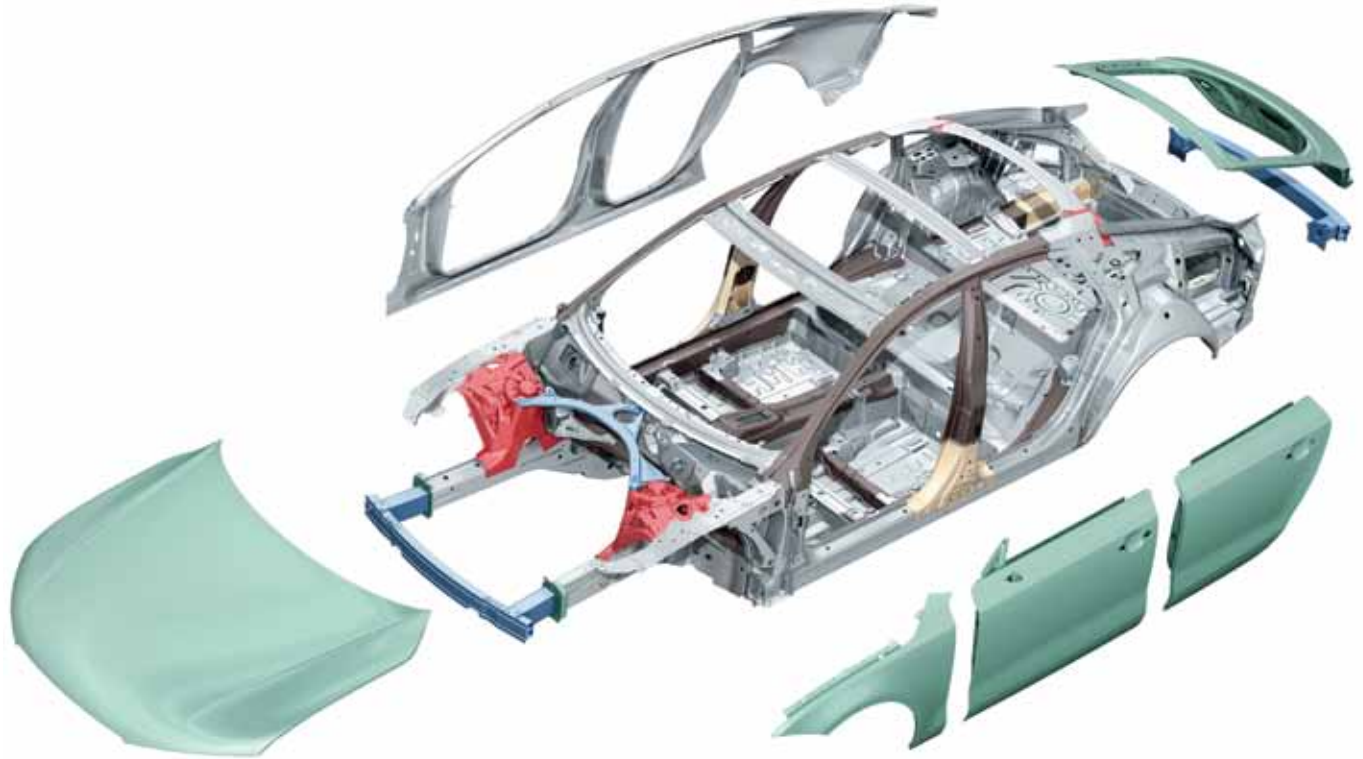
Materials

- Mild steel
- High-strength steel
- Advanced high-strength steel
- Ultra-high-strength steel
- Ultra-high-strength hot-formed steel
- Aluminum casting



Materials

- Aluminum sheet
- Aluminum casting
- Aluminum extrusion
- Mild steel
- High-strength steel in B-pillars and side members
- Ultra-high-strength hot-formed steel



Body Structure
Ultra-high-strength hot-formed components improve rigidity and crash safety. These components and assemblies are made from ultra-high-strength steel:

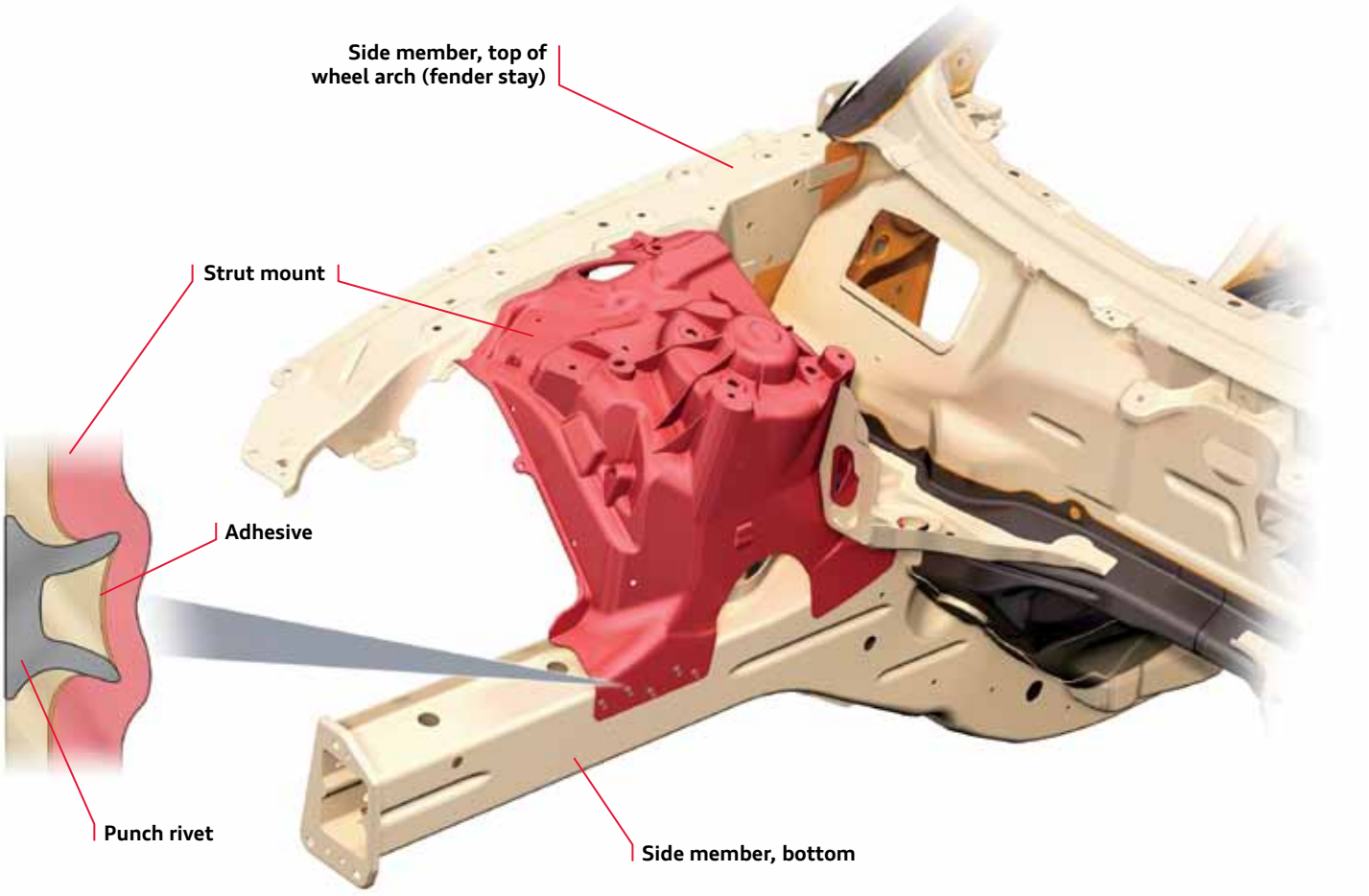
- Front side member reinforcement
- Bulkhead
- A-pillar and roof frame side
- B-pillar
- Chassis rail (sill)
- Front-seat crossmember
- Tunnel reinforcement
- Rear longitudinal member

Body Attachments
The front and rear bumper mounts, fenders, strut brace, doors and flaps are made of aluminum.

B-Pillar
Its component assembly is very hard at the top end and softer below a narrow transition zone. This enables side-impact forces to be absorbed effectively.

Side Member
Manufactured from two tailored blanks, the side member is high-strength sheet metal at the rear and ultra-high-strength hot-formed steel at the occupant cell. Both sheet metal blanks are butt-joined by a laser weld prior to forming.

Structural integration of front end and strut mount



Aluminum Castings

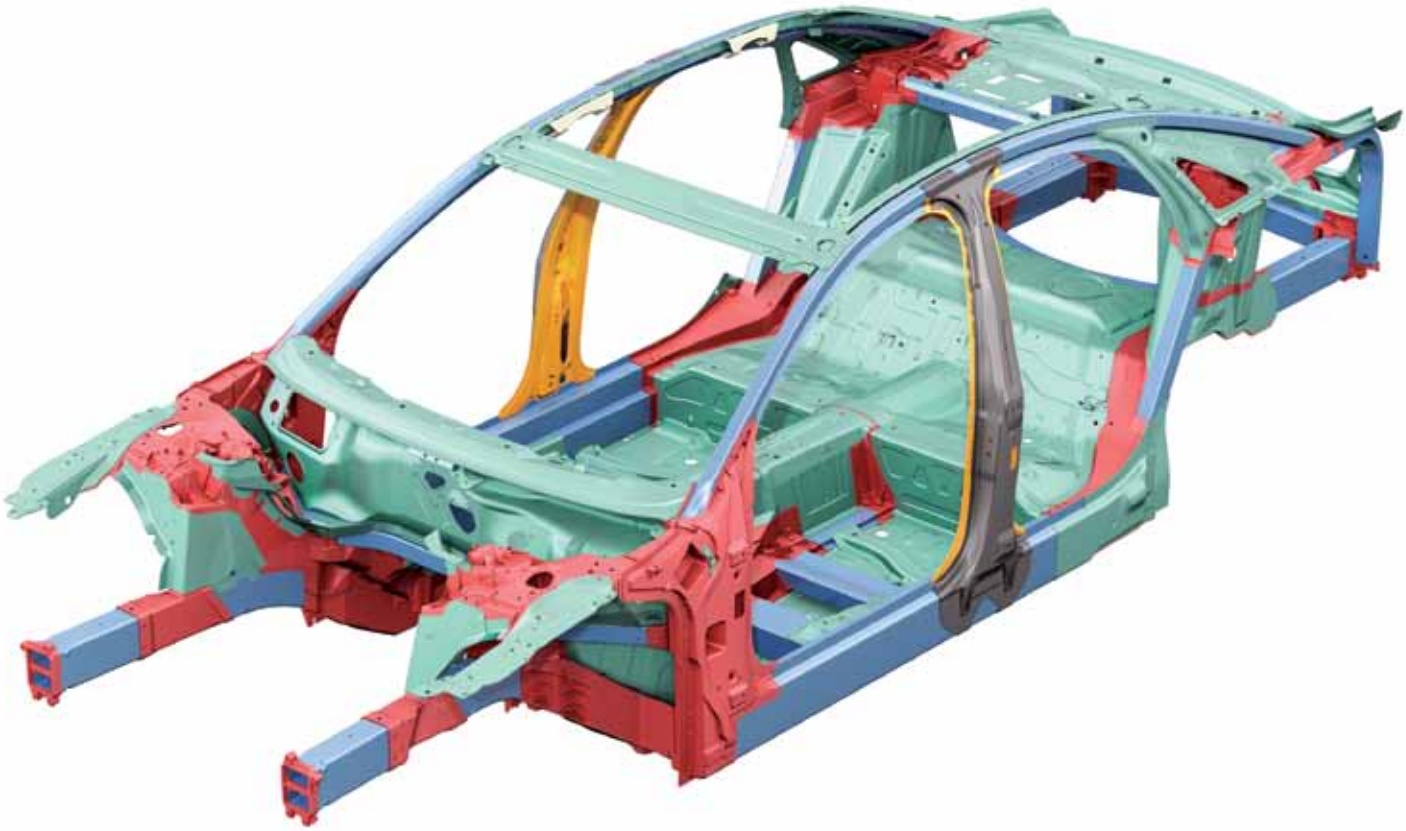
The aluminum castings in the vehicle structure are joined to adjacent parts with punch rivets and structural adhesive. The adhesive between these two materials also acts as an insulator and prevents contact corrosion. This method of joining was also used on the 2007 Audi TT and 2011 Audi A8. Specific repair procedures have been developed for repairing damage to the aluminum castings and adjacent parts, as well as straightening or reshaping of steel components and aluminum castings, which may not be easily detected.

Reference

For further information about punch riveting, refer to Self-Study Program 994703, *The 2008 Audi TT Body*.

Materials

- Aluminum sheet
- Aluminum casting
- Aluminum extrusion
- Advanced-high-strength steel
- Ultra-high-strength hot-formed steel



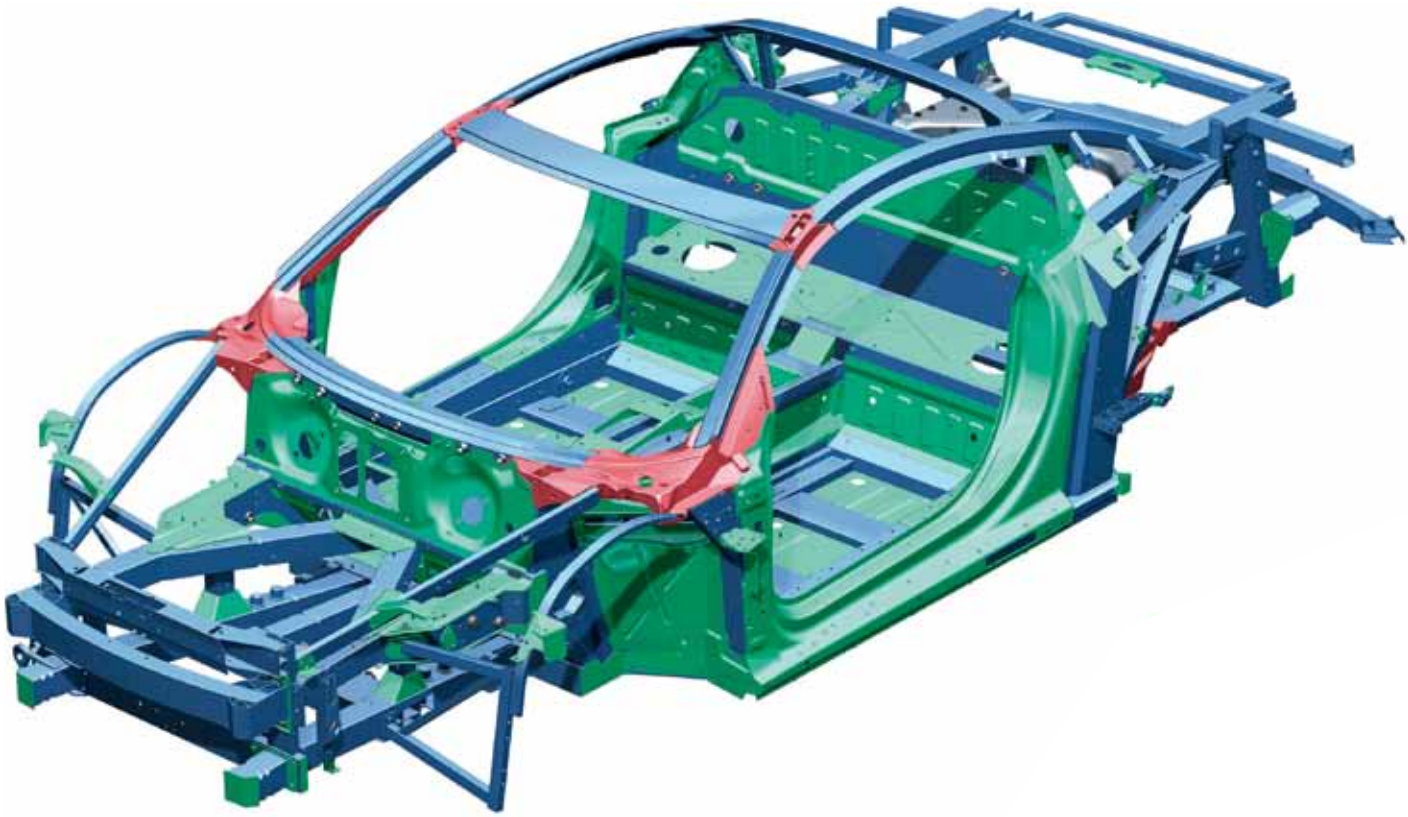
ASF Body

The body of the 2011 Audi A8 employs the proven Aluminum Space Frame (ASF) design. The structure is a composite of aluminum extrusions, aluminum castings, and aluminum sheet components.

Audi uses 13 different grades of aluminum and several different grades of ultra-high-strength and advanced high-strength steel in the 2011 A8.

Materials

- Aluminum sheet
- Aluminum casting
- Aluminum extrusion
- Magnesium

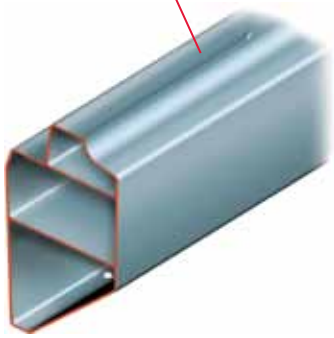


Materials

- Aluminum sheet
- Aluminum casting
- Aluminum extrusion
- Steel sheet (galvanized)

Sill section Audi TT
Four-chamber extruded section

Sill section Audi A8
Three-chamber extruded section



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