Volkswagen

Comparison of Product and Repair Costs for Golf VII Body Parts – Crash Test.

Accident repair with competing parts: Only Genuine is truly cheaper.

Around 45 % of all accidents take place at low speeds and result in damage to the frontal section of the vehicle. This leads to billions in losses to the insurance industry every year.

In order to reduce costs, the necessary repairs are frequently carried out using after-market parts from competitors. An international product comparison test, performed on behalf of Volkswagen AG and based on a comparison of randomly selected body panels in 2014, has now shown that this often provides only an economic benefit - often at the cost of quality, vehicle appearance and safety (see page 3).

On the basis of this comparison, Volkswagen Group mandated a second test which further tests the performance of Genuine Parts and Independent After Market (IAM) parts in a standardised accident situation (low-speed crash tests).

The testing institution

In order to ensure the objectivity of the test results, the comparative test was carried out under the responsibility of testing institution Kraftfahrzeugtechnische Dienstleistungen GmbH (KTD), with support from Dekra Automobil GmbH, DEKRA Certification GmbH and Continental AG.

Automobil GmbH Saarbrücken

Certification GmbH Stuttgart

Background: International product comparison test of body parts, 2014.

In 2014 a total of 268 body panels - Volkswagen Genuine Parts® and after-market parts from various manufacturers - were extensively examined for the five group companies: Volkswagen, Audi, SEAT, ŠKODA and Volkswagen Commercial Vehicles. Five parts which are frequently damaged in frontal collisions were examined on the basis of random samples: front mask, cross member, bumper trim, bonnet and mud guard.

The result: a majority of the tested after-market parts already showed significant defects upon purchase and did not meet Volkswagen Group standards in terms of material composition, processing and resilience. In addition, during the installation test defective fit tolerances and extensive adjustment work increased the installation time, offsetting any alleged cost benefits. The Genuine Parts were clear victors in the comparison test, which left the competition far behind in terms of both quality and installation time - conclusively showing that Genuine Parts are the most economical choice.

The test.

Assumption: A vehicle is repaired with IAM parts rather than Genuine Parts following an accident. It then suffers a second accident. How do repair costs differ from a car repaired with Genuine Parts following this subsequent accident? And: Is a possible price benefit offset by different quality standards - with the corresponding follow-up costs for drivers and insurers? A direct comparison should provide a conclusive answer to this question.

1. Hypothetical accident and repair of a production vehicle

Hypothetical assumption for our test: Following a frontal collision by a Golf VII, the front parts – front mask, cross member, bumper trim, bonnet and mud guard - are damaged. The dealer/vehicle owner are now faced with the choice: repair with Genuine Parts or IAM parts? Our test therefore uses exclusively Genuine Parts for one of the test vehicles while the other uses exclusively IAM parts from the independent replacement parts market.

2. Crash test of a 'repaired' car

To simulate an accident, three test vehicles were then subjected to a crash according to the RCAR Standard*, involving a 15 kph impact against a fixed barrier. The test vehicles included a Golf VII repaired with Genuine Parts, another repaired with IAM parts and, for comparison, a vehicle in factory condition.

3. Examination of the parts used

All of the parts used for the repairs underwent extensive visual, physical and chemical examination prior to installation. The parts were selected on the basis of the market and competition analysis conducted in the context of the international product comparison test of body parts 2014 carried out on behalf of Volkswagen AG and of random sampling. The selection of competing parts available was relatively limited due to the recent launch of the Golf VII.

4. Calculation of repair costs

The extent of the necessary repairs and associated costs was then calculated for each vehicle on the basis of a vehicle measurement and extensive damage assessment. The relevant calculations were carried out using Audatex**.

The hypothetical sample invoice shows an alleged cost benefit of € 435.76. This alleged cost benefit is very clearly put into perspective following the subsequent crash (see crash test).

Front part replacements tested

		1. Part prices Genuine Parts		2. Part prices IAM parts	
	Part number	Manufacturer	Price (RRP)	Manufacturer	Price (RRP)
Cross member	5G0 807 109 H	Volkswagen AG	€ 113.50	Yih Sheng	€ 67.62
Bonnet	5G0 823 031 J	Volkswagen AG	€ 275.00	Tong Yang Group	€ 265.00
Mud guard	5G0 521 105 A	Volkswagen AG	€ 152.00	Gordon	€ 79.23
Bumper trim	5GO 807 217 BN GRU	Volkswagen AG	€ 266.00	I.S.A.M. S.p.A.	€ 107.91
Front mask	5G0 805 588 AC	Volkswagen AG	€ 228.00	Tong Yang Group	€ 78.98
Total			**€ 1,034.50**		**€ 598.74**

Status: March 2016

* Crash test standard developed by an international working group of the Research Council for Automobile Repairs (RCAR) under the leadership of the Allianz Zentrum für Technik (AZT).
** Audatex: global provider of claims solutions, software and services to the automotive industry.
You can find a detailed overview of repair costs in the table on page 19.

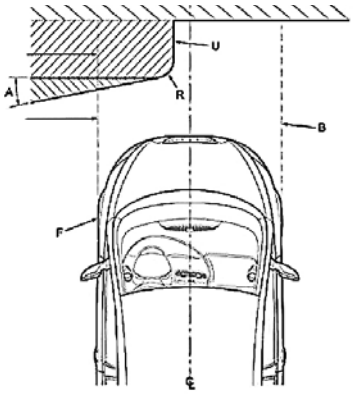
The crash test:
A comparison that's worth it...

Three test vehicles, all Volkswagen Golf VII, were included in the RCAR Standard-compliant* crash: one vehicle was in factory condition, one was equipped with Genuine Parts and another with IAM parts.

All test vehicles had their accident-free record and fit accuracy examined before testing. Furthermore, the body of each car was measured before and after the test so that possible changes to the vehicle structure through impact could be seen.

At first sight, the Golf VII equipped with competitor parts already shows a visibly higher level of damage after the crash test, which indicates serious qualitative differences to Genuine Parts.

RCAR Standard for crash compliance



U = 40 % overlap
B = vehicle width (front)
R = 150 mm radius
F = test vehicle
A = 10° barrier angle

* Crash test standard developed by an international working group of the Research Council for Automobile Repairs (RCAR) under the leadership of the Allianz Zentrum für Technik (AZT).

The test configuration in detail:

- Vehicular impact against a fixed barrier, according to the RCAR Standard
- Offset crash
- 40 % overlap (U)
- Impact on driver's side
- Measured vehicle speed: 15.00 km/h
- Barrier angle: 10° (A)
- Barrier height: visibly higher than car's front
- Barrier depth: the wall next to the offset barrier cannot be touched by the vehicle
- Rounding: 150 mm (R)

Vehicle condition:

- No driver during impact and free of driving forces
- Ready-to-drive condition
- Battery connected
- Ignition turned on
- Safety features (seatbelts, airbags) functioning
- Brakes released
- Gearstick put into neutral

Golf VII equipped with Genuine Parts after the crash test.

Golf VII equipped with IAM parts after the crash test.

The result of the crash test:

A detailed damage assessment was carried out after the crash test. The test vehicles were also measured again.

Repair with IAM parts: 3.5x higher repair costs.

While the test vehicle with IAM parts had 38 parts damaged and in need of replacement, the test vehicle with Genuine Parts only had 15. **The part price for the repair alone increased by 3.5 times as a result:** while € 1,419.77 was estimated for the repair of the vehicle equipped with Genuine Parts, the estimate for the vehicle with IAM parts was € 5,007.71.

This has a corresponding impact on the total repair costs: they amounted to € 2,715.37 for the test vehicle with Genuine Parts and € 7,440.65 for the vehicle with IAM parts*.

	Vehicle with Genuine Parts	Vehicle with IAM parts
Damaged parts	15	38
Repair part price	€ 1,419.77	€ 5,007.71
Total repair costs	€ 2,715.37	€ 7,440.65

* Repair costs were calculated using the Audatex standard. You can find a detailed overview of repair costs in the table on page 19.

Vehicle measurement

The second body frame measurement of the Golf VII equipped with IAM parts also showed a measurement point outside of the manufacturer's tolerance after the crash test: this difference also had to be repaired, which in turn increased repair costs. All relevant measurement points on the test vehicle equipped with Genuine Parts were identical before and after the crash test.

Overall the evaluation shows: repairing a car with IAM parts can result in high follow-up costs even though they may seem cheaper to purchase. These costs can largely be attributed to the visibly larger damage to the test vehicle resulting from qualitative differences in after-market parts (see also pages 12-17) than those when the vehicle is equipped with Genuine Parts.

Summary of the crash test

Repairing with Genuine Parts...
... ideally leads to restoration of the vehicle almost to factory standards,
... can help protect the vehicle against increased damage in the event of another accident - damage which occurs when using IAM parts,
... can help better protect vehicle occupants in individual cases.

Damage incurred through crash test

Golf VII with Genuine Parts

- Crashbox measurement: previously 114 mm, afterwards 77 mm

Damage

- Present at front right and left
- Bonnet, left headlight, radiator grille and bumper cover
- Front mask as well as right and left front mask struts
- Bumper absorbers and support
- Radiator airflow left and right
- Mud guard
- Gap dimensions from right and left mud guard to door consistent
- Gap dimensions from mud guard to left of bumper not accurate
- Gap dimensions from right and left mud guard to bonnet accurate
- Lid lock

Golf VII mit IAM-Teilen

- Crashbox measurement: previously 114 mm, afterwards 34 mm

Damage

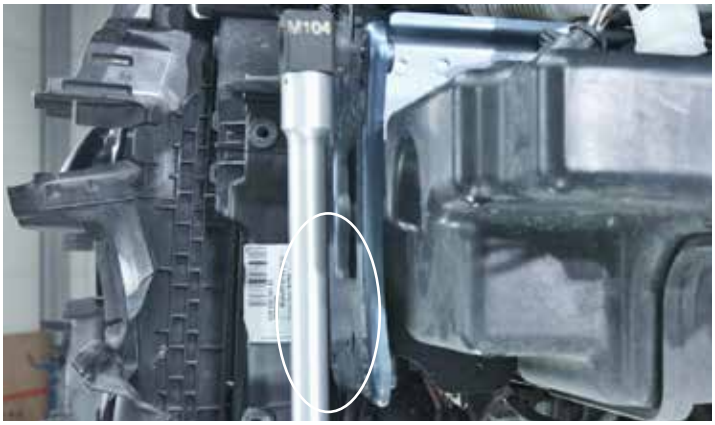
- Present at front right and left
- Bonnet, left headlight, radiator grille and bumper cover
- Right and left front mask panel struts
- Bumper cover, absorbers and support
- Defective radiator airflow on left and right, air filter on intake pipe also affected
- Gap dimensions from right mud guard to door consistent, from left mud guard to door inconsistent
- Gap dimensions from left mud guard to bumper are inaccurate
- Gap dimensions from right mud guard to bonnet are inaccurate
- Driver airbag, passenger airbag and knee airbag triggered; windscreen and dashboard are damaged
- Paint damage on driver door and right mud guard
- Left mounting for impact attenuator (flange) deformed

Golf VII interior with Genuine Parts post-crash.

Airbags triggered. Golf VII interior with IAM parts post-crash.

Golf VII with Genuine Parts. Crashbox dented by 37 mm after the crash.

Golf VII with IAM parts. Crashbox dented by 80 mm after the crash.



Golf VII with Genuine Parts. Flange after the crash: no adjustment work required.

Golf VII with IAM parts. Flange after the crash: adjustment work required.

Golf VII with Genuine Parts. Damages to the front after the crash.

Golf VII with IAM parts. Damages to the front after the crash.

Golf VII with Genuine Parts. Deformations after the crash.

Golf VII with IAM parts. Deformations after the crash.

Golf VII with Genuine Parts. Front mask mounting after the crash: lightly bent.

Golf VII with IAM parts. Front mask mounting after the crash: highly bent.

Lab examination of materials.

The result of the crash test was clear: the use of IAM parts in the test vehicle's frontal section led to noticeably greater damage and thereby far higher repair costs than for the vehicle with Genuine Parts. Clear evidence of qualitative differences in after-market parts - which were confirmed in the subsequent scientific examination of materials used. The examination of the IAM parts tested broadly corresponded with the results already ascertained in the international product comparison test of body parts, mentioned at the start.

Some of the IAM parts tested were also insufficient in terms of their fit. As a result, assembly times were partly increased in the installation test for reworking - a cost factor that makes for noticeably higher repair costs in the workshop.

To assess the material composition as well as the body parts' physical and chemical properties, DEKRA Automobil GmbH in Saarbrücken carried out the following examinations using anonymous samples:

Components made from plastic:

- Infrared analysis
- Thermogravimetric assessment per DIN EN ISO 11358: 1997-11
- Dynamic reference calorimetry per DIN EN ISO 11357-1: 2010-03
- Combustion in muffle furnace with remains documented
- Tension test per DIN EN ISO 527-1: 2012-06
- Impact bending test per DIN EN ISO 179-1: 2001-06 in conjunction with VW specification TL 52625: 2014-09
- Ball-drop test per VW specification PV 3905: 2005-09

Components made from metal:

- Spectrochemical analysis
- Tension test per DIN EN ISO 6892-1: 2009-12

The cross member:
By hook or by crook...

The cross member must absorb the majority of the impact energy created during a frontal collision or an offset crash (like the present test). The crashbox, as a central element of the cross member, is primarily responsible for this. As a safety-relevant component, it is exactly this part that must display a high thickness at maximum strength as well as the high level of material quality required. The IAM part from Taiwanese manufacturer Yih Sheng built into the test vehicle could meet neither of the criteria - and was therefore identified as one of the main causes for the extent of the damage.

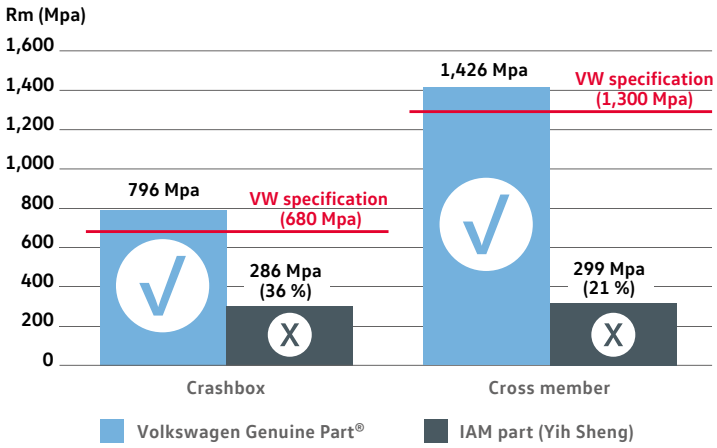
The examination results

In the crashbox area, the IAM cross member from manufacturer Yih Sheng has a material strength of only 65% compared to the Genuine Part. Even more significant is the difference when it comes to the strength of the cross member element: while the Genuine Part reaches a value of 1,400 megapascal (N/mm²) here, the IAM part tested reaches no more than 300 megapascal (N/mm²), i.e. around 21%. Additionally, the cross member tested in the crashbox area did not show any welding points, instead only showing gas-shielded welding seams. These are meant to offset the lacking fit accuracy of the individual parts.

In the case of the competitor tested, these differences lead to visibly worse deformation behaviour in the cross member. The consequences: In the crash test it cannot absorb a sufficient level of impact energy, which results in the test vehicle becoming strongly damaged and even triggering the airbags.

IAM part manufacturer: Yih Sheng, Taiwan
Part number: 5G0 807 109 H

Tensile strength of cross member



Overview of qualitative differences in IAM cross member with crashbox

The graph shows a visible difference in tensile strength:

- The tested IAM crashbox only had 36% of the tensile strength of the Genuine crashbox (see graph)
- Even more significantly, the tested IAM cross member only had 21% of the tensile strength of the Genuine cross member (see graph)

Differences in material strength could similarly be demonstrated:

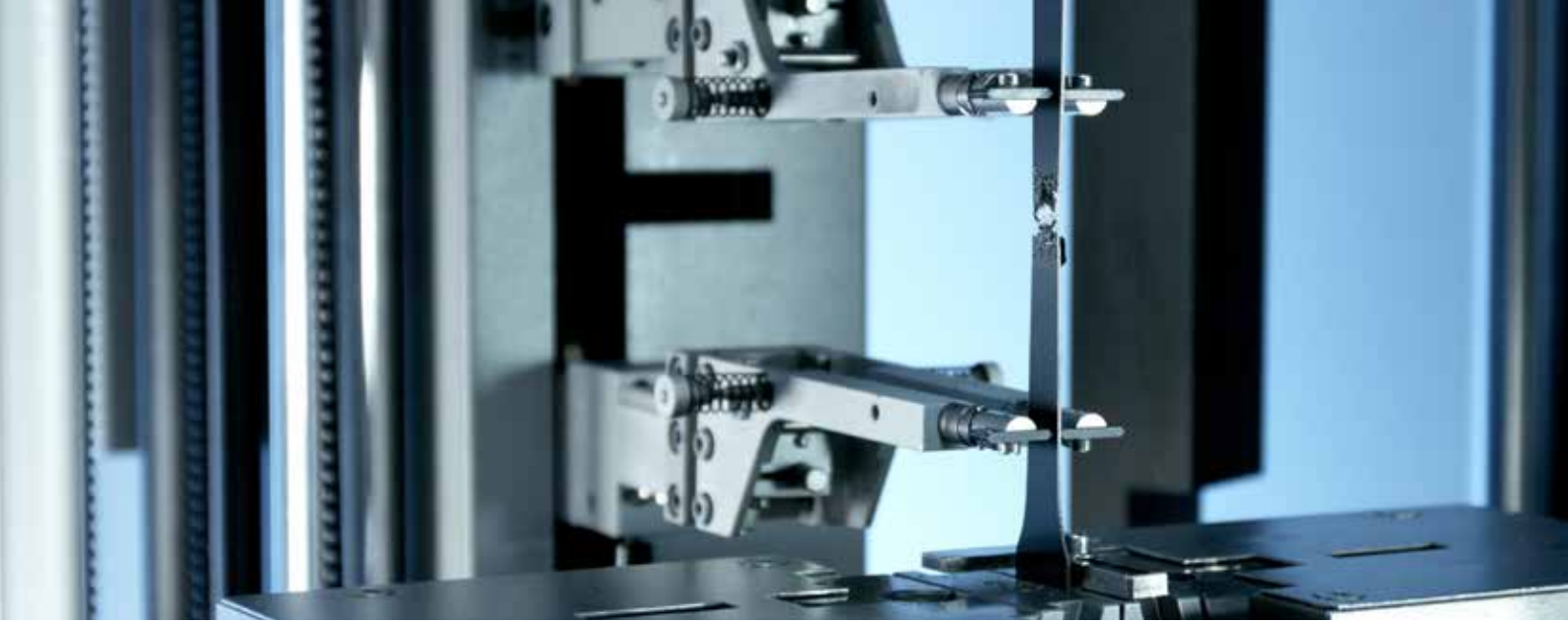
- The tested IAM crashbox had 65% of the material strength of the Genuine crashbox
- The tested IAM cross member had 87% of the material strength of the Genuine cross member

Furthermore:

- Inconsistent welding seams on the cross member
- Only gas-shielded welding seams in the crashbox area, instead of regular welding seams. Potential consequence: lower crashbox resistance.

Volkswagen Genuine cross member after the crash test.

IAM cross member from manufacturer Yih Sheng after the crash test.



The bonnet:
No protection against corrosion.

The bonnet is one of the body parts in the frontal section that absorb impact energy in the event of an accident. In a high-speed crash it must guarantee controlled deformation behaviour in order to prevent the passenger compartment from being penetrated. The bonnet from Taiwanese manufacturer Tong Yang Group built in for the test, however, showed differences that raise doubt in this respect.

The examination results

While the IAM bonnet tested had no significant weight difference compared to the Genuine Part, it displayed other, partly considerable differences. For example, unlike the Genuine Part, it was not equipped with a layer of zinc to protect against corrosion (red rust).

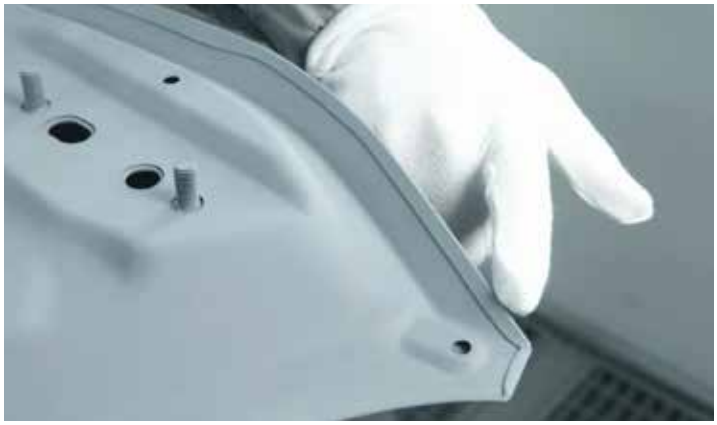
The seam was also unsealed, which can result in moisture penetrating the seam and joining area between the exterior and interior construction of the bonnet and cause crevice corrosion. The stiffness of the bonnet also decreases through this, which can have negative consequences for the stability of the vehicle structure in a high-speed accident.

Overview of qualitative differences in the IAM engine bonnet

- No zinc layer (corrosion)
- Seams unsealed
- Unclean bonds on exterior and frame

IAM part manufacturer: Tong Yang Group, Taiwan
Part number: 5G0 823 031 J

Volkswagen Genuine bonnet with seam sealing.



IAM bonnet from manufacturer Tong Yang Group without seam sealing.

The mud guard:
If it doesn‘t fit...

The mud guard is usually the connecting link between the bonnet, the front mask and the door area. For this reason, the replacement part used during a repair should, where possible, show an ideal, accurate fit. In addition to looking good on the car, it also reduces assembly time - the most important cost factor for a repair aside from purchase costs. The IAM part from Taiwanese manufacturer Gordon that was examined however was not able to satisfy the testers in this regard.

The examination results

The fit of the mud guard tested was insufficiently accurate in all areas (A-pillar, door, bonnet), had sharp edges and undulating fixing edges. Like with the cross member, a zinc layering was also absent, which can contribute to corrosion through red rust. Finally, the IAM part was 20 % heavier than the Genuine Part. This indeed increased fuel consumption and CO_2 emissions and did not increase the strength of the mud guard, as evident in the tension test. Thus the IAM part tested in this instance also did not provide any cost benefits for insurers or vehicle owners.

Overview of qualitative differences in IAM mud guard

- Deficient fit accuracy and consequently higher assembly costs
- No zinc coating (corrosion)
- Sharp edges
- Undulating fixing edges
- 20 % heavier than the Genuine Part

IAM part manufacturer: Gordon, Taiwan
Part number: 5G0 521 105 A

Volkswagen Genuine mud guard.

IAM mud guard from manufacturer Gordon.

The bumper trim:
The gloss has gone.

Together with the cross members lying directly behind it, the bumper trim is subject to impact energy in the event of a head-on collision. It also performs an important function as a design element and for protecting pedestrians. Also relevant is that it is able to be painted without problem after a repair, so that the car's appearance can be completely restored. The tested IAM part from Italian manufacturer I.S.A.M. S.p.A. does not offer good conditions for this.

The examination results

The bumper trim was 10 % lighter than the Genuine Part and had sharp edges. The bad deburring was also evidence of less than diligent workmanship. In particular, however, primer - essential for this component - was absent. Because of this, paint does not keep as well on the bumper trim's plastic surface, which has a negative impact on the vehicle's appearance and thus its value.

Overview of qualitative differences in the IAM bumper trim

- Impact energy absorption 50 % lower in accidents than with the Genuine Part
- 10 % lighter than the Genuine Part
- Sharp edges
- Bad deburring
- No primer for paint application

IAM part manufacturer: I.S.A.M. S.p.A., Italy
Part number: 5GO 807 217 BN GRU

Volkswagen Genuine bumper trim with primer.

IAM bumper trim from manufacturer I.S.A.M. S.p.A. without primer.

The front mask:
Small differences.

The front mask is the connecting element between bonnet, cross member and bumper trim. It is an important part of the front end of the vehicle – and therefore a safety-relevant component with material composition that should prevent brittle fractures in the event of an accident.

The examination results

Aside from a small weight difference, the tested IAM front mask from manufacturer Tong Yang Group did not show any other differences. The material composition was in line with specifications and the replacement costs were almost identical to those of the Genuine Part.

Overview of qualitative differences in the IAM front mask

- 5 % lighter than the Genuine Part
- No other differences

IAM part manufacturer: Tong Yang Group
Part number: 5G0 805 588 AC

Volkswagen Genuine Parts®:
They are worth the price!

Summary of the comparison

A repair with IAM body parts is only at first glance cheaper. Not only because repair costs after a subsequent accident are visibly higher than when using Genuine Parts: The many qualitative differences also affect the vehicle's residual value - by affecting the vehicle's appearance, and also for example through lacking protection against corrosion.

The Genuine Part is thus the better choice for post-accident repairs in many ways

Front bumper cover

Manufacturer	Weight	Cold impact	Material composition	Primer	Tensile strength	Filler content present, absent
Volkswagen	✓ 3,270 g	✓	✓ PE/PP	✓ available	✓ 16 N/mm²	✓ 9.5 %
I.S.A.M. S.p.A.	✗ 3,050 g	✓	✓ PE/PP	✗ missing	✓ 20 N/mm²	✓ 12.0 %

Bonnet

Manufacturer	Weight	Zinc layer thickness	Layer thickness primer incl. zinc	Tensile strength	Seam sealing
Volkswagen	✓ 16,050 g	✓ 5.9 µm	✓ 34 µm	✓ 372 N/mm²	✓ available
Tong Yang Group	✗ 15,000 g	✗ 0.0 µm	✓ 24.7µm	✓ 375 N/mm²	✗ missing

Cross member

Manufacturer	Weight	Panel thickness crashbox	Panel thickness cross member	Zinc layer thickness	Layer thickness primer incl. zinc	Crashbox strength	Cross member strength
Volkswagen	✓ 7,160 g	✓ 2.62 mm	✓ 1.85 mm	✓ 8.7 µm	✓ 36.2 µm	✓ 796 N/mm²	✓ 1,426 N/mm²
Yih Sheng	✗ 6,690 g	✗ 1.6 mm	✗ 1.6 mm	✗ 2.5 µm	✗ 13.6 µm	✗ 285 N/mm²	✗ 299 N/mm²

Left mud guard

Manufacturer	Weight	Zinc layer thickness	Layer thickness primer incl. zinc	Tensile strength
Volkswagen	✓ 1,740 g	✓ 6.9 µm	✓ 28 µm	✓ 285 N/mm²
Gordon	✗ 1,910 g	✗ 0.0 µm	✗ 9.4 µm	✓ 295 N/mm²

Front mask

Manufacturer	Weight	Tensile strength	Filler content present, absent	Energy intake Pendulum impact
Volkswagen	✓ 2,110 g	✓ 155 N/mm²	✓ 40 %	✓ 60.66 KJ/m²
Tong Yang Group	✗ 2,040 g	✓ 39 N/mm²	✗ 38 %	✗ 23.60 KJ/m²

The results of the crash test and detailed examination of the IAM repair parts speak for themselves. **This also applies for the repair costs, which were 3.5 times higher when using IAM parts as opposed to Genuine Parts.** Below we have calculated and gathered the costs for you using Audatex standards.

Summary cost breakdown Golf VII

	Vehicle with Genuine Parts (calculated with Audatex)	**Vehicle with IAM parts** (calculated with Audatex)
Number of parts replaced	15	38
Costs for replacement parts	€ 1,325.65	€ 4,675.73
Replacement part surcharge 5 %	€ 66.28	€ 233.79
Small part surcharge 2 %	€ 27.84	€ 98.19
Total costs for replacement parts	€ 1,419.77	€ 5,007.71
Labour costs for body works	€ 578.00	€ 1,368.50
Individual price per LV* € 8.50/number LV*:	68.0 LV*	161.0 LV*
Labour costs for painting work	€ 552.00	€ 818.80
Individual price per LV* € 9.20/number LV*:	60.0 LV*	89.0 LV*
Sum of surcharge for paint material 30 %	€ 165.60	€ 245.64
Total repair costs	**€ 2,715.37**	**€ 7,440.65**

* LV = labour value, equivalent to 6 minutes

Comparison of product and repair costs for body - test performance 2016
The test was commissioned by: Volkswagen AG, Genuine Parts Division and Service, Product Management, 34219 Baunatal, Germany.

The documented tests used random sampling. The test reports from the independent testing institutions are on file with us and can be viewed upon request.

Contact: Volkswagen AG, Volkswagen After Sales Product Management (VSO-2/a), Mailbox 014/ 1944, 34219 Baunatal, Germany

Volkswagen After Sales, VSO-2

Date 08/2016
Subject to alterations.

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