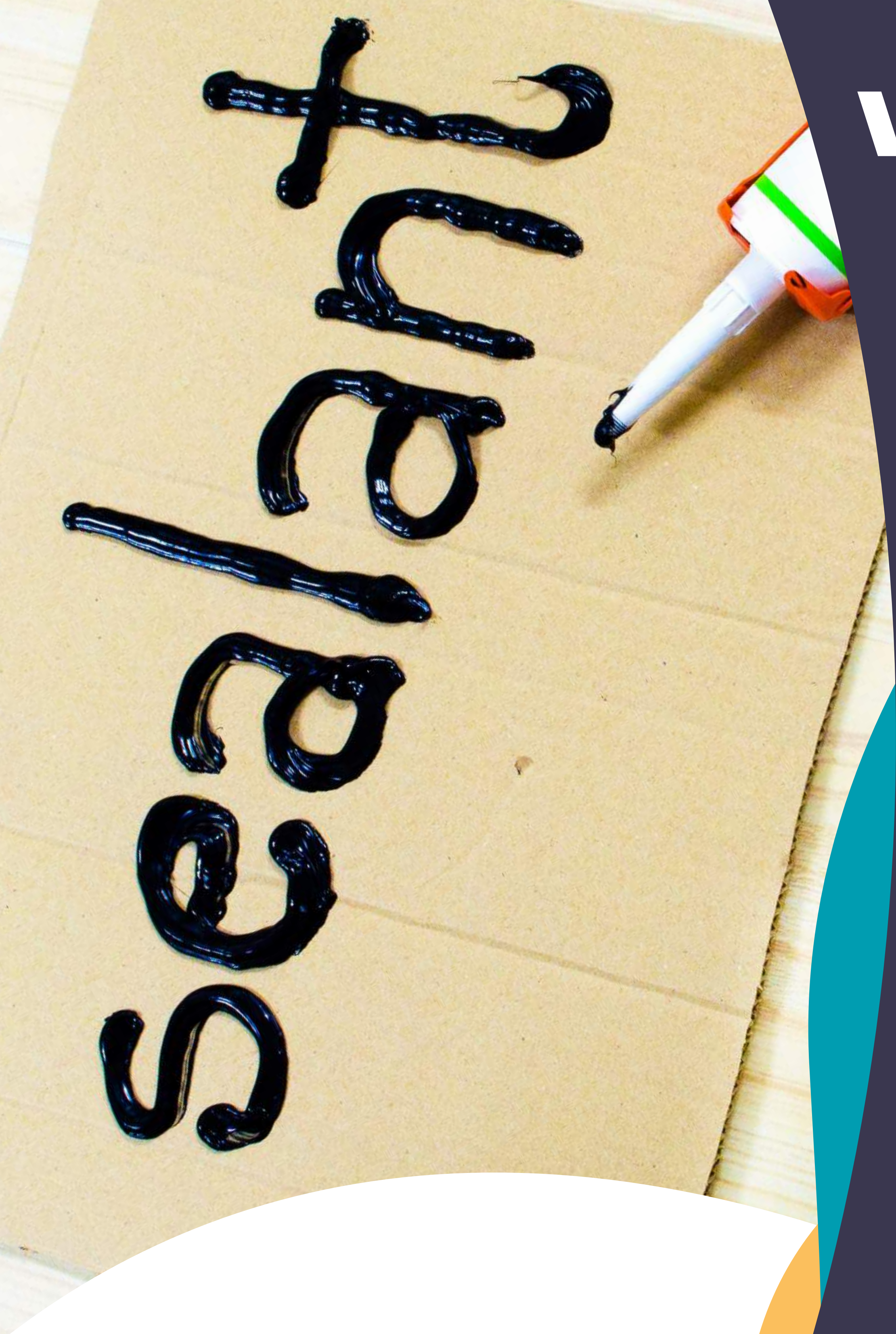


vestolit

# Sealant

For use in variety of applications

orbia
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Polymer Solutions

# Content



Image 1: Silicone for Sealants

# Sealants

**Sealants can be used in a wide variety of applications including underbody coatings, caulks and caps and closures. We offer a diverse range of resins based on the respective application, PVC versatility and performance at the best cost.**

As the main part of the Sealant production, caps and closures can be produced in various forms, all tailored to the specific end uses and performance requirements. In addition to the pasteurizable, retort or standard grade closures, caulk and underbody coating Sealants also make up a part of the PVC-based production in this field.

Image 2: Application of caulk

# Caps / Closures

**Closures are essential to beverage and food packaging. PVC is used in traditional bottle tops removed with a bottle opener, twist off/vacuum lug closure such as glass jars or sauces for bottles as well as screw caps.**

Glass bottles are extensively used in packaging consumable goods like fruits, vegetables, processed food and meat. The metal lids for these types of bottles require a Sealant that will give an airtight, chemically resistant seal to the packaged food for extended periods of time. These sealant materials are based on specially formulated plastisols which contain PVC resin, plasticiser and other additives that individually and collectively have to meet stringent (FDA, EU or equivalent) food contact-rules and regulations.

### Sealant Application

After the metal cap closures are formed, they are fed into a coating line, where a controlled amount of plastisol (generally a thixotropic fluid) is injected on to the interior surface of a spinning cap. This spinning centrifugal force causes the coating to be uniformly deposited as a ring (see figure 1) towards the inner edge of the cap. The coated metal caps then pass through a controlled bake cycle in an oven, causing the plastisol to solidify and ready to provide an airtight seal. Often, the plastisol is formulated to foam during the bake cycle to give improved sealing capabilities, including drawing a vacuum after filling. Plastisol formulations fall under three distinct types – standard grade, pasteurizable grade, and retort grades – each designed for specific end uses, food types and performance requirements.

### Standard Grade

These are recommended for food process lines where the food is filled into the glass bottles in a hot state, and then sealed right away. As the sealed glass bottle and contents cool down, a vacuum seal is created. Packaged food types include fruit juices.

### Pasteurizable Grade

These plastisol grades are chosen when either cold or hot food is filled in bottles, sealed with a cap, and then pasteurized. Pasteurization involves heating the filled food containers to around 90°C in a hot water bath to eliminate pathogens and extend shelf life. Packaged food types include fruits and vegetables.

### Retort Grade

This is the most demanding of the three types because of the exposure to a combination of heat (from sterilization) and pressure cooking of filled and capped containers. Packaged food types include tomato juice, soups, poultry or fish. A schematic of the three grades and food types packaged is shown in figure 1.

As mentioned above, the PVC resin needed to produce such plastisols must demonstrate a good balance between mechanical properties, foamability, low VOC, adhesion and resistance/inertness to the packaged food. Vestolit offers two high performance resins that meet European as well as US food contact specifications.

| Product Code | K value | Description |
|---|---|---|
| VESTOLIT XG 217 | 63 | Medium molecular weight homopolymer blending resin used to adjust rheology |
| VESTOLIT B 7021 ULTRA | 70 | Low viscosity, good plastisol aged viscosity, approved for food contact usage. General purpose |
| VESTOLIT G 121 A | 74 | High molecular weight, good mechanical properties, foaming, approved for food contact applications |
| VESTOLIT G M 120 LV | 75 | High molecular weight, good mechanical property, clarity, adhesion to metal, foaming, approved for food contact applications |
| VESTOLIT B 7521 Ultra | 75 | High molecular weight, good mechanical property, good plastisol aged viscosity stability, approved for food contact usage |

Table A: Product overview for Caps and Closures

## Cap Sealant application schematic

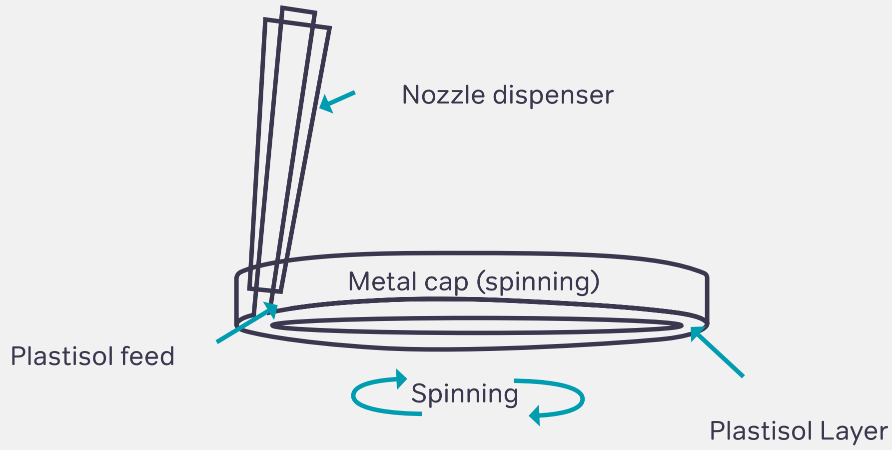


Figure 1: Cap Sealant application schematic

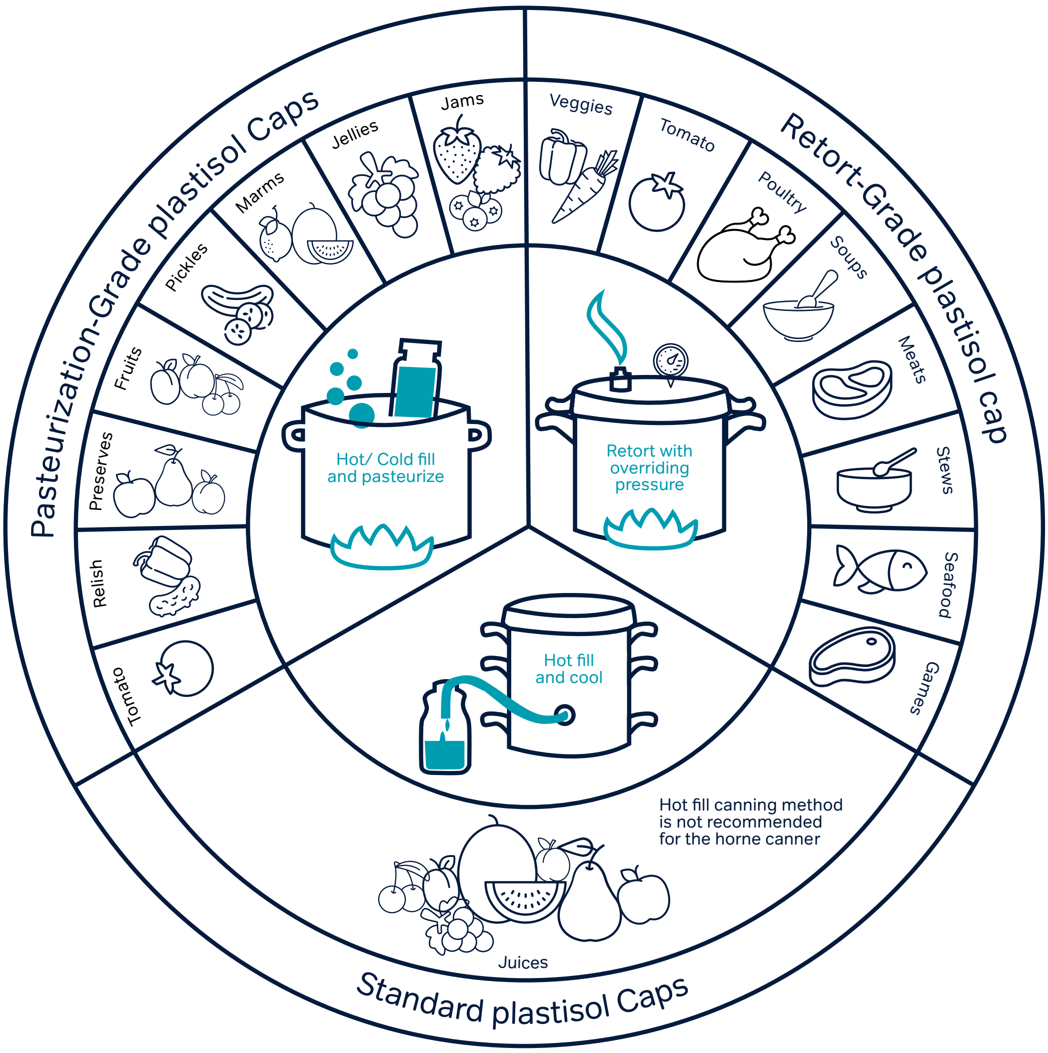


Figure 2: Food contact applications where Sealants are used

# Caulk

PVC is used to provide flexibility and help prevent shrinkage in architectural and industrial Caulks. It is also used as a functional filler for improved rheology.

Caulking compounds are used to fill cracks and joints to prevent leakage in pipes and other structures. They are selected for rigid applications in situations of much expansion and contraction. Commercial caulking compounds are differentiated based on their resin type – namely Acrylic, Silicone, Polyurethane, Butyl rubber and so on. Each type has its own unique performance at-tributes and durability.

### Manufacturing

PVC resins find niche use as an "additive" in the manufacture of caulking compounds, primarily the polyurethane type. The PVC resin is first mixed with a suitable plastisol and heated just below its glass transition temperature to form a controlled "pre-gelled" structure. This pre-gel which provides the needed thixotropy for the caulking compound is then incorporated with the primary Polyurethane components (Base Polyol, Isocynate, Catalysts, Pigments, Fillers) and solvents in an inert atmosphere and filled in dispensing tubes. During mixing and filling, care is taken to prevent the Polyurethane components from coming in contact with moisture. Similarly, the choice of raw materials is equally important from the point that they should have high moisture contents. This process is shown schematically in figure 2.

### Application

The tip of the caulking tube is cut prior to Application to allow the compound to be pushed out using a caulking gun (picture shown).

When applied, the moisture in the air will initiate a chemical reaction between the isocyanate and the base resin to form a crosslinked Polyurethane. The PVC pre-gel provides the needed flexibility during the useful shelf life of the caulking compound.

Vestolit offers select specialty resins that are suitable for such caulking Applications (see table B).

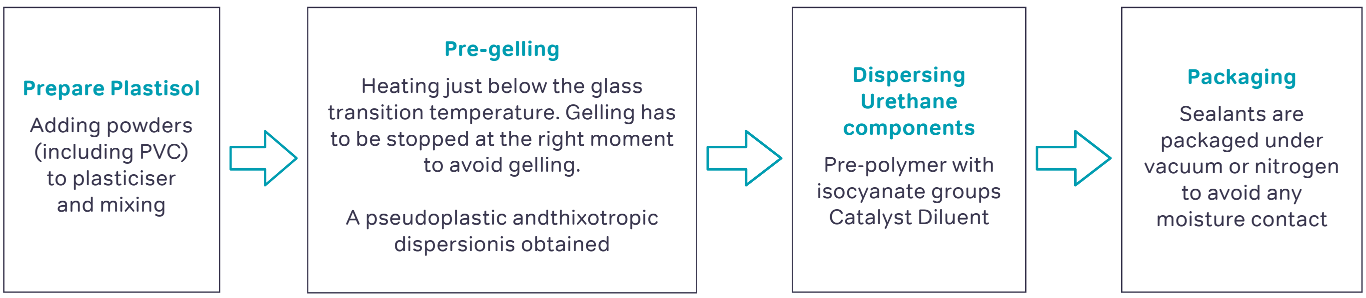


Figure 3: Scheme of the caulk preparation

| Product Code | K value | Description |
|---|---|---|
| VESTOLIT G 173 | 70 | Medium molecular weight, fine particle size, controlled gelation, clarity, low moisture content |
| VESTOLIT G 179 | 75 | High molecular weight, fine particle size, controlled gelation, clarity, low moisture content |

Table B: Recommended Grades for caulks

# Underbody Coatings (UBC)

Seam seals made of soft PVC find usage in the automotive industry. They serve as sound and vibration dampeners and as underbody protection thanks to their good weather resistance.

For protection, PVC based coatings are typically sprayed on the underbody. Thanks to its heat, cold, and abrasion resistance properties, these coatings are particularly suitable for sound deadening and protecting the underbody of a motor vehicle from rust and stone chips.

Automobiles typically get 5 different types of coatings for protection as well as aesthetics. They can be classified and sequenced as follows:

1. Pretreatment (phosphate) – for metal coating preparation and corrosion protection. Average coating thickness = 4–7µ.

2. Electrodeposition (ED) – a coating for corrosion protection: Average thickness = 15–25µ. The coated body is sent through a baking oven to achieve full cure.

3. Underbody Coating and Sealants: for anti-corrosion, elimination of water leaks, and minimization of chipping and vibrational noise. Applied in select areas of the automobile industry.

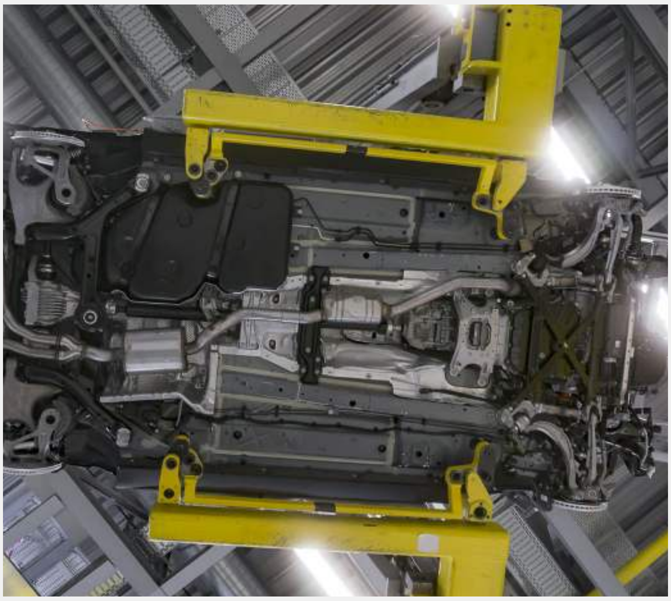

Image 3: Car underbody

4. Primer – to provide inter-coat adhesion between previous coats and the subsequent topcoat. Can also provide additional corrosion and chip resistance.

5. Topcoat – consisting of a base color coat and clearcoat for gloss, smoothness and UV resistance. Where each of these coatings are applied is shown schematically in figure 4.


Figure 4: Coated automotive regions

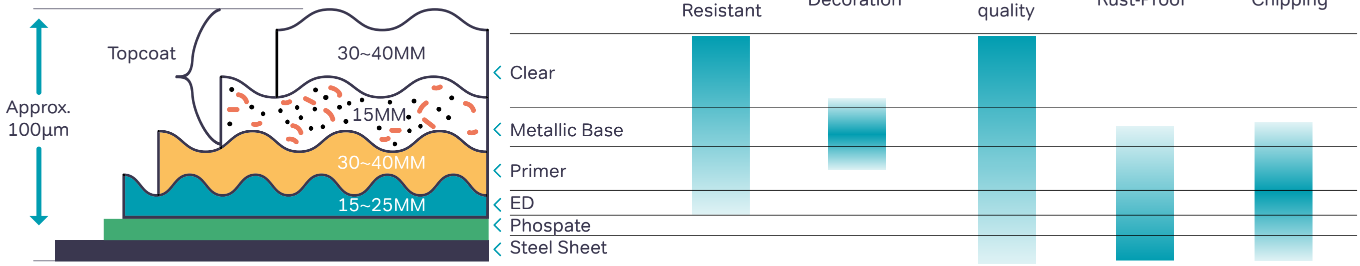


Figure 5: Scheme of an automotive paint coating

UBCs and Sealants are the third, but critical part of the overall coating process to provide corrosion protection, chip resistance and to prevent leaks from welded seams. Sealants are applied to numerous parts of an automobile like doors (around and inside), hood, trunk, exterior/interior of metal joints, wheel well and front dash. Application of Sealants onto an automobile is done either manually or with robots.

Image 4: Applying Underbody Coat

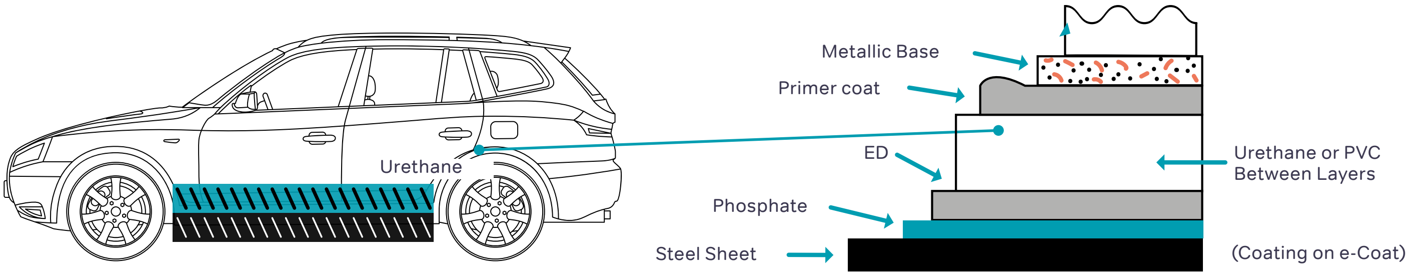


Figure 6: Scheme of an automotive paint coating

Underbody Coatings (UBCs) are used for chip resistance and corrosion protection, and in more recent times, also for additional sound/noise insulation during operation. These are typically applied either manually or robotically by using airless spray equipment. Coating thickness of the UBCs can vary widely, and are dictated by each automobile coating manufacturer. Typical areas to apply UBCs are shown in figure 6.

Each of the above-mentioned applications has different requirements, thus requiring sealant manufacturers to develop specific recipes and application techniques for each end use.

A common, but critical requirement for successful application of such a Sealant/Coating is excellent sag resistance. This is achieved by properly balancing the recipe components to get a consistent thixotropic, shear thinning behavior – low viscosity at high application shear rates, quickly reverting to high viscosity after it is applied. PVC resins are extensively used in the formulation of plastisols for automotive Sealants. Predetermined amounts of PVC resin, plasticisers, fillers, pigments, and flow control additives are used to formulate various types of Sealants. Some are specifically designed to be able to foam to achieve lower coating density and insulation. Formulators often rely on either the PVC resin and/or fillers to achieve the desired thixotropy. The choice of PVC resin and plasticiser determines the fusion cure temperature of the Sealant and the overall mechanical properties of the Sealant. In OEM settings, the fusion and cure properties of these Sealants and UBCs are matched to the OEM primer cure cycles, typically at 30 minutes at 130–150 °C. Although those requirements are trending lower in temperature. These are further subjected to an additional topcoat base cycles of 30 to 40 minutes at 125–135 °C; wet on wet technologies eliminate use of additional steps. Vestolit offers a wide range of homopolymer and copolymer resins from each of its manufacturing locations for the global Sealants and UBC market. Resin codes, the resin type, as well as key attributes are summarized in table C.

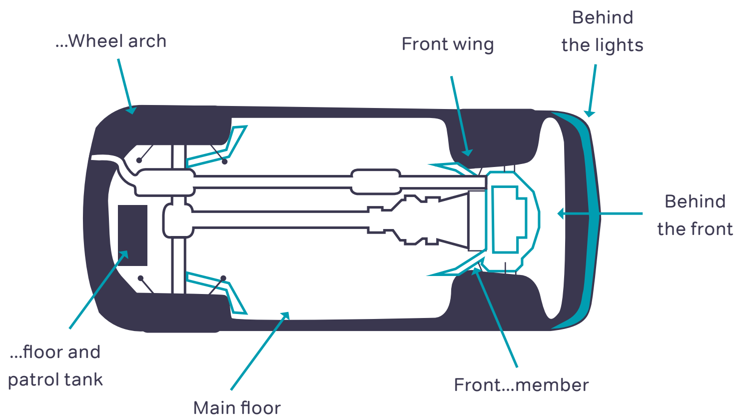


Figure 7: Coated underbody regions

| Product Code | K value | Description |
|---|---|---|
| **Homopolymers** | | |
| VESTOLIT S 67 | 67 | High viscosity, pseudoplastic |
| VESTOLIT E 7031 | 70 | Pseudo-plasticity |
| VESTOLIT P 1353 K | 70 | Producing high viscosity pastes with pronounced pseudoplastic flow for compact processing and for chemical expansion |
| VESTOLIT P 1353 KB | 70 | Producing high viscosity pastes with pronounced pseudoplastic flow for compact processing and for chemical expansion |
| VESTOLIT A 74 LM | 74 | Pseudo-plasticity, medium viscosity |
| VESTOLIT A 74 L | 74 | Pseudo-plasticity, medium viscosity |
| VESTOLIT G 121 A | 74 | Good chemical foamability for producing medium to high density foams Good dispersibility for easier plastisol preparation |
| **Copolymers** | | |
| VESTOLIT B 7090 Ultra | 67 | Low viscosity, low fusion, excellent storage stability |
| VESTOLIT P 135 LV | 69 | 4% Vinyl Acetate content. Designed for low fusion temperature applications, potential energy savings |
| VESTOLIT P 139 LV | 69 | 7% Vinyl Acetate content. Designed for low fusion temperature applications, with the beneficial of potential energy savings |
| VESTOLIT G 136 | 70 | 5% Vinyl Ester content. Designed for low fusion temperature applications, potential energy savings |
| VESTOLIT G 138 | 75 | 5% Vinyl Ester content. Designed for low fusion temperature applications, potential energy savings |
| **Blending Resin** | | |
| VESTOLIT XG FIT 074 | 60 | Aged viscosity stability, particle size |
| VESTOLIT XM 100X122 | 64 | Aged viscosity stability, particle size |
| VESTOLIT XG 215 | 64 | Aged viscosity stability, particle size |
| VESTOLIT XC 866 | 66 | Low gloss, good air release, fast fusion |
| VESTOLIT XG 217 | 67 | Aged viscosity stability, particle size |
| VESTOLIT XG FIT E-51 | 67 | Aged viscosity stability, particle size |
| VESTOLIT XG FIT E-52 | 72 | Aged viscosity stability, particle size |
| **Blending Copolymer** | | |
| VESTOLIT CS 6205 LP | 62 | Fast fusion, plastisol viscosity aging, particle size |

Table C: products for Underboday Coatings

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## About Orbia

Orbia is a company driven by a shared purpose: to advance life around the world. The five Orbia business groups have a collective focus on expanding access to health and wellness, reinventing the future of cities and homes, ensuring food and water security, connecting communities to information and accelerating a circular economy with basic and advanced materials, specialty products and innovative solutions.

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