PORSCHE
Engineering Services, Inc..

# 6 Body-In-White Concepts

*The first design priority was frontal crashworthiness performance, thereby establishing the general design and arrangement of the front-end strcuture load paths and powertrain package.*

## 6.1 BACKGROUND

One of the fundamental tasks for ULSAB-AVC was to develop two different vehicle-type body structures that met program targets including:

- Crashworthiness
- Mass
- Structural performance
- Vehicle dimensions
- Common platform

The first priority was frontal crashworthiness performance, thereby establishing the general design and arrangement of the front-end structure load paths for the selected powertrain package. Considering the stringent side impact crash demands, the focus of attention was then first set on the passenger compartment environment and next the rear end structure.

Based on the philosophy that the structural performance in one region of a vehicle may, or will influence that of another, an holistic design approach was used for the development of the ULSAB-AVC body structure architecture.

## 6.2. Common Platform Approach – Body Structure

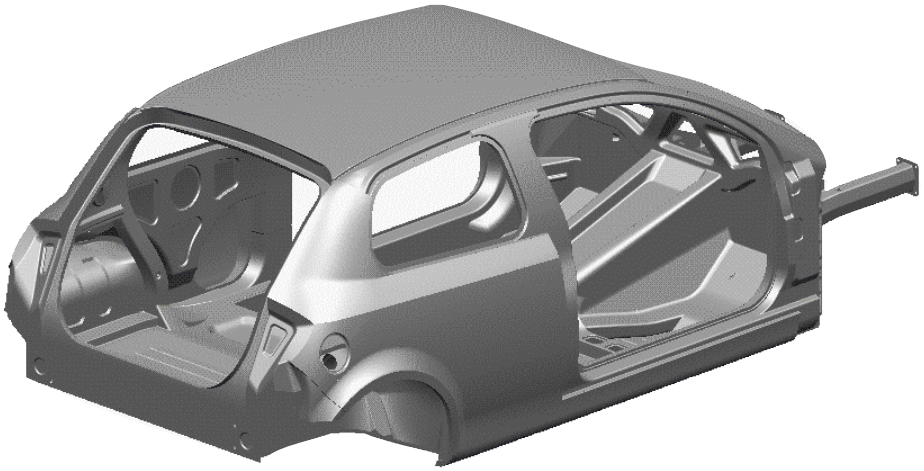


**Figure 6.2-1 Body structure – C-Class vehicle**

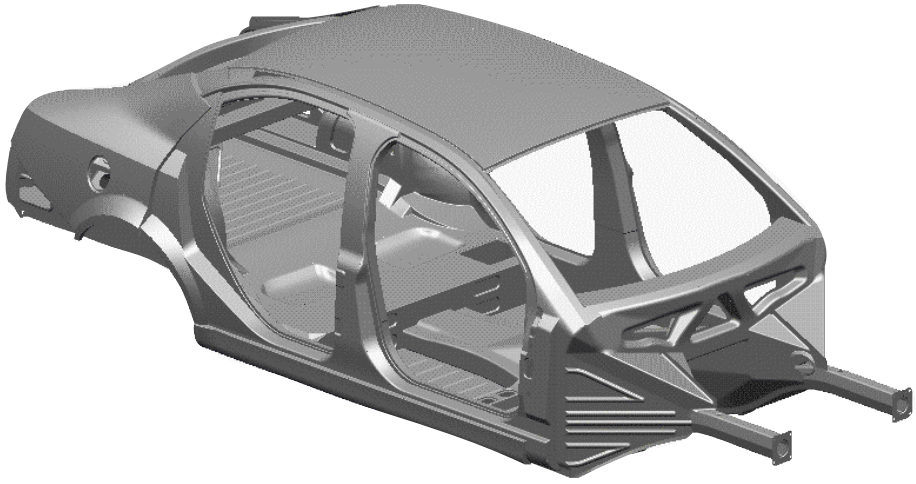


**Figure 6.2-2 Body structure - PNGV-Class vehicle**

One very important aspect of the conceptual design approach to the ULSAB-AVC program, was the development of two different body structures as shown in Figures 6.2-1 and 6.2-2 (2-door hatchback, 4-door sedan) of two different vehicle classes (C-Class and PNGV-Class), while at the same time integrating as much common structure, individual parts, joints or complete sub-assemblies, into both structure variants. By integrating as many parts as possible, into both vehicle variants, cost-related benefits, such as part manufacturing costs, body assembly costs and vehicle assembly costs can be achieved. Figures 6.2-3 and 6.2-4 show the C-Class and PNGV-Class vehicles split to emphasize the common front end. In addition, the rear end structures also share some common parts and joints.

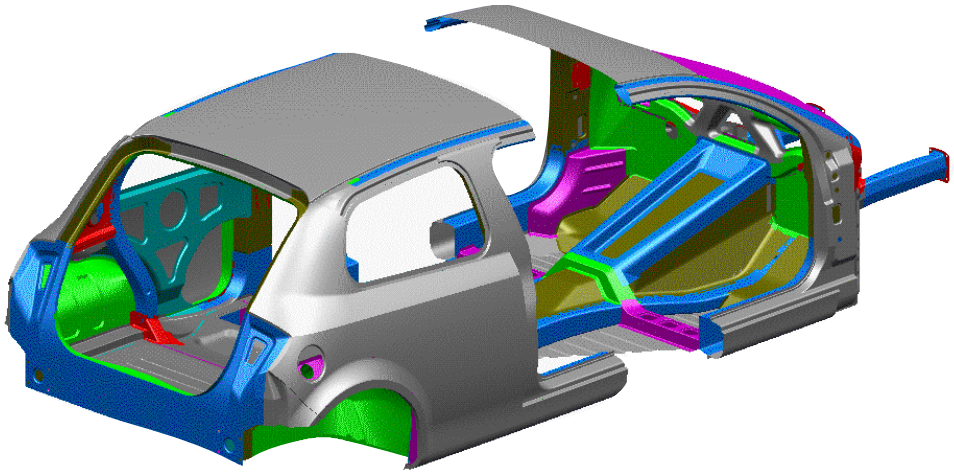


**Figure 6.2-3 C-Class**

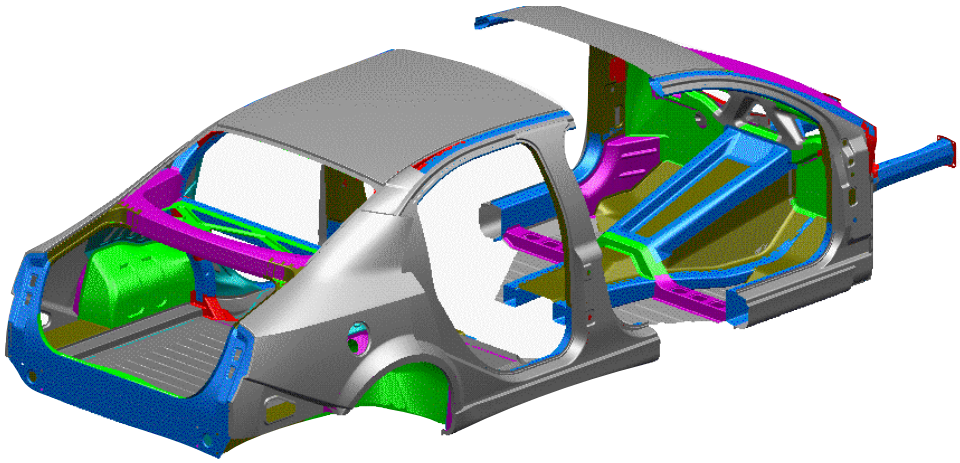


**Figure 6.2-4 PNGV-Class**

The program goals for a platform approach of both vehicle concepts have been accomplished. Figure 6.2-5 shows the features of the common platform approach.

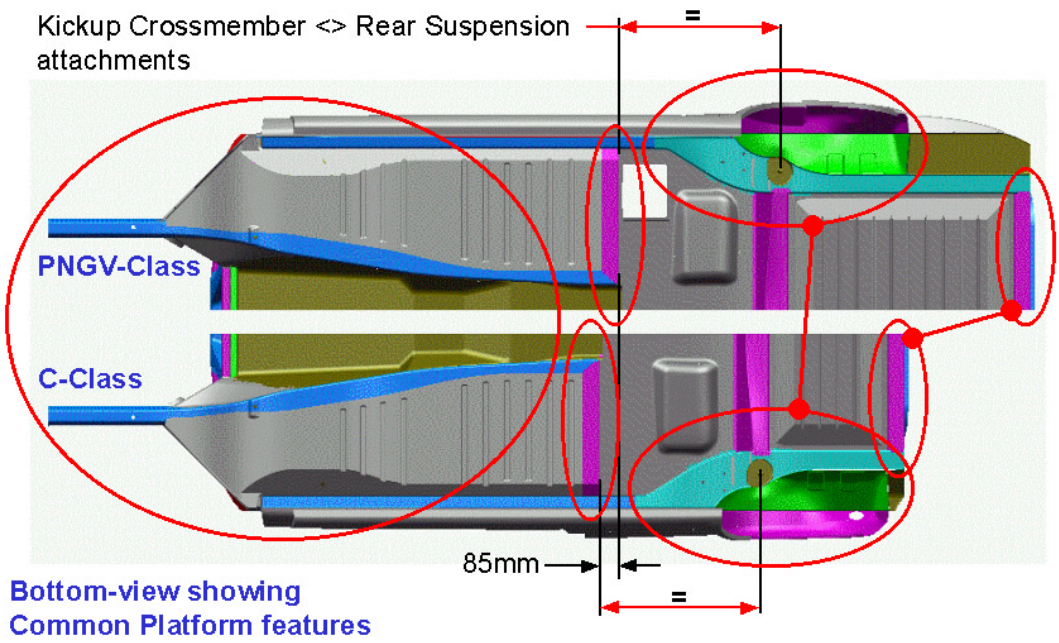



**Figure 6.2-5 Common Platform features**

Apart from the body side outer panels, body side members and rocker inner panels, the front-end structure is virtually identical for both vehicle variants up to the B-pillar. Minor exceptions can be found at the front rail members, tunnel, and front floor panels. Nevertheless, these parts can be manufactured using common dies, followed by similar trim operations respectively. The A-pillar, and all joints pertaining to it, are common. Although very different in design, some areas of the body side outer panels, body side members and rocker inner panels are similar.

Figures 6.2-6 and 6.2-7 show the exploded view of C-Class and PNGV-Class respectively.

Parts Numbers are identified according to the following convention in Table 6.2-1. Table 6.2-2 is the Parts List for both the C-Class and PNGV-Class body structures respectively.

**Table 6.2-1 ULSAB-AVC part and CAD model number convention**

**ULSAB-AVC Part and CAD Model Number Convention**

| | Number | | | | | Criteria |
|---|---|---|---|---|---|---|
| AVC | **1** | | | | | C-Class & PNGV-Class - Common Parts |
| AVC | **2** | | | | | C-Class (only) - Unique Parts |
| AVC | **3** | | | | | PNGV-Class (only) - Unique Parts |
| AVC | | **1** | | | | Body Structure |
| AVC | | **2** | | | | Closure Structure |
| AVC | | **3** | | | | Glass / Hardware |
| AVC | | **4** | | | | Front End Modules / Fascias / Interior Trim Etc. |
| AVC | | **5** | | | | Package |
| AVC | | **6** | | | | Structure Weld Assembly |
| AVC | | **7** | | | | Typical Sections |
| AVC | | | **X** | **X** | **X** | **0 0 0** to **9 9 9** Sub-Category Numbers |
| AVC | | | **X** | **X** | **X** | Exploded View Part Identification |

The number of parts has been minimized in both vehicle variants due to the extensive utilization of advanced high strength steel materials and manufacturing technologies and joining processes, such as tailor welded blanks, hydroforming and laser welding.

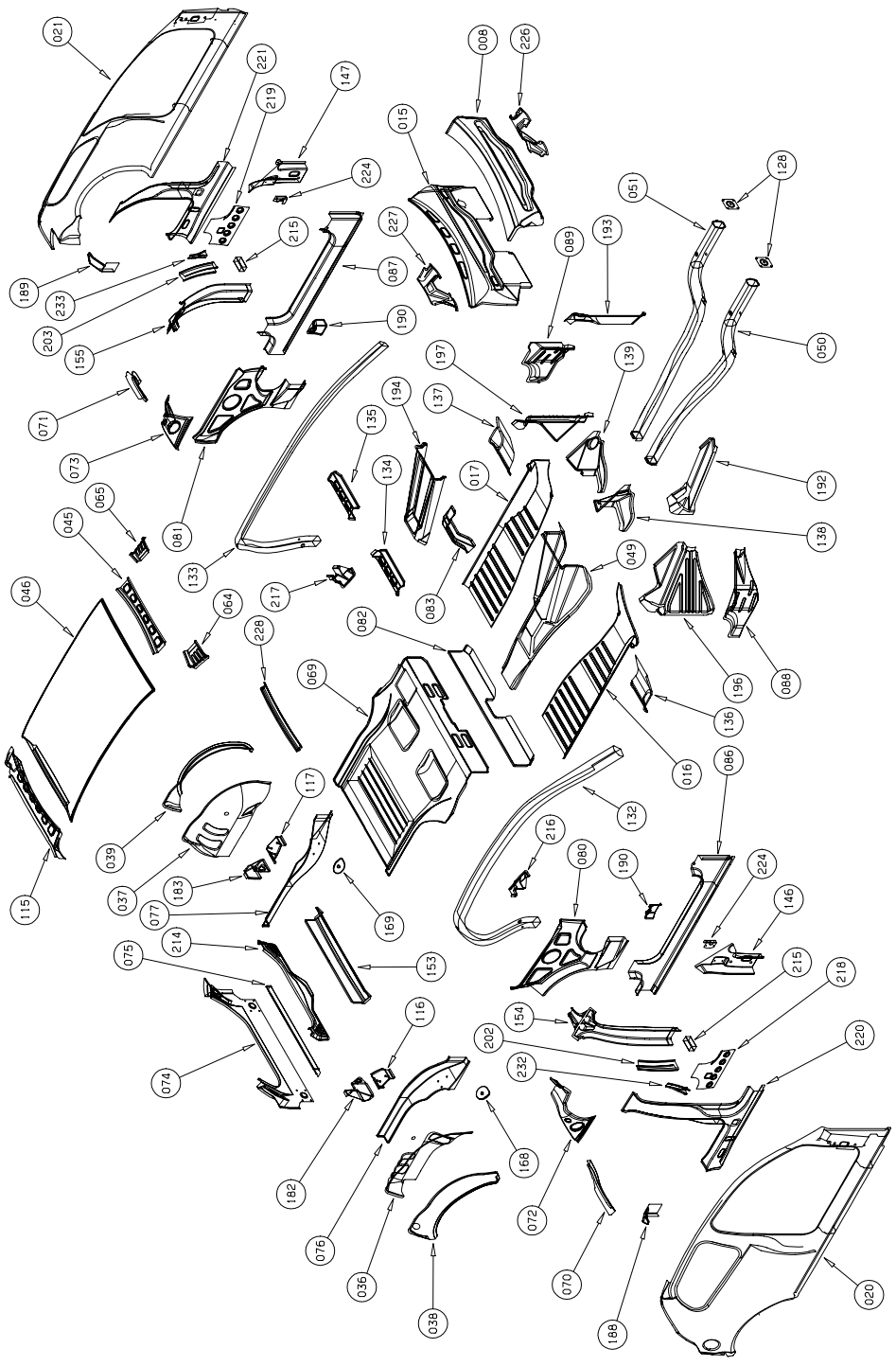



**Figure 6.2-6 Exploded view C-Class body structure**

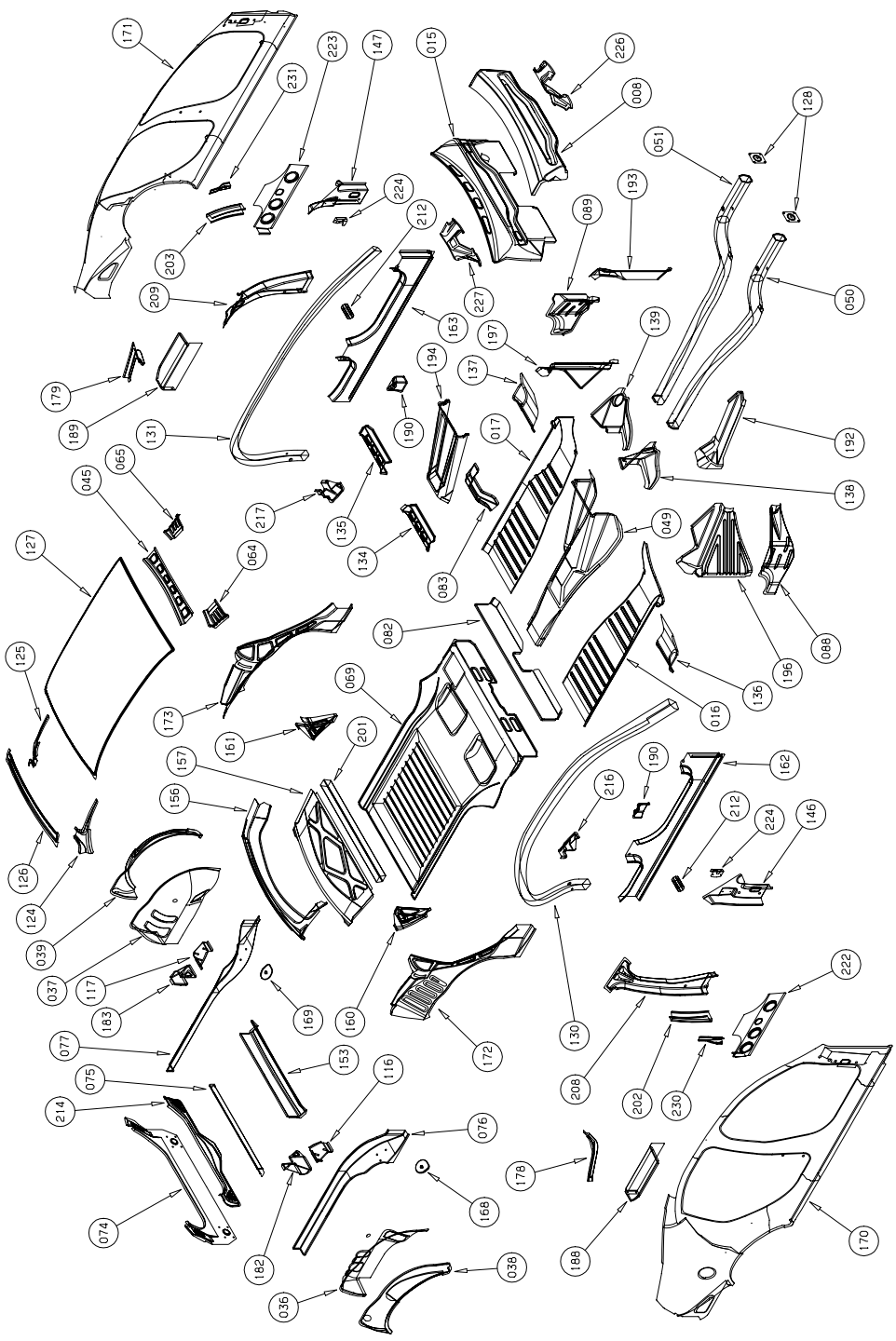



**Figure 6.2-7 Exploded view PNGV-Class body structure**

## Table 6.2-2 ULSAB-AVC body structure parts list (C-Class and PNGV-Class)

**Revision Level: A21 Date: 27 JUL 01**

| Number | | | Name | Revision Level | Date | Blank No. | Gage (mm) | Material Type | Grade (MPa) | | Manuf. Process Code | Designed M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Yield Strength | Tensile Strength | | C-Class |
| AVC | 1 | 1008 | Cowl Front | D03 | 05-Mar-01 | | 0.80 | DP | 500 | 800 | S | 4.416 |
| AVC | 1 | 1015 | Dash | C15 | 22-Mar-01 | | 0.65 | DP | 280 | 600 | S | 4.381 |
| AVC | 1 | 1045 | Header Front | E01 | 09-Mar-01 | | 0.70 | IF | 300 | 420 | S | 0.686 |
| AVC | 1 | 1064 | Support Header Front RH | D00 | 06-Jan-01 | | 0.70 | DP | 280 | 600 | S | 0.231 |
| AVC | 1 | 1065 | Support Header Front LH | D00 | 06-Jan-01 | | 0.70 | DP | 280 | 600 | S | 0.231 |
| AVC | 1 | 1075 | Crossmember Back Panel | C00 | 24-Oct-00 | | 0.65 | DP | 280 | 600 | S | 0.832 |
| AVC | 1 | 1082 | Crossmember Kick-Up | E04 | 27-Feb-01 | | 0.70 | DP | 700 | 1000 | S | 2.002 |
| AVC | 1 | 1083 | Crossmember Tunnel | B00 | 17-Aug-00 | | 0.70 | HSLA | 350 | 450 | S | 0.602 |
| AVC | 1 | 1088 | Bulkhead Crash Box Dash RH | D01 | 04-Dec-00 | | 1.20 | DP | 700 | 1000 | S | 2.376 |
| AVC | 1 | 1089 | Bulkhead Crash Box Dash LH | D01 | 04-Dec-00 | | 1.20 | DP | 700 | 1000 | S | 2.376 |
| AVC | 1 | 1116 | Assy Reinf Rail Rear Suspension Attach RH | B01 | 21-Jul-00 | | 1.30 | DP | 500 | 800 | S | 0.455 |
| AVC | 1 | 1117 | Assy Reinf Rail Rear Suspension Attach LH | B01 | 21-Jul-00 | | 1.30 | DP | 500 | 800 | S | 0.455 |
| AVC | 1 | 1128 | Plate Crash Box Rail Front Attach (x2) | A00 | 30-Mar-00 | | 3.00 | DP | 700 | 1000 | S | 0.600 |
| AVC | 1 | 1134 | Crossmember Support Front Seat Front RH | C03 | 09-Mar-01 | | 0.70 | CP | 700 | 800 | S | 0.567 |
| AVC | 1 | 1135 | Crossmember Support Front Seat Front LH | C03 | 09-Mar-01 | | 0.70 | CP | 700 | 800 | S | 0.567 |
| AVC | 1 | 1136 | Closeout Lower Crash Box Dash RH | C00 | 05-Dec-00 | | 0.90 | DP | 500 | 800 | S | 1.161 |
| AVC | 1 | 1137 | Closeout Lower Crash Box Dash LH | C00 | 05-Dec-00 | | 0.90 | DP | 500 | 800 | S | 1.161 |
| AVC | 1 | 1138 | Closeout Inner Crash Box Dash RH | A05 | 20-Oct-00 | | 0.80 | DP | 400 | 700 | S | 1.072 |
| AVC | 1 | 1139 | Closeout Inner Crash Box Dash LH | A05 | 20-Oct-00 | | 0.80 | DP | 400 | 700 | S | 1.040 |
| AVC | 1 | 1146 | A-Post Inner RH | A06 | 11-Apr-01 | | 0.90 | DP | 700 | 1000 | S | 1.152 |
| AVC | 1 | 1147 | A-Post Inner LH | A06 | 11-Apr-01 | | 0.90 | DP | 700 | 1000 | S | 1.152 |
| AVC | 1 | 1153 | Crossmember Rear Suspension | D01 | 19-Feb-01 | | 1.00 | DP | 700 | 1000 | S | 2.640 |
| AVC | 1 | 1168 | Reinf Rail Rear Spring Attach RH | B01 | 03-Feb-01 | | 1.20 | HSLA | 350 | 450 | S | 0.144 |
| AVC | 1 | 1169 | Reinf Rail Rear Spring Attach LH | B01 | 03-Feb-01 | | 1.20 | HSLA | 350 | 450 | S | 0.144 |
| AVC | 1 | 1182 | Reinf Rail Rear Suspension C-Member RH | B01 | 16-Feb-01 | | 1.50 | HSLA | 350 | 450 | S | 0.765 |
| AVC | 1 | 1183 | Reinf Rail Rear Suspension C-Member LH | B01 | 16-Feb-01 | | 1.50 | HSLA | 350 | 450 | S | 0.765 |
| AVC | 1 | 1190 | Bracket Support Front Seat Rear (x2) | B01 | 06-Dec-00 | | 1.20 | DP | 500 | 800 | S | 0.576 |
| AVC | 1 | 1192 | Reinf Crash Box Dash RH | A03 | 25-Jan-01 | | 1.00 | DP | 400 | 700 | S | 1.170 |
| AVC | 1 | 1193 | Reinf Crash Box Dash LH | A03 | 25-Jan-01 | | 1.00 | DP | 400 | 700 | S | 1.170 |
| AVC | 1 | 1194 | Reinf Tunnel | C03 | 05-Mar-01 | | 0.70 | Mart | 950 | 1200 | S | 2.394 |
| AVC | 1 | 1196 | Closeout Outer Crash Box Dash RH | A10 | 25-Jan-01 | | 0.80 | DP | 400 | 700 | S | 2.344 |
| AVC | 1 | 1197 | Closeout Outer Crash Box Dash LH | A10 | 25-Jan-01 | | 0.80 | DP | 400 | 700 | S | 2.344 |
| AVC | 1 | 1202 | Reinf Waist B-Pillar Inner RH | B02 | 21-Apr-01 | | 1.50 | Mart | 1250 | 1520 | S | 0.885 |
| AVC | 1 | 1203 | Reinf Waist B-Pillar Inner LH | B02 | 21-Apr-01 | | 1.50 | Mart | 1250 | 1520 | S | 0.885 |
| AVC | 1 | 1216 | Bracket Member Body Side Inner Att Rear RH | A02 | 15-Mar-01 | | 1.20 | DP | 500 | 800 | S | 0.396 |
| AVC | 1 | 1217 | Bracket Member Body Side Inner Att Rear LH | A02 | 15-Mar-01 | | 1.20 | DP | 500 | 800 | S | 0.396 |
| AVC | 1 | 1224 | Bracket Crossmember Inst Panel Attach RH | A00 | 27-Feb-01 | | 1.20 | HSLA | 350 | 450 | S | 0.132 |
| AVC | 1 | 1225 | Bracket Crossmember Inst Panel Attach LH | A00 | 27-Feb-01 | | 1.20 | HSLA | 350 | 450 | S | 0.132 |
| AVC | 1 | 1226 | A-Brace Cowl Front | A00 | 05-Mar-01 | | 1.00 | DP | 500 | 800 | S | 0.980 |
| AVC | 1 | 1227 | A-Brace Cowl Rear | A01 | 22-Mar-01 | | 1.00 | DP | 500 | 800 | S | 0.820 |
| AVC | 2 | 1016 | Floor Front RH | E01 | 28-Feb-01 | | 0.65 | TRIP | 450 | 800 | S | 4.219 |
| AVC | 2 | 1017 | Floor Front LH | E01 | 28-Feb-01 | | 0.65 | TRIP | 450 | 800 | S | 4.219 |
| AVC | 2 | 1020 | Body Side Outer RH | D05 | 11-Apr-01 | 1 | 1.50 | DP | 700 | 1000 | S/TWB | 3.645 |
| | | | | | | 2 | 0.70 | BH | 260 | 370 | | 8.358 |
| | | | | | | 3 | 1.80 | DP | 700 | 1000 | | 3.618 |
| AVC | 2 | 1021 | Body Side Outer LH | D05 | 11-Apr-01 | 1 | 1.50 | DP | 700 | 1000 | S/TWB | 3.645 |
| | | | | | | 2 | 0.70 | BH | 260 | 370 | | 8.414 |
| | | | | | | 3 | 1.80 | DP | 700 | 1000 | | 3.618 |
| AVC | 2 | 1036 | Wheelhouse Inner RH | C11 | 06-Mar-01 | 1 | 0.60 | DP | 500 | 800 | S/TWB | 1.320 |
| | | | | | | 2 | 1.40 | DP | 700 | 1000 | | 0.966 |
| | | | | | | 3 | 1.10 | DP | 700 | 1000 | | 0.616 |
| AVC | 2 | 1037 | Wheelhouse Inner LH | C11 | 06-Mar-01 | 1 | 0.60 | DP | 500 | 800 | S/TWB | 1.320 |
| | | | | | | 2 | 1.40 | DP | 700 | 1000 | | 0.966 |
| | | | | | | 3 | 1.10 | DP | 700 | 1000 | | 0.616 |
| AVC | 2 | 1038 | Wheelhouse Outer RH | D04 | 28-Feb-01 | | 0.60 | DP | 280 | 600 | S | 1.074 |
| AVC | 2 | 1039 | Wheelhouse Outer LH | D04 | 28-Feb-01 | | 0.60 | DP | 280 | 600 | S | 1.092 |
| AVC | 2 | 1046 | Roof | D01 | 03-Feb-01 | | 0.65 | DP | 300 | 500 | S or HFS | 9.464 |
| AVC | 2 | 1049 | Tunnel | C07 | 28-Feb-01 | | 0.65 | DP | 300 | 500 | S | 5.122 |
| AVC | 2 | 1050 | Member Rail Front RH | C10 | 28-Feb-01 | 1 | 1.50 | DP * | 500 | 800 | HFT/TWT | 1.845 |
| | | | | | | 2 | 1.30 | DP * | 500 | 800 | | 6.331 |
| AVC | 2 | 1051 | Member Rail Front LH | C10 | 28-Feb-01 | 1 | 1.50 | DP * | 500 | 800 | HFT/TWT | 1.845 |
| | | | | | | 2 | 1.30 | DP * | 500 | 800 | | 6.331 |
| AVC | 2 | 1069 | Floor Rear | B13 | 08-Mar-01 | 1 | 0.60 | BH | 210 | 340 | S/TWB | 5.838 |
| | | | | | | 2 | 1.10 | DP | 350 | 600 | | 2.519 |
| | | | | | | 3 | 1.10 | DP | 350 | 600 | | 2.255 |
| | | | | | | 4 | 0.70 | DP | 700 | 1000 | | 1.988 |

## Table 6.2-2 ULSAB-AVC body structures parts list (continued)

| Number | | | Name | Revision Level | Date | Blank No. | Gage (mm) | Material Type | Grade (MPa) | | Manuf. Process Code | Designed Mass (kg) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Yield Strength | Tensile Strength | | C-Class | PNGV-Class |
| AVC | 2 | 1070 | Gutter C-Pillar RH | C01 | 03-Feb-01 | | 0.65 | BH | 210 | 340 | S | 0.403 | |
| AVC | 2 | 1071 | Gutter C-Pillar LH | C01 | 03-Feb-01 | | 0.65 | BH | 210 | 340 | S | 0.403 | |
| AVC | 2 | 1072 | C-Pillar Inner RH | C04 | 06-Mar-01 | | 0.65 | DP | 500 | 800 | S | 0.774 | |
| AVC | 2 | 1073 | C-Pillar Inner LH | C04 | 06-Mar-01 | | 0.65 | DP | 500 | 800 | S | 0.774 | |
| AVC | 2 | 1074 | Back Panel | D00 | 12-Jan-01 | | 0.60 | DP | 300 | 500 | S | 2.532 | |
| AVC | 2 | 1076 | Rail Rear RH | B08 | 02-Feb-01 | 1 | 1.80 | DP | 700 | 1000 | S/TWB | 3.168 | |
| | | | | | | 2 | 1.10 | DP | 500 | 800 | | 0.737 | |
| AVC | 2 | 1077 | Rail Rear LH | B08 | 02-Feb-01 | 1 | 1.80 | DP | 700 | 1000 | S/TWB | 3.168 | |
| | | | | | | 2 | 1.10 | DP | 500 | 800 | | 0.737 | |
| AVC | 2 | 1080 | Body Side Inner Rear RH | C02 | 10-Feb-01 | | 0.70 | IF | 300 | 420 | S | 2.541 | |
| AVC | 2 | 1081 | Body Side Inner Rear LH | C02 | 10-Feb-01 | | 0.70 | IF | 300 | 420 | S | 2.541 | |
| AVC | 2 | 1086 | Rocker Inner RH | B14 | 11-Apr-01 | 1 | 1.50 | DP | 700 | 1000 | S/TWB | 1.815 | |
| | | | | | | 2 | 0.70 | DP | 700 | 1000 | | 2.345 | |
| AVC | 2 | 1087 | Rocker Inner LH | B14 | 11-Apr-01 | 1 | 1.50 | DP | 700 | 1000 | S/TWB | 1.815 | |
| | | | | | | 2 | 0.70 | DP | 700 | 1000 | | 2.345 | |
| AVC | 2 | 1115 | Header Rear | E04 | 22-Mar-01 | | 0.65 | DP | 350 | 600 | S | 1.807 | |
| AVC | 2 | 1132 | Member Body Side Inner RH | B03 | 19-Feb-01 | | 1.00 | DP * | 500 | 800 | HFT | 7.120 | |
| AVC | 2 | 1133 | Member Body Side Inner LH | B03 | 19-Feb-01 | | 1.00 | DP * | 500 | 800 | HFT | 7.120 | |
| AVC | 2 | 1154 | B-Pillar Inner RH | B03 | 07-Mar-01 | | 0.70 | Mart | 950 | 1200 | S | 1.610 | |
| AVC | 2 | 1155 | B-Pillar Inner LH | B03 | 07-Mar-01 | | 0.70 | Mart | 950 | 1200 | S | 1.610 | |
| AVC | 2 | 1188 | Rail Rear Outer Floor Extension RH | A00 | 12-Jan-01 | | 1.10 | DP | 500 | 800 | S | 0.319 | |
| AVC | 2 | 1189 | Rail Rear Outer Floor Extension LH | A00 | 12-Jan-01 | | 1.10 | DP | 500 | 800 | S | 0.319 | |
| AVC | 2 | 1214 | Support Back Panel | B00 | 11-Jan-01 | | 0.60 | DP | 300 | 500 | S | 1.020 | |
| AVC | 2 | 1215 | Extension C-Member Kick-Up (x2) | A00 | 08-Mar-01 | | 1.20 | Mart* | 950 | 1200 | ST | 0.480 | |
| AVC | 2 | 1218 | Reinf B-Pillar Lower RH | A02 | 08-Mar-01 | | 0.70 | DP | 700 | 1000 | S | 0.595 | |
| AVC | 2 | 1219 | Reinf B-Pillar Lower LH | A02 | 08-Feb-01 | | 0.70 | DP | 700 | 1000 | S | 0.595 | |
| AVC | 2 | 1220 | Reinf B-Pillar Rocker Rear RH | A05 | 08-Mar-01 | 1 | 1.20 | DP | 700 | 1000 | S/TWB | 3.216 | |
| | | | | | | 2 | 1.40 | DP | 700 | 1000 | | 2.184 | |
| AVC | 2 | 1221 | Reinf B-Pillar Rocker Rear LH | A05 | 08-Mar-01 | 1 | 1.20 | DP | 700 | 1000 | S/TWB | 3.216 | |
| | | | | | | 2 | 1.40 | DP | 700 | 1000 | | 2.184 | |
| AVC | 2 | 1228 | Crossmember Roof | A00 | 07-Mar-01 | | 0.70 | DP | 700 | 1000 | S | 0.490 | |
| AVC | 2 | 1232 | Reinf Waist B-Pillar Outer RH | A00 | 25-Apr-01 | | 0.80 | DP | 700 | 1000 | S | 0.104 | |
| AVC | 2 | 1233 | Reinf Waist B-Pillar Outer LH | A00 | 25-Apr-01 | | 0.80 | DP | 700 | 1000 | S | 0.104 | |
| AVC | 3 | 1016 | Floor Front RH | E01 | 28-Feb-01 | | 0.65 | TRIP | 450 | 800 | S | | 4.459 |
| AVC | 3 | 1017 | Floor Front LH | E01 | 28-Feb-01 | | 0.65 | TRIP | 450 | 800 | S | | 4.459 |
| AVC | 3 | 1036 | Wheelhouse Inner RH | C10 | 06-Mar-01 | 1 | 0.60 | DP | 500 | 800 | S/TWB | | 1.356 |
| | | | | | | 2 | 1.40 | DP | 700 | 1000 | | | 0.966 |
| | | | | | | 3 | 1.10 | DP | 700 | 1000 | | | 0.660 |
| AVC | 3 | 1037 | Wheelhouse Inner LH | C10 | 06-Mar-01 | 1 | 0.60 | DP | 500 | 800 | S/TWB | | 1.356 |
| | | | | | | 2 | 1.40 | DP | 700 | 1000 | | | 0.966 |
| | | | | | | 3 | 1.10 | DP | 700 | 1000 | | | 0.660 |
| AVC | 3 | 1038 | Wheelhouse Outer RH | D03 | 28-Feb-01 | | 0.60 | DP | 280 | 600 | S | | 1.134 |
| AVC | 3 | 1039 | Wheelhouse Outer LH | D03 | 28-Feb-01 | | 0.60 | DP | 280 | 600 | S | | 1.146 |
| AVC | 3 | 1049 | Tunnel | C07 | 28-Feb-01 | | 0.65 | DP | 300 | 500 | S | | 5.252 |
| AVC | 3 | 1050 | Member Rail Front RH | C10 | 28-Feb-01 | 1 | 1.50 | DP * | 500 | 800 | HFT/TWT | | 1.845 |
| | | | | | | 2 | 1.30 | DP * | 500 | 800 | | | 6.604 |
| AVC | 3 | 1051 | Member Rail Front LH | C10 | 28-Feb-01 | 1 | 1.50 | DP * | 500 | 800 | HFT/TWT | | 1.845 |
| | | | | | | 2 | 1.30 | DP * | 500 | 800 | | | 6.604 |
| AVC | 3 | 1069 | Floor Rear | B10 | 08-Mar-01 | 1 | 0.60 | BH | 210 | 340 | S/TWB | | 7.932 |
| | | | | | | 2 | 1.10 | DP | 350 | 600 | | | 3.135 |
| | | | | | | 3 | 1.10 | DP | 350 | 600 | | | 2.882 |
| | | | | | | 4 | 0.70 | DP | 700 | 1000 | | | 2.002 |
| AVC | 3 | 1074 | Back Panel | D00 | 04-Jan-01 | | 0.60 | DP | 300 | 500 | S | | 2.172 |
| AVC | 3 | 1076 | Rail Rear RH | B08 | 02-Feb-01 | 1 | 1.80 | DP | 700 | 1000 | S/TWB | | 3.168 |
| | | | | | | 2 | 1.10 | DP | 500 | 800 | | | 1.408 |
| AVC | 3 | 1077 | Rail Rear LH | B08 | 02-Feb-01 | 1 | 1.80 | DP | 700 | 1000 | S/TWB | | 3.168 |
| | | | | | | 2 | 1.10 | DP | 500 | 800 | | | 1.408 |
| AVC | 3 | 1124 | Support Header Rear RH | E00 | 03-Jan-01 | | 0.70 | IF | 300 | 420 | S | | 0.336 |
| AVC | 3 | 1125 | Support Header Rear LH | E00 | 03-Jan-01 | | 0.70 | IF | 300 | 420 | S | | 0.336 |
| AVC | 3 | 1126 | Header Rear | E00 | 03-Jan-01 | | 0.70 | IF | 300 | 420 | S | | 0.938 |
| AVC | 3 | 1127 | Roof | D00 | 06-Jan-01 | | 0.65 | DP | 300 | 500 | S or HFS | | 8.905 |
| AVC | 3 | 1130 | Member Body Side Inner RH | B03 | 19-Feb-01 | | 1.00 | DP * | 500 | 800 | HFT | | 7.070 |
| AVC | 3 | 1131 | Member Body Side Inner LH | B03 | 19-Feb-01 | | 1.00 | DP * | 500 | 800 | HFT | | 7.070 |
| AVC | 3 | 1156 | Package Tray Upper | C02 | 08-Jan-01 | | 0.60 | DP | 280 | 600 | S | | 2.316 |
| AVC | 3 | 1157 | Package Tray Lower | C00 | 22-Dec-00 | | 0.60 | DP | 280 | 600 | S | | 2.208 |

## Table 6.2-2 ULSAB-AVC body structures parts list (continued)

| Number | | | Name | Revision Level | Date | Blank No. | Gage (mm) | Material Type | Grade (MPa) | | Manuf. Process Code | Designed Mass (kg) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Yield Strength | Tensile Strength | | C-Class | PNGV-Class |
| AVC | 3 | 1162 | Rocker Inner RH | A12 | 11-Apr-01 | 1 | 1.50 | DP | 700 | 1000 | S/TWB | | 1.815 |
| | | | | | | 2 | 0.70 | DP | 700 | 1000 | | | 2.527 |
| AVC | 3 | 1163 | Rocker Inner LH | A12 | 11-Apr-01 | 1 | 1.50 | DP | 700 | 1000 | S/TWB | | 1.815 |
| | | | | | | 2 | 0.70 | DP | 700 | 1000 | | | 2.527 |
| AVC | 3 | 1170 | Body Side Outer RH | B05 | 10-Apr-01 | 1 | 1.50 | DP | 700 | 1000 | S/TWB | | 3.645 |
| | | | | | | 2 | 0.70 | BH | 260 | 370 | | | 0.280 |
| | | | | | | 3 | 1.80 | DP | 700 | 1000 | | | 9.108 |
| | | | | | | 4 | 1.20 | DP | 700 | 1000 | | | 2.148 |
| | | | | | | 5 | 0.70 | BH | 260 | 370 | | | 5.649 |
| AVC | 3 | 1171 | Body Side Outer LH | B05 | 10-Apr-01 | 1 | 1.50 | DP | 700 | 1000 | S/TWB | | 3.645 |
| | | | | | | 2 | 0.70 | BH | 260 | 370 | | | 0.280 |
| | | | | | | 3 | 1.80 | DP | 700 | 1000 | | | 9.108 |
| | | | | | | 4 | 1.20 | DP | 700 | 1000 | | | 2.148 |
| | | | | | | 5 | 0.70 | BH | 260 | 370 | | | 5.712 |
| AVC | 3 | 1172 | Body Side Inner Rear RH | B03 | 08-Mar-01 | | 0.70 | IF | 300 | 420 | S | | 2.555 |
| AVC | 3 | 1173 | Body Side Inner Rear LH | B03 | 08-Mar-01 | | 0.70 | IF | 300 | 420 | S | | 2.555 |
| AVC | 3 | 1178 | Gutter Deck Lid RH | B01 | 04-Jan-01 | | 0.70 | BH | 260 | 370 | S | | 0.385 |
| AVC | 3 | 1179 | Gutter Deck Lid LH | B01 | 04-Jan-01 | | 0.70 | BH | 260 | 370 | S | | 0.385 |
| AVC | 3 | 1188 | Rail Rear Outer Floor Extension RH | B03 | 06-Jan-01 | 1 | 1.10 | DP | 500 | 800 | S/TWB | | 0.913 |
| | | | | | | 2 | 0.60 | BH | 210 | 340 | | | 0.378 |
| AVC | 3 | 1189 | Rail Rear Outer Floor Extension LH | B03 | 06-Jan-01 | 1 | 1.10 | DP | 500 | 800 | S/TWB | | 0.913 |
| | | | | | | 2 | 0.60 | BH | 210 | 340 | | | 0.378 |
| AVC | 3 | 1201 | Crossmember Package Tray | B00 | 22-Dec-00 | | 1.00 | DP * | 280 | 600 | ST | | 2.540 |
| AVC | 3 | 1208 | B-Pillar Inner RH | B01 | 11-Apr-01 | | 0.70 | Mart | 950 | 1200 | S | | 1.491 |
| AVC | 3 | 1209 | B-Pillar Inner LH | B01 | 11-Apr-01 | | 0.70 | Mart | 950 | 1200 | S | | 1.491 |
| AVC | 3 | 1212 | Extension C-Member Supt Front Seat Rr (x2) | A01 | 05-Jan-01 | | 1.20 | Mart* | 950 | 1200 | ST | | 0.456 |
| AVC | 3 | 1214 | Support Back Panel | A01 | 04-Jan-01 | | 0.60 | DP | 300 | 500 | S | | 1.068 |
| AVC | 3 | 1222 | Reinf B-Pillar Lower RH | B01 | 06-Jan-01 | | 1.00 | DP | 700 | 1000 | S | | 1.430 |
| AVC | 3 | 1223 | Reinf B-Pillar Lower LH | B01 | 06-Jan-01 | | 1.00 | DP | 700 | 1000 | S | | 1.430 |
| AVC | 3 | 1230 | Reinf Waist B-Pillar Outer RH | A00 | 25-Apr-01 | | 0.80 | DP | 700 | 1000 | S | | 0.120 |
| AVC | 3 | 1231 | Reinf Waist B-Pillar Outer LH | A00 | 25-Apr-01 | | 0.80 | DP | 700 | 1000 | S | | 0.120 |
| AVC | - | 1900 | Brackets, Reinforcements and Hinges NOT Designed | | | | | | | | Misc | 3.746 | 5.042 |
| **TOTAL** | | | | | | | | | | | | 201.776 | 218.124 |

| Code | Manufacturing Process |
|---|---|
| S | Stamped |
| S/TWB | Stamped / Tailor Welded Blanks |
| HFT | Hydroformed Tube |
| HFT/TWT | Hydroformed Tube / Tailor Welded Tubes |
| S or HFS | Stamped or Hydroformed Sheet |
| ST | Straight or Shaped Tube |
| Misc | Miscellaneous |

| Code | Steel Types |
|---|---|
| BH | Bake Hardenable |
| CP | Complex Phase |
| DP | Dual Phase |
| HSLA | High Strength, Low Alloy |
| IF | Interstitial-Free |
| Mart | Martensitic |
| TRIP | Transformation-Induced Plasticity |

* denotes **Tube**

### 6.2.1. Common Parts

Figure 6.2.1-1 illustrates the common parts for both ULSAB-AVC vehicle structures in an exploded view. Figure 6.2.1-2 shows the common parts and their relative locations, shown for the C-Class vehicle and listed in Table 6.2.1-1.

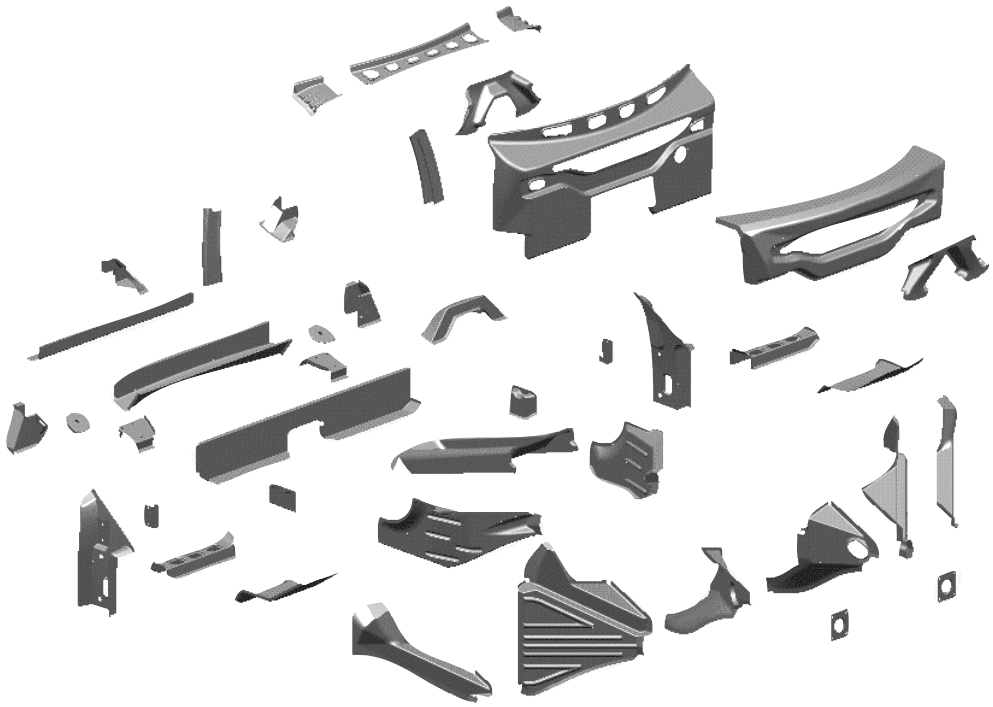


**Figure 6.2.1-1 ULSAB-AVC common parts (C-Class & PNGV-Class) exploded view**

The two rear end structures share several essential common sub-structures or joints that have evolved through intense development. The entire kick-up structure inboard of the rocker inner panels is identical, although 85-mm different in longitudinal body position. The kick-up crossmember panel (AVC# 11082) is common for both vehicle variants.

Using the same rear suspension system has resulted in common joints and parts in the rear rail environment, as a result of the identical suspension trailing arm, spring, and shock absorber attachments. The suspension crossmember is identical for both variants.

The upper structure incorporates several common parts. These include the front header panel, two support panels, and two B-pillar inner reinforcements.

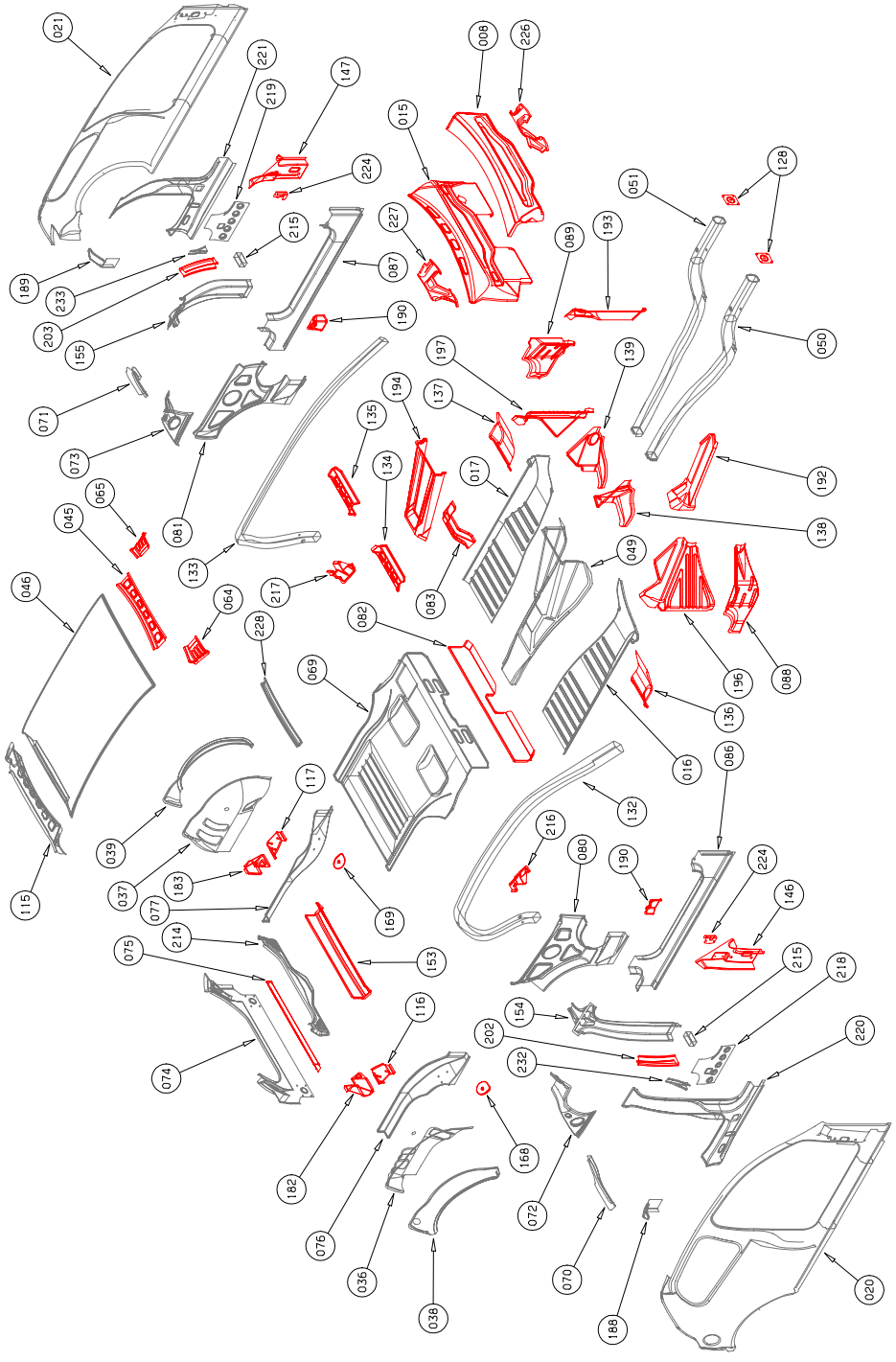



**Figure 6.2.1-2 Exploded view of common parts**

## Table 6.2.1-1 ULSAB-AVC body structure common parts list (C-Class & PNGV-Class)

| Number | | | Name | Revision Level | Date | Blank No. | Gage (mm) | Material Type | Grade (MPa) | | Manuf. Process Code | Designed Mass (kg) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Yield Strength | Tensile Strength | | C-Class | PNGV-Class |
| AVC | 1 | 1008 | Cowl Front | D03 | 05-Mar-01 | | 0.80 | DP | 500 | 800 | S | 4.416 | 4.416 |
| AVC | 1 | 1015 | Dash | C15 | 22-Mar-01 | | 0.65 | DP | 280 | 600 | S | 4.381 | 4.381 |
| AVC | 1 | 1045 | Header Front | E01 | 09-Mar-01 | | 0.70 | IF | 300 | 420 | S | 0.686 | 0.686 |
| AVC | 1 | 1064 | Support Header Front RH | D00 | 06-Jan-01 | | 0.70 | DP | 280 | 600 | S | 0.231 | 0.231 |
| AVC | 1 | 1065 | Support Header Front LH | D00 | 06-Jan-01 | | 0.70 | DP | 280 | 600 | S | 0.231 | 0.231 |
| AVC | 1 | 1075 | Crossmember Back Panel | C00 | 24-Oct-00 | | 0.65 | DP | 280 | 600 | S | 0.832 | 0.832 |
| AVC | 1 | 1082 | Crossmember Kick-Up | E04 | 27-Feb-01 | | 0.70 | DP | 700 | 1000 | S | 2.002 | 2.002 |
| AVC | 1 | 1083 | Crossmember Tunnel | B00 | 17-Aug-00 | | 0.70 | HSLA | 350 | 450 | S | 0.602 | 0.602 |
| AVC | 1 | 1088 | Bulkhead Crash Box Dash RH | D01 | 04-Dec-00 | | 1.20 | DP | 700 | 1000 | S | 2.376 | 2.376 |
| AVC | 1 | 1089 | Bulkhead Crash Box Dash LH | D01 | 04-Dec-00 | | 1.20 | DP | 700 | 1000 | S | 2.376 | 2.376 |
| AVC | 1 | 1116 | Assy Reinf Rail Rear Suspension Attach RH | B01 | 21-Jul-00 | | 1.30 | DP | 500 | 800 | S | 0.455 | 0.455 |
| AVC | 1 | 1117 | Assy Reinf Rail Rear Suspension Attach LH | B01 | 21-Jul-00 | | 1.30 | DP | 500 | 800 | S | 0.455 | 0.455 |
| AVC | 1 | 1128 | Plate Crash Box Rail Front Attach (x2) | A00 | 30-Mar-00 | | 3.00 | DP | 700 | 1000 | S | 0.600 | 0.600 |
| AVC | 1 | 1134 | Crossmember Support Front Seat Front RH | C03 | 09-Mar-01 | | 0.70 | CP | 700 | 800 | S | 0.567 | 0.567 |
| AVC | 1 | 1135 | Crossmember Support Front Seat Front LH | C03 | 09-Mar-01 | | 0.70 | CP | 700 | 800 | S | 0.567 | 0.567 |
| AVC | 1 | 1136 | Closeout Lower Crash Box Dash RH | C00 | 05-Dec-00 | | 0.90 | DP | 500 | 800 | S | 1.161 | 1.161 |
| AVC | 1 | 1137 | Closeout Lower Crash Box Dash LH | C00 | 05-Dec-00 | | 0.90 | DP | 500 | 800 | S | 1.161 | 1.161 |
| AVC | 1 | 1138 | Closeout Inner Crash Box Dash RH | A05 | 20-Oct-00 | | 0.80 | DP | 400 | 700 | S | 1.072 | 1.072 |
| AVC | 1 | 1139 | Closeout Inner Crash Box Dash LH | A05 | 20-Oct-00 | | 0.80 | DP | 400 | 700 | S | 1.040 | 1.040 |
| AVC | 1 | 1146 | A-Post Inner RH | A06 | 11-Apr-01 | | 0.90 | DP | 700 | 1000 | S | 1.152 | 1.152 |
| AVC | 1 | 1147 | A-Post Inner LH | A06 | 11-Apr-01 | | 0.90 | DP | 700 | 1000 | S | 1.152 | 1.152 |
| AVC | 1 | 1153 | Crossmember Rear Suspension | D01 | 19-Feb-01 | | 1.00 | DP | 700 | 1000 | S | 2.640 | 2.640 |
| AVC | 1 | 1168 | Reinf Rail Rear Spring Attach RH | B01 | 03-Feb-01 | | 1.20 | HSLA | 350 | 450 | S | 0.144 | 0.144 |
| AVC | 1 | 1169 | Reinf Rail Rear Spring Attach LH | B01 | 03-Feb-01 | | 1.20 | HSLA | 350 | 450 | S | 0.144 | 0.144 |
| AVC | 1 | 1182 | Reinf Rail Rear Suspension C-Member RH | B01 | 16-Feb-01 | | 1.50 | HSLA | 350 | 450 | S | 0.765 | 0.765 |
| AVC | 1 | 1183 | Reinf Rail Rear Suspension C-Member LH | B01 | 16-Feb-01 | | 1.50 | HSLA | 350 | 450 | S | 0.765 | 0.765 |
| AVC | 1 | 1190 | Bracket Support Front Seat Rear (x2) | B01 | 06-Dec-00 | | 1.20 | DP | 500 | 800 | S | 0.576 | 0.576 |
| AVC | 1 | 1192 | Reinf Crash Box Dash RH | A03 | 25-Jan-01 | | 1.00 | DP | 400 | 700 | S | 1.170 | 1.170 |
| AVC | 1 | 1193 | Reinf Crash Box Dash LH | A03 | 25-Jan-01 | | 1.00 | DP | 400 | 700 | S | 1.170 | 1.170 |
| AVC | 1 | 1194 | Reinf Tunnel | C03 | 05-Mar-01 | | 0.70 | Mart | 950 | 1200 | S | 2.394 | 2.394 |
| AVC | 1 | 1196 | Closeout Outer Crash Box Dash RH | A10 | 25-Jan-01 | | 0.80 | DP | 400 | 700 | S | 2.344 | 2.344 |
| AVC | 1 | 1197 | Closeout Outer Crash Box Dash LH | A10 | 25-Jan-01 | | 0.80 | DP | 400 | 700 | S | 2.344 | 2.344 |
| AVC | 1 | 1202 | Reinf Waist B-Pillar Inner RH | B02 | 21-Apr-01 | | 1.50 | Mart | 1250 | 1520 | S | 0.885 | 0.885 |
| AVC | 1 | 1203 | Reinf Waist B-Pillar Inner LH | B02 | 21-Apr-01 | | 1.50 | Mart | 1250 | 1520 | S | 0.885 | 0.885 |
| AVC | 1 | 1216 | Bracket Member Body Side Inner Att Rear RH | A02 | 15-Mar-01 | | 1.20 | DP | 500 | 800 | S | 0.396 | 0.396 |
| AVC | 1 | 1217 | Bracket Member Body Side Inner Att Rear LH | A02 | 15-Mar-01 | | 1.20 | DP | 500 | 800 | S | 0.396 | 0.396 |
| AVC | 1 | 1224 | Bracket Crossmember Inst Panel Attach RH | A00 | 27-Feb-01 | | 1.20 | HSLA | 350 | 450 | S | 0.132 | 0.132 |
| AVC | 1 | 1225 | Bracket Crossmember Inst Panel Attach LH | A00 | 27-Feb-01 | | 1.20 | HSLA | 350 | 450 | S | 0.132 | 0.132 |
| AVC | 1 | 1226 | A-Brace Cowl Front | A00 | 05-Mar-01 | | 1.00 | DP | 500 | 800 | S | 0.980 | 0.980 |
| AVC | 1 | 1227 | A-Brace Cowl Rear | A01 | 22-Mar-01 | | 1.00 | DP | 500 | 800 | S | 0.820 | 0.820 |

The percentage of common parts by the body structure mass are 23% and 21% for the C-Class and PNGV-Class respectively (Figures 6.2.1-3 and 6.2.1-4).

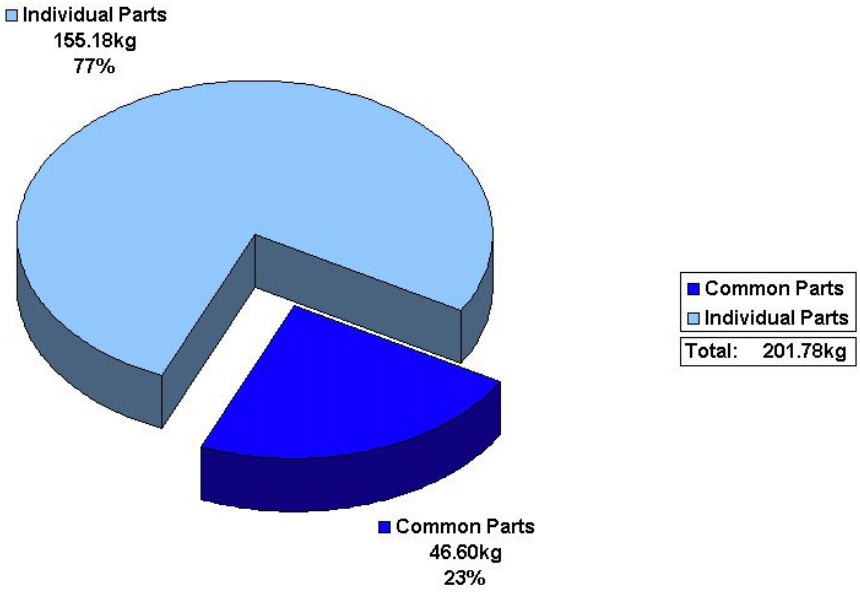



**Figure 6.2.1-3 C-Class common parts body structure**

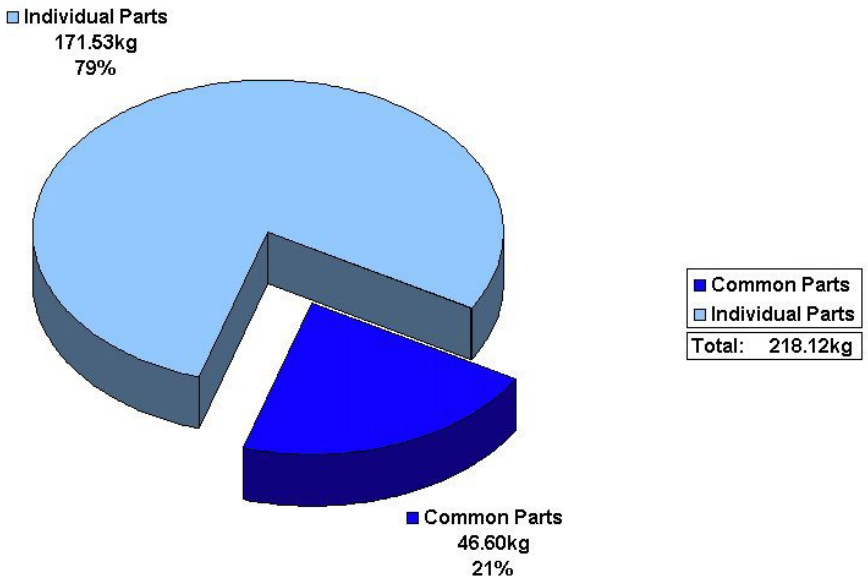



**Figure 6.2.1-4 PNGV-Class common parts body structure**

### 6.2.2. Parts Manufactured from Common Dies

Parts manufactured from common dies are defined as parts using the same stamping or hydroforming tool followed by different trim operations to adjust the parts for a difference in size for both vehicle variants. The two large rear floor panels are very similar in design. The PNGV-Class floor is extended by 85 mm at its rear end compared with the C-Class floor. The distance between kick-up and rear axle center is identical, resulting in almost identical parts in this environment. Similarly, the PNGV-Class longitudinal rail is a rear extended version, of the C-Class rail.

Figures 6.2.2-1 show parts with the potential to be manufactured using common dies. Actual verification requires a detailed design phase working together with the tool and die and the part manufacturers. The area of the part, which undergoes different trim operations is indicated (red).

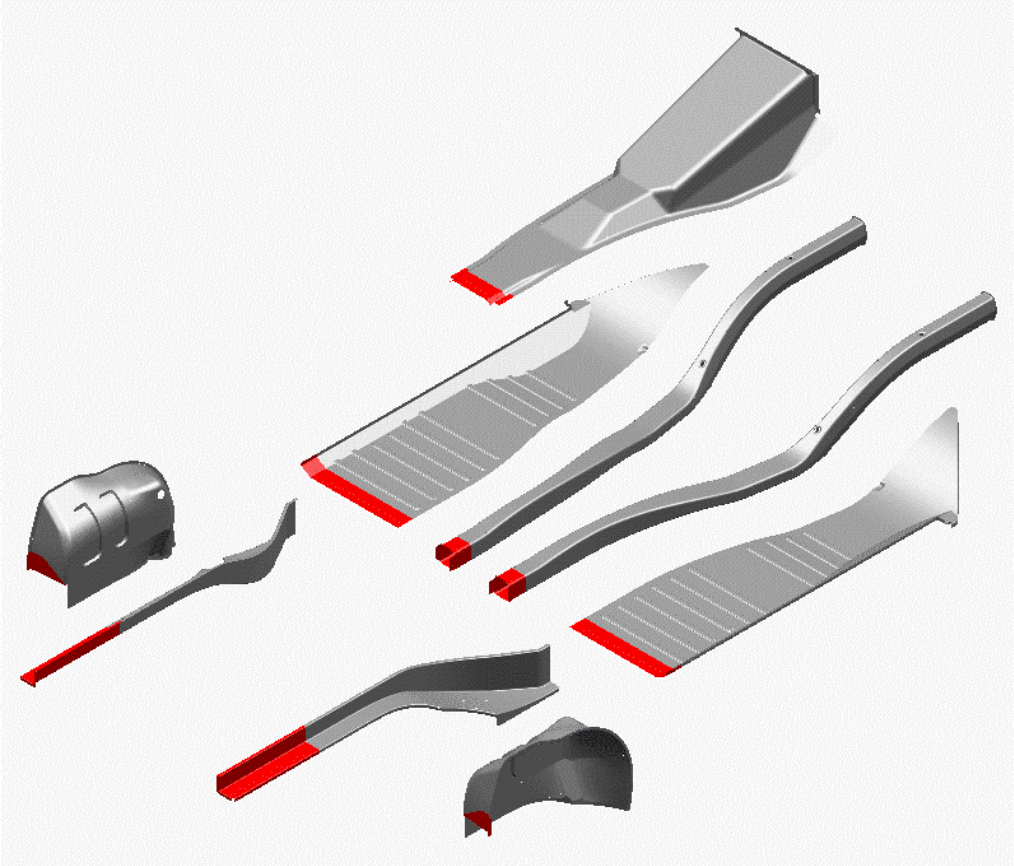


**Figure 6.2.2-1 C-Class and PNGV-Class parts from common dies**

Although not identical, the wheelhouse inner panels require only one small different trim operation. The tubular hydroformed body side members are laser welded to the wheelhouse inner panels. The tubes terminate above the rear longitudinal rails using a common attachment bracket. At the rear ends, the floor joints result in a common rear crossmember panel.

The results of the common platform approach is summarized for the C-Class in Figure 6.2.2-2 with common parts shown in red and parts manufactured from common dies shown in blue.

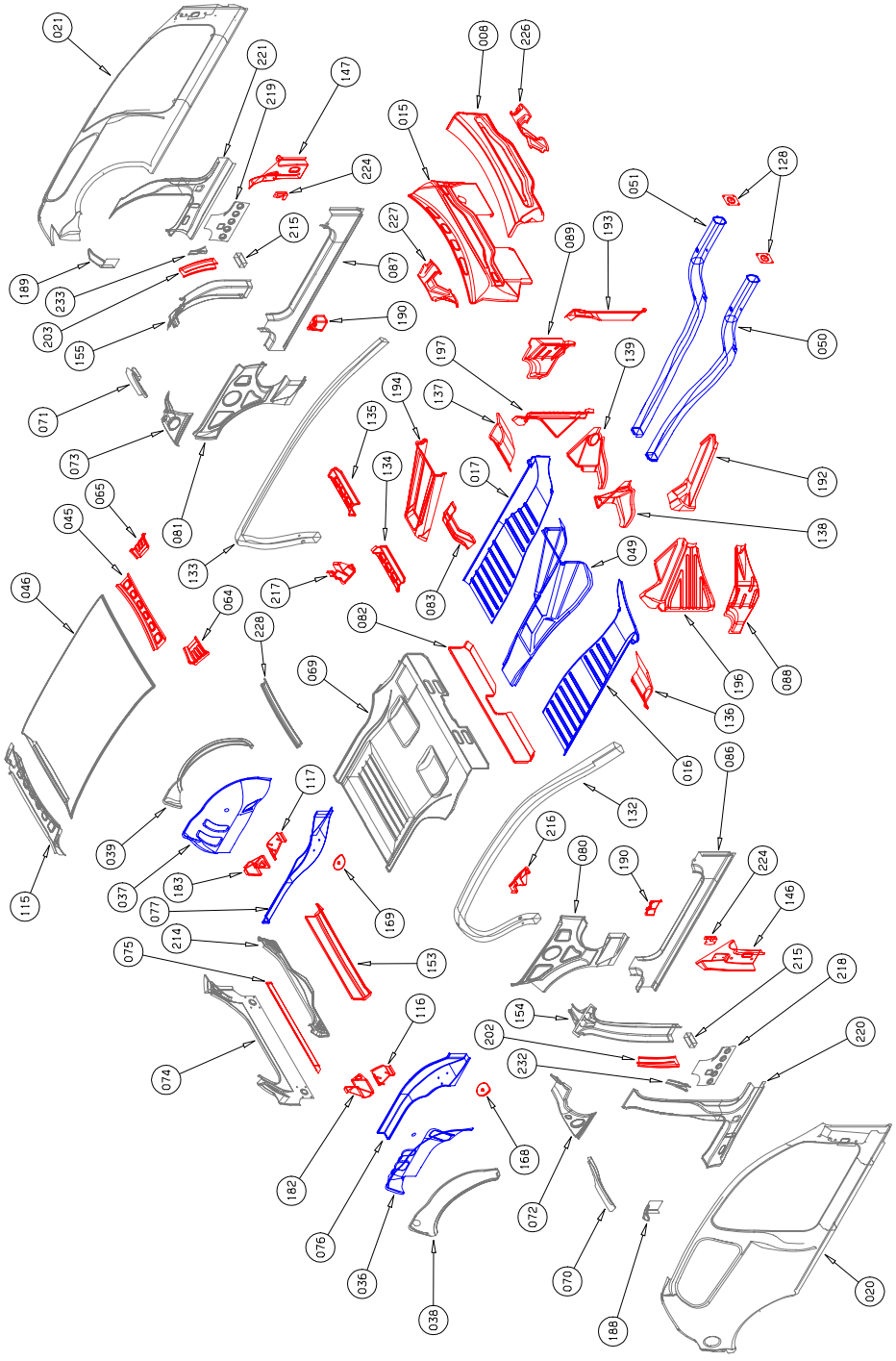



**Figure 6.2.2-2 ULSAB-AVC common parts and parts manufactured with common dies (common dies shown in blue, common parts shown in red)**

## 6.3. Front End Structure - C-Class and PNGV-Class

### 6.3.1. Underbody - Front

Frontal crash energy management is achieved with load distribution into the two tubular longitudinal rails. Each rail is tubular hydroformed from two tailor-welded 100 mm diameter DP 500/800 MPa tubes. The front and rear tube material thicknesses are 1.5 mm / 1.3 mm respectively. Due to the suspension design concept with a transverse leaf spring and a subframe incorporating the upper shock attachment, a front shock tower is not required in the body structure. This eliminates an upper longitudinal load path. Frontal crash loads are transferred through the rails via the bumper beam and crash box. The two crash boxes are designed as two-piece stampings, and absorb energy in case of low speed impact (0 degree, 15km/h frontal impact), and welded to the bumper, which is used for attachment of the front fascia module to the vehicle structure.

The engine/suspension subframe four-point attachment to the front rails and the attachments of the bumper to the rails are shown in Figure 6.3.1-1.

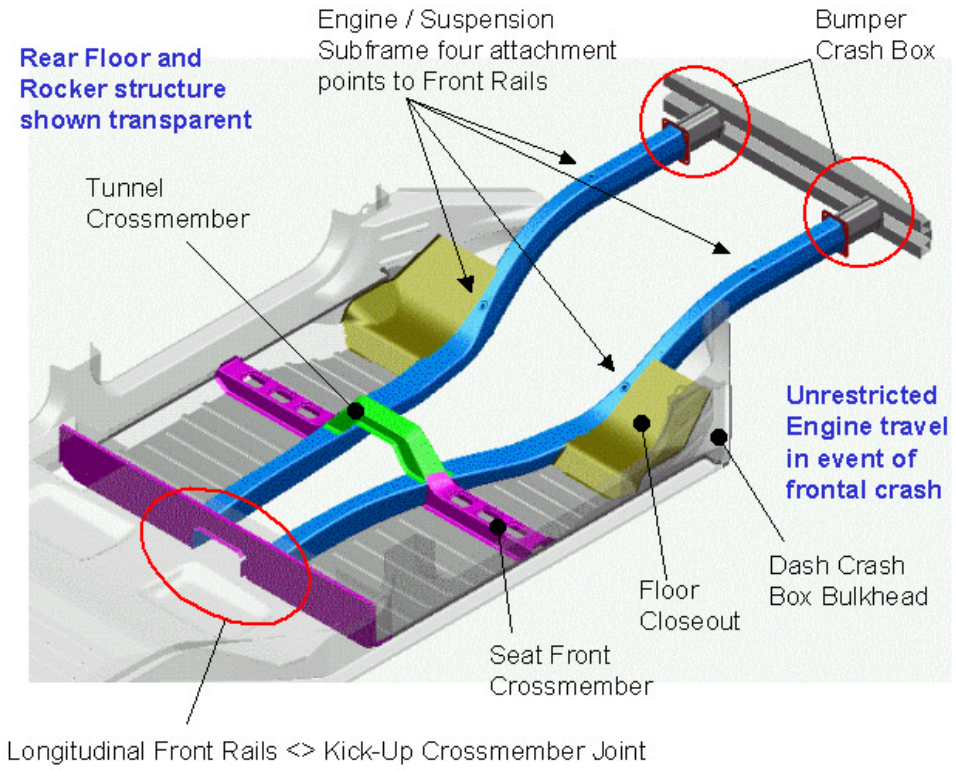



**Figure 6.3.1-1 Bumper subframe attachment to rails**

Rear of the front subframe attachments, front rail longitudinal loads are transferred to the rocker, a-pillar, upper tunnel, and lower tunnel. In a frontal crash, the subframe rear attachments are designed and positioned to allow movement of the engine inside the tunnel, thereby minimizing cockpit intrusion.

Terminating within the kick-up crossmember box-section, the longitudinal rails represent the backbone of the entire underbody structure. The floor is laser welded to the lower outboard rail surface providing enhanced underbody aerodynamic efficiency. Integrating the front rails and upper tunnel, while forming a cross-car connection between the rocker and front floor crossmember, the tunnel crossmember is an important component within this environment. The tunnel crossmember is also a critical component. Integrating the front rails and upper tunnel reinforcement, it forms a cross-car connection between the two front seat support crossmembers. Figure 6.3.1-2 shows the front floor panel, which is laser welded to the tubular hydroformed longitudinal front rails.

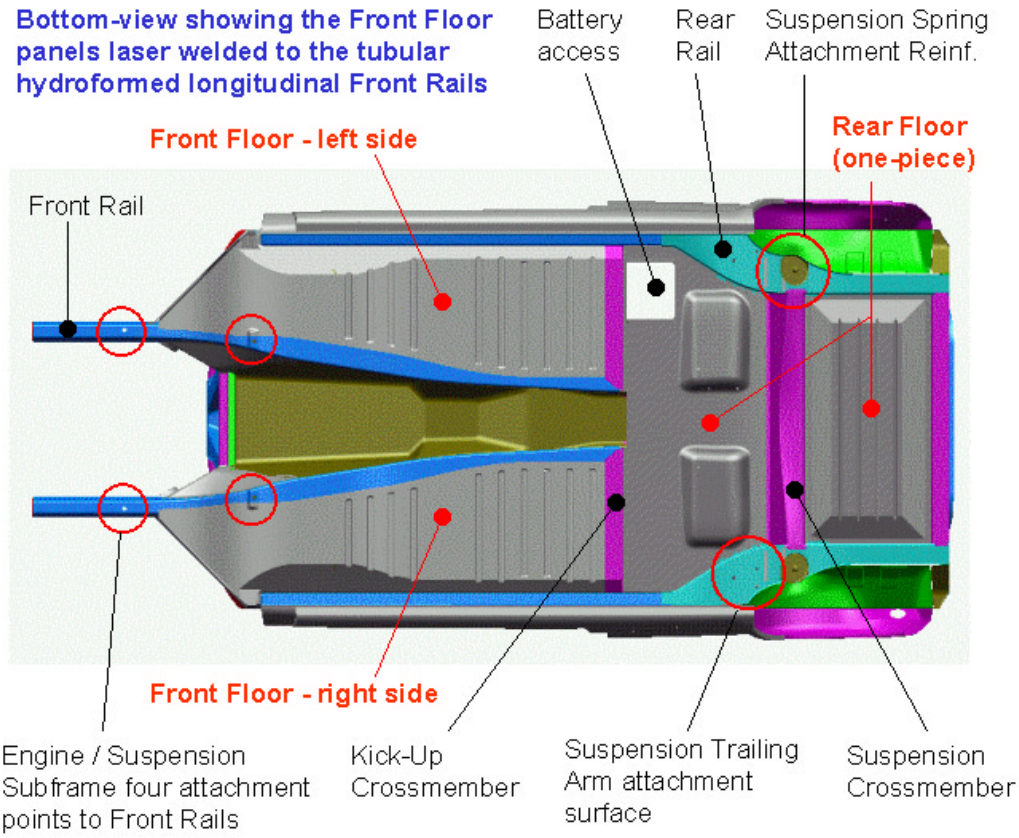



**Figure 6.3.1-2 Bottom view of front and rear floor panels**

### 6.3.2. Front End Load Distribution

The front end forward of the A-post has been designed primarily to absorb energy in a frontal crash. The structure achieves a good compromise between the very different and stringent demands imposed by the 100% frontal and 40% offset crash events. Furthermore, it provides a good load path. The dash crash box incorporates an inner lower diagonal bulkhead and lower closeout panel that transfer loads between rail and rocker. It also incorporates an upper diagonal reinforcement for load transfer between rail and A-pillar. Additionally, lateral loads are transferred into the dash crossmember, tunnel and cowl. The front rail to dash crash box joints are two of the most significant joints in the vehicle structure.

Figure 6.3.2-1 shows the common front end structure of both vehicles in front isometric view and in a top view identifying the load distribution from the front rails into the structure. Figure 6.3.2-2 shows the common front end structure in front view. Figure 6.3.2-3 shows it in side view.

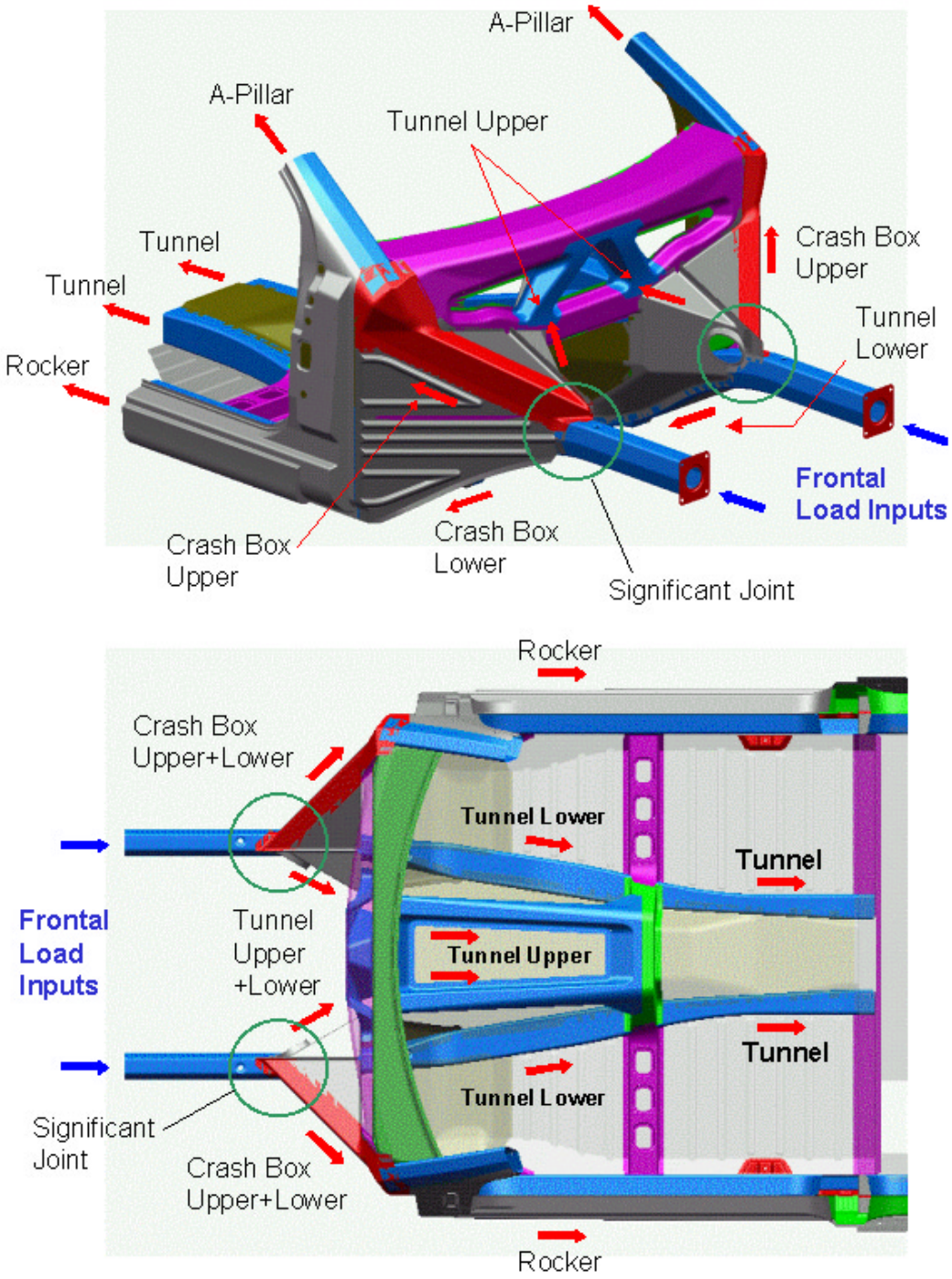



**Figure 6.3.2-1 Front load paths**

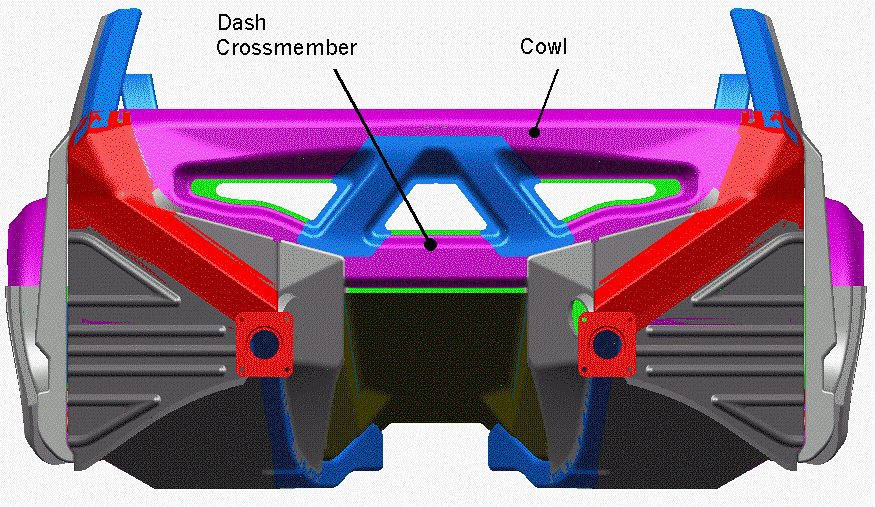



**Figure 6.3.2-2 Front end structure front view**

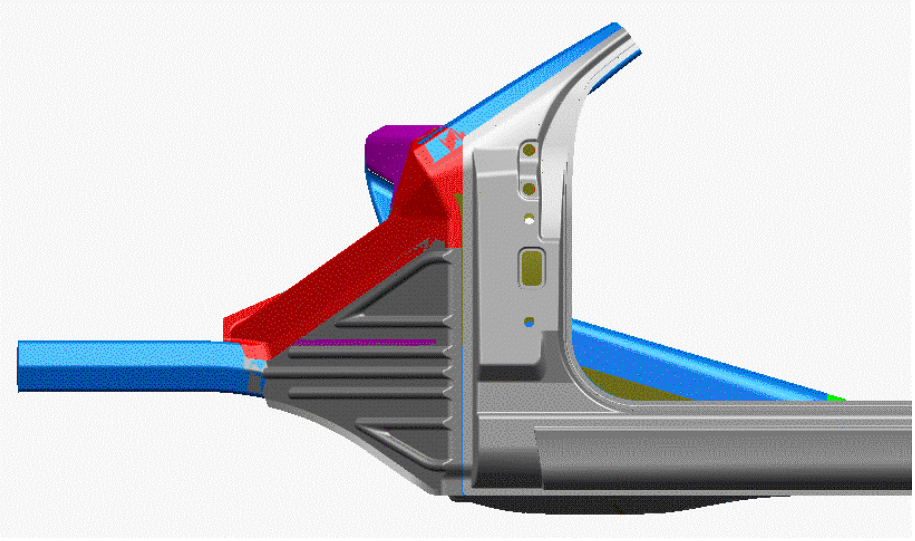


**Figure 6.3.2-3 Front-end structure side view**

Integrated into the dash and cowl structure are both upper and lower crossmembers, connected by a two-piece stamped A-brace at the center of the vehicle. The lower crossmember and A-brace provide a good foundation for the tunnel and tunnel reinforcement joint. Packaged within the engine cover module (forward of the dash above the engine), is the HVAC unit. This location provides additional package space within the passenger compartment. As shown in Sec-A, Figure 6.3.2-4, air is transferred from the HVAC between the A-brace diagonal structure, to the air distribution unit incorporated within the instrument panel. Additional lateral support is provided by the front floor closeout panel, creating a closed box section rear of the dash panel inboard of the crash box.

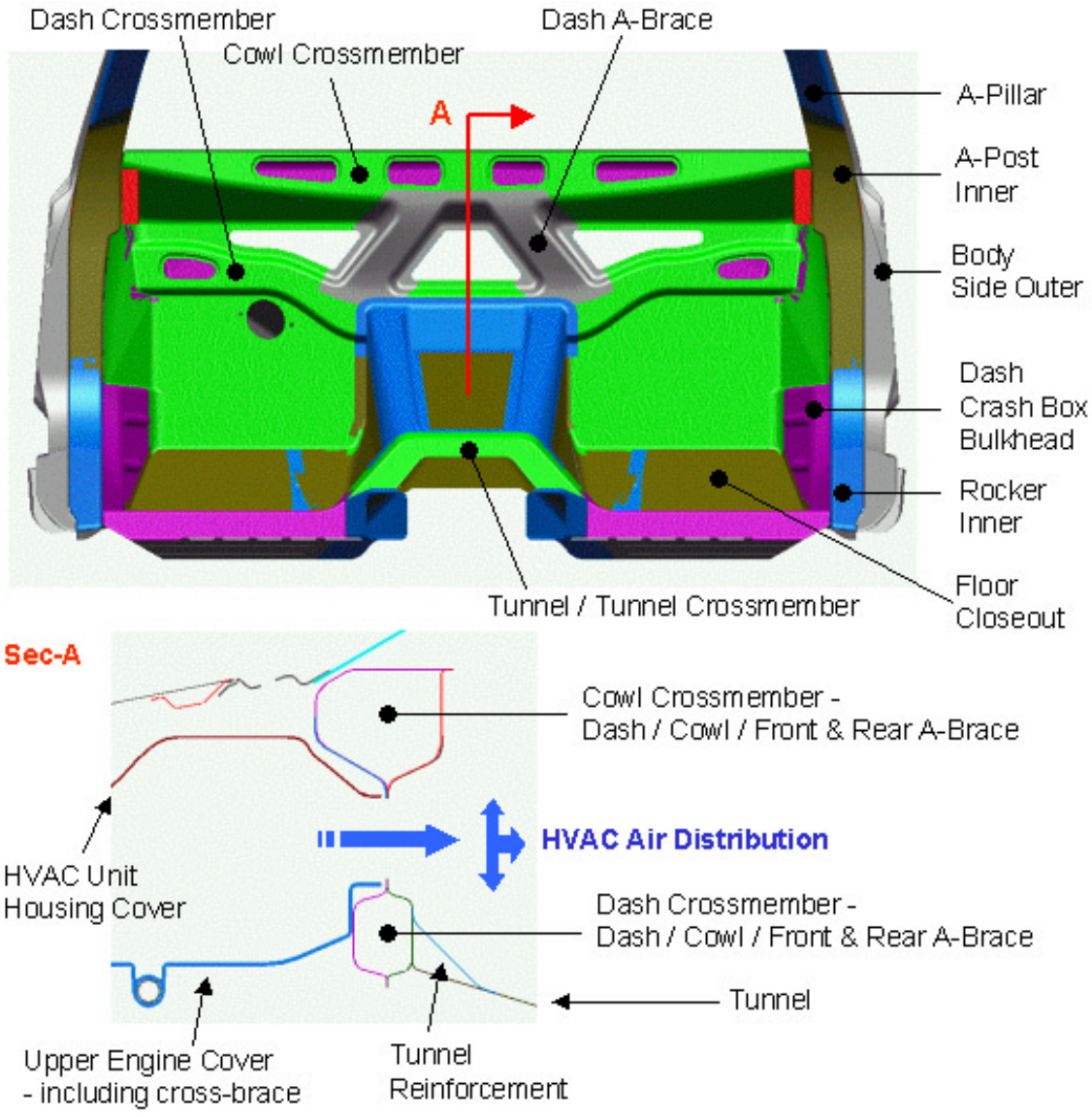



**Figure 6.3.2-4 Front-end structure rear view**

## 6.4 Side Structure

The rocker structure as shown in Figure 6.4-1 for C-Class and 6.4-2 for PNGV-Class is identical forward of the C-Class B-pillar reinforcement and forward of PNGV-Class lower B-pillar reinforcement. To optimize the rocker and A-post sections to reduce part count, and to eliminate unnecessary joints, there are no inner rocker and a-post reinforcements or bulkheads. To compensate, the rocker inner and body side outer panels are manufactured from tailor welded blanks. Furthermore, the door hinges incorporate the hinge stem passing through the A-post, and welded to the A-post inner and body side outer panels.

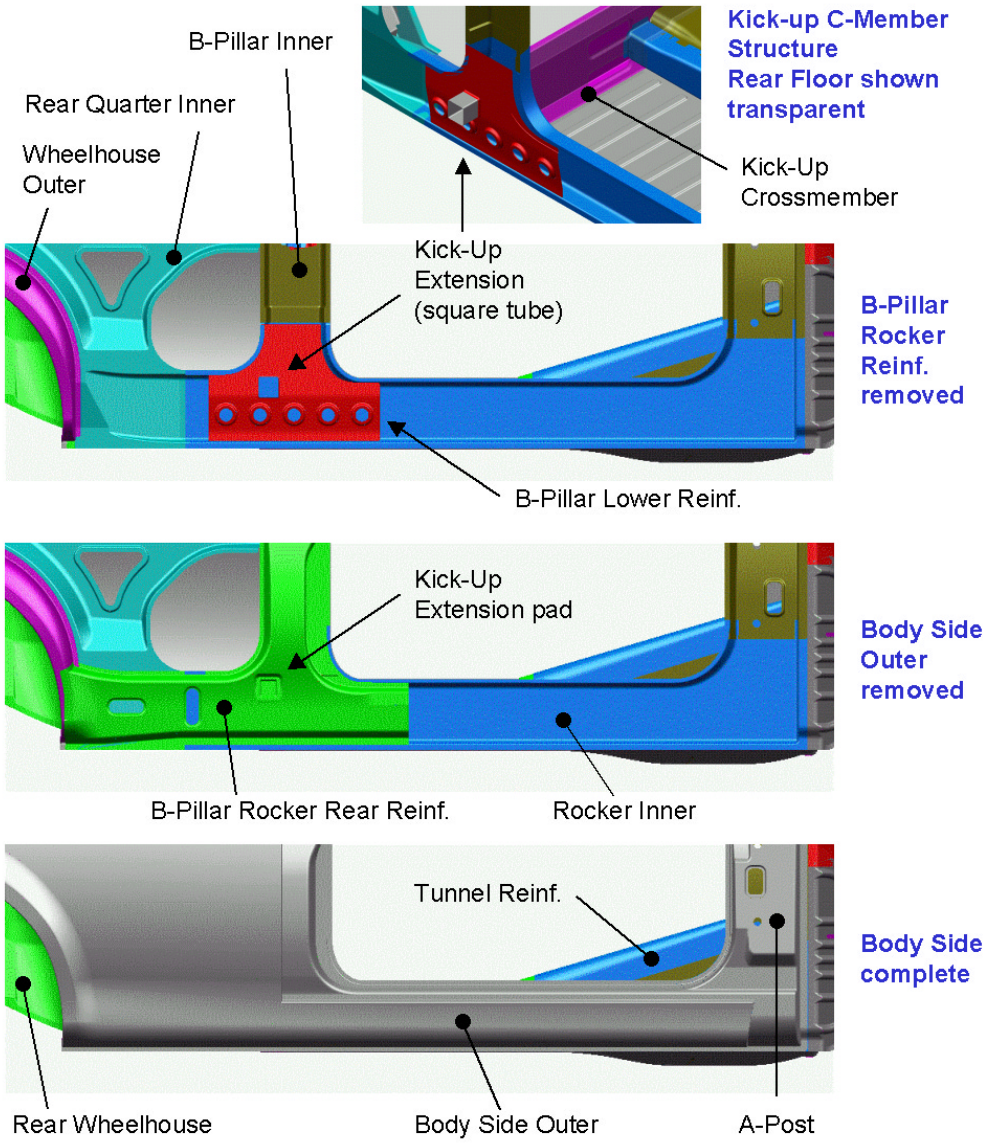



**Figure 6.4-1 Rocker with kick-up crossmember C-Class**

Between the rocker inner panels, the kick-up crossmember structure is identical for C-Class and PNGV-Class. Nevertheless, due to package criteria, the PNGV-Class kick-up is 85 mm further rearward in vehicle. To maintain the same joint structure for both body variants, the PNGV-Class front rails, front floor and tunnel are extended by 85 mm. The kick-up crossmember incorporates a rectangular closed box section. The rear vertical wall is a single stamped part, whereas the forward vertical wall and top surface is part of the tailor welded four-blank rear floor. The front rails and tunnel pass through the box section, providing weld joints front and rear.

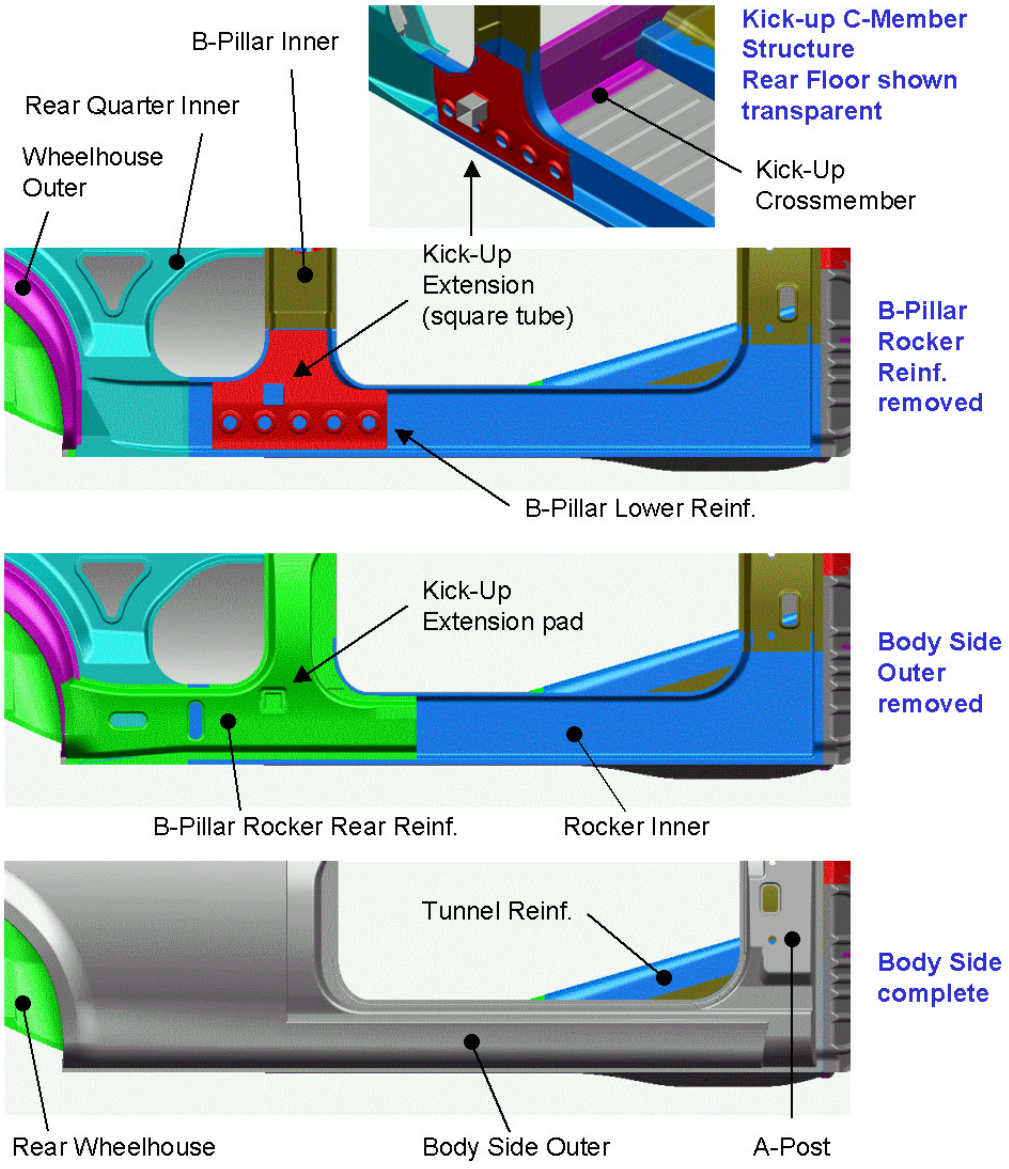



**Figure 6.4-2 Rocker with front seat rear crossmember PNGV-Class**

## 6.5. Rear End Structure

### 6.5.1. C-Class

The rear longitudinal rails consist primarily of three components – rear floor, rear rail and wheelhouse inner. To optimize for body stiffness, crashworthiness, and mass reduction, all three parts are manufactured from tailor welded blanks. The floor panel forms the upper and (upper) inside wall, the rocker panel forms the lower and inside wall, and the wheelhouse panel forms the outer vertical wall of the rear rail.

Unlike the 4-door PNGV-Class rocker that uses the body side outer panel to close the rocker section rear of the b-pillar, the C-Class (no rear door) uses the b-pillar/rocker reinforcement to do this. While maintaining a smooth and consistent transition from rocker to rear rail, the design provides adequate package space for the fuel tank (see Figure 6.5.1-1). The tank is packaged on the right side of vehicle between the kick-up and suspension crossmember. Integrated within the rail section, is the suspension trailing arm attachment reinforcement.

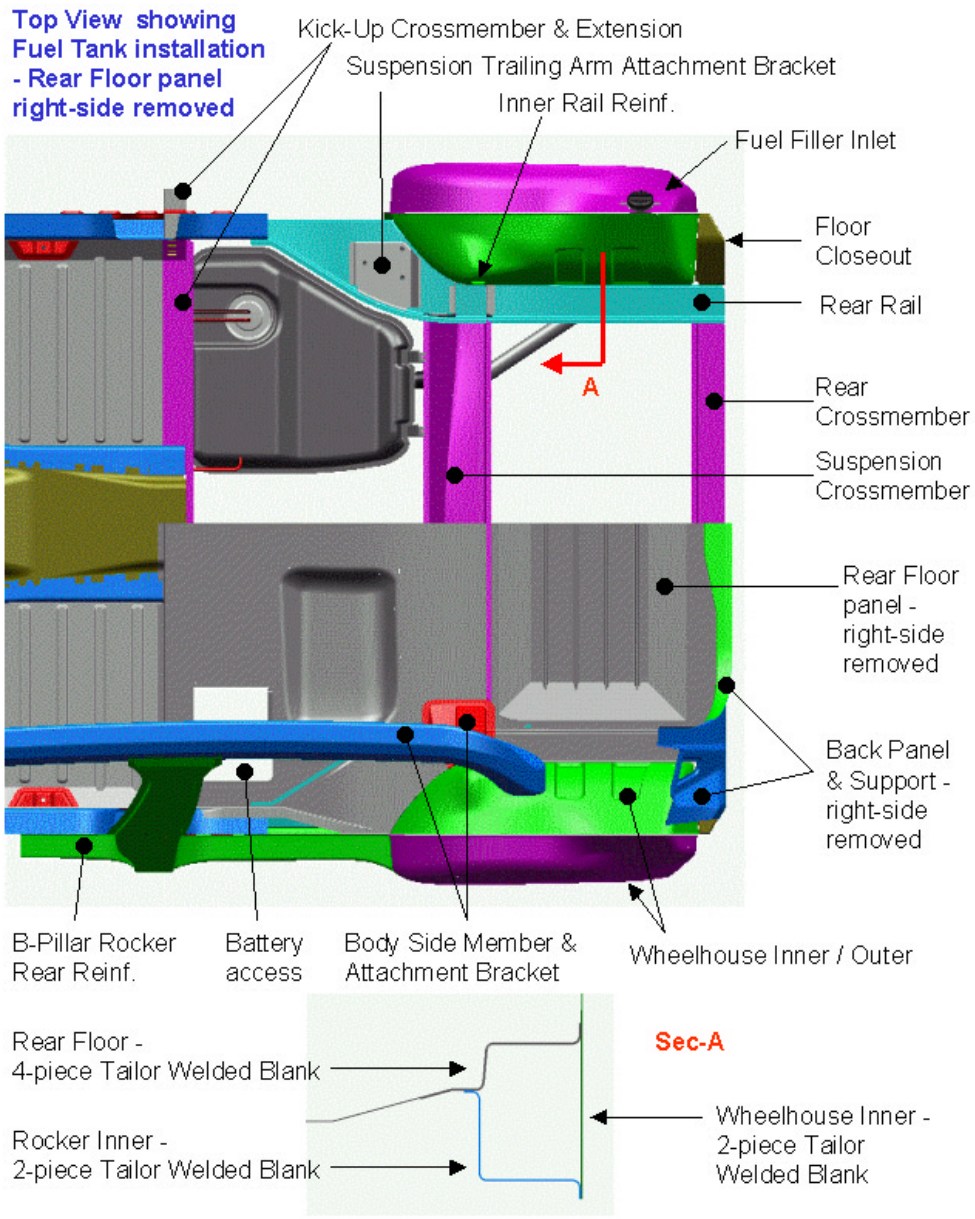



**Figure 6.5.1-1 C-Class rear floor structure (top view)**

The U-profile suspension crossmember is laser welded to the rear floor, creating a closed box section below the floor. The crossmember creates an important load path between the rails. Furthermore, due to the attachment of the body side member directly above the rail at this connection, this joint is one of the most significant on the entire body structure. Here the suspension spring attachment reinforcement is laser welded to the rail lower surface. Within the joint and rail section, and directly above it, are two important reinforcements.

The inner rail reinforcement is designed to maintain rail section, to provide backup for suspension spring loads, and the body side member attachment bracket reinforces the section from above.

Connecting the rear floor, back panel and rails is the L-profile rear crossmember. Rear crash loads are transferred through the rails via the bumper beam and rear crash box (not shown). Identical in design to the front bumper crash box, but shorter due to different package and crash behavior requirements, the rear bumper crash box is a two-piece stamping used for attachment of the fascia module to the rails and back panel.

Using the same joint and design principles, the kick-up crossmember, suspension crossmember, rear crossmember, and all rear suspension attachment reinforcements are common parts used on both C-Class and PNGV-Class structure.

### 6.5.2. PNGV-Class

PNGV-Class rear body structure (see Figure 6.5.2-1) employs the same joint and design parameters as the C-Class structure, such as kick-up crossmember, suspension crossmember, rear crossmember, and all rear suspension attachment reinforcements. In principle, the longitudinal rear rails have similar characteristics as C-Class structure, but they are an extended version. The rails consist primarily of three components – rear floor, rear rail and wheelhouse inner - all three components using tailor welded blank technology for optimum rail performance. Both vehicle variants have a rear floor extension, the PNGV-Class extension is considerably longer, and is tailor welded. Separating the wheelhouse from back panel, the floor extension forms the outside vertical wall of the rail section, replacing that of the wheelhouse, and closing off the section.

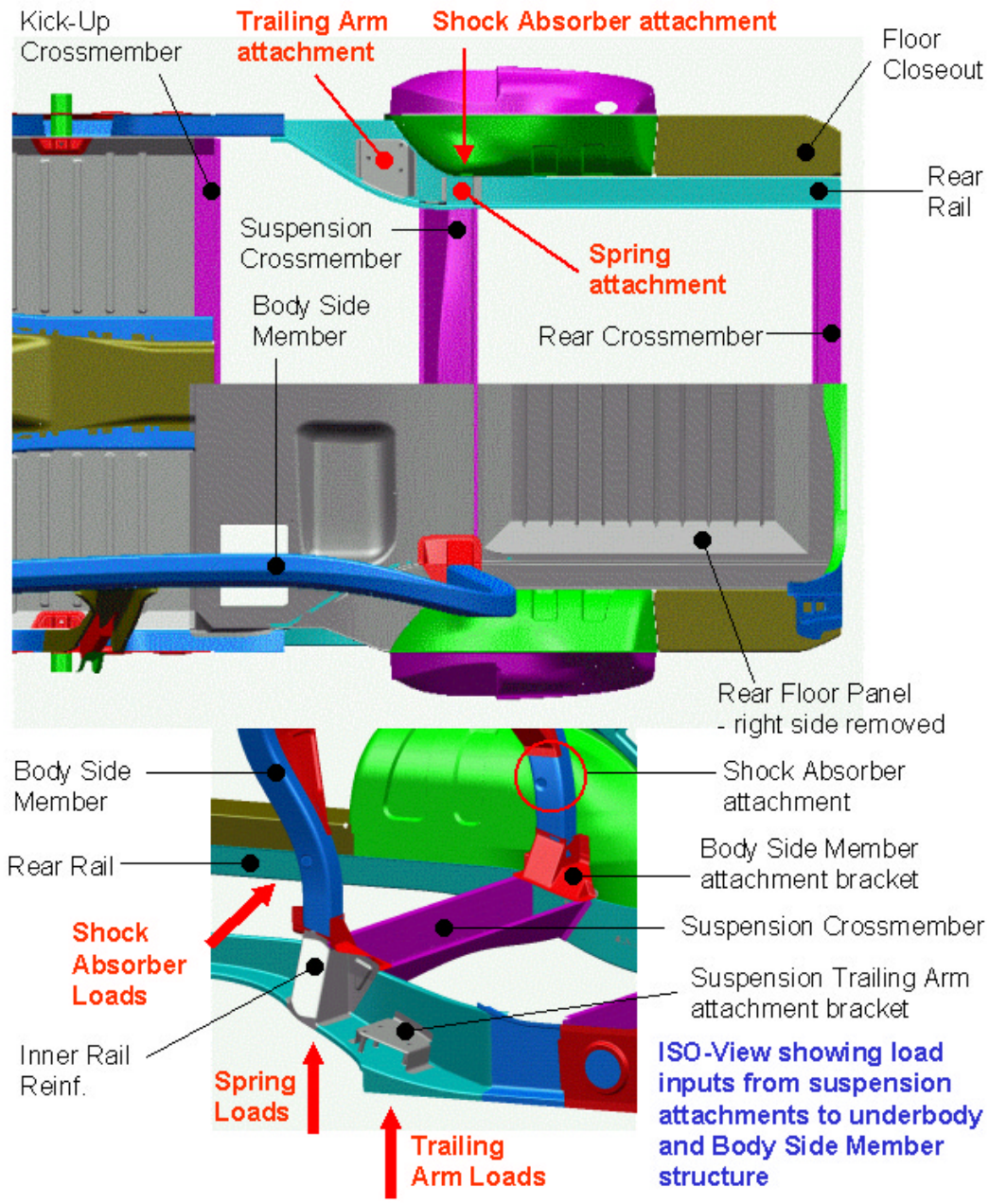



**Figure 6.5.2-1 PNGV-Class rear floor structure (top and isometric view)**

A vertical wall portion of the quarter inner panel, reinforces the transition from rocker to rear rail, for both structural and manufacturing reasons. It forms a connection between the wheelhouse inner-outer slip plane weld flange and the rocker inner panel. Welded to this inside wall, is the rail inner panel. The front tailor welded blank is manufactured from DP 700/1000 with a thickness of 1.8 mm. Complimenting this, and closing off the rail section as it transitions rearward, are the rear floor panel and wheelhouse inner panels, with material types DP 350/600 and DP 700/1000 and material thicknesses of 1.1 mm and 1.4-mm respectively. In this area, the suspension trailing arm is attached to the lower surface of the rail, by a reinforcement incorporated within the rail section. The 5-blank tailor welded body side outer panel closes off the outside of the rocker rear end. This portion of the outer panel is manufactured from DP 700/1000, with a thickness 1.2 mm. - forward of this the outer panel blank thickness is 1.8 mm.

## 6.6. Upper Structure

### 6.6.1. C-Class

The most distinct aspect of the upper structure is the two tubular body side members designed to transfer loads between the A-post and rear longitudinal rails; as the tubes incorporate the A-pillar, roof side rail and partial C-pillar structure. Each member is hydroformed from an 85 mm diameter DP 500/800 tube, with a material thickness of 1.0 mm. At the front end, loads are transferred from the front rails through the dash crash box into the members at the A-post. The tube diameter is expanded and material axially fed into the tool during the manufacturing process (tubular hydroforming). In this way, a larger weld surface is created at the A-post joint.

Figures 6.6.1-1 and 6.6.1-2 show the two tubular hydroformed body side members located in the C-Class body structure.

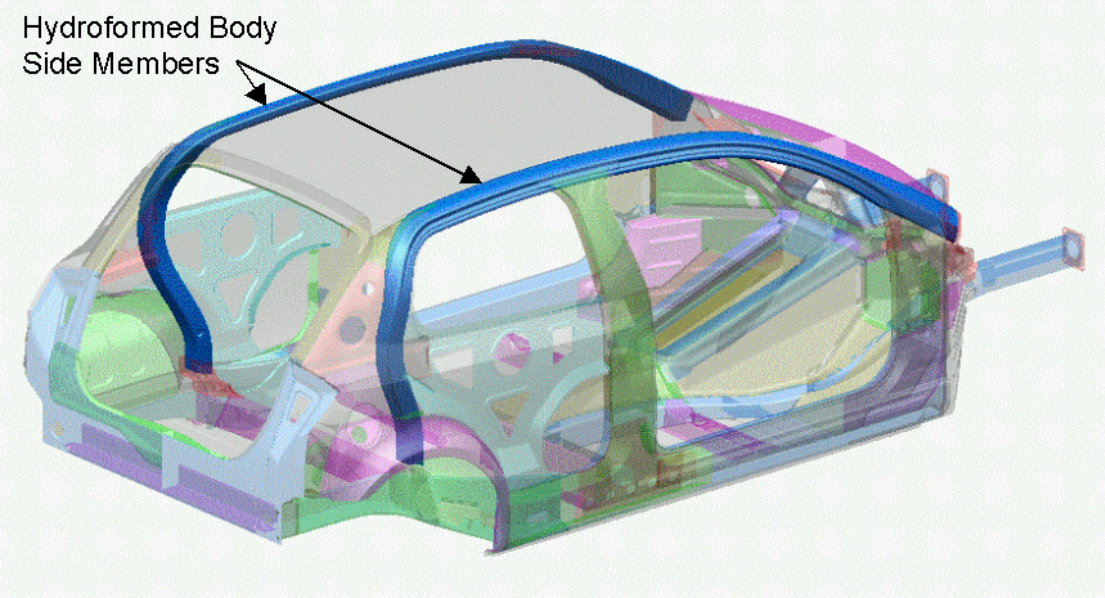



**Figure 6.6.1-1 C-Class tubular hydroformed body side members 3/4 rear view**

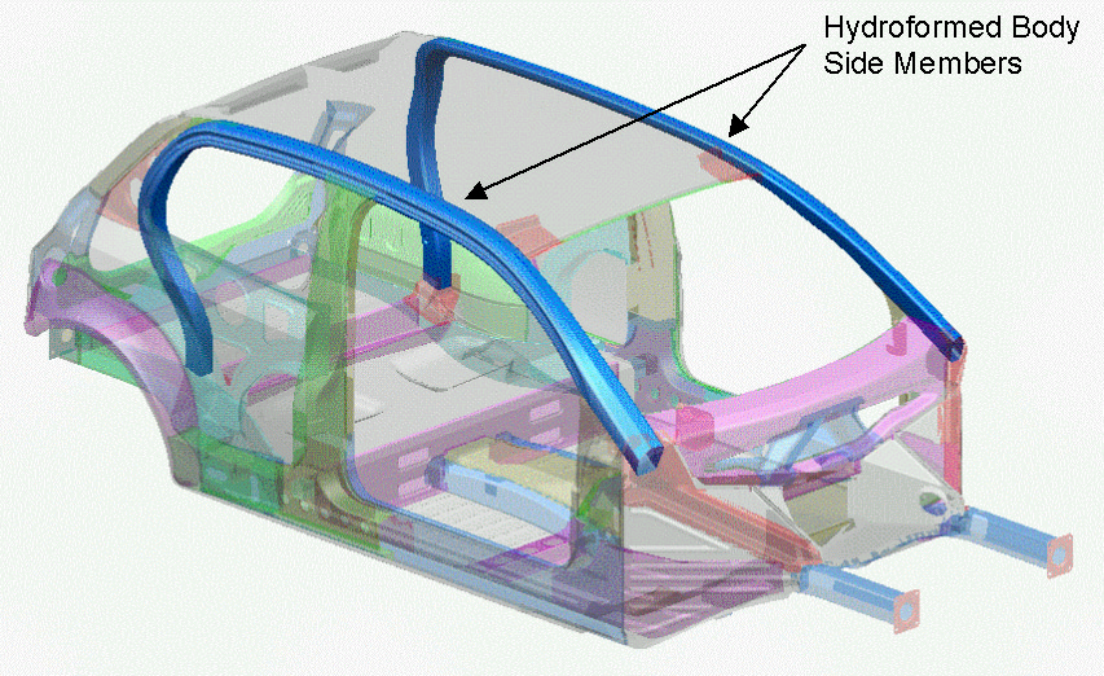
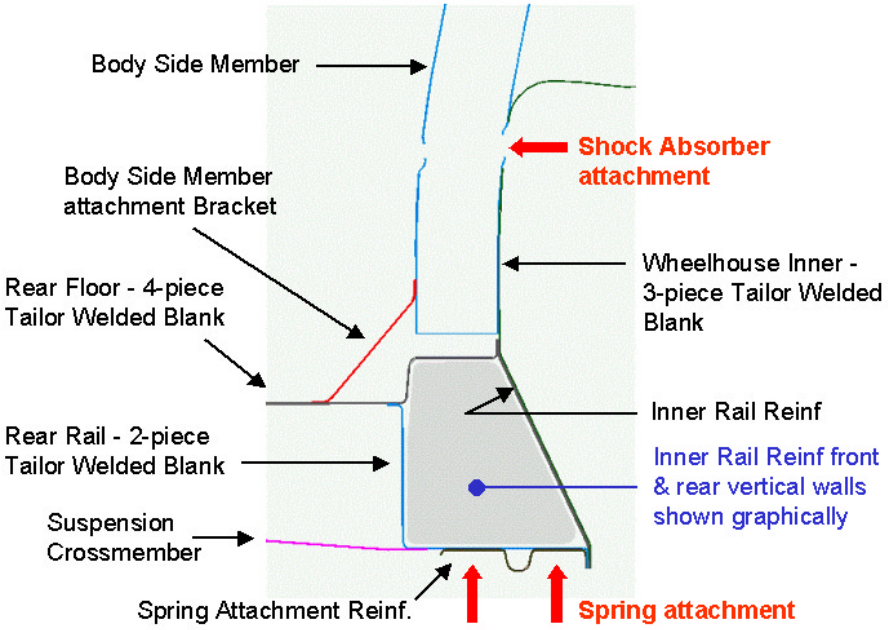



**Figure 6.6.1-2 C-Class tubular hydroformed body side members 3/4 front view**

At the rear, the body side members are attached on the top surface of the rear floor (upper part of the longitudinal rails) with a bracket connecting both longitudinal rails and rear rail upper surface (see Figure 6.6.1-3). Positioned directly below the body side member, and attached to the inner reinforcement on the rail lower surface, is the suspension spring reinforcement. The suspension shock absorber attachment bushings are integrated into the tube, and are reinforced by the member attachment bracket. With this arrangement, loads are transferred from the suspension spring and the shock absorber attachments from the outside into the longitudinal rails and the body side members.



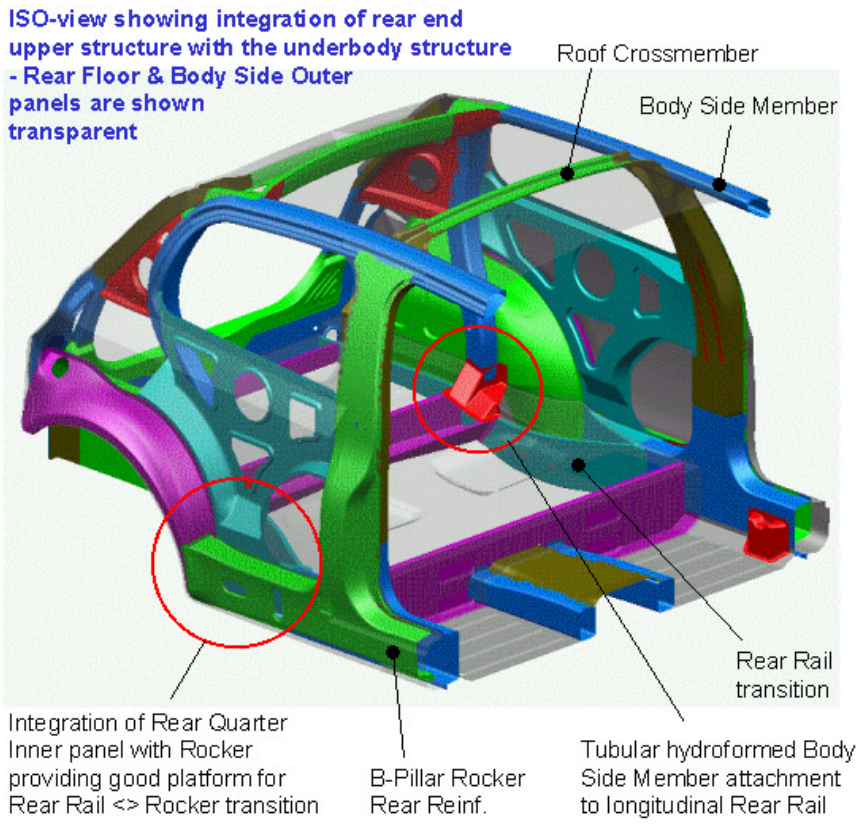




**Figure 6.6.1-3 C-Class Rear end upper structure**

The two body side members are as essential to the ULSAB-AVC upper structure architecture as the front longitudinal rails are to the underbody structure. For improved body stiffness and for manufacturing reasons, much consideration was given to the rear header to C-pillar joint concept as shown in Figure 6.6.1-4. The header panel, front adhesive bonded and rear welded to the roof panel, creates a closed box section at each end. This design, not only creates a good joint, but provides a welding base for the roof panel.

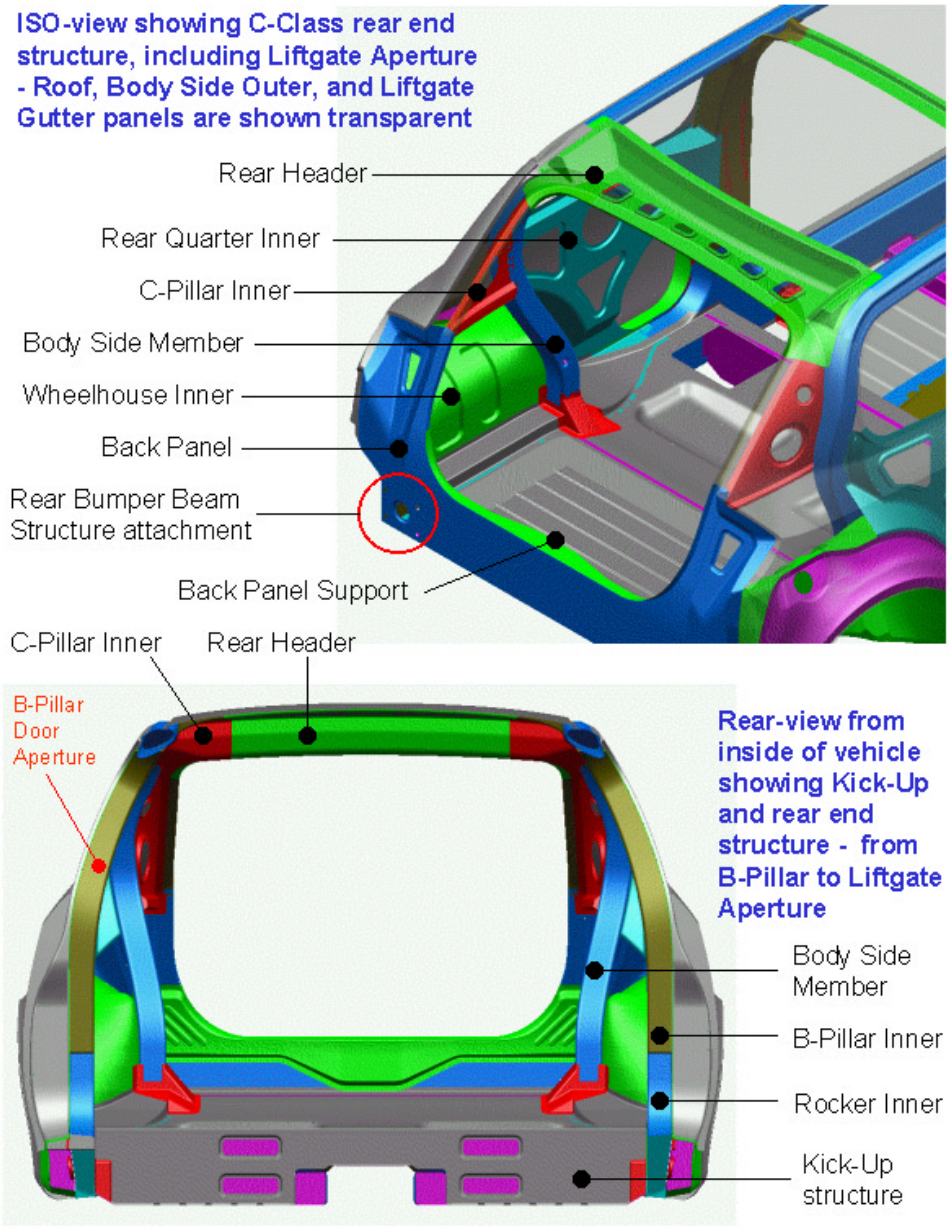



**Figure 6.6.1-4 C-Class rear end structure**

### 6.6.2. PNGV-Class

Identical in principle as the C-Class concept, the PNGV-Class upper structure employs two hydroformed members (see Figures 6.6.2-1 and 6.6.2-2), designed to transfer loads between the a-post and rear longitudinal rails, as the tubes include the A-pillar, roof side rail, and partial C-pillar structure.

The design concept also integrates the package tray structure. Each member is hydroformed from an 85 mm diameter DP tube 500/800, with a material thickness of 1.0 mm. At the lower a-pillar, loads are transferred from the front rails though the dash crash box into the body side members. Although different at the rear end, the body side member terminates at the rear rail in an identical manner as its C-Class counterparts, while using the same components for joining of the body side member to the rear (see Figure 6.6.2-3).

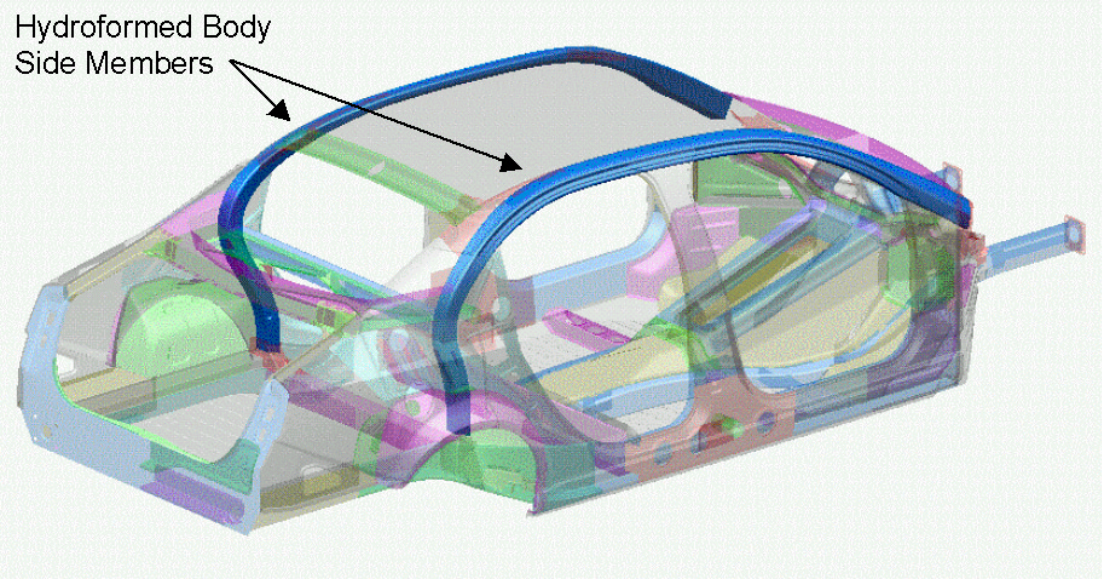



**Figure 6.6.2-1 PNGV-Class tubular hydroformed body side member 3/4 rear view**

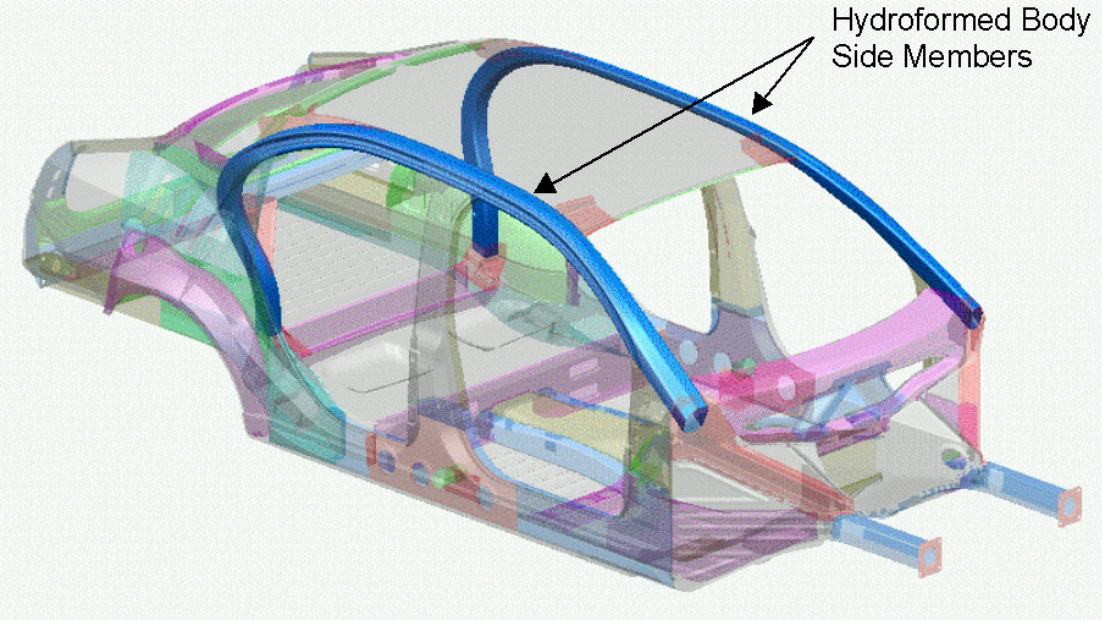



**Figure 6.6.2-2 PNGV-Class tubular hydroformed body side members 3/4 front view**

At the juncture at which the body side members deflect from the roof panel, and redirect towards the rear longitudinal rails, the rear header support panels, which are laser welded to the side members, provide a good structural platform and weld surface for the roof panel. The roof panel is joined to the structure during final assembly, with the application of one continuous laser weld on both sides of the vehicle structure.

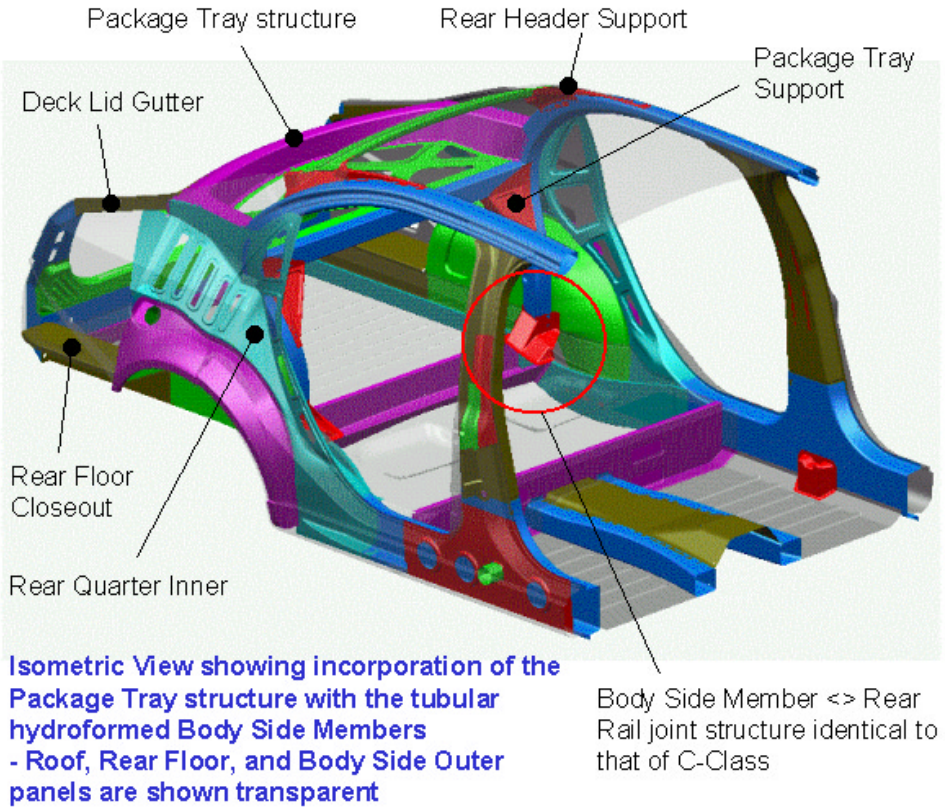



**Figure 6.6.2-3 Upper structure PNGV-Class 3/4 front view**

Much attention has been given to the package tray design concept. The rear seating arrangement employs a 60/40 split seat back and seat cushion. Similar to that of C-Class, both cushions tilt forward independently in the vehicle, allowing the back rests to tilt and lay flat. This provides package space and access from the rear of the vehicle. For this reason, it was imperative to develop a package tray concept without either diagonal braces or a sheer wall that would otherwise restrict access.

The package tray assembly is shown in Figure 6.6.2-4. The package tray crossmember consists of a 72 mm square DP tube 280/600 with a material thickness of 1.0 mm. The crossmember vertical walls are aligned with those of the body side members, and are supported by the package tray support brackets that are laser welded to the body side members and to the package tray crossmember. The tray upper is an inverted U-profile stamping that provides the rear glass attachment surface, and is laser welded forward in the vehicle

to the body side members above the crossmember joints. The package tray lower panel, which is laser welded to the crossmember top surface, closes the U-section package tray upper from underneath. This package tray design, which incorporates the package tray crossmember provides a cross-vehicle load path, which is important for torsional rigidity of the structure.

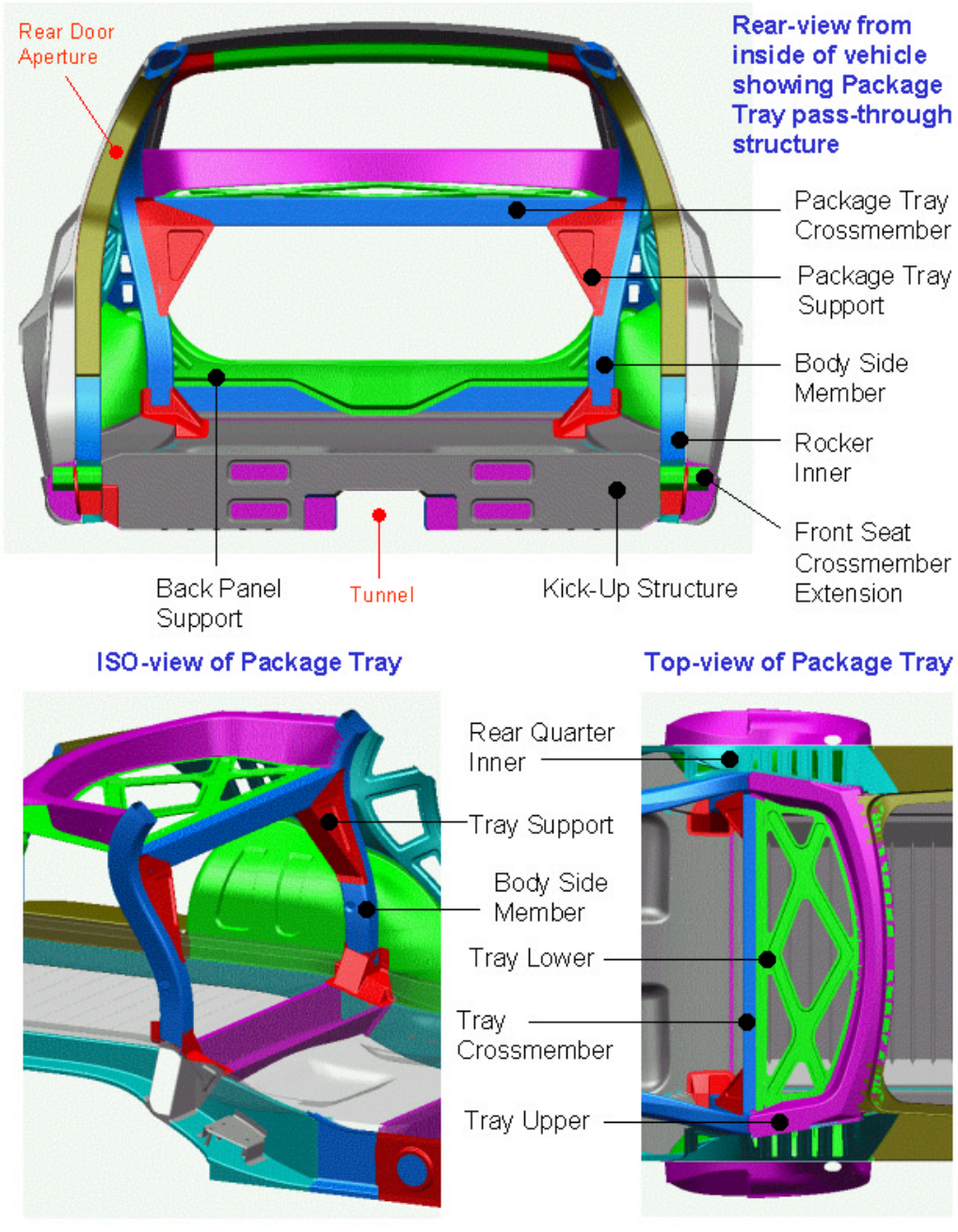



**Figure 6.6.2-4 Package tray**

## 6.7. B-Pillar Structure

### 6.7.1. C-Class

In the C-Class B-pillar design (see Figure 6.7.1-1), the design criteria included the US-SINCAP 38.5 mph side impact event, Side Pole crash event and the Roof Crush. The B-pillar design concept contributes largely towards meeting the stringent demands imposed by these crash events. Unlike the PNGV-Class structure, the absence of a rear door presented a challenge, resulting in a very different approach for C-Class than for PNGV-Class.

A U-profile B-pillar inner panel connects the rocker to the body side member. Creating a closed section, a full-length B-pillar inner reinforcement is incorporated into the rocker section, between the lower B-pillar joint and wheelhouse.

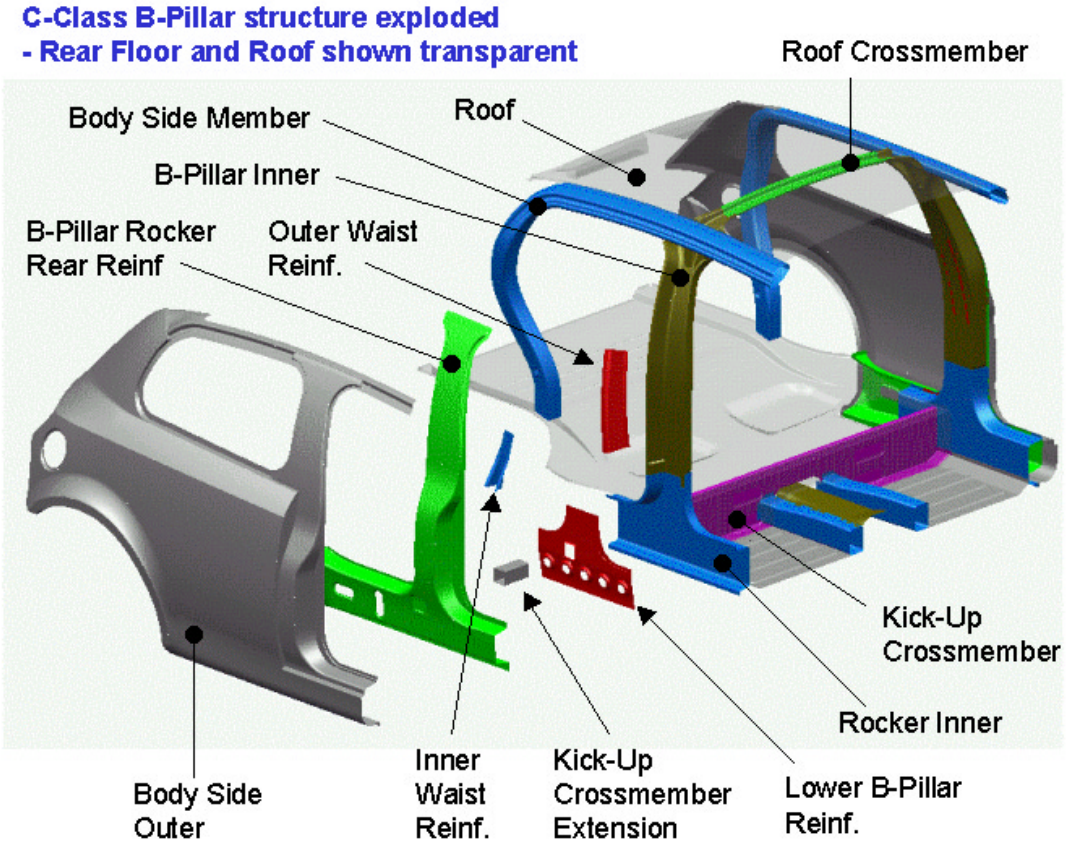



**Figure 6.7.1-1 C-Class B-Pillar structure partial exploded view**

The lower joint has a flat reinforcement, creating a sheer plane between the lower rocker weld flange, and the door aperture seal attachment weld flange. Passing through the reinforcement laterally is the kick-up crossmember extension is a 55-mm square section Mart tube 950/1200 with a material thickness of 1.2 mm (see Figure 6.7.1-3). This tube transfers load in the side crash events into the kick-up crossmember.

To restrict major B-pillar bending and deformation in Side Impact, two U-profile reinforcements (AVC# 11202 and AVC 21232) are incorporated within the closed B-pillar section as shown in Figure 6.7.1-2. They are positioned at the transition from lower pillar structure to upper glass-support structure. The inner reinforcement is welded to the B-pillar inner panel, extending the length of the transition. The opposing outer reinforcement is welded to the B-pillar reinforcement, below the waist, occupying the space created by increasing the lateral section. The reinforcements are not aligned due to the door latch packaging constraints of the 2-door hatchback.

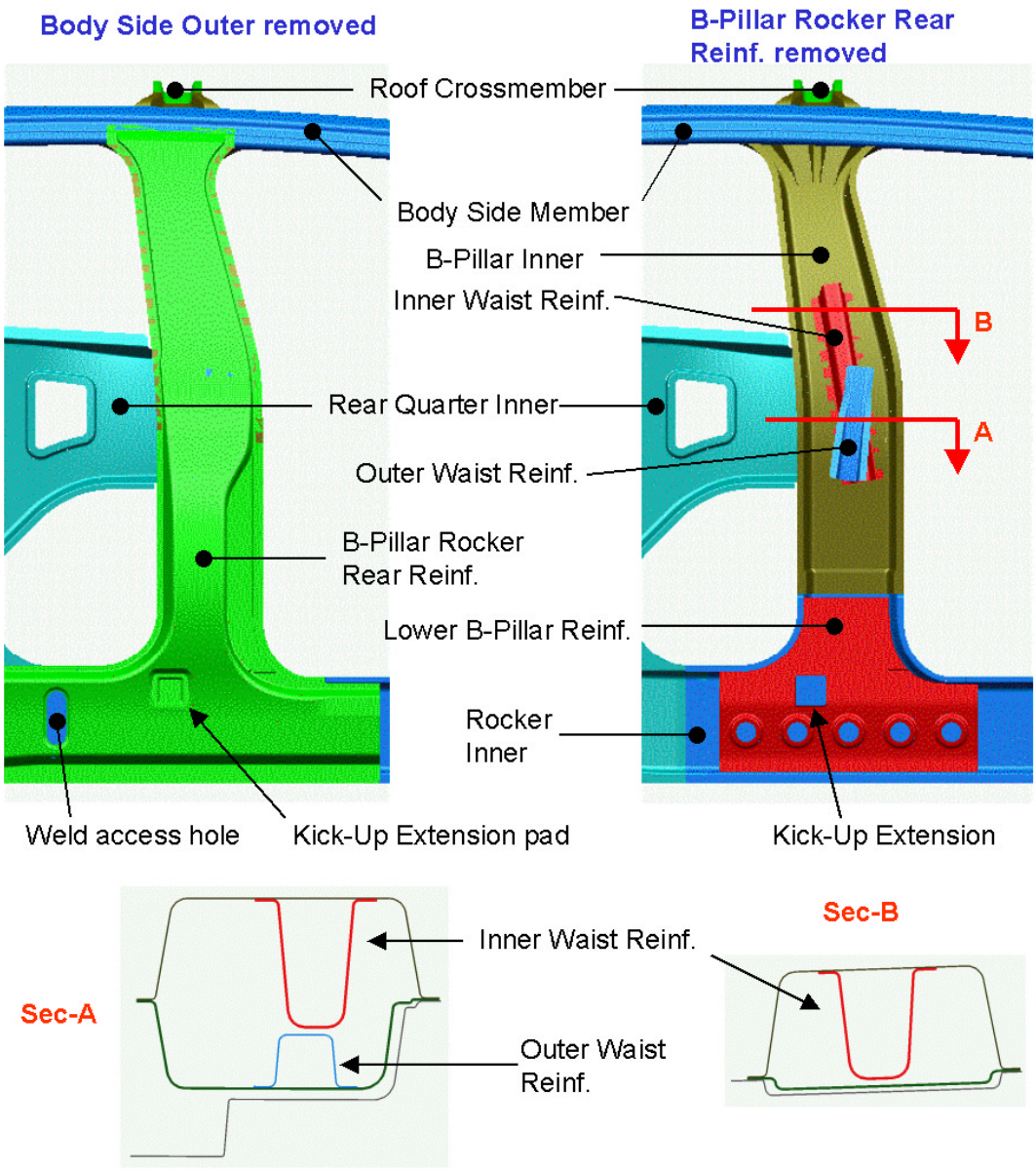



**Figure 6.7.1-2 B-Pillar structure C-Class**

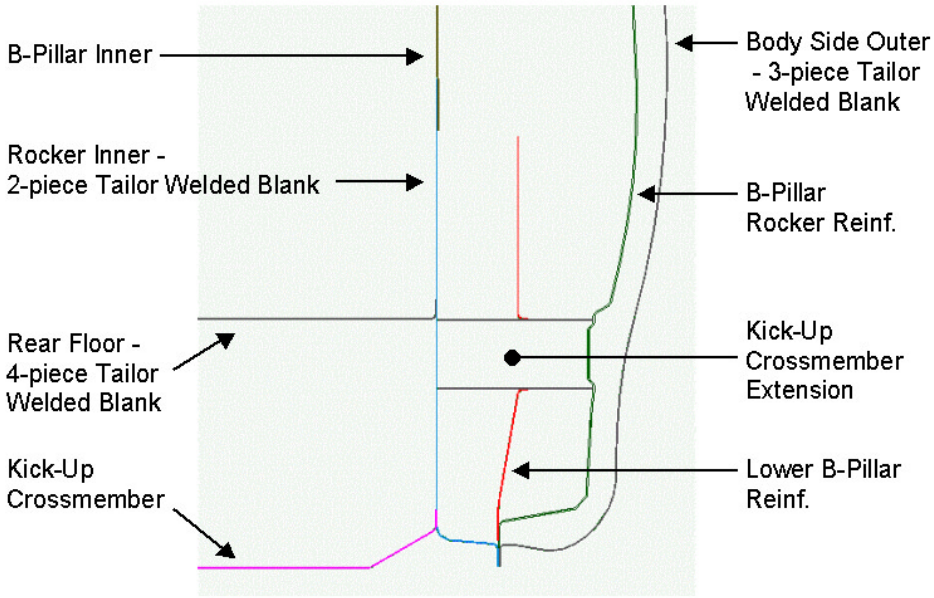



**Figure 6.7.1-3 Section through Kick-up crossmember extension**

### 6.7.2. PNGV-Class

Although equally as important as the C-Class B-pillar, the PNGV-Class B-pillar (see Figure 6.7.2-1) is different in design as a result of the requirements for a 4-door sedan.

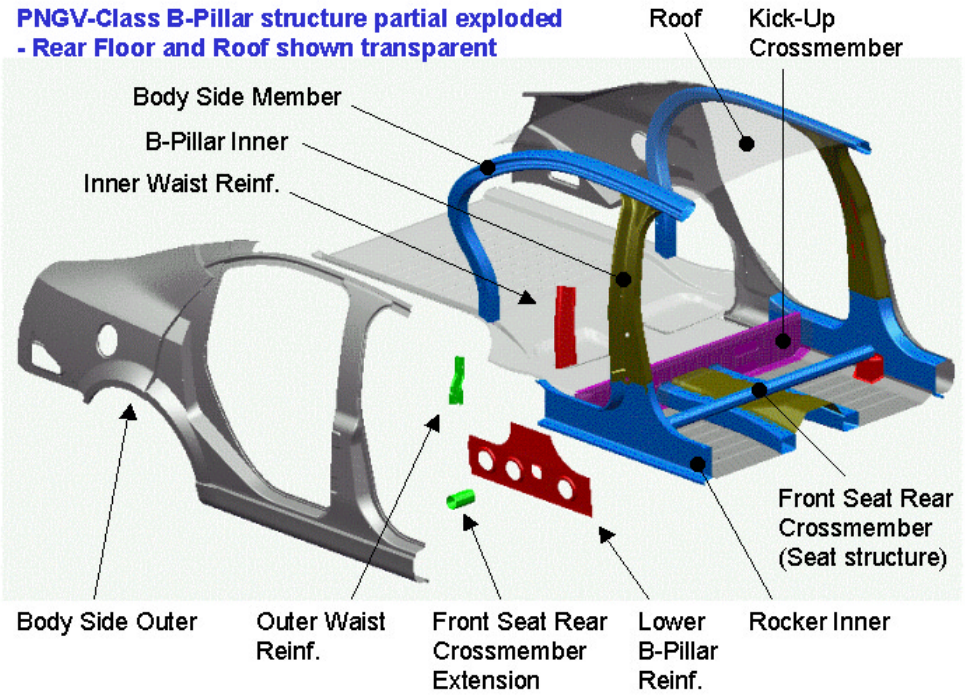



**Figure 6.7.2-1 PNGV-Class B-pillar structure partial exploded view**

As in the C-Class, a U-profile B-pillar inner panel connects the rocker inner panel to the body side member. However, in the PNGV-Class B-pillar design, a 5-blank tailor welded body side outer panel replaces the full-length b-pillar inner reinforcement. The outer B-pillar portion of the complex body side outer blank is dual phase steel, with a 700 MPa yield strength, and 1.8 mm thickness.

Similar in principle to C-Class and shown in Figure 6.7.2-2, the lower joint has a flat reinforcement that creates a sheer plane between the lower, vertical rocker weld flange and both door aperture seal attachment weld flanges. Passing through the flat reinforcement laterally is an octagonal extension Mart tube 950/1200 with a material thickness of 1.2 mm and has the same dimensions as the seat crossmember of 60 mm. Whereas, the C-Class design uses a square tube (with the same material specifications) to transfer loads into the kick-up crossmember, in the PNGV-Class design, this tube is aligned with the front seat rear crossmember matching its 60 mm size. A section through the seat crossmember and the seat crossmember extension is shown in Figure 6.7.2-3.

To restrict major b-pillar bending and deformation at the waist, PNGV-Class employs the same concept shown in Figure 6.7.2-2 as C-Class. Two U-profile reinforcements are incorporated within the closed b-pillar section. The reinforcement joined to the inner panel is common to both vehicle variants. The similar outer reinforcement is welded to the body side outer panel instead of the C-Class full length reinforcement. Both arrangements result in good side impact performance.

The door attachment system for the rear door is identical to that of the front door. The hinge body incorporates a stem that passes through the B-pillar, and that is welded to both the B-pillar inner panel and body side outer panel. In conjunction with the 1.8 mm blank thickness of the body side outer panel, this concept results in increased body structure stiffness, as well as potential reduction in both part-count and in manufacturing costs.

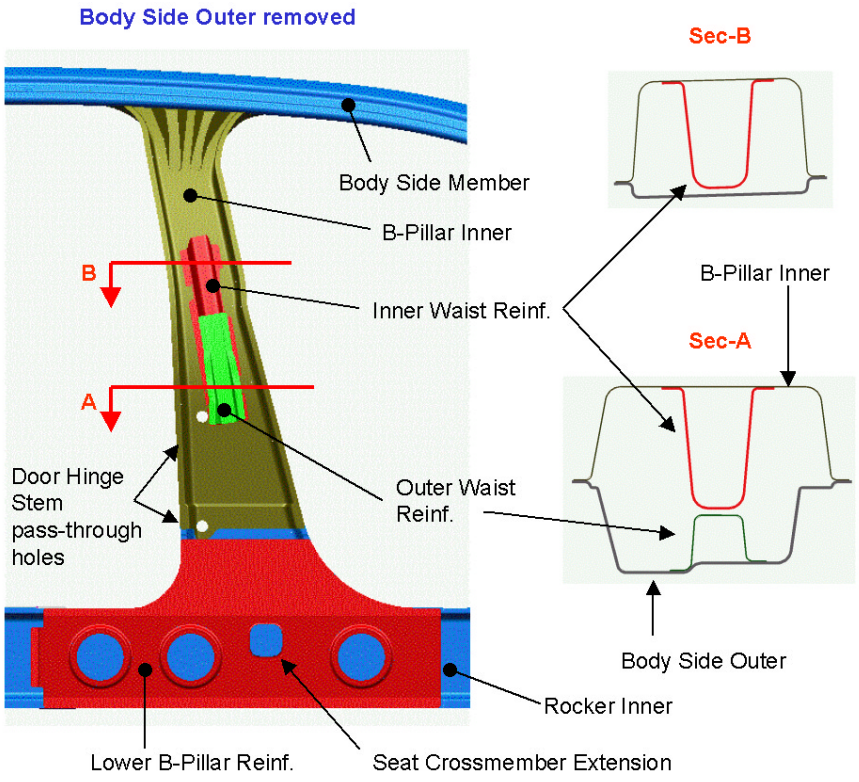



**Figure 6.7.2-2 B-Pillar structure PNGV-Class**

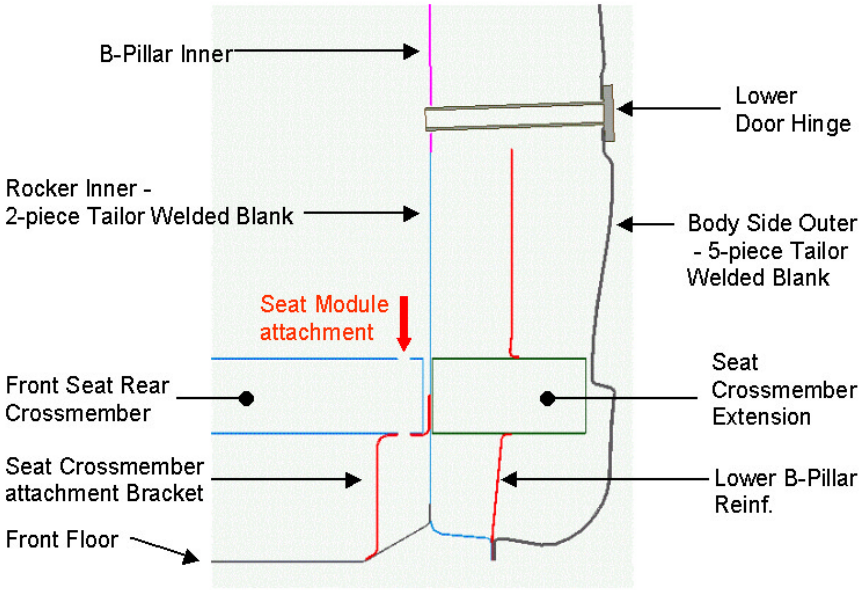



**Figure 6.7.2-3 PNGV-Class seat crossmember section**

## 6.8. Closure Structures

A comprehensive detailed description of development of criteria pertaining to doors, hood, liftgate and decklid can be found in the ULSAC Phase-1 & ULSAC Phase-2 Engineering Reports.

Closure structures for ULSAB-AVC represent concept designs, therefore, structural performances will have to be verified in a detail design phase.

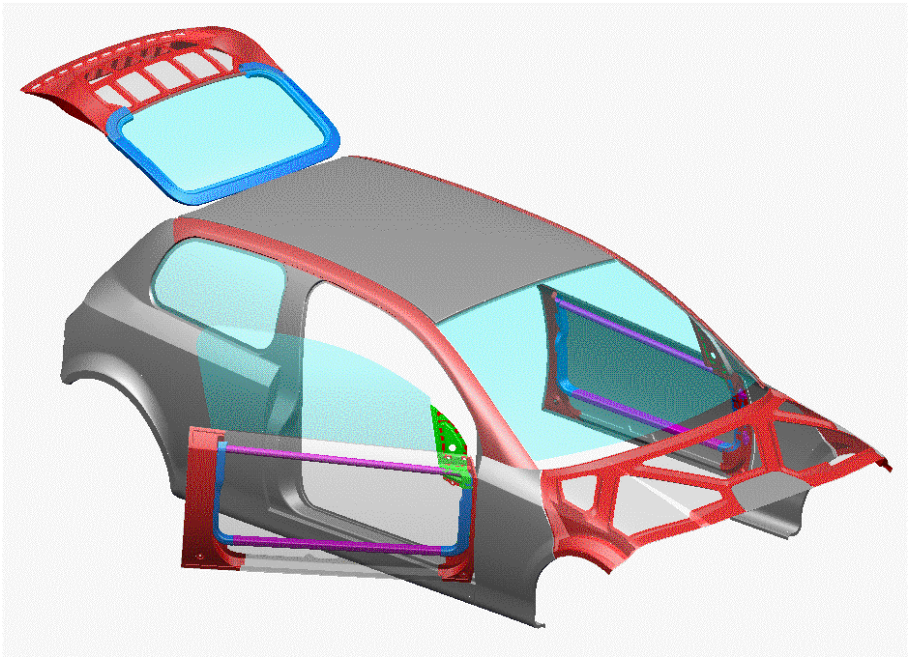


**Figure 6.8-1 C-Class closure structures including glass 3/4 front view**

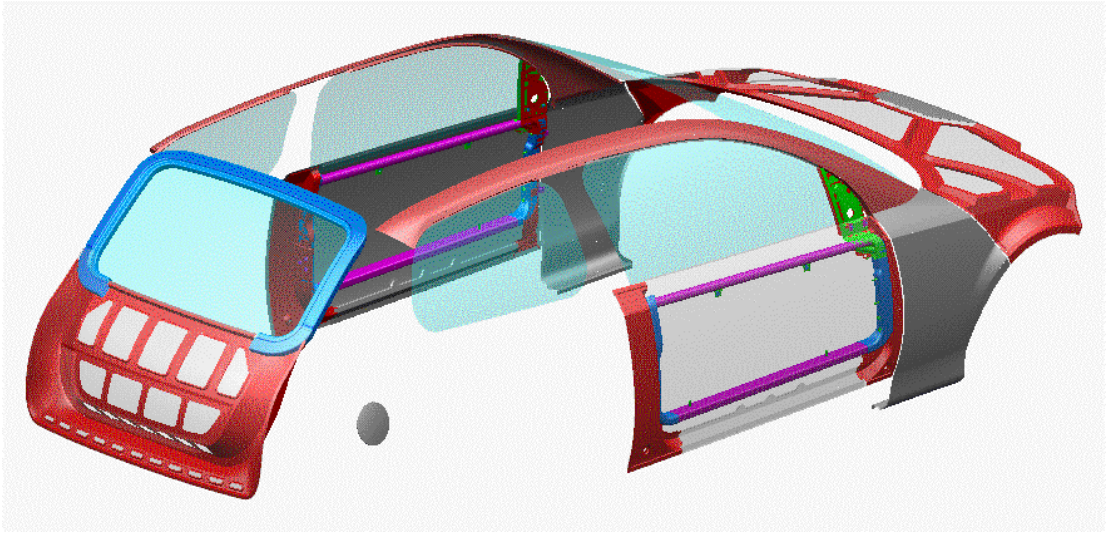


**Figure 6.8-2 C-Class closure structures including glass 3/4 rear view**

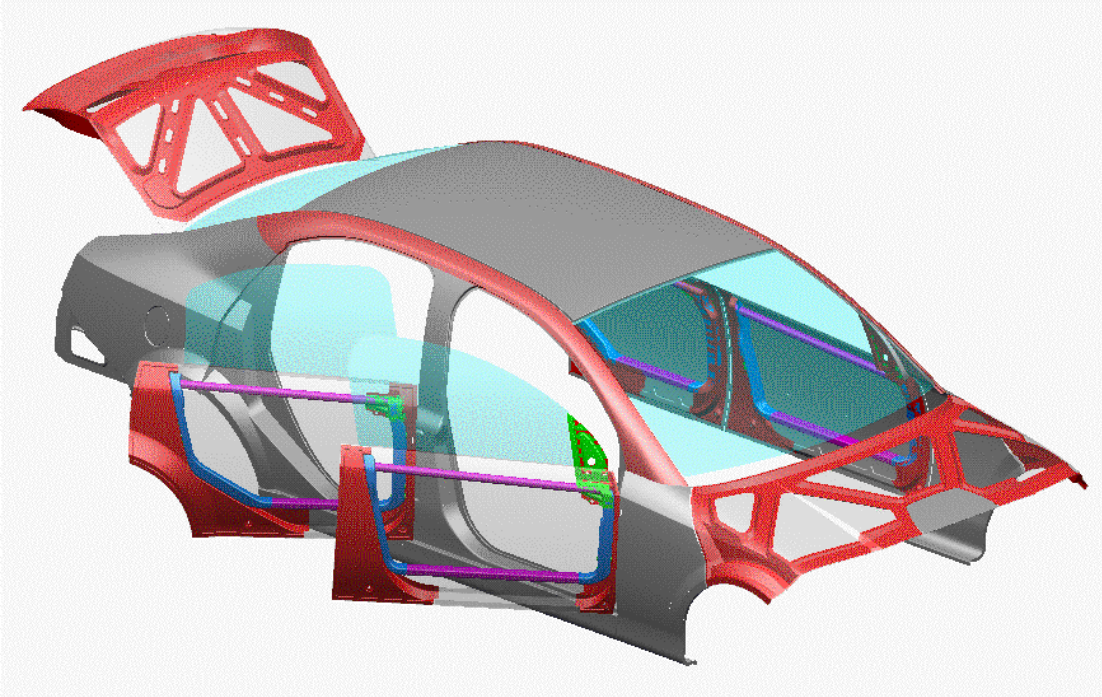


Figure 6.8-3 PNGV-Class closure structures including glass 3/4 front view

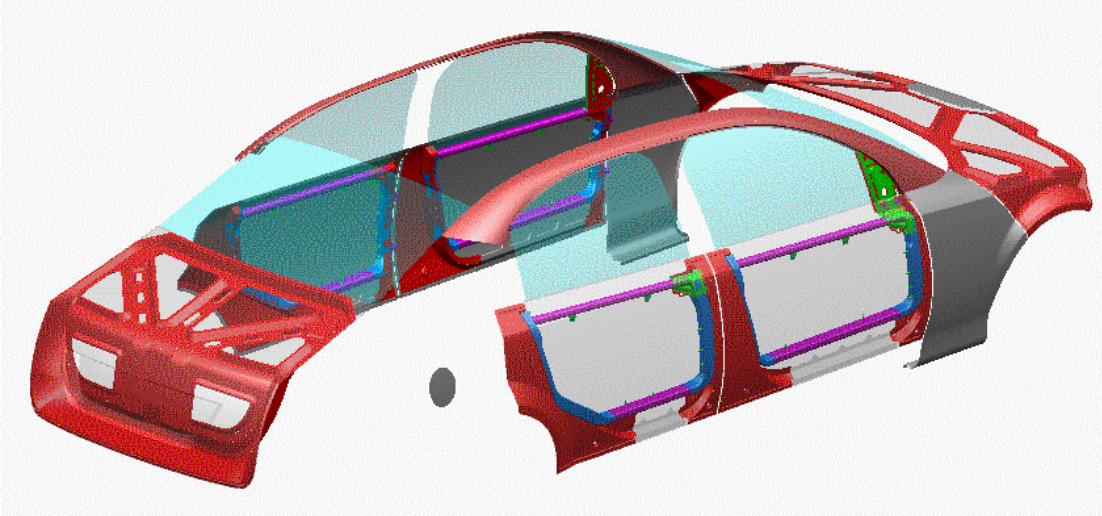


Figure 6.8-4 PNGV-Class closure structures including glass 3/4 rear view

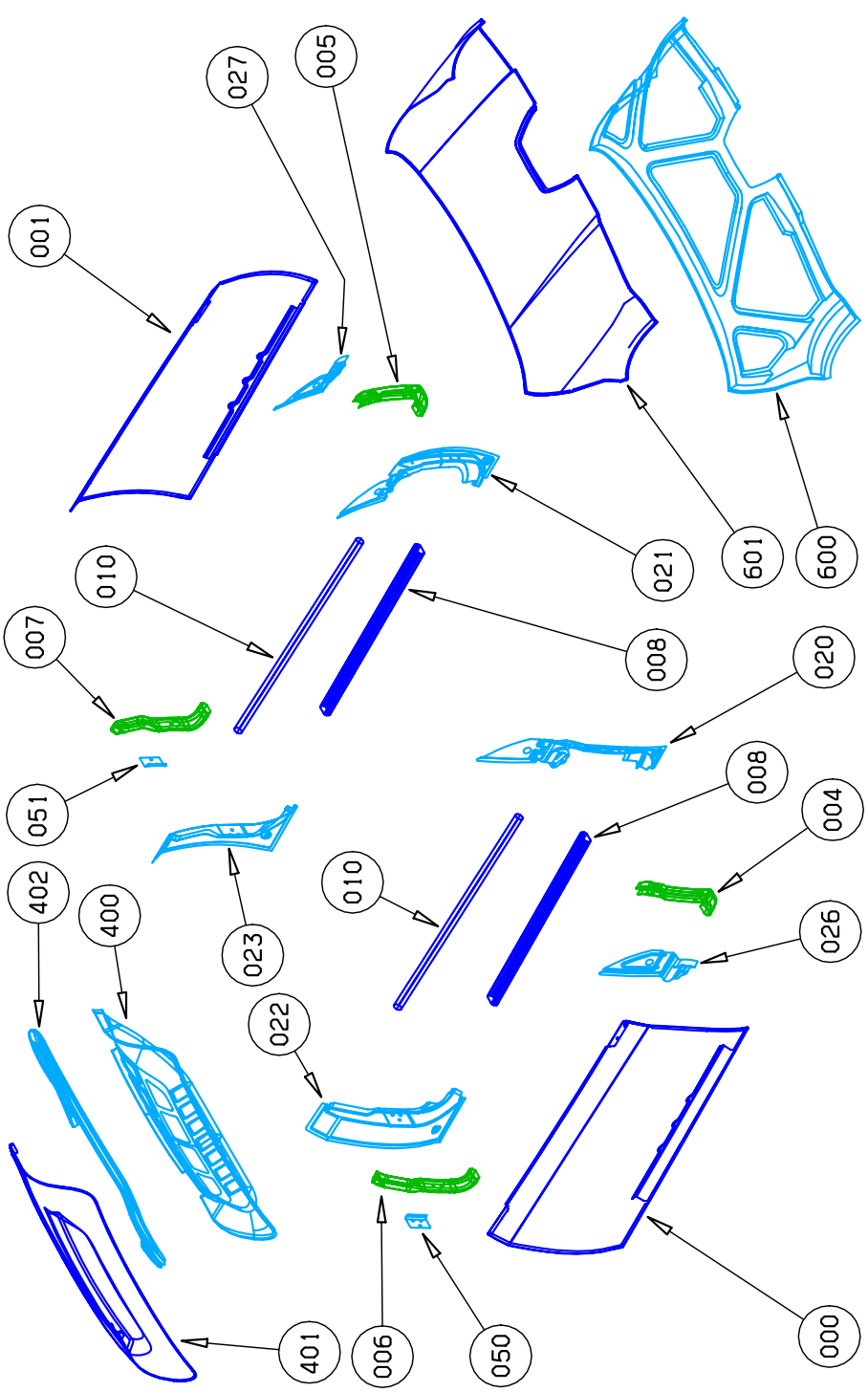



**Figure 6.8-5 Exploded view C-Class closures structure**

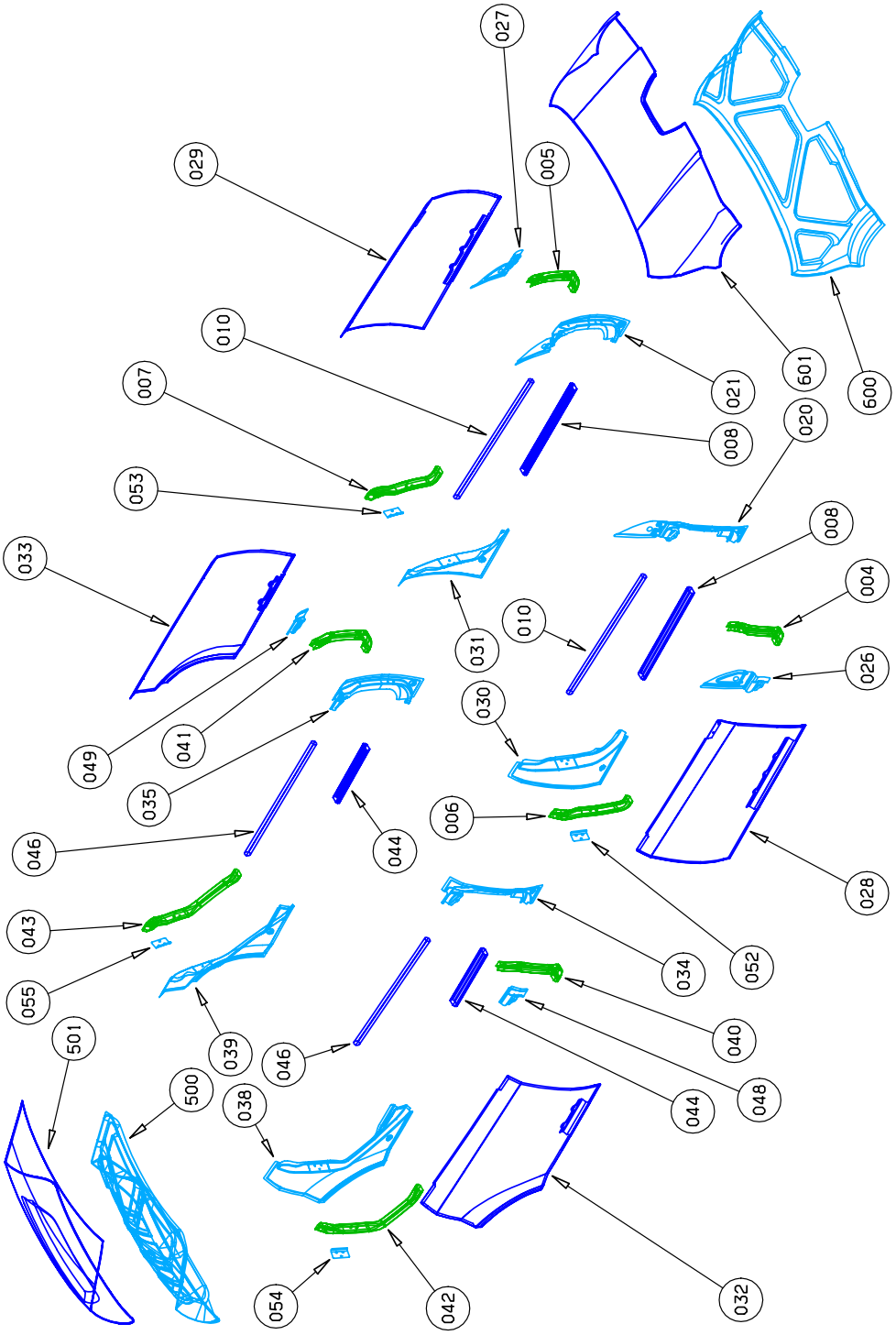



**Figure 6.8-6 Exploded view PNGV-Class closures structure**

### 6.8.1. Doors – C-Class and PNGV-Class

In principle, the same conceptual design approach, and technologies were used on the current ULSAB-AVC program, as were used during ULSAC Validation Phase.

For the ULSAB-AVC program, two front doors were developed. The C-Class door (see Figure 6.8.1-1) is an extended version of the PNGV-Class door (see Figure 6.8.1-2). In keeping with the ULSAC design, both doors employ tubular hydroformed front and rear vertical members for hinge and latch attachment, connected by straight upper and lower longitudinal tubes.

Completing the basic structure are partial front and rear inner panels, an outer panel, mirror flag panel, and latch reinforcement. The PNGV-Class rear door is very similar to the front door, except the mirror flag panel is replaced by partial front-end waist reinforcement.

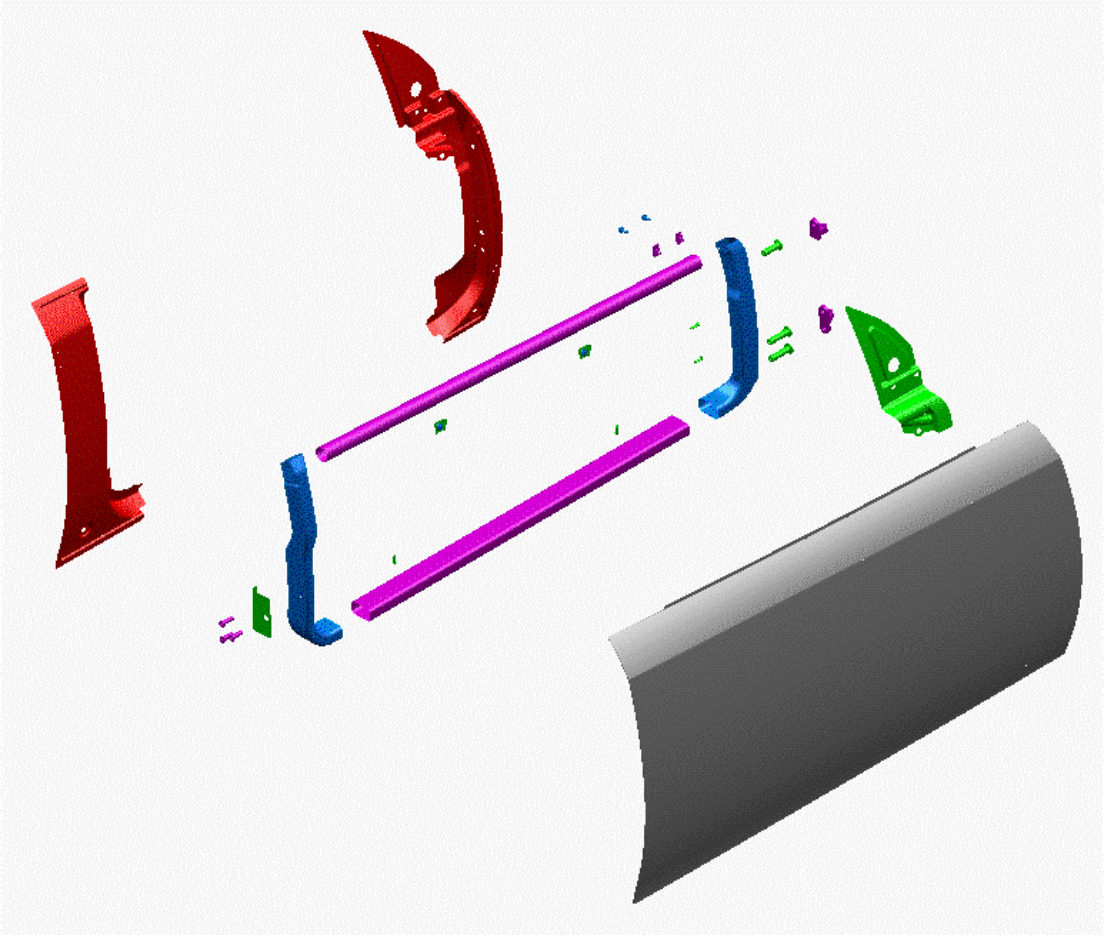


**Figure 6.8.1-1 Exploded view of C-Class Door Structure**

## Table 6.8.1-1 Parts list C-Class - Front Door RH/LH

**File Revision Level: A14 Date: 27 JUL 01**

| Number | | | Name | Revision Level | Date | Blank No. | Gage (mm) | Material Type | Grade (MPa) | | Manuf. Process Code | Designed Mass (kg) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Yield Strength | Tensile Strength | | C-Class | PNGV-Class |
| AVC | 1 | 2004 | Hinge Tube - Front Door RH | C02 | 09-Apr-01 | | 1.20 | IF * | 260 | 410 | HFT | 0.648 | |
| AVC | 1 | 2005 | Hinge Tube - Front Door LH | C02 | 09-Apr-01 | | 1.20 | IF * | 260 | 410 | HFT | 0.648 | |
| AVC | 1 | 2020 | Inner Front - Front Door RH | B03 | 10-Apr-01 | 1 | 1.00 | Mild | 140 | 270 | S/TWB | 0.500 | |
| | | | | | | 2 | 1.20 | Mild | 140 | 270 | | 0.384 | |
| AVC | 1 | 2021 | Inner Front - Front Door LH | B03 | 10-Apr-01 | 1 | 1.00 | Mild | 140 | 270 | S/TWB | 0.500 | |
| | | | | | | 2 | 1.20 | Mild | 140 | 270 | | 0.384 | |
| AVC | 1 | 2026 | Mirror Flag Outer - Front Door RH | B03 | 04-Apr-01 | | 1.00 | Mild | 140 | 270 | S | 0.330 | |
| AVC | 1 | 2027 | Mirror Flag Outer - Front Door LH | B03 | 04-Apr-01 | | 1.00 | Mild | 140 | 270 | S | 0.330 | |
| AVC | 1 | 2045 | Assy W-Reg Attach Upper - FD (0.007kg x4) | A00 | 09-May-01 | | 0.90 | Mild | 140 | 270 | S | 0.028 | |
| AVC | 1 | 2047 | Hinge Bushing - Front Door (0.041kg x6) | A00 | 09-May-01 | | NA | NA | NA | NA | NA | 0.246 | |
| AVC | 1 | 2056 | Latch Bushing - Front Door (0.014kg x6) | A00 | 09-May-01 | | NA | NA | NA | NA | NA | 0.084 | |
| AVC | 1 | 2057 | U-Clip M6 x 1.00 - Front Door (0.011kg x4) | A00 | 09-May-01 | | NA | NA | NA | NA | NA | 0.044 | |
| AVC | 1 | 2058 | Hex Flange Head M6 x 15 - FD (0.040kg x4) | A00 | 09-May-01 | | NA | NA | NA | NA | NA | 0.160 | |
| AVC | 1 | 2059 | Weld Stud M6 x 16 - Front Door (0.005kg x8) | A00 | 09-May-01 | | NA | NA | NA | NA | NA | 0.040 | |
| AVC | 1 | 2060 | Adhesive Bond Lwr Tube - FD (0.070kg x2) | A00 | 09-May-01 | | NA | NA | NA | NA | NA | 0.140 | |
| AVC | 2 | 2000 | Outer - Front Door RH | C04 | 08-Apr-01 | | 0.60 | DP | 350 | 600 | S orHFS | 4.542 | |
| AVC | 2 | 2001 | Outer - Front Door LH | C04 | 08-Apr-01 | | 0.60 | DP | 350 | 600 | S or HFS | 4.542 | |
| AVC | 2 | 2006 | Latch Tube - Front Door RH | C02 | 09-Apr-01 | | 1.00 | IF * | 260 | 410 | HFT | 0.610 | |
| AVC | 2 | 2007 | Latch Tube - Front Door LH | C02 | 09-Apr-01 | | 1.00 | IF * | 260 | 410 | HFT | 0.610 | |
| AVC | 2 | 2008 | Lower Tube - Front Door (x2) | D00 | 04-Apr-01 | | 1.50 | DP * | 500 | 800 | ST | 3.450 | |
| AVC | 2 | 2010 | Outer Belt Reinforcement - Front Door (x2) | D00 | 05-Apr-01 | | 1.00 | DP * | 500 | 800 | ST | 1.860 | |
| AVC | 2 | 2022 | Inner Rear - Front Door RH | B02 | 11-Apr-01 | | 0.60 | Mild | 140 | 270 | S | 0.696 | |
| AVC | 2 | 2023 | Inner Rear - Front Door LH | B02 | 11-Apr-01 | | 0.60 | Mild | 140 | 270 | S | 0.696 | |
| AVC | 2 | 2050 | Reinforcement Latch - Front Door RH | A00 | 02-Apr-01 | | 1.20 | Mild | 140 | 270 | S | 0.060 | |
| AVC | 2 | 2051 | Reinforcement Latch - Front Door LH | A00 | 02-Apr-01 | | 1.20 | Mild | 140 | 270 | S | 0.060 | |
| **TOTAL** | | | | | | | | | | | | **21.592** | |

| Code | Manufacturing Process |
|---|---|
| S | Stamped |
| S/TWB | Stamped / Tailor Welded Blanks |
| HFT | Hydroformed Tube |
| S or HFS | Stamped or Hydroformed Sheet |
| ST | Straight or Shaped Tube |

| Code | Steel Types |
|---|---|
| DP | Dual Phase |
| IF | Interstitial-Free |
| Mild | Mild Steel |

* denotes **Tube**

PORSCHE Engineering Services, Inc.

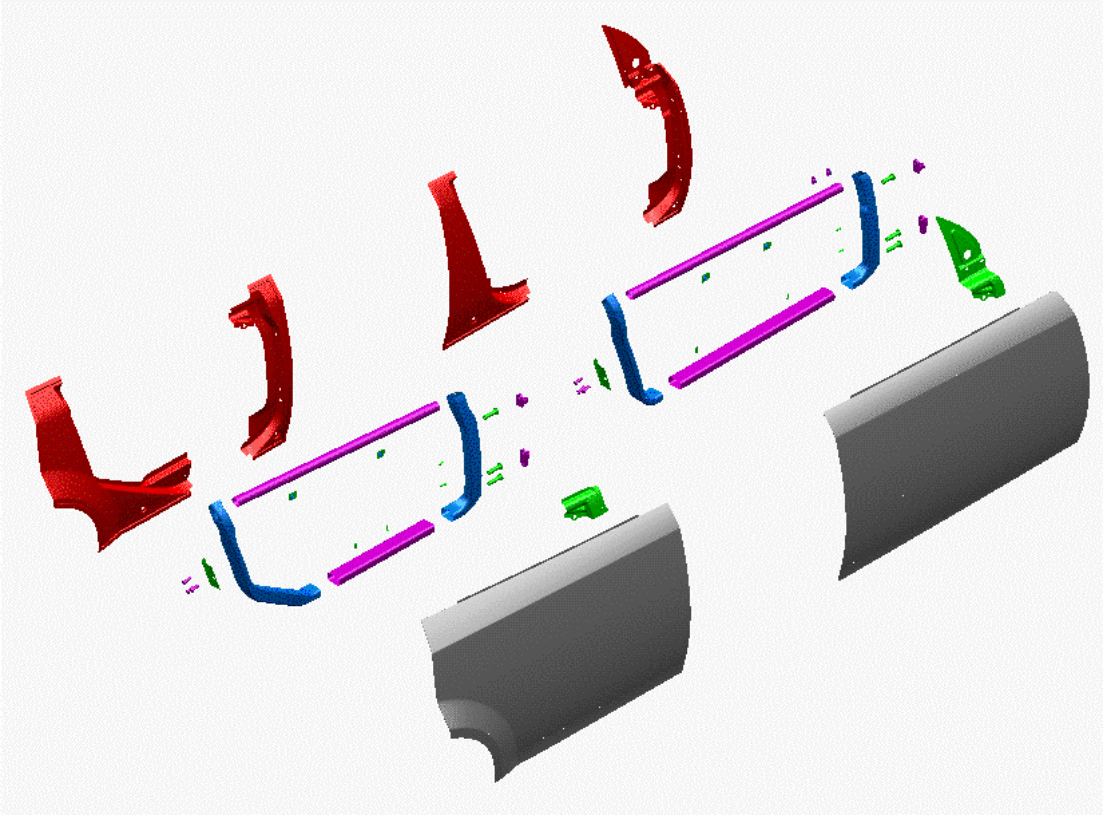


**Figure 6.8.1-2 Exploded view of PNGV-Class front and rear door structure**

## Table 6.8.1-2 Parts list PNGV-Class - Front Door RH/LH

**File Revision Level: A14 Date: 27 JUL 01**

| Number | | | Name | Revision Level | Date | Blank No. | Gage (mm) | Material Type | Grade (MPa) | | Manuf. Process Code | Designed Mass (kg) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Yield Strength | Tensile Strength | | C-Class | PNGV-Class |
| AVC | 1 | 2004 | Hinge Tube - Front Door RH | C02 | 09-Apr-01 | | 1.20 | IF * | 260 | 410 | HFT | | 0.648 |
| AVC | 1 | 2005 | Hinge Tube - Front Door LH | C02 | 09-Apr-01 | | 1.20 | IF * | 260 | 410 | HFT | | 0.648 |
| AVC | 1 | 2020 | Inner Front - Front Door RH | B03 | 10-Apr-01 | 1 | 1.00 | Mild | 140 | 270 | S/TWB | | 0.500 |
| | | | | | | 2 | 1.20 | Mild | 140 | 270 | | | 0.384 |
| AVC | 1 | 2021 | Inner Front - Front Door LH | B03 | 10-Apr-01 | 1 | 1.00 | Mild | 140 | 270 | S/TWB | | 0.500 |
| | | | | | | 2 | 1.20 | Mild | 140 | 270 | | | 0.384 |
| AVC | 1 | 2045 | Assy W-Reg Attach Upper - FD (0.007kg x4) | A00 | 09-May-01 | | 0.90 | Mild | 140 | 270 | S | | 0.028 |
| AVC | 1 | 2047 | Hinge Bushing - Front Door (0.041kg x6) | A00 | 09-May-01 | | NA | NA | NA | NA | NA | | 0.246 |
| AVC | 1 | 2056 | Latch Bushing - Front Door (0.014kg x6) | A00 | 09-May-01 | | NA | NA | NA | NA | NA | | 0.084 |
| AVC | 1 | 2057 | U-Clip M6 x 1.00 - Front Door (0.011kg x4) | A00 | 09-May-01 | | NA | NA | NA | NA | NA | | 0.044 |
| AVC | 1 | 2058 | Hex Flange Head M6 x 15 - FD (0.040kg x4) | A00 | 09-May-01 | | NA | NA | NA | NA | NA | | 0.160 |
| AVC | 1 | 2059 | Weld Stud M6 x 16 - Front Door (0.005kg x8) | A00 | 09-May-01 | | NA | NA | NA | NA | NA | | 0.040 |
| AVC | 1 | 2060 | Adhesive Bond Lwr Tube - FD (0.070kg x2) | A00 | 09-May-01 | | NA | NA | NA | NA | NA | | 0.140 |
| AVC | 1 | 2026 | Mirror Flag Outer - Front Door RH | B03 | 04-Apr-01 | | 1.00 | Mild | 140 | 270 | S | | 0.330 |
| AVC | 1 | 2027 | Mirror Flag Outer - Front Door LH | B03 | 04-Apr-01 | | 1.00 | Mild | 140 | 270 | S | | 0.330 |
| AVC | 3 | 2006 | Latch Tube - Front Door RH | C02 | 10-Apr-01 | | 1.00 | IF * | 260 | 410 | HFT | | 0.620 |
| AVC | 3 | 2007 | Latch Tube - Front Door LH | C02 | 10-Apr-01 | | 1.00 | IF * | 260 | 410 | HFT | | 0.620 |
| AVC | 3 | 2008 | Lower Tube - Front Door (x2) | D00 | 04-Apr-01 | | 1.50 | DP * | 500 | 800 | ST | | 2.580 |
| AVC | 3 | 2010 | Outer Belt Reinforcement - Front Door (x2) | D00 | 05-Apr-01 | | 1.00 | DP * | 500 | 800 | ST | | 1.600 |
| AVC | 3 | 2028 | Outer - Front Door RH | B05 | 08-Apr-01 | | 0.60 | DP | 350 | 600 | S or HFS | | 3.792 |
| AVC | 3 | 2029 | Outer - Front Door LH | B05 | 08-Apr-01 | | 0.60 | DP | 350 | 600 | S or HFS | | 3.792 |
| AVC | 3 | 2030 | Inner Rear - Front Door RH | B02 | 10-Apr-01 | | 0.60 | Mild | 140 | 270 | S | | 0.798 |
| AVC | 3 | 2031 | Inner Rear - Front Door LH | B02 | 10-Apr-01 | | 0.60 | Mild | 140 | 270 | S | | 0.798 |
| AVC | 3 | 2052 | Reinforcement Latch - Front Door RH | A00 | 02-Apr-01 | | 1.20 | Mild | 140 | 270 | S | | 0.060 |
| AVC | 3 | 2053 | Reinforcement Latch - Front Door LH | A00 | 02-Apr-01 | | 1.20 | Mild | 140 | 270 | S | | 0.060 |
| **TOTAL** | | | | | | | | | | | | | **19.186** |

| Code | Manufacturing Process |
|---|---|
| S | Stamped |
| S/TWB | Stamped / Tailor Welded Blanks |
| HFT | Hydroformed Tube |
| S or HFS | Stamped or Hydroformed Sheet |
| ST | Straight or Shaped Tube |

| Code | Steel Types |
|---|---|
| DP | Dual Phase |
| IF | Interstitial-Free |
| Mild | Mild Steel |

* denotes **Tube**

## Table 6.8.1-3 Parts list PNGV-Class - Rear Doors RH/LH

**File Revision Level: A14 Date: 27 JUL 01**

| Number | | | Name | Revision Level | Date | Blank No. | Gage (mm) | Material Type | Grade (MPa) | | Manuf. Process Code | Designed Mass (kg) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Yield Strength | Tensile Strength | | C-Class | PNGV-Class |
| AVC | 1 | 2045 | Assy W-Reg Attach Upper - FD (0.007kg x4) | A00 | 09-May-01 | | 0.90 | Mild | 140 | 270 | S | | 0.028 |
| AVC | 1 | 2047 | Hinge Bushing - Front Door (0.041kg x6) | A00 | 09-May-01 | | NA | NA | NA | NA | NA | | 0.246 |
| AVC | 1 | 2056 | Latch Bushing - Front Door (0.014kg x6) | A00 | 09-May-01 | | NA | NA | NA | NA | NA | | 0.084 |
| AVC | 1 | 2059 | Weld Stud M6 x 16 - Front Door (0.005kg x8) | A00 | 09-May-01 | | NA | NA | NA | NA | NA | | 0.040 |
| AVC | 1 | 2060 | Adhesive Bond Lwr Tube - FD (0.070kg x2) | A00 | 09-May-01 | | NA | NA | NA | NA | NA | | 0.140 |
| AVC | 3 | 2032 | Outer - Rear Door RH | B02 | 05-Apr-01 | | 0.60 | DP | 350 | 600 | S or HFS | | 3.792 |
| AVC | 3 | 2033 | Outer - Rear Door LH | B02 | 05-Apr-01 | | 0.60 | DP | 350 | 600 | S or HFS | | 3.792 |
| AVC | 3 | 2034 | Inner Front - Rear Door RH | B02 | 12-Apr-01 | 1 | 1.00 | Mild | 140 | 270 | S/TWB | | 0.430 |
| | | | | | | 2 | 1.20 | Mild | 140 | 270 | | | 0.408 |
| AVC | 3 | 2035 | Inner Front - Rear Door LH | B02 | 12-Apr-01 | 1 | 1.00 | Mild | 140 | 270 | S/TWB | | 0.430 |
| | | | | | | 2 | 1.20 | Mild | 140 | 270 | | | 0.408 |
| AVC | 3 | 2038 | Inner Rear - Rear Door RH | B02 | 12-Apr-01 | | 0.60 | Mild | 140 | 270 | S | | 1.062 |
| AVC | 3 | 2039 | Inner Rear - Rear Door LH | B02 | 12-Apr-01 | | 0.60 | Mild | 140 | 270 | S | | 1.062 |
| AVC | 3 | 2040 | Hinge Tube - Rear Door RH | B02 | 12-Apr-01 | | 1.20 | IF * | 260 | 410 | HFT | | 0.744 |
| AVC | 3 | 2041 | Hinge Tube - Rear Door LH | B02 | 10-Apr-01 | | 1.20 | IF * | 260 | 410 | HFT | | 0.744 |
| AVC | 3 | 2042 | Latch Tube - Rear Door RH | B02 | 12-Apr-01 | | 1.00 | IF * | 260 | 410 | HFT | | 0.850 |
| AVC | 3 | 2043 | Latch Tube - Rear Door LH | B02 | 12-Apr-01 | | 1.00 | IF * | 260 | 410 | HFT | | 0.850 |
| AVC | 3 | 2044 | Lower Tube - Rear Door (x2) | C00 | 04-Apr-01 | | 1.50 | DP * | 500 | 800 | ST | | 1.560 |
| AVC | 3 | 2046 | Outer Belt Reinforcement - Rear Door (x2) | C00 | 05-Apr-01 | | 1.00 | DP * | 500 | 800 | ST | | 1.480 |
| AVC | 3 | 2048 | Reinf Belt Hinge Tube - Rear Door RH | B02 | 12-Apr-01 | | 1.10 | Mild | 140 | 270 | S | | 0.143 |
| AVC | 3 | 2049 | Reinf Belt Hinge Tube - Rear Door LH | B02 | 12-Apr-01 | | 1.10 | Mild | 140 | 270 | S | | 0.143 |
| AVC | 3 | 2054 | Reinforcement Latch - Rear Door RH | A00 | 02-Apr-01 | | 1.20 | Mild | 140 | 270 | S | | 0.060 |
| AVC | 3 | 2055 | Reinforcement Latch - Rear Door LH | A00 | 02-Apr-01 | | 1.20 | Mild | 140 | 270 | S | | 0.060 |
| **TOTAL** | | | | | | | | | | | | | **18.556** |

| Code | Manufacturing Process |
|---|---|
| S | Stamped |
| S/TWB | Stamped / Tailor Welded Blanks |
| HFT | Hydroformed Tube |
| S or HFS | Stamped or Hydroformed Sheet |
| ST | Straight or Shaped Tube |

| Code | Steel Types |
|---|---|
| DP | Dual Phase |
| IF | Interstitial-Free |
| Mild | Mild Steel |

* denotes **Tube**

### 6.8.2. Hood – C-Class and PNGV-Class

The same principles were used to develop the ULSAB-AVC hood, as were developed in the ULSAC Program.

Common for both AVC vehicle variants, the ULSAB-AVC hood design (see Figure 6.8.2-1) features a stamped or sheet hydroformed outer panel attached to a stamped inner panel. Due to the engine/suspension compact design concept, the hood provides access to an additional stowage compartment, as well as the HVAC system incorporated into the engine cover module.

The hood is attached to the body at the rear and latched at the front to the engine cover module in two locations.

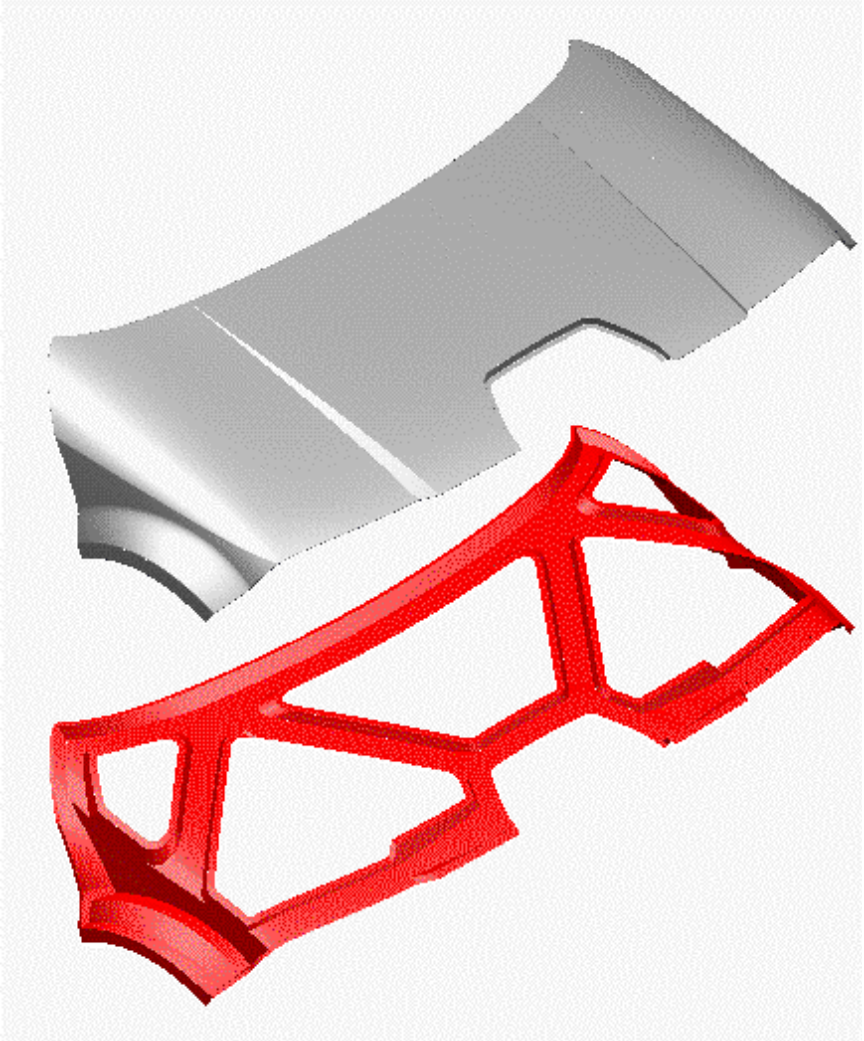


**Figure 6.8.2-1 Exploded view of C-Class & PNGV-Class hood structure**

## Table 6.8.2-2 Parts list C-Class and PNGV-Class – Hood

**File Revision Level: A14 Date: 27 JUL 01**

| Number | | | Name | Revision Level | Date | Blank No. | Gage (mm) | Material Type | Grade (MPa) | | Manuf. Process Code | Designed Mass (kg) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Yield Strength | Tensile Strength | | C-Class | PNGV-Class |
| AVC | 1 | 2600 | Inner - Hood | B01 | 10-Apr-01 | | 0.60 | Mild | 140 | 270 | S | 3.408 | 3.408 |
| AVC | 1 | 2601 | Outer - Hood | B00 | 09-Feb-01 | | 0.60 | DP | 350 | 600 | S or HFS | 5.676 | 5.676 |
| AVC | 1 | x | Striker Assembly - Hood | Ref: ULSAC Phase-1 | | | 2.50 | Mild | 140 | 270 | S | 0.070 | 0.070 |
| AVC | 1 | x | Reinforcement Striker - Hood | Ref: ULSAC Phase-1 | | | 1.50 | Mild | 140 | 270 | S | 0.070 | 0.070 |
| AVC | 1 | x | Reinforcement Hinge - Hood (x2) | Ref: ULSAC Phase-1 | | | 1.50 | Mild | 140 | 270 | S | 0.310 | 0.310 |
| **TOTAL** | | | | | | | | | | | | **9.534** | **9.534** |

| Code | Manufacturing Process |
|---|---|
| S | Stamped |
| S/TWB | Stamped / Tailor Welded Blanks |
| HFT | Hydroformed Tube |
| S or HFS | Stamped or Hydroformed Sheet |
| ST | Straight or Shaped Tube |

| Code | Steel Types |
|---|---|
| DP | Dual Phase |
| IF | Interstitial-Free |
| Mild | Mild Steel |

* denotes **Tube**

## 6.8.3. Liftgate – C-Class

The same principles were used to develop the C-Class liftgate, as were used during the ULSAC Program.

The liftgate, shown in Figure 6.8.3-1, incorporates an upper frame, manufactured from a hydroformed tube. Creating the lower structure, and encapsulating the two lower tube ends, are the liftgate inner and outer panels. The liftgate features a stamped or sheet hydroformed outer panel attached to a stamped inner panel.

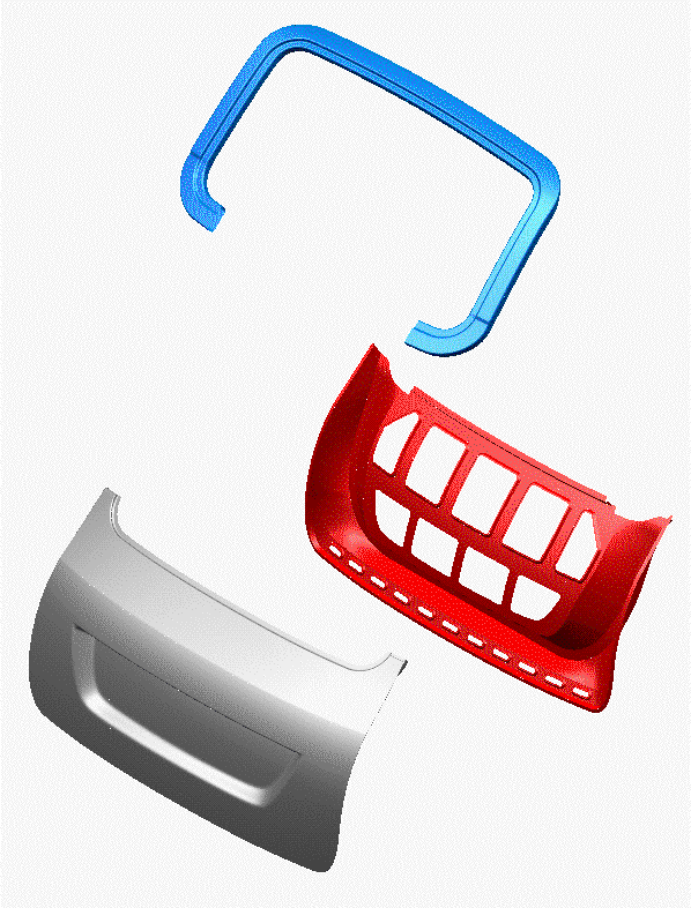


**Figure 6.8.3-1 Exploded view of C-Class liftgate structure**

## Table 6.8.3-1 Parts list liftgate - C-Class

**File Revision Level: A14 Date: 27 JUL 01**

| Number | | | Name | Revision Level | Date | Blank No. | Gage (mm) | Material Type | Grade (MPa) | | Manuf. Process Code | Designed Mass (kg) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Yield Strength | Tensile Strength | | C-Class | PNGV-Class |
| AVC | 2 | 2400 | Inner - Liftgate | B03 | 14-Feb-01 | | 0.60 | Mild | 140 | 270 | S | 2.796 | |
| AVC | 2 | 2401 | Outer - Liftgate | B03 | 14-Feb-01 | | 0.60 | DP | 350 | 600 | S or HFS | 3.408 | |
| AVC | 2 | 2402 | Member Aperture - Liftgate | B00 | 02-Feb-01 | | 0.70 | Mild * | 140 | 270 | HFT | 2.240 | |
| AVC | 2 | x | Reinforcement Latch - Liftgate | Ref: ULSAC Phase-1 | | | 1.50 | Mild | 140 | 270 | S | 0.120 | |
| **TOTAL** | | | | | | | | | | | | **8.564** | |

| Code | Manufacturing Process |
|---|---|
| S | Stamped |
| S/TWB | Stamped / Tailor Welded Blanks |
| HFT | Hydroformed Tube |
| S or HFS | Stamped or Hydroformed Sheet |
| ST | Straight or Shaped Tube |

| Code | Steel Types |
|---|---|
| DP | Dual Phase |
| IF | Interstitial-Free |
| Mild | Mild Steel |

* denotes **Tube**

### 6.8.4. Decklid – PNGV-Class

The same principle technologies were used to develop the PNGV-Class decklid, as were used during the ULSAC Program.

The design principal features a stamped or sheet hydroformed outer panel attached to a stamped inner panel.

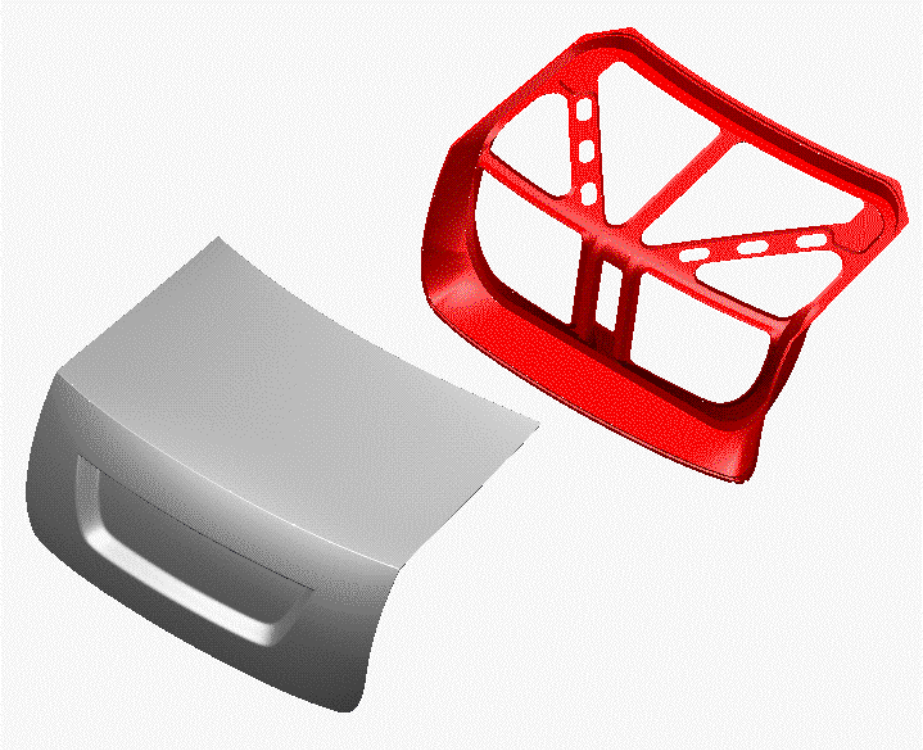


**Figure 6.8.4-1 Exploded view of PNGV-Class decklid structure**

### Table 6.8.4-1 Parts list PNGV-Class - Deck Lid

**File Revision Level: A14 Date: 27 JUL 01**

| Number | | | Name | Revision Level | Date | Blank No. | Gage (mm) | Material Type | Grade (MPa) | | Manuf. Process Code | Designed Mass (kg) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Yield Strength | Tensile Strength | | C-Class | PNGV-Class |
| AVC | 3 | 2500 | Inner - Deck Lid | C01 | 10-Apr-01 | | 0.60 | Mild | 140 | 270 | S | | 3.768 |
| AVC | 3 | 2501 | Outer - Deck Lid | C00 | 12-Jan-01 | | 0.60 | DP | 350 | 600 | S or HFS | | 6.072 |
| AVC | 3 | x | Striker Assembly - Decklid | Ref: ULSAC Phase-1 | | | 1.50 | Mild | 140 | 270 | S | | 0.070 |
| AVC | 3 | x | Reinforcement Striker - Decklid | Ref: ULSAC Phase-1 | | | 1.50 | Mild | 140 | 270 | S | | 0.040 |
| AVC | 3 | x | Reinforcement Hinge - Decklid (x2) | Ref: ULSAC Phase-1 | | | 1.20 | Mild | 140 | 270 | S | | 0.320 |
| **TOTAL** | | | | | | | | | | | | | **10.270** |

| Code | Manufacturing Process |
|---|---|
| S | Stamped |
| S/TWB | Stamped / Tailor Welded Blanks |
| HFT | Hydroformed Tube |
| S or HFS | Stamped or Hydroformed Sheet |
| ST | Straight or Shaped Tube |

| * denotes **Tube** |
|---|

| Code | Steel Types |
|---|---|
| DP | Dual Phase |
| IF | Interstitial-Free |
| Mild | Mild Steel |

## 6.9. Ancillary Closures

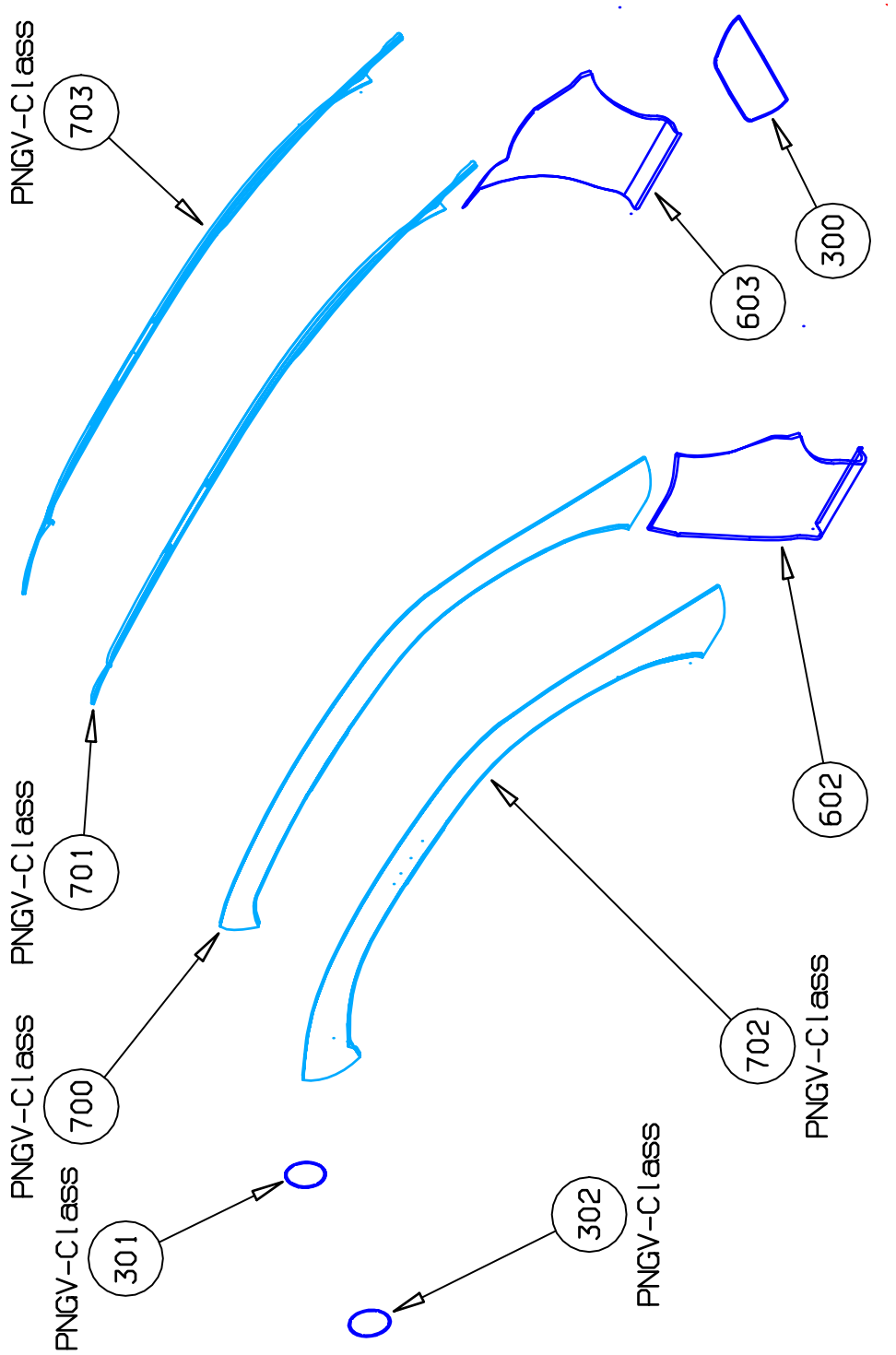



**Figure 6.9-1 Exploded view of ancillary closures**

## Table 6.9-1 Parts list Ancillary Closures

**File Revision Level: A14 Date: 27 JUL 01**

| Number | | | Name | Revision Level | Date | Blank No. | Gage (mm) | Material Type | Grade (MPa) | | Manuf. Process Code | Designed Mass (kg) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Yield Strength | Tensile Strength | | C-Class | PNGV-Class |
| AVC | 1 | 2300 | Engine Service Lid | A00 | 20-Feb-01 | | 0.60 | Mild | 140 | 270 | S | 0.348 | 0.348 |
| AVC | 1 | 2602 | Fender RH | B01 | 19-Feb-01 | | 0.60 | DP | 350 | 600 | S or HFS | 1.608 | 1.608 |
| AVC | 1 | 2603 | Fender LH | B01 | 19-Feb-01 | | 0.60 | DP | 350 | 600 | S or HFS | 1.608 | 1.608 |
| AVC | 2 | 2301 | Fuel Filler Lid | A00 | 20-Feb-01 | | 0.60 | Mild | 140 | 270 | S | 0.090 | |
| AVC | 2 | 2700 | Applique - Roof Side Rail RH | A02 | 19-Feb-01 | | 0.50 | Mild | 140 | 270 | S | 1.290 | |
| AVC | 2 | 2701 | Applique - Roof Side Rail LH | A02 | 19-Feb-01 | | 0.50 | Mild | 140 | 270 | S | 1.290 | |
| AVC | 3 | 2302 | Fuel Filler Lid | A00 | 20-Feb-01 | | 0.60 | Mild | 140 | 270 | S | | 0.090 |
| AVC | 3 | 2702 | Applique - Roof Side Rail RH | A02 | 19-Feb-01 | | 0.50 | Mild | 140 | 270 | S | | 1.430 |
| AVC | 3 | 2703 | Applique - Roof Side Rail LH | A02 | 19-Feb-01 | | 0.50 | Mild | 140 | 270 | S | | 1.430 |
| **TOTAL** | | | | | | | | | | | | **6.234** | **6.514** |

| Code | Manufacturing Process |
|---|---|
| S | Stamped |
| S/TWB | Stamped / Tailor Welded Blanks |
| HFT | Hydroformed Tube |
| S or HFS | Stamped or Hydroformed Sheet |
| ST | Straight or Shaped Tube |

| Code | Steel Types |
|---|---|
| DP | Dual Phase |
| IF | Interstitial-Free |
| Mild | Mild Steel |

* denotes **Tube**

### 6.9.1. Fenders

Due to the wrap-over design of the hood that encompasses much of the wheelhouse, the front fenders (see Figure 6.9.1-1) are relatively small and basic in design. The fenders are manufactured utilizing stamping or sheet hydroforming. They are mechanically attached to the A-post at the rear. The lower and front openings are mechanically attached to the upper engine cover module. The fenders are common for both vehicle variants.

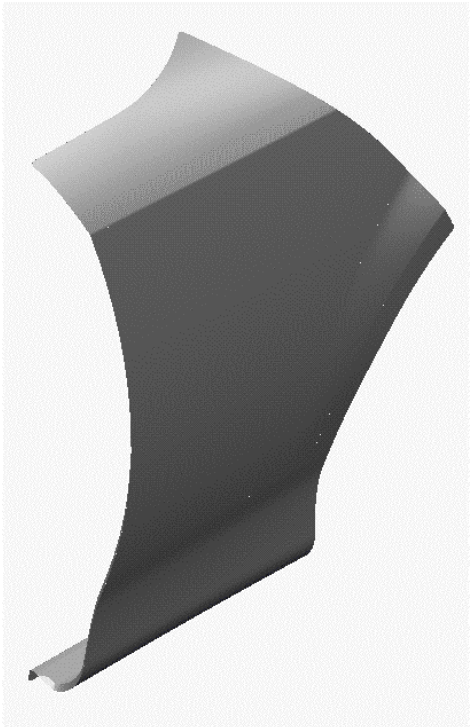


**Figure 6.9.1-1 C-Class & PNGV-Class vehicles right side fender**

### 6.9.2. Fuel Filler Lids

The fuel filler lids (see Figure 6.9.2-1) were designed as one-piece stampings, hemmed edges, and flanged according to hinge attachment requirements.

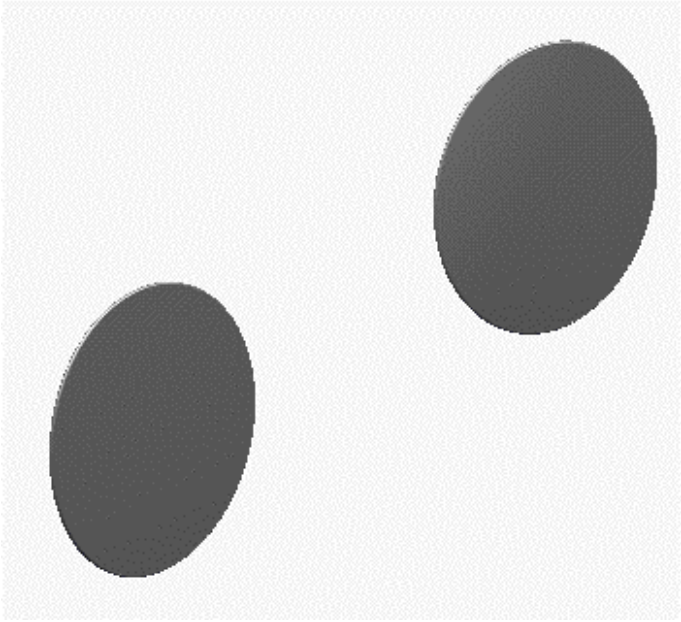


**Figure 6.9.2-1 View of C-Class & PNGV-Class fuel filler lids**

### 6.9.3. Roof Side Rail Appliques

In principle, the roof side rail appliques have both functional and decorative purposes.

First, tailor welded blanks are used to manufacture both C-Class and PNGV-Class body side outer panels. Visible laser-welded joints exist on the a-pillar and roof side rail surfaces. In part, the appliques are used to cover the laser-welded joints.

Second, special decorative paint treatments and coatings may be applied to the post body paint shop appliques, thereby providing the customer with exterior trim and color options.

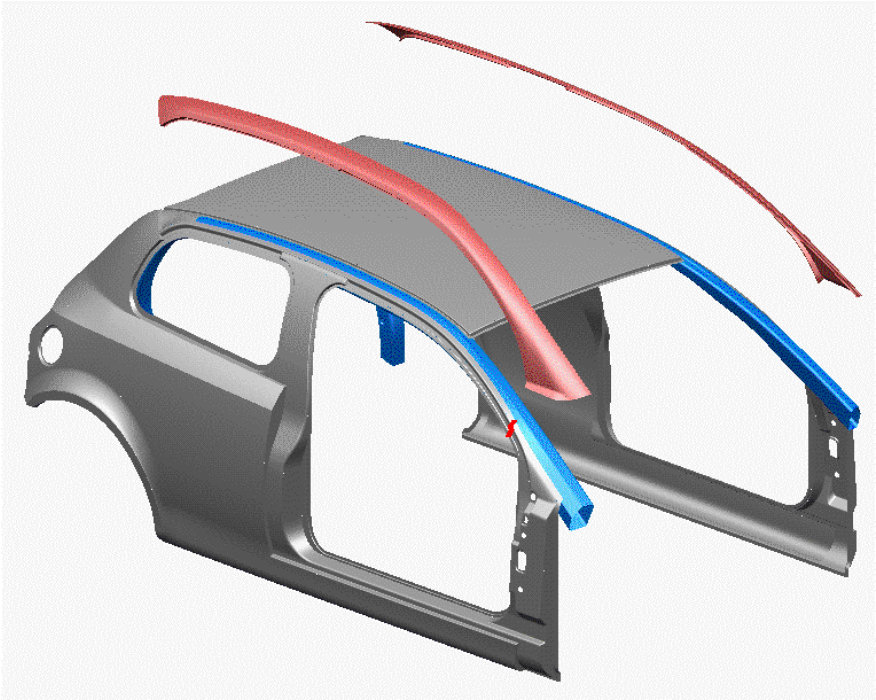


**Figure 6.9.3-1 View of C-Class roof side rail appliques exposing the body side outer laser welded joints and roof side rail joints.**

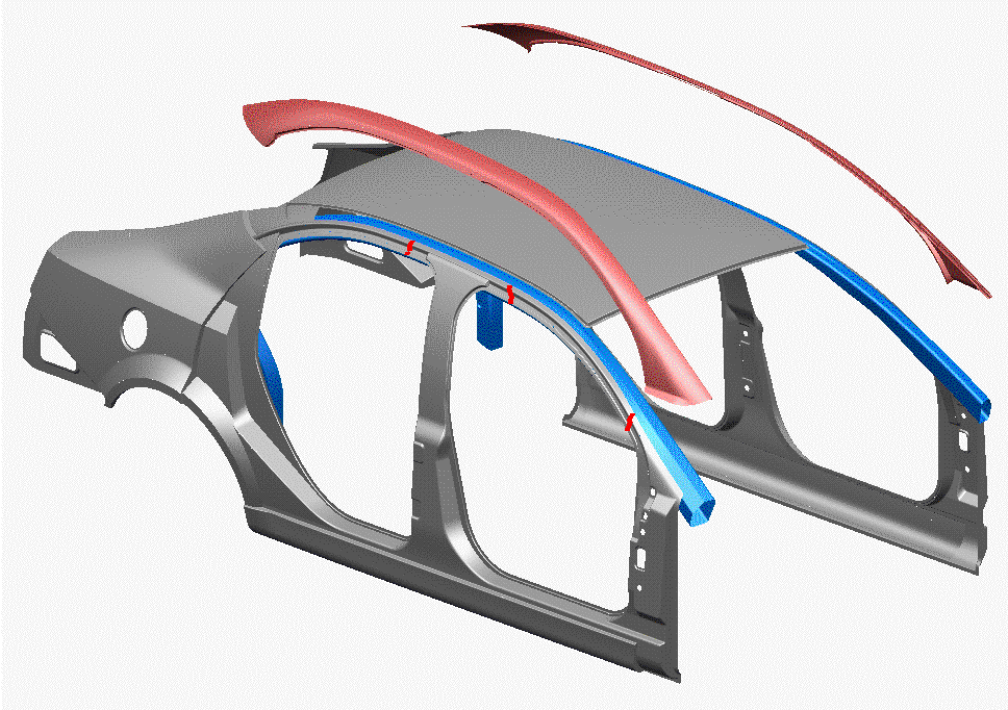


**Figure 6.9.3-2 View of PNGV-Class roof side rail appliques exposing the body side outer laser welded joints and roof side rail joints.**

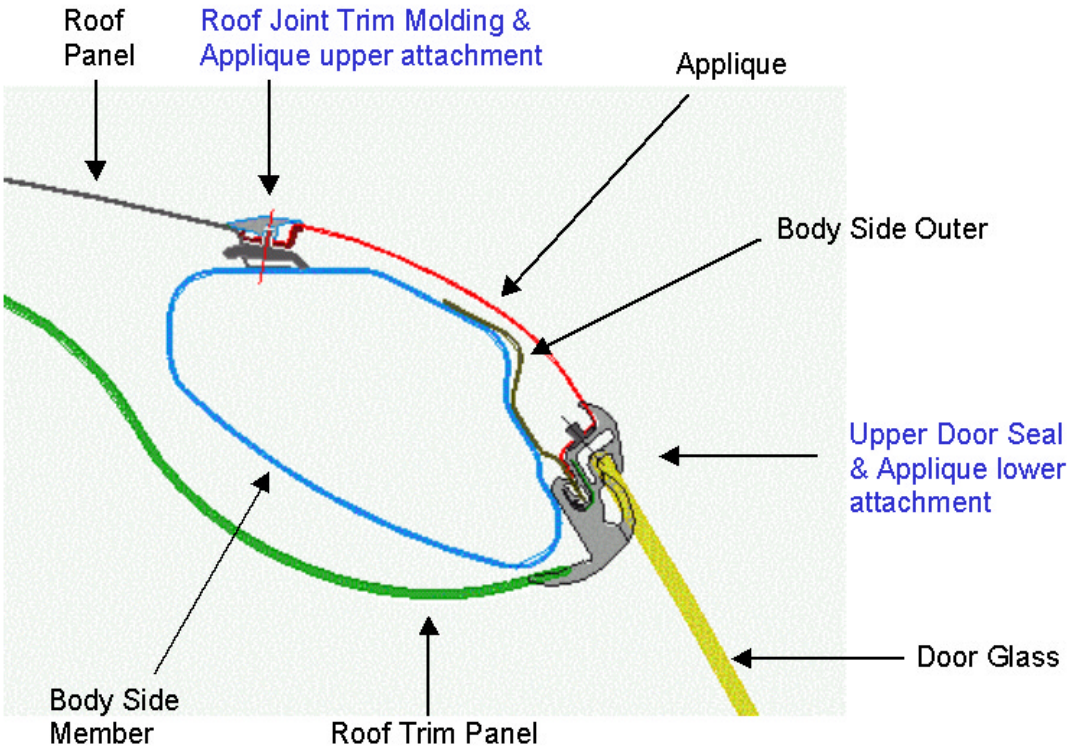



**Figure 6.9.3-3 Roof side rail applique section**

### 6.9.4. Engine Service Lid

The engine service lid provides easy access to the engine oil filler, engine coolant filler, and windshield washer liquid filler. Although a separate component, the service lid is integrated into the front of the hood and into the rear of the front fascia module. Manufactured from a one-piece stamping, hemmed edge, and flanged according to hinge attachment requirements, the lid is common for both vehicle variants.

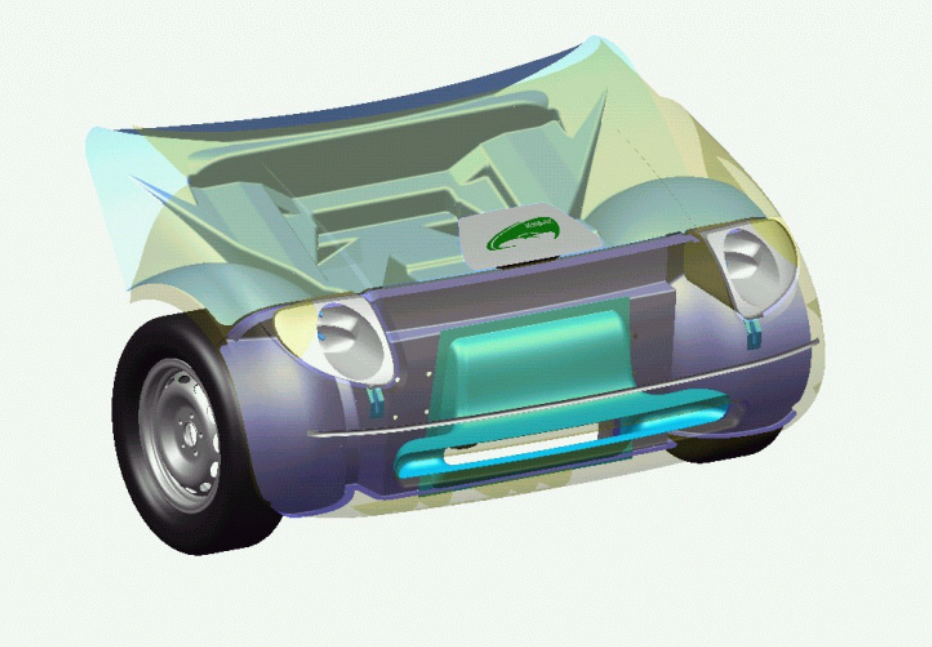


**Figure 6.9.4-1 Location of engine service lid (closed)**

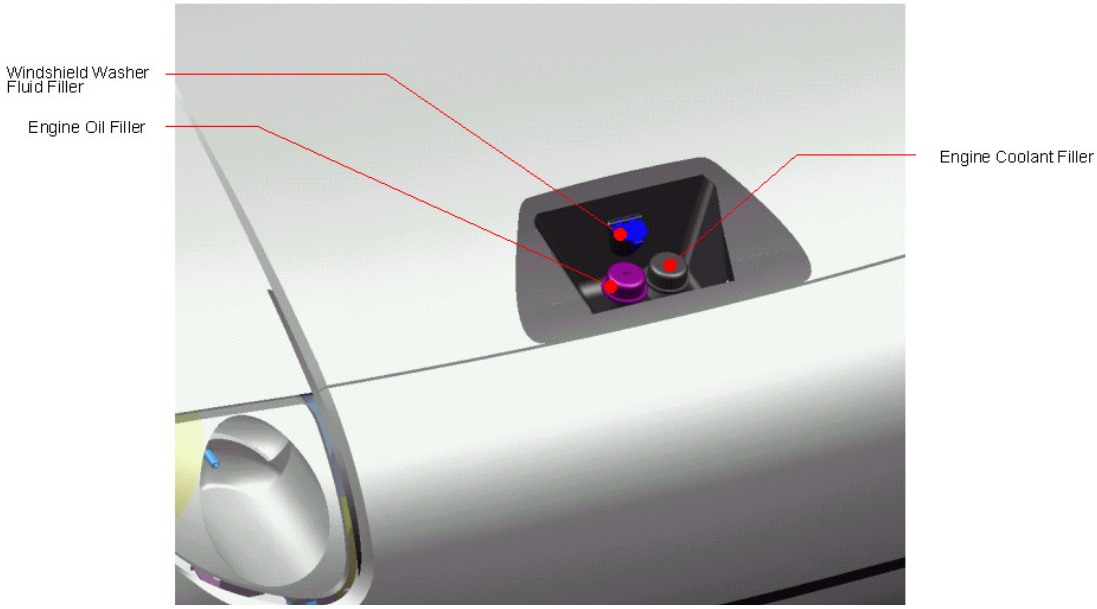



**Figure 6.9.4-2 Engine service compartment**