

# Reliable solutions from Dow for automotive appearance

## Formulation guide

**DOW**

®



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# Auto care formulation information

## General auto polish and formulation tips

### 1. Introduction

The word “polish” is a non-specific name but may be defined as any product that enhances and protects the painted surface of an automobile by depositing a thin layer or film of material. More specifically, the name polish is assigned to a product with particular properties, as listed below. Polishes may contain many different ingredients and come in various forms that contribute to a range of final product properties. It is essential to choose the correct ingredients and form to satisfy customers’ needs for specific applications. The following information should assist in making those choices.

Silicones are used to improve a number of auto polish properties, including:

- Ease of application
- Polish cleaning ability
- Ease of buffing
- Gloss
- Color intensity
- Durability and detergent resistance
- Water repellency

The best choice of silicone will depend on the relative importance of the properties above. This is because a polish is essentially a compromise of all the properties.

### 2. Polish types

Polishes can be described in terms of their physical form, carrier system, ability to clean and durability. Physical forms of polishes include pastes, pre-softened pastes (non-flowing emulsions), liquids and gels. There are three types of carrier system:

#### 2.1. Water-free polishes

Where the active ingredients are dissolved in a compatible carrier such as a hydrocarbon solvent.

#### 2.2. Emulsion polishes

Combining two incompatible phases (hydrocarbon solvent + water) by incorporating a surfactant to form a bridge between the two phases.

#### 2.3. Solvent-free polishes

Using pre-emulsified materials with the carrier being water.

The ability of a polish to clean depends on the presence of powders and solvents. Powders clean physically by removing the oxidation layer and smoothing the surface. Solvents clean chemically by dissolving the films and dirt present on the surface. Powder-free polishes, typically referred to as paint conditioners and glazes, are used strictly to provide gloss and protection. They should be applied only to non-oxidized painted surfaces.

A polish may also be described by its level of durability.



Durability ranges from temporary (a few weeks) to durable films that remain after numerous detergent washes or months (formerly called “polymer sealants”). To the user, durability is typically judged by a polish’s ability to sustain water beading.

### 3. Active ingredients

The term “active ingredient,” as used here, is defined as that part of the polish left behind in the form of a film on the polished surface after application.

#### 3.1 Silicones

A variety of silicones, including polydimethylsiloxanes, aminofunctional silicones and silicone resins, are used as active ingredients in polish formulations. Silicone emulsifiers, waxes and volatile silicones are also used in polish formulations and will be addressed in other sections.

Polydimethylsiloxane is a nonreactive linear silicone fluid, which is supplied in a number of viscosities. In the auto polish industry the convention is to classify polydimethylsiloxane as either “intermediate” (350-1000 mm<sup>2</sup>/s) or “high” (above 1000 mm<sup>2</sup>/s) viscosity.

Intermediate-viscosity polydimethylsiloxanes are lower in molecular weight. They provide excellent application ease and rubout, as well as streak resistance. Due to their low surface tension, they can improve polish cleaning abilities by increasing the surface wettability. This enables a more direct contact between the powder and the painted surface. They are very good at spreading and thus provide excellent film continuity. The film provided by intermediate-viscosity polydimethylsiloxanes, especially at (1000 mm<sup>2</sup>/s, provides high shine.

High-viscosity polydimethylsiloxanes are much higher in molecular weight. They provide improvements in durability and provide excellent shine characteristics. However, they are more likely to cause streaking. In general, solvent-in-water polishes





use 50-1000 mm<sup>2</sup>/s polydimethylsiloxane, while water-in-solvent polishes enable higher-viscosity polydimethylsiloxanes to be used. In polish formulations it is advantageous to use a combination of high-and intermediate-viscosity fluids favoring the following broad spectrum:

$$\begin{array}{ccc} 3 & : & 1 & : & 1 \\ 350 & & 1000 & & 12,500 \end{array}$$

This helps to optimize shine and durability in comparison to ease of use and film continuity.

Aminofunctional silicone fluids are also used extensively in polishes in both curable (crosslinking) and noncurable forms. They provide properties similar to the polydimethylsiloxanes, but with enhanced durability and detergent resistance, particularly with the curable forms.

One advantage of aminofunctional silicones is that they contain a polar amine group that provides excellent deposition or surface affinity. This effectively anchors the product to the substrate. In the case of the curable amine silicones, a reactive alkoxy group undergoes a condensation reaction that provides a crosslinked film on the substrate. Aminofunctional silicones are available with different viscosities, which allow optimization of properties for a particular application. They are compatible with other silicone fluids and resins and therefore may be blended to create the desired polish performance. **Fatty acids may be combined with aminofunctional silicones to improve the corrosion resistance of a polish film.** Stearic or lauric acid is often used for this purpose. These can also crosslink with acid waxes through the amino group.

Silicone resins may also be used in polish formulations. These networked silicones are available either bodied or linear and provide intermediate durability to the polish film. When used in conjunction with polydimethylsiloxanes, they provide improved durability with excellent leveling while maintaining similar ease-of-use, shine and water-repellent characteristics.

### 3.2 Waxes

Waxes are commonly found in polish formulations. A wide variety of different waxes are available, including naturally occurring (carnauba), synthetic (silicone wax, polyethylene) and refined (paraffin) waxes. If properly selected, a wax may reduce smear, improve film continuity (or uniformity), provide durability and promote stability by acting as a thickener.

Most waxes may be described as either soft or hard wax. Hard waxes, such as carnauba and polypropylene, tend to have higher melting points. They provide a harder film finish and promote good gloss, color intensity and durability. However, they are often more difficult to apply and buff out.

Softer waxes, such as paraffin and beeswax, tend to be better at lubricating, providing better application in terms of rubout ease and improved spreading. However, soft waxes provide less shine to the system. In most formulations, it is best to blend a hard wax with a soft wax to optimize their benefits in the formulation.

A recent innovation has been the introduction of silicone waxes into auto polishes. These provide a different combination of properties to that of the traditional waxes. While having a low melting point, they can provide a film with increased

detergent resistance and weathering abilities, especially when combined with functionalized silicones. They provide a dry film that improves the resistance to dirt pickup, while retaining the application ease, spreading characteristics and shine associated with softer waxes.

### 3.3 Solvents

Solvents are another component of most polish systems and can have an impact on the overall formulation performance. The purpose of the solvent in a polish is to carry the active ingredients; to “wet” the surface so a uniform film is produced; and to clean the surface. In choosing a solvent, drying rates, combustibility, compatibility with the surface and compatibility with the packaging must be considered.

It is important to optimize the solvent choice to provide appropriate drying time for the specific application and actives in the formulation. Too little or too much drying time for a specific formulation may lead to poor performance by leaving streaks or a discontinuous film finish. Aliphatic hydrocarbons with Kauri-Butanol values of less than 32 are recommended for polishes. Examples of these include de-aromatized and Isopar rafinic solvents. Solvents that contain aromatic substances are not recommended for use in these products because they may damage the surface and may raise flammability, health and environmental issues.

Volatile silicones are an alternative to these traditional solvents. Volatile silicones provide some unique application properties such as better spreading and lubrication properties due to their lower surface tension, and improved compatibility with silicones. Different evaporation rates can be achieved by blending. This allows even deposition of other ingredients, while their cleaning ability for various deposits is comparable to traditional solvents. It has been shown that volatile silicones do not contribute to tropospheric ozone formation. Therefore, volatile silicones are not classified as VOCs in the USA.

### 3.4 Powders

Powders or polishing agents provide physical surface preparation and cleaning, and aid leveling of the deposited film. The ability of a powder to clean and smooth out surface imperfections depends on the particle size, its shape and hardness. The larger and less uniform the powder particle the greater the cleaning ability to remove the oxidized paint layer. Milder powders are composed of more uniform, smaller particles, which polish more and clean less, giving greater gloss. These are better suited to surfaces with little or no oxidation. For cars less than one year old, it may not be necessary to include powders in the formulation. Most powders contain kaolin clays, diatomaceous earths and hydrated aluminas such as Sillitin, Kaopolite, Diafil and Alcan grades.

### 3.5 Emulsifiers

A polish emulsion may be described by either its emulsion system or its ionic character.

An oil-in-water (o/w) emulsion is a system in which the water is the external or continuous phase and the oil is in the form of suspended droplets. These can give a better shine than the other emulsion type, are less flammable and may be considered safer for skin contact.



Water-in-oil (w/o) polishes are popular due to easier processing in some cases and better cleaning properties. Here the oil is the continuous phase, with the water suspended as droplets. Emulsifiers for this type of system have a hydrophilic/hydrophobic balance favoring the oil phase, e.g., silicone emulsifiers. For best results, the water and oil phases are blended separately, and then the water phase is slowly added to the oil phase using a mixer that provides high shear. With some formulations it is possible to blend the phases in a certain order in one vessel.

Silicone emulsifiers represent a unique material for use in water-in-oil polish formulations. These lipophilic materials produce very stable, shear-thickened emulsions. In addition, they are thixotropic, providing excellent application ease. The inherent lubricating nature of the silicone improves rubout. As emulsifiers they can provide better shine than their organic counterparts due to compatibility with active residual material in the polish film.

Emulsions defined by their ionic character are either anionic, nonionic or cationic. An anionic emulsion particle shows a net negative charge typical of the formulations, based on the saponification of a fatty acid such as oleic acid and an alkali. Nonionic emulsions show no net charge and are typical of the emulsions, based on alcohol ethoxylates. Cationic emulsion particles have a net positive charge similar to the alkyl quaternary compounds, giving good wetting and substantivity properties as well as synergy with silicones.

The key to making stable polishes is using the right level of emulsifier, correct HLB value and chemical type for the system – with the ingredients added in the proper order. Oleic acid and a volatile amine can be used together because this combination leaves no residual surfactant on the surface and therefore avoids re-emulsification. Substituting a higher-molecular-weight fatty acid, such as stearic, for the oleic can increase the emulsion viscosity and improve stability.

### 3.6 Thickeners

A variety of thickeners are commonly used in polish formulations to provide better stability and improved consistency. For maximum efficiency, the external phase should be thickened with no more thickener used than necessary.

In a water-in-oil system, a solvent-based thickener such as bentonite clay can be used. This will increase the viscosity and improve the product consistency as well as reduce the phase separation. The presence of aminofunctional silicones provides a richer, thicker end product with this emulsion type.

With oil-in-water formulations, the aqueous phase may be thickened with natural gums, cellulose gums or acrylic acid polymers. Magnesium aluminium silicates provide minimum thickening, but tend to reduce powder settlement. This is of particular benefit in spray-and-wipe formulations where lower viscosity is desired.

### 3.7 Biocides

Microbes can spoil polishes, causing breakdown of the product as indicated by a color change or offensive odor. Microbes can also affect the packaging of the polish by distorting the container. Microbial testing must be undertaken to verify whether the product needs protecting.

### 3.8 Miscellaneous

Other additives may be added to the polish as desired. For example, coloring agents can be added to shade the polish, while fragrances give an attractive smell. Both are typically incorporated at 0.1-0.2% by weight (higher levels of fragrance can affect stability). In other situations the coloring agent (pigment or dye) is added in larger amounts to create “colored polishes.” Other resins, such as acrylic and polyurethane, can be incorporated at low levels to increase the immediate water resistance (not repellency). However, compatibility needs to be determined.

## 4. Formulation tips

### 4.1 Stability problems

#### 4.1.1 Oil-in-water polishes

Many different stability problems occur in oil-in-water polishes, but the most common ones can be remedied fairly easily. One such problem occurs when the emulsifying system is the reaction product of a reactive amine source with a fatty acid. If there is interference with this reaction, there will be insufficient surfactant to emulsify the internal phase. It is advisable to combine the reactants in the same phase (usually the oil phase) and allow them to pre-react before adding reactive ingredients such as aminofunctional silicones or neutralizing agents. Problems also occur when the amine content of silicones or other ingredients is too great as this tends to favor water-in-oil emulsions and can actually prevent oil-in-water polishes from forming properly.

If the emulsion forms, but is prone to settling or breaking, thickening the emulsion will often enhance the stability. This may be accomplished by thickening the external phase with gums or acrylic acid polymers.

#### 4.1.2 Water-in-oil polishes

Probably the most common type of instability in water-in-oil polishes is “oiling out” of the phases. This condition occurs because of the natural tendency of the less dense solvents to collect at the top of the polish, but can normally be redispersed by agitation such as shaking. To eliminate this tendency, the emulsion can be made extra thick to reduce the mobility of the phases. Alternatively, steps can be taken to make the phases more compatible, for example by adding a hydrophilic co-surfactant.

Also, applying more shear will reduce the particle size of the emulsion and thicken the polish. It is possible however to overshear the polish and make the particles too small, consuming the surfactant and contributing to instability. When using silicone emulsifiers, adding 0.5-1.0 of a water-soluble electrolyte, such as sodium citrate, in the water phase can substantially enhance stability.



## 4.2 Performance issues

### 4.2.1 Streaking problems

Streaking is generally defined as marks or imperfections in the polish film that are immovable, or hard to move, with simple rubbing. In extreme cases streaking appears as harder swirl marks where the polish was originally applied. Generally there are two main causes for streaking:

- The film-forming ingredients cannot level and spread well.
- The film-forming ingredients interfere with each other.

The first cause is usually manifested by insufficient drying time, improper solvent choice or improper application conditions. Allowing too little or too much drying time can have negative effects on the polish film. It is important to choose appropriate solvents as well as the proper phase ratios (water phase versus oil phase) to provide a drying time that allows the polish active ingredients to wet out to a thin, uniform film.

Polishes that dry too quickly tend to leave a film that varies in thickness over the surface. This creates a film with poor gloss properties because the actives do not have time to wet out prior to solvent evaporation. This is especially the case for higher-viscosity and reactive silicones.

Polishes that are left to dry for too long may also yield a non-uniform film with poor gloss and color enhancement. This is because after the solvent has evaporated, the remaining actives cannot be buffed to a smooth finish – especially if the materials have begun to crosslink and anchor to the surface. Environmental conditions (primarily temperature and humidity) affect the required drying times; on warm surfaces the solvent evaporates too quickly for reactive polymers to wet out. It is important to consider these factors when choosing the solvent or solvent blend for your formulation. In most cases a polydimethylsiloxane will be more flexible than a reactive polymer, and can accommodate a variety of drying times. If these measures do not eliminate the problem, then a wetting agent should be tried at low dosage levels, typically 0.1-0.3%. Silicone polyethers are effective wetting agents used in small quantities; they reduce the tendency to re-emulsify, and avoid incompatibility problems.

The second cause of streaking (i.e., the film-forming ingredients interfering with each other) can be more difficult to resolve. An approach would be to eliminate each ingredient in turn to determine the source of the interference. Sometimes the final film may be compatible, but in getting to that film, there may be stages where ingredients interfere with each other and cause streaking. In this case, choosing coalescing solvents that help solubilize all of the active ingredients can help.

Finally, it must be said that streaking is not an easy problem to solve, so plenty of persistence is required.

### 4.2.2 Smearing

Smearing is the tendency of a polish film to be too mobile. This can contribute to a more hazy appearance, and show fingerprints or an oily look. Smearing is usually caused by overdeposition of higher-viscosity active ingredients. One solution is to reduce the level of high-viscosity ingredients such as silicones and other materials, or change the ratio of low and

high-viscosity actives. The choice and level of powders can play a significant part in the amount of material left behind on the surface. This can be optimized by trying to incrementally increase or decrease powder and active levels, but this too is a bit of a balancing act and requires perseverance. Every ingredient added or subtracted in a formulation can affect the final properties and physical form of a polish.

### 4.2.3 Gloss and color

These properties are a function of several factors of a formulation as well as the conditions and surface where it is applied. Gloss can be measured by reflectance properties and clarity of image, while color is assessed from such factors as hue, lightness and saturation.

“Clarity of image” is how well the finish shows details of the reflected image. A common way to assess clarity is to hold a ruler or printed page perpendicular to the surface of the paint and observe the reflected markings and letters on the paint. This is usually affected by how smooth the surface is. A film-former that is smeary can cause unevenness in the image and can distort the image. However, a film-former that is too rigid, or one that dried too quickly, can cause a spotty or mottled deposition, also resulting in distortion. Clarity can be improved by blending different film-formers; by choosing slower- or faster-drying solvents; or by using a very fine grade of powder to polish the surface to a smooth finish.

Color intensity is often referred to as “jetting” or “wet look” and is influenced by the type of film-former used. Thicker films (e.g., higher-viscosity silicones) will usually help the jetting but this can be carried too far and result in smearing. Hard waxes have the same benefits and problems as high-viscosity silicones but have the disadvantage of being difficult to buff. In some instances, where a high level of reactive silicones or hard waxes is used, it is possible for some of the powder residues to be trapped in the film and left on the surface. This reduces the wet look.

### 4.2.4 Durability versus ease of use

Waxes were the first reasonably durable polish components and were applied from solvent over the surface, then buffed to a smooth appearance. The harder the wax the better the durability but the harder it was to buff. Polydimethylsiloxanes were introduced to help lubricate waxes and allowed easier buffing, but these compromised durability. The solution was curable silicones, which allow easy application, spreading and buffing. They then cure in place and become more durable.

The curable silicones used in automotive polishes are normally aminofunctional ones. The requirement is to apply as much as needed for good durability while retaining good gloss and ease of use. Low-viscosity aminofunctional silicones are more reactive and more durable, but do not provide significant levels of gloss or lubricity. By blending with higher-viscosity aminofunctional silicones or polydimethylsiloxanes, the best balance of durability and ease of use can be achieved.

The typical ratio of reactive amino-silicones used in traditional polishes is 4 to 6 parts high viscosity to 1 part lower viscosity. This balance can be adjusted to affect ease of application, buffing, gloss and durability. Small, incremental changes are best, because altering one property can affect another.



## 5. Notes on formulations shown

- 5.1. Unless stated, all quantities are in percentage parts by weight.
- 5.2. All formulations are for illustrative purposes only and have been subjected to limited stability tests. You should perform your own stability and performance tests.
- 5.3. While Dow endeavors to provide up-to-date information on all the toxicological aspects of its products, it cannot provide such information on other ingredients mentioned in the formulations. As the formulations themselves have not been subjected to safety tests, formulators must satisfy themselves that their final products are safe and compliant with current legislation.
- 5.4. Note that these are representative formulations only and are not commercialized products. Information and data contained in the formulations are based on information Dow believes to be reliable, but Dow does not warrant merchantability, fitness for use, performance or efficacy. It is the formulator's obligation to test any application and to conclude satisfactory performance and safety tests before commercialization. Suggestions of uses should not be taken as inducements to infringe any particular patent.
- 5.5. Please note that certain aminofunctional siloxanes can display acute toxicity via aerosol inhalational exposure. Safety data sheets should be referred to before handling and formulating with these products.
- 5.6. Soft water should be used for all formulations.
- 5.7. Biocides have not been shown but all formulations should be subjected to microbial testing. Coloring agents and fragrances may also be included at low addition levels.

The developed polishes presented by Dow have been formulated to satisfy one of the requirements in the table below:

## 6. Tire care and protectants

Tire dressings, also known as tire renovators, and protectants, also known as vinyl dressings, have the purpose of enhancing the appearance of rubber and plastic surfaces. These

	Condition of painted surface		
	New	Good	Slightly weathered
<b>Abrasive</b>	0-5%	5-12%	10-15%
<b>Durable</b>	Wax conditioner	Poly sealant liquid	Poly sealant paste
<b>Semi-durable</b>	Hard wax	"Polish"	-
<b>Temporary</b>	Instant	-	-

products can be water- or solvent-based. Protectants are typically water-based products. Silicone emulsions made of polydimethylsiloxane fluids can be combined to achieve desired gloss levels. It is recommended to start with emulsions made of intermediate-viscosity fluids and use emulsions made of high-viscosity fluids to improve depth of gloss. Aminofunctional silicone emulsions can be incorporated to impart durability to these products. Notice that some aminofunctional silicone emulsions have cationic surfactants. Choose nonionic or cationic emulsions when combining with these emulsions.

The recommended silicone actives content for tire dressings and protectants formulations is 15-25%.

Silicone polyethers such as XIAMETER™ OFX-5211 Fluid can be utilized to enhance wetting properties for these products. The recommendation is to use 0.1-0.3% depending on how difficult to wet the surface is.

Elastomer emulsions and dispersions, silicone polyethers and silicone waxes can help to create innovative look and feel finishes such as soft or dry feel. These types of silicones can help to formulate non-oily-feel products.

Solvent-based tire dressings can be formulated following the recommended ratios found in section 3.1 (Silicones). The same principles found in polishes on how to achieve different levels of gloss apply to tire dressings.



# Table I: Application selector guide

Target application →	Benefit ↓	Wash and rinse aid	Exterior wax, conditioner and sealant	Exterior trim protectant	Upholstery care
Water-based	<b>Gloss</b>	DOWSIL™ FZ-4658 Emulsion XIAMETER™ MEM-0349 Emulsion XIAMETER™ MEM-0346 Emulsion	XIAMETER™ MEM-0349 Emulsion XIAMETER™ MEM-0346 Emulsion XIAMETER™ MEM-0062 Emulsion XIAMETER™ MEM-1473 Emulsion	XIAMETER™ MEM-0349 Emulsion XIAMETER™ MEM-0346 Emulsion XIAMETER™ MEM-0062 Emulsion XIAMETER™ MEM-0039 Emulsion	XIAMETER™ MEM-0349 Emulsion XIAMETER™ MEM-0346 Emulsion
	<b>Durability</b>	XIAMETER™ MEM-8035 Emulsion DOWSIL™ FZ-4658 Emulsion	XIAMETER™ MEM-8035 Emulsion DOWSIL™ BY 22-749 SR Emulsion	XIAMETER™ MEM-8035 Emulsion DOWSIL™ HV 496 Emulsion XIAMETER™ MEM-0062 Emulsion PS XIAMETER™ MEM-1101 Emulsion	
	<b>Ease of use</b>	XIAMETER™ MEM-0349 Emulsion XIAMETER™ MEM-0346 Emulsion	XIAMETER™ MEM-0349 Emulsion XIAMETER™ MEM-0346 Emulsion	XIAMETER™ MEM-0349 Emulsion XIAMETER™ MEM-0346 Emulsion	
	<b>Water beading</b>	DOWSIL™ FZ-4658 Emulsion XIAMETER™ MEM-8035 Emulsion XIAMETER™ MEM-0062 Emulsion	DOWSIL™ BY 22-749 SR Emulsion	XIAMETER™ MEM-8035 Emulsion	
	<b>Leveling</b>	XIAMETER™ MEM-0349 Emulsion XIAMETER™ MEM-0346 Emulsion XIAMETER™ MEM-1473 Emulsion	XIAMETER™ MEM-0349 Emulsion XIAMETER™ MEM-0346 Emulsion XIAMETER™ MEM-0039 Emulsion XIAMETER™ MEM-1473 Emulsion	XIAMETER™ MEM-0349 Emulsion XIAMETER™ MEM-0346 Emulsion XIAMETER™ MEM-0039 Emulsion XIAMETER™ MEM-1473 Emulsion	
	<b>Paintability</b>		XIAMETER™ MEM-5009 Emulsion DOWSIL™ 2418 Release Emulsion	XIAMETER™ MEM-5009 Emulsion DOWSIL™ 2418 Release Emulsion	
	<b>Wetting</b>	XIAMETER™ MEM-0349 Emulsion XIAMETER™ MEM-0346 Emulsion XIAMETER™ MEM-8035 Emulsion XIAMETER™ MEM-0062 Emulsion PS			
	<b>Slip</b>	XIAMETER™ MEM-0349 Emulsion XIAMETER™ MEM-0346 Emulsion XIAMETER™ MEM-8035 Emulsion XIAMETER™ MEM-0062 Emulsion PS		XIAMETER™ MEM-1101 Emulsion XIAMETER™ MEM-0349 Emulsion XIAMETER™ MEM-0346 Emulsion	
	<b>Color enhancement</b>		DOWSIL™ HV 496 Emulsion XIAMETER™ MEM-1101 Emulsion	DOWSIL™ HV 496 Emulsion XIAMETER™ MEM-1101 Emulsion	





Interior trim renovator	Leather conditioner	Glass care	Vinyl protectant	Tire care
XIAMETER™ MEM-0349 Emulsion XIAMETER™ MEM-1473 Emulsion XIAMETER™ MEM-0039 Emulsion XIAMETER™ MEM-0346 Emulsion	XIAMETER™ MEM-0349 Emulsion XIAMETER™ MEM-1473 Emulsion XIAMETER™ MEM-0346 Emulsion XIAMETER™ MEM-0062 Emulsion XIAMETER™ MEM-0039 Emulsion	XIAMETER™ OFX-0193 Fluid	XIAMETER™ MEM-0349 Emulsion XIAMETER™ MEM-0346 Emulsion	XIAMETER™ MEM-0349 Emulsion XIAMETER™ MEM-0346 Emulsion XIAMETER™ MEM-0039 Emulsion XIAMETER™ MEM-0062 Emulsion PS
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DOWSIL™ 2418 Release Emulsion			XIAMETER™ MEM-5009 Emulsion DOWSIL™ 2418 Release Emulsion	
XIAMETER™ MEM-0349 Emulsion XIAMETER™ MEM-0346 Emulsion XIAMETER™ MEM-8035 Emulsion	XIAMETER™ MEM-0349 Emulsion XIAMETER™ MEM-0346 Emulsion XIAMETER™ MEM-0062 Emulsion PS	XIAMETER™ OFX-5211 Fluid XIAMETER™ OFX-0193 Fluid		XIAMETER™ MEM-0349 Emulsion XIAMETER™ MEM-0346 Emulsion XIAMETER™ MEM-0062 Emulsion PS XIAMETER™ MEM-1101 Emulsion XIAMETER™ MEM-8035 Emulsion
XIAMETER™ MEM-8035 Emulsion XIAMETER™ MEM-0349 Emulsion XIAMETER™ MEM-0346 Emulsion	XIAMETER™ MEM-0062 Emulsion PS XIAMETER™ MEM-0349 Emulsion XIAMETER™ MEM-0346 Emulsion			XIAMETER™ MEM-8035 Emulsion XIAMETER™ MEM-1101 Emulsion XIAMETER™ MEM-0062 Emulsion PS XIAMETER™ MEM-0349 Emulsion XIAMETER™ MEM-0346 Emulsion
DOWSIL™ HV 496 Emulsion XIAMETER™ MEM-1101 Emulsion	DOWSIL™ HV 496 Emulsion XIAMETER™ MEM-1101 Emulsion			XIAMETER™ MEM-1101 Emulsion DOWSIL™ HV 496 Emulsion



Target application →	Wash and rinse aid	Exterior wax, conditioner and sealant	Exterior trim protectant	Upholstery care
<b>Gloss</b>		XIAMETER™ PMX-200 Silicone Fluid (350-1,000 cSt) XIAMETER™ OFX-0531 Fluid DOWSIL™ 3527 Release Agent DOWSIL™ 2-1912 Fluid DOWSIL™ 2-5088 Wax	XIAMETER™ PMX-200 Silicone Fluid (350-1,000 cSt) XIAMETER™ OFX-0531 Fluid DOWSIL™ 3527 Release Agent DOWSIL™ 2-1912 Fluid	
<b>Durability</b>	XIAMETER™ OFX-8630 Fluid	XIAMETER™ OFX-0536 Fluid XIAMETER™ OFX-0531 Fluid DOWSIL™ 3527 Release Agent DOWSIL™ 2-1912 Fluid DOWSIL™ 593 Fluid DOWSIL™ 2-5088 Wax XIAMETER™ OFX-8630 Fluid	DOWSIL™ 3527 Release Agent DOWSIL™ 593 Fluid DOWSIL™ 2-1912 Fluid	
<b>Ease of use</b>		XIAMETER™ PMX-200 Silicone Fluid (50-1,000 cSt) XIAMETER™ OFX-0531 Fluid	XIAMETER™ PMX-200 Silicone Fluid (50-1,000 cSt) XIAMETER™ OFX-0531 Fluid	
<b>Water beading</b>	XIAMETER™ PMX-0245 Cyclopentasiloxane XIAMETER™ PMX-200 Silicone Fluid XIAMETER™ OFX-8630 Silicone Fluid	DOWSIL™ 3527 Release Agent DOWSIL™ 2-1912 Fluid XIAMETER™ PMX-0531 Silicone Fluid DOWSIL™ 2-5088 Wax XIAMETER™ PMX-200 Silicone Fluid	DOWSIL™ 593 Fluid XIAMETER™ OFX-0531 Fluid XIAMETER™ OFX-0536 Fluid DOWSIL™ 2-5088 Wax XIAMETER™ PMX-200 Silicone Fluid	DOWSIL™ FBL-0563 Formulated Blend
<b>Leveling</b>	XIAMETER™ PMX-0245 Cyclopentasiloxane	XIAMETER™ PMX-200 Silicone Fluid DOWSIL™ 593 Fluid	XIAMETER™ PMX-200 Silicone Fluid	
<b>Paintability</b>		DOWSIL™ 2-5088 Wax XIAMETER™ OFX-0203 Fluid XIAMETER™ OFX-0230 Fluid	XIAMETER™ OFX-0203 Fluid XIAMETER™ OFX-0230 Fluid	
<b>Dry finish</b>		DOWSIL™ 2-5088 Wax		
<b>Wetting</b>	XIAMETER™ PMX-0245 Cyclopentasiloxane	XIAMETER™ PMX-200 Silicone Fluid	XIAMETER™ PMX-200 Silicone Fluid	XIAMETER™ PMX-200 Silicone Fluid
<b>Slip</b>		XIAMETER™ PMX-200 Silicone Fluid	XIAMETER™ PMX-200 Silicone Fluid	XIAMETER™ PMX-200 Silicone Fluid
<b>Color enhancement</b>		XIAMETER™ PMX-200 Silicone Fluid (10,000-60,000 cSt)	XIAMETER™ PMX-200 Silicone Fluid (10,000-60,000 cSt)	

Solvent-based



Interior trim renovator	Leather conditioner	Glass care	Vinyl protectant	Tire care
XIAMETER™ PMX-200 Silicone Fluid (350-1,000 cSt)	XIAMETER™ PMX-200 Silicone Fluid (350-1,000 cSt) DOWSIL™ 2-5088 Wax		XIAMETER™ PMX-200 Silicone Fluid (350-1,000 cSt)	XIAMETER™ PMX-200 Silicone Fluid (350-1,000 cSt)
	DOWSIL™ 2-5088 Wax			XIAMETER™ PMX-200 Silicone Fluid (12,500-60,000 cSt) XIAMETER™ OFX-8630 Fluid DOWSIL™ 3527 Release Agent DOWSIL™ 593 Fluid DOWSIL™ 2-1912 Fluid
XIAMETER™ PMX-200 Silicone Fluid (50-1,000 cSt)	XIAMETER™ PMX-200 Silicone Fluid (50-1,000 cSt)		XIAMETER™ PMX-200 Silicone Fluid (50-1,000 cSt)	XIAMETER™ PMX-200 Silicone Fluid (50-1,000 cSt)
DOWSIL™ 593 Fluid DOWSIL™ 2-1912 Fluid DOWSIL™ 3527 Release Agent XIAMETER™ PMX-200 Silicone Fluid	DOWSIL™ 2-5088 Wax	DOWSIL™ 3527 Release Agent	XIAMETER™ PMX-200 Silicone Fluid	DOWSIL™ 2-1912 Fluid DOWSIL™ 593 Fluid DOWSIL™ 3527 Release Agent XIAMETER™ PMX-200 Silicone Fluid
XIAMETER™ PMX-200 Silicone Fluid	XIAMETER™ PMX-200 Silicone Fluid		XIAMETER™ PMX-200 Silicone Fluid	XIAMETER™ PMX-0244 Cyclotetrasiloxane XIAMETER™ PMX-0245 Cyclopentasiloxane DOWSIL™ OS-2 Silicone Cleaner and Solvent
XIAMETER™ OFX-0203 Fluid XIAMETER™ OFX-0230 Fluid	DOWSIL™ 2-5088 Wax		XIAMETER™ OFX-0203 Fluid XIAMETER™ OFX-0230 Fluid DOWSIL™ 2-5088 Wax	XIAMETER™ OFX-0230 Fluid XIAMETER™ OFX-0203 Fluid
	DOWSIL™ 2-5088 Wax			
XIAMETER™ PMX-200 Silicone Fluid	XIAMETER™ PMX-200 Silicone Fluid		XIAMETER™ PMX-200 Silicone Fluid	XIAMETER™ PMX-0244 Cyclotetrasiloxane XIAMETER™ PMX-0245 Cyclopentasiloxane XIAMETER™ PMX-0345 Siloxane Blend DOWSIL™ OS-2 Silicone Cleaner & Solvent XIAMETER™ PMX-200 Silicone Fluid
XIAMETER™ PMX-200 Silicone Fluid	XIAMETER™ PMX-200 Silicone Fluid		XIAMETER™ PMX-200 Silicone Fluid	
XIAMETER™ PMX-200 Silicone Fluid (10,000-60,000 cSt)	XIAMETER™ PMX-200 Silicone Fluid (10,000-60,000 cSt)			XIAMETER™ PMX-200 Silicone Fluid (10,000-60,000 cSt)



## Table II: Water-based product comparison

Description	Currently available in these Geographic areas	Product	Functions, benefits and recommendations	Comparison ratings <sup>1</sup>	
				Shine	Durability
<b>Silicone Fluid Emulsion</b>	Americas, Asia	XIAMETER™ MEM-0349 Emulsion	Preferred for water-based formulations, these emulsions and microemulsions offer significant advantages when formulating flexibility is desirable; good compatibility; good surface abrasion characteristics; good gloss, minimum smear; for use in automotive polishes and rubber/vinyl protectant formulations, cleaning properties; provide proven performance, reliable quality and speed to market; the small particle size of the microemulsion products offers better penetration, improved wetting out, more consistent coatings.	••••	•••
	Americas, Asia	XIAMETER™ MEM-0039 Emulsion		••	••
	Americas	XIAMETER™ MEM-0062 PS Emulsion		••	•••
	Americas	XIAMETER™ MEM-1101 Emulsion		•••	••
	Europe	XIAMETER™ MEM-0346 Emulsion		••••	•••
	Europe	XIAMETER™ MEM-1473 Emulsion		••••	•••
	Global	XIAMETER™ MEM-0347G Emulsion		•••	••
	Global	DOWSIL™ HV 496 Emulsion		••••	••••
<b>Amino Functional Silicone Emulsion</b>	Global	XIAMETER™ MEM-8035 Emulsion	Provide outstanding bonding and adhesion properties to automotive finishes, allowing repeated washings and adverse weather conditions.	•••	••••
<b>Alkylaryl Functional Silicone Emulsion</b>	Global	XIAMETER™ MEM-5009 Emulsion	Have properties similar to intermediate-viscosity fluids, but with alkyl functionality; serve as actives for leather conditioners; provide preferred technologies to formulate products for body shop use.	••	••
	Europe	DOWSIL™ 2418 Release Emulsion		•••	•••
<b>Amino Microemulsion</b>	Japan	DOWSIL™ FZ-4658 Emulsion	Provides durable water repellency to shampoo for automated car washes; the small particle size prevents blockage in the pipes of the washing mechanism.	•••	••••

1. Comparison Ratings (••••• = Best, • = Moderate). Note: Ratings are a preliminary guideline only. See product data sheets for detailed information. All tested products have been tested at 5% actives on automotive panels using a suitable solvent.
2. There are restrictions under TASCAs applicable in the U.S.





Ease of use	Wetting	Slip	Viscosity, cSt <sup>‡</sup> (polymer viscosity for the emulsion products)	% Actives	Emulsifier type	Free of APEO surfactants	Compliant with European detergent regulations EC 648/2004	Notes
••••	•••	••	350 <sup>‡</sup>	60	Nonionic	Yes	Yes	
•••	••	•	350 <sup>‡</sup>	35	Nonionic	Yes	Yes	
•••	•••	••	1,000 <sup>‡</sup>	60	Slightly cationic	Yes		Emulsifiers are readily biodegradable
•••	•••	•••	125,000 <sup>‡</sup>	60	Anionic	Yes		
••••	•••	••	350 <sup>‡</sup>	60	Nonionic	Yes	Yes	
•••	•••	•	400	50	Nonionic	Yes	Yes	
••••	•••	•	OH Functional	60	Nonionic	Yes	Yes	
•	•••	••	100,000 <sup>‡</sup>	35	Anionic	Yes	Yes	
••	•	••••	-	35	Cationic	Yes	Yes	
•••	•••	••	-	50	Nonionic	Yes		Emulsifiers are readily biodegradable
•••	•••	•	-	50	Nonionic	Yes	No	
••••	•••	•••		15	Nonionic	Yes	Yes	Translucent gray



## Table III: Solvent-based product comparison

Description	Currently available in these Geographic areas	Product	Functions, benefits and recommendations
<b>Volatile Silicone</b>	Global	XIAMETER™ PMX-200 Silicone Fluid, 0.65 cSt	Volatile, low-viscosity fluids designed for use as carriers, high-performance non-VOC <sup>3</sup> solvents and cleaning aids in a wide range of automotive polish formulations; effective wetting properties deliver actives to the automotive surface; slip, water repellency and gloss characteristics are present for a limited time; replace mineral seal oil in rinse aids; effective microemulsions can be achieved when combined with silicone surfactants.
	Global	DOWSIL™ OS-2 Silicone Cleaner and Solvent	
	Global	XIAMETER™ PMX-1184 Silicone Fluid	
	Global	XIAMETER™ PMX-0244 Cyclotetrasiloxane	
	Global	XIAMETER™ PMX-0245 Cyclopentasiloxane	
	Global	XIAMETER™ PMX-0345 Cyclosiloxane Blend	
<b>Silicone Fluid</b>	Global	XIAMETER™ PMX-200 Silicone Fluid	High-viscosity fluids provide excellent depth of gloss and improvements in durability and water resistance; useful in solvent-based formulations; blend of intermediate- and high-viscosity fluids recommended to achieve a good balance in gloss, application ease and rub-out; a 3:1:1 ratio of 350, 1,000 and 12,500 cSt products optimizes shine and durability; products are available in emulsion form.
<b>Amino Functional Silicone</b>	Global	XIAMETER™ OFX-0531 Fluid	Offering enhanced durability, detergent resistance and corrosion resistance; offered in crosslinkable (curable) and non-crosslinkable versions; curable products produce a continuous film; non-crosslinkable products offer excellent stability and shelf life; deposit and adhere strongly to automobile finishes, chrome and aluminum surfaces.
	Global	XIAMETER™ OFX-0536 Fluid	
	Global	XIAMETER™ OFX-8630 Fluid	
<b>Alkylaryl Functional Fluid</b>	Global	XIAMETER™ OFX-0203 Fluid	Have properties similar to intermediate-viscosity fluids, but with alkyl functionality; serve as actives for leather conditioners; provide preferred technologies to formulate products for body shop use.
	Global	XIAMETER™ OFX-0230 Fluid	
<b>Silicone Wax</b>	Global	DOWSIL™ 2-5088 Wax	Serves as active for leather conditioners; provides preferred technologies to formulate products for body shop use; serves as an ingredient for hard waxes, paintable polishes, wax conditioners, polishes and polymer sealants.
<b>Emulsifier Wetting Agent</b>	Global	XIAMETER™ OFX-0190 Fluid	Cleaning and wetting properties; lubricity in glass cleaners; ability to be used in water-in-oil and water-in-silicone emulsions makes them unique to formulate non-VOC products; XIAMETER™ OFX-0190 Fluid, XIAMETER™ OFX-0193 Fluid and XIAMETER™ OFX-3667 Fluid are suited for cosurfactants; XIAMETER™ OFX-0193 Fluid for anti-fog applications; DOWSIL™ 5225C Formulation Aid for water-in-silicone emulsions; DOWSIL™ 5200 Formulation Aid for water-in-oil emulsions.
	Global	XIAMETER™ OFX-0193 Fluid	
	Global	DOWSIL™ 5225C Formulation Aid	
	Global	XIAMETER™ OFX-3667 Fluid	
	Global	DOWSIL™ 5200 Formulation Aid	
<b>Silicone Resin</b>	Global	DOWSIL™ 593 Fluid	Long-lasting water durability and repellency that protects automotive surfaces; preferred when enhanced water beading is desired; some can be reacted with catalyst agents to formulate fabric water repellents.
	Global	DOWSIL™ FBL-0563 Formulated Blend	
	Global	DOWSIL™ 2-1912 Fluid	
	Global	DOWSIL™ 3527 Release Agent	

1. Comparison Ratings (●●●● = Best; ● = Moderate). Note: Ratings are a preliminary guideline only. See product data sheets for detailed information. All tested products have been tested at 5% actives on automotive panels using a suitable solvent.
2. The above information is not intended for use in preparing product specifications. Contact Dow before writing specifications.
3. VOC = Volatile Organic Compounds, according to the U.S. Clean Air Act. Contact Dow for product compliance in your area.
4. California Air Resources Board.



Comparison Ratings <sup>1</sup>							
Shine	Durability	Ease of use	Wetting	Slip	Viscosity, cSt <sup>2</sup>	% Actives	Notes
		•••••	•••••		0.65	100	Volatile carrier; CARB <sup>4</sup> compliant
			••••		0.78	100	
					1.6	100	Not tested for comparison ratings
					2.5	100	Volatile carrier; CARB <sup>4</sup> compliant; not tested for comparison ratings
		•••••	•••••		4.0	100	Volatile carrier; CARB <sup>4</sup> compliant
		•••••	•••••		5.0	100	Volatile carrier; CARB <sup>4</sup> compliant
••••	••	••••	••••	•••••	50 - 1,000	100	
••••	••••	••	•	••••	10,000 - 60,000	100	
•••••	•••	•••	••	•	160	50	
••	•••••	•••	•	••	40	100	
•	••••	•••	••	••	500	100	
•••	•••	•••	•••	•	1,200	100	Not tested for comparison ratings
					1,125 - 1,645	100	
••••	••••	••		•	-	100	Melt at 70°C prior to use
					2,000	100	Not tested for comparison ratings
•		•••••	•••••	•	400	100	
•	•	•••	•••	•	700	100	
					200 - 500	100	Not tested for comparison ratings
••••	•	••	••	•	2,500	100	
••	••	••••	••••	•••	700	100	
					7	42	Air-drying, air-curing; imparts a high degree of water repellency on natural and synthetic fabrics; not tested for comparison ratings
••••	••	••••	••••	•••	700	100	
•••	•••	•••	•••	••	2,000	100	



## Reformulate your tire and vinyl dressings with products from Dow and avoid costly fines

Dow C.A.R.B. – Compliant solutions for automotive surfaces

*Failure to comply with the California Air Resources Board's (C.A.R.B.'s) volatile organic compound (VOC) limits could cost you up to \$50,000 per day in fines.*

*The good news is that Dow can help you easily reformulate your products to meet C.A.R.B. requirements.*

### **A challenging task**

Effective January 1, 2003, non-aerosol automotive rubber and vinyl protectants sold in the state of California required a maximum VOC limit of 3 percent. (To learn more about how C.A.R.B. regulations impact your business, read our Tip Sheet on California regulations for auto appearance products.) Today's consumers enjoy beautifying their vehicles and making them look like new. And they rely on your vinyl and tire dressings to help them do just that. We understand how difficult it can be to reformulate solvent-based dressings that comply with environmental regulations without sacrificing the performance your customers have come to expect.

### **Reliable solutions**

Dow can offer you reliable solutions that deliver both high performance and C.A.R.B. compliance.

There are many ways to reformulate, including cost-inventing water-based formulas and VOC-exempt solvent alternatives. However, many of these solutions come with trade-offs. The decision to switch from your current solvent to slow-drying Isopar affin solvents, for example, could short-change your product (and your customers) in critical performance benefits.

Dow offers solutions that can help you

- Control your wetting properties and drying time
- Enhance color for that new-car showroom look
- Modify shine and durability
- Make your product easier to apply

We have prepared sample formulations to show you how easy it is to formulate a VOC-exempt Fast Dry tire dressing using DOWSIL™ OS-2 Fluid. Compare the outstanding results Dow delivers (Figure 1) to the results obtained using an Isopar affin-based formula (Figure 2).





Or, if a water-based formula is an option for you, try the XIAMETER™ MEM-0349 Emulsion multi-surface dressing formulation with vertical clinging properties (Figure 3).

### Compare the alternatives

The drying-time chart (Figure 4) lets you compare the performance of Dow's volatile siloxanes vs. common organic-based solvents. As you can see, an organic-based VOC-exempt solvent may not meet your formulation requirements. Dow's VOC-exempt fluids, on the other hand, can give you the flexibility you need to formulate compliant products that live up to your customers' expectations.

Need to know if your product or proposed formulation will stand up to a C.A.R.B. inspection?

Dow Analytical Services has the capability to analyze for water content, ammonium content, prohibited compounds, ketones, and alcohols to help you determine if you are meeting the C.A.R.B. guidelines for volatile content. There is a fee for these services, but they can save you money, time, and trouble by helping you avoid violations and costly fines.

Copies of our California regulations Tip Sheet and C.A.R.B.-compliant prototype formulations are available from your Dow representative.

**Keep your business moving forward.  
Save money, time, and trouble with  
Dow Service Solutions.**

**Figure 4: Drying-Time Chart – VOC-exempt solvents are shown in purple**

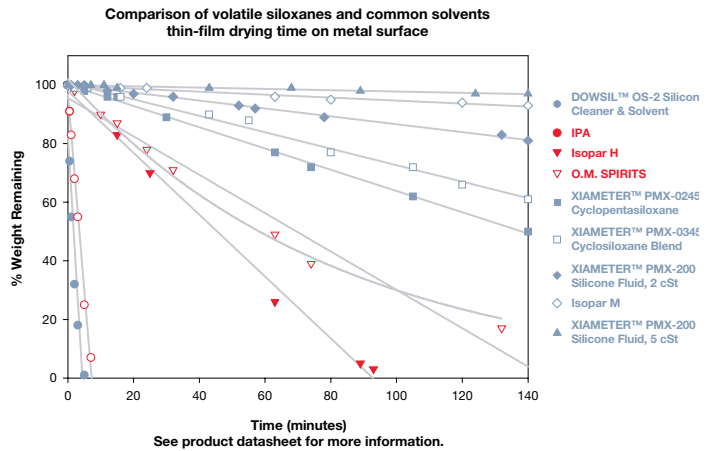


Figure 1: Tire treated with Tire Dressing Formula TP-750 (XIAMETER™ PMX-1077 Fluid), Form No. 26-1613



Figure 2: Tire treated with Tire Dressing Formula TP-770 (Isopar affin), Form No. 26-1615



Figure 3: Tire treated with Water-Based Tire Dressing Formula IP-580 (XIAMETER™ MEM-0349 Emulsion), Form No. 26-1616



# Tip sheet for california regulations for auto appearance products

The California Air Resources Board (C.A.R.B.) has a Consumer Products Compliance Program that implements regulations and ensures compliance for the amount of volatile organic compounds (VOCs) in consumer products.

## WHO is impacted by these regulations?

Companies that manufacture, distribute and/or sell consumer products for both retail sales and institutional sales in the state of California.

Because both retail sales and institutional use are included in these regulations, it is important to know the difference between these categories.

In retail sale the end formula is purchased for personal use by a consumer at a retail store, such as a gas station, retail chain or auto specialty store. Whereas with institutional use the end formula is purchased by a company such as a car dealership, body shop, rental car agency or car wash and the user is an employee of that company.

## WHAT auto products are affected and WHEN do the regulations become effective?

The table on page 19 is a partial list from the Consumer Products Program.

## WHERE can I find more information about these regulations?

Visit [www.arb.ca.gov](http://www.arb.ca.gov) for more information on the Consumer Products Program of the California Air Resources Board (C.A.R.B.).

## WHY are some solvents classified as “VOC-exempt”?

There are two ways a solvent can be classified as “VOC-exempt” for the California Consumer Products Program. First, if a solvent is a low vapor pressure or high boiling point compound, it is considered exempt. These solvents are called “LVP-VOC” compounds and are dramatically slower to dry than traditional solvents used in auto appearance products (such as odorless mineral spirits). Second, there is a small family of fast-drying solvents that have been exempted by the California Consumer Products Program. Dow volatile methyl siloxanes are recognized as being non-ozone-depleting; they are exempt from U.S. EPA VOC regulations and are also exempt by the California Consumer Products Program.

## ARE OTHER STATES adopting these or similar standards?

YES, various states in the country are or have already adopted these standards. Consult the specific state regulations on air quality or air resources of your concern. Below, we offer links to assist you.

## New York:

- [www.dec.ny.gov/regs/2492.html](http://www.dec.ny.gov/regs/2492.html)
- [www.dec.ny.gov/regs/4201.html](http://www.dec.ny.gov/regs/4201.html)

## New Jersey:

Subchapter 24: Prevention of Air Pollution from Consumer Products and Subchapter 16: Control and Prohibition of Air Pollution by Volatile Organic Compounds

- [www.state.nj.us/dep/aqm/rules.html#27](http://www.state.nj.us/dep/aqm/rules.html#27)

## Pennsylvania:

- [www.dep.state.pa.us/dep/deputate/airwaste/air/regs/regs.html](http://www.dep.state.pa.us/dep/deputate/airwaste/air/regs/regs.html)
- [www.pacode.com/secure/data/00.25/chapter130/s130.211.html](http://www.pacode.com/secure/data/00.25/chapter130/s130.211.html)

## Virginia

9VAC5-40-7270. Standard for volatile organic compounds

- <http://leg1.state.va.us/cgi-bin/legp504.exe?000+reg+9VAC5-40-7270>

## Delaware

Regulation No. 1141: Limiting Emissions of Volatile Organic Compounds from Consumer and Commercial Products

- <http://regulations.delaware.gov/AdminCode/title7/1000/1100/1141.shtml>

## District of Columbia

Chapter 7 – Volatile Organic Compounds

- <http://ddoe.dc.gov/ddoe/frames.asp?doc=/ddoe/lib/ddoe/information2/air.reg.leg/chapter7revised.pdf>

## Maine

Bureau of Air Quality

Chapter 152: Control of Emissions of Volatile Organic Compounds from Consumer Products

- [www.maine.gov/dep/air/regulations/docs/CHAP152%20Consumer%20Products%202007.pdf](http://www.maine.gov/dep/air/regulations/docs/CHAP152%20Consumer%20Products%202007.pdf)

Chapter 159: Control of Volatile Organic Compounds from Adhesives and Sealants

- [www.maine.gov/dep/air/regulations/recentlyadopted.htm](http://www.maine.gov/dep/air/regulations/recentlyadopted.htm)

## Maryland

Code of Maryland Regulations 26.11.32 Control of Emissions of Volatile Organic Compounds from Consumer Products

- [www.mde.state.md.us/ResearchCenter/laws\\_regs/procreg\\_26\\_11\\_32\\_033007.asp](http://www.mde.state.md.us/ResearchCenter/laws_regs/procreg_26_11_32_033007.asp)
- [www.mde.state.md.us/ResearchCenter/laws\\_regs/index.asp](http://www.mde.state.md.us/ResearchCenter/laws_regs/index.asp)



## HOW can auto appearance products be formulated to meet these requirements?

Look at the following examples:

- Clear (solvent-based) rubber and vinyl protectants can be modified to include VOC-exempt solvents.
- The type of rubber and vinyl protectant formula can change to a white water-based emulsion.
- Liquid polishes or hard pastes (water-in-solvent emulsions) can be modified to include a mixture of a VOC-exempt solvent and a traditional solvent (such as odorless mineral spirits).

Dow supplies VOC-exempt volatile methyl siloxanes with a variety of drying times to meet your needs for solvent-based formulas or for water-in-solvent emulsions (liquid polishes or hard pastes). A few of our products include XIAMETER™ PMX-0245 Cyclopentasiloxane, XIAMETER™ PMX-0345 Cyclosiloxane Blend and DOWSIL™ OS-2 Silicone Cleaner and Solvent. See your Dow representative for a comparison of volatile methyl siloxanes from Dow versus other common solvents with which you may already be familiar.

Dow also supplies a variety of silicon-based actives in emulsion form for direct formulation into your water-based formulas. See Dow's prototype formulations for a variety of choices and ideas for protectants for rubber, vinyl, and tire surfaces.

Contact your local distributor or Dow directly for formulation ideas and product recommendations that match your interests.

Product category	Effective date	VOC standard (maximum)
Automotive rubbing or polishing compounds	01/01/2005	17%
Automotive wax/polish/sealant/glaze		
Instant detailers	01/01/2001	3%
Hard paste wax	01/01/2005	45%
All other forms	01/01/2005	15%
Brake cleaners	12/31/2010	10%
Bug and tar remover	01/01/2002	40%
Engine degreasers		
Aerosols	12/31/2010	10%
Non-aerosols	12/31/2004	5%
Fabric protectants		
aerosols	01/01/1997	60%
non-aerosols	12/31/2010	1%
Rubber and vinyl protectant		
Aerosols	01/01/2005	10%
non-aerosols	01/01/2003	3%



# Auto care raw material explanations

Raw material	Function	Supplier
Acetic acid	An acid used to solubilize aminofunctional silicones.	Various
Acrylic thickener	A polyacrylic acid polymer thickener used to increase viscosity and give stability (e.g., Carbopol ETD 2001).	The Lubrizol Corporation lubrizol.com
Alcan SF7	An aluminum trihydroxide powder with a very fine particle size used to give extremely gentle polishing action. The function is to remove light oxidization and minor surface blemishes from paintwork. The powder also aids in leveling of the polish film during buffing and helps promote high shine.	Alcan Chemicals alcan.com
Alkamuls PSMO 20	PEG-20 Sorbitan oleate. ALKAMULS® PSMO-20 acts as a non-ionic surfactant with HLB 14.9 with 60 moles of EO. It is a versatile o/w emulsifier and co-emulsifier with sorbitan esters for parafinic oils	Solvay
Alkamuls SMO UNBL	Non-ionic emulsifier also described as sorbitan monooleate. Useful to form W/O emulsions.	Solvay
Amadol 511	Non-ionic/Alkanolamide surfactant.	Nouryon <a href="https://www.nouryon.com/">https://www.nouryon.com/</a>
Bentone 38	Rheological additive used to modify viscosity.	Elementis www.elementis.com
Bio-soft NI-7	Alcohol ethoxylate. A biodegradable surfactant used to replace Makon 10, a nonylphenylethoxylate.	Stepan Co. stepan.com
Brij LT4	A non-ionic emulsifier with the chemical name ethoxy (4) synthetic C12-C13 alcohols.	Croda Inc. www.crodapersonalcare.com
Brij O10	A non-ionic surfactant with the chemical name alcohol ethoxylate, based on tridecanol and used for detergency.	Croda Inc. www.crodapersonalcare.com
Cabosil EH-5	Fumed silica used as a thickener for organic solvents.	Cabot Corporation cabot-corp.com
Calfoam ES-702	A sodium salt of lauryl alcohol ethoxy sulfate containing an average of 2 moles of ethylene oxide.	Pilot Chemical Company www.pilotchemical.com
Cellulose thickener	Hydroxyethyl cellulose thickener used to increase viscosity and stabilize the formulation.	Ashland Inc. ashland.com
Carnauba wax	An organic wax used to give a hard film with good shine.	Various
Crodamet T8	A non-ionic emulsifier with the chemical name ethoxy (8) tallow amine.	Croda Inc. croda.com
Crodasinic LS35	An emulsifier with the chemical name sodium lauroyl sarcosine.	Croda Inc. croda.com
Dimethylamino ethanol	Reacts with oleic acid to form a salt, which acts as an emulsifier.	Various
DOWSIL™ HV 496 Emulsion	A polymer, non-ionic emulsion of 60,000 cSt dimethyl fluid (OH terminated) that offers excellent color improvement and good durability to auto polish and vinyl/tire protectants.	Dow dow.com
DOWSIL™ RSN-9118 Resin	A silicone resin in a volatile fluid that provides durability and shine when formulated into auto polishes and tire/vinyl protectants.	Dow dow.com
DOWSIL™ 593 Fluid	A silicone resin in dimethyl fluid that provides very good leveling properties to auto polishes.	Dow dow.com

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Raw material	Function	Supplier
DOWSIL™ 2-1912 Fluid	A silicone resin in dimethyl fluid that imparts shine, durability and ease of use to auto polishes and tire/vinyl protectants.	Dow dow.com
DOWSIL™ 2200 Antifoam	A silicone antifoam used to slowly collapse generated foam.	Dow dow.com
DOWSIL™ 5225C Formulation Aid	A silicone polyether used as an emulsifier.	Dow dow.com
DOWSIL™ 3527 Release Agent	A silicone resin in dimethyl fluid that imparts shine, durability and ease of use to auto polishes and tire/vinyl protectants.	Dow dow.com
DOWSIL™ 5200 Formulation Aid	A silicone polyether used as an emulsifier.	Dow dow.com
DOWANOL™ DPM Glycol Ether	A solvent to remove road film, with the chemical name dipropylene glycol methyl ether.	Dow dow.com
DOWANOL™ DPnB Glycol Ether	A coalescing agent with the chemical name dipropylene glycol n-butyl ether.	Dow dow.com
DOWANOL™ PM Glycol Ether	A fast-evaporating solvent to remove road film, with the chemical name propylene glycol methyl ether.	Dow dow.com
DOWANOL™ PnB Glycol Ether	A coalescing agent with the chemical name propylene glycol n-butyl ether.	Dow dow.com
ECOSURF™ EH-9	A water soluble, biodegradable nonionic surfactant with low odor. Readily biodegradable. Provides performance equal to alkylphenol ethoxylate (APE) surfactants, and better than primary alcohol ethoxylate (PAE) surfactants in many applications. EU Ecolabel	Dow dow.com
Empicol ESB 70	An anionic surfactant with the chemical name sodium lauryl ethoxy sulphate. Used for detergency and quick foaming.	Innospec innospec.com
Empilan 2502	A non-ionic surfactant with the chemical name coconut diethanolamide. Used to increase viscosity and improve foam generation.	Alfa Chemicals alfa-chemical.co.uk
Exxsol D40 (Low aromatic solvent 160/190°C) (also known as Mineral Spirits)	A medium-evaporating solvent, used as a carrier for actives (silicones). This solvent also has cleaning properties and can remove tar, etc.	Mineral Spirits – ExxonMobil exxonmobilchemical.com
Exxsol D80 (Low aromatic solvent 200/250°C)	A slow-evaporating solvent, used as a carrier for actives (wax and silicones). This solvent also has cleaning properties for tar, etc.	ExxonMobil exxonmobilchemical.com
Heptane	A fast-evaporating aliphatic solvent used as a carrier for silicone actives.	Univar Chemcentral.com
Isopropanol	A fast-evaporating solvent used for its cleaning and anti-freeze properties.	Various
Kaopolite SF Kaopolite AB Kaopolite 1152	Anhydrous aluminum silicate powders used for removing oxidized paintwork and very minor surface blemishes. Also aid in leveling of the polish film during buffing.	IMERYS www.imerys-performance-minerals.com
KATHON LX	A preservative agent.	DuPont dupont.com



Raw material	Function	Supplier
Lanolin Oil	An oil to help restore and maintain the suppleness of leather.	Various
Makon TD-12	A non-ionic surfactant, tridecyl alcohol ethoxylate, POE-12.	Stepan Co. stepan.com
Ninol 49-CE	A coconut DEA.	Stepan Co. stepan.com
Norpar 6	A very fast-evaporating aliphatic solvent, used as a carrier for actives (silicones).	ExxonMobil Chemical exxonmobilchemical.com
Oleic acid	An acid that reacts with dimethylamino ethanol to form a salt that acts as an emulsifier.	Various
Paraffin wax	A softer organic wax that gives less durability and shine than carnauba; however, it is easily buffable.	Various
CARBOWAX™ Polyethylene Glycol (PEG) 6000	High-molecular-weight polymer of ethylene oxide, used as an emulsifier in waxes and polishes.	Dow dow.com
Pine oil	A wetting and cleaning agent.	Various
Polawax GP200	A blend of fatty acids with non-ionic surfactants that functions as an emulsifier. Forms oil/water emulsions, which can convert to water/oil on application.	Croda Inc. croda.com
Polyethylene wax	An organic wax that gives hardness and durability to films. Also has solvent-binding ability.	Various
Propylene glycol	A slow-evaporating water-miscible solvent that assists to deposit a uniform film, anti-freeze property.	Dow dow.com
Rhodapex ESB 70	An anionic surfactant with the chemical name sodium lauryl ethoxy sulphate. Used for detergency and quick foaming.	Rhodia Inc. rhodia.com
Rust inhibitor	Sodium benzoate or similar to eliminate rusting of aerosol can.	Emerald
Sillikolloid P87	Quartz and kaolinite filler.	Hoffmann Mineral hoffmann-mineral.com
Sillitin Z86	Quartz and kaolinite filler.	Hoffmann Mineral hoffmann-mineral.com
Span 80	A non-ionic emulsifier with the chemical name sorbitan trioleate.	Croda Inc. croda.com
Span 120 (formerly Crill 6)	A non-ionic emulsifier with the chemical name sorbitan monoisostearate.	Croda Inc. croda.com
Syncrowax AWI	A hard wax (blend of C18-C36 acids), used for protection.	Croda Inc. croda.com
Syncrowax ERL	An ethylene glycol ester of C18-C36 fatty acids that can be buffed to a high gloss.	Croda Inc. croda.com



Raw material	Function	Supplier
TERGITOL™ 15-S-12 Surfactant	Readily biodegradable, rapid wetting & spreading on hard surfaces, lower aqueous surface tension than other ethoxylated surfactants, fast foam collapse rates for easy rinsing, Dissolves easily in aqueous solutions, Narrow gel range, Non-APE based.	Dow dow.com
Tomamine Amphoteric L	Cocoamidopropyl betaine. An amphoteric surfactant used for detergency and foam generation.	Evonik evonik.com
Tomamine AO-728	An amine oxide-type amphoteric surfactant used as a foam booster/foam stabilizer.	Evonik evonik.com
Tomamine Emulsifier Four	An emulsifier with the chemical name cationic dialkyl quaternary ammonium chloride, used to aid water repellency.	Evonik evonik.com
Tomamine Q-17-2	A cationic surfactant with the chemical name isotridecylcyloxypropyl dihydroxyethyl methyl ammonium chloride that is used to enhance detergency performance.	Evonik evonik.com
Triethanolamine	Used as part of emulsifier system/thickener system.	Dow dow.com
Tween 80	A non-ionic emulsifier with the chemical name polyoxyethylene (20) sorbitan monooleate.	Croda Inc. croda.com
Veegum Pro	Gum thickener (amine-modified hydrated magnesium aluminum silicate).	Vanderbilt Mineral www.vanderbiltminerals.com
Wax emulsion Michem Lube 155	A 25% active blend of soft/hard wax, with a particle size such that a non-level film is created that scatters light, causing the sheen effect.	Michelman Inc. michem.com
Wax Emulsion 7619	Carnauba/beeswax blend to aid gloss and water repellency.	Marlin Chemicals marlinchemicals.co.uk
XIAMETER™ MEM-0039 Emulsion	A non-ionic emulsion of intermediate-viscosity dimethyl fluid that improves the leveling and ease of use of auto polish formulations. Also imparts gloss to both polishes and tire/vinyl protectants.	Dow dow.com
XIAMETER™ MEM-0062 Emulsion PS	A cationic silicone emulsion (55% active silicone) of 1,000 cSt dimethyl fluid. The emulsion promotes gloss and improves wet-out characteristics of vinyl and tire dressings.	Dow dow.com
XIAMETER™ MEM-0346 Emulsion	A non-ionic emulsion of intermediate-viscosity dimethyl fluid that improves the leveling and ease of use of auto polish formulations. Also imparts gloss to both polishes and tire/vinyl protectants.	Dow dow.com
XIAMETER™ MEM-0349 Emulsion	A non-ionic emulsion of intermediate-viscosity dimethyl fluid that improves the leveling and ease of use of auto polish formulations. Also imparts gloss to both polishes and tire/vinyl protectants.	Dow dow.com
XIAMETER™ MEM-8035 Emulsion	A cationic aminosilicone emulsion that provides shine and protection when formulated into polishes and vinyl/tire protectants.	Dow dow.com
XIAMETER™ OFX-0193 Fluid	A silicone polyether surfactant that acts as a wetting and foam-boosting agent. This polyether also has moderate cleaning properties and acts as a surface tension depressant, wetting agent, emulsifier and foam builder.	Dow dow.com



<b>Raw material</b>	<b>Function</b>	<b>Supplier</b>
XIAMETER™ OFX-0203 Fluid	An alkylaryl polysiloxane fluid that imparts gloss and ease of use to polish formulations. This fluid also offers the benefit of paintability.	Dow dow.com
XIAMETER™ OFX-0531 Fluid	An aminofunctional silicone fluid that provides good gloss in polish formulations. This fluid works in conjunction with XIAMETER™ OFX-0536 Fluid to plasticize it.	Dow dow.com
XIAMETER™ OFX-0536 Fluid	An aminofunctional silicone fluid that gives excellent durability and protection properties. This fluid works in conjunction with XIAMETER™ OFX-0531 Fluid.	Dow dow.com
XIAMETER™ OFX-3667 Fluid	A silicone polyether emulsifier.	Dow dow.com
XIAMETER™ PMX-0245 Cyclopentasiloxane XIAMETER™ PMX-0246 Cyclohexasiloxane	A volatile cyclic siloxane fluid that promotes water removal when used in rinse aid formulations. Also can be used as a VOC-exempt solvent in protectant formulations.	Dow dow.com
XIAMETER™ PMX-200 Silicone Fluid, 350 cSt	A low-viscosity dimethyl fluid that promotes leveling of auto polishes, provides gloss and improves ease of use.	Dow dow.com
XIAMETER™ PMX-200 Silicone Fluid, 1,000 cSt	An intermediate-viscosity dimethyl fluid that gives high gloss, aids rubout and improves ease of use when incorporated into polish formulations.	Dow dow.com
XIAMETER™ PMX-200 Silicone Fluid, 12,500 cSt	An intermediate-viscosity dimethyl fluid that enhances color and shine when formulated into auto polishes. Also provides protection against minor scratches.	Dow dow.com
XIAMETER™ PMX-200 Silicone Fluid, 60,000 cSt	A high-viscosity dimethyl fluid that gives excellent color enhancement and protection properties when formulated into automotive polishes.	Dow dow.com



# Prototype formulation for automotive wax

Auto care formulation information

## Emulsion hard wax

Formulation reference: PW-310



## Description

This formulation features a blend of silicones to promote shine and water beading. Also, this product contains a much lower solvent level than traditional hard-wax formulations.

Ingredient	Weight (%)	Supplier
<b>Phase A</b>		
1. Low aromatic solvent 160/190°C	20.0	Odorless mineral spirits
2. XIAMETER™ PMX-200 Silicone Fluid, 350 cSt	1.1	Dow
3. XIAMETER™ PMX-200 Silicone Fluid, 1,000 cSt	0.7	Dow
4. Syncrowax AWI	1.5	Croda Ltd.
5. DOWSIL™ 2-5088 Wax	1.5	Dow
6. Crill 6	1.4	Croda Ltd.
7. Polawax GP200	0.9	Croda Ltd.
8. Triethanolamine	0.9	Dow
9. 50% sodium citrate in water	2.0	
<b>Phase B</b>		
10. Water	72.0	

## Procedure

1. Mix Phase A ingredients in the main vessel using low-speed stirring while heating to 70°C.
2. In an auxiliary vessel, heat Phase B ingredient to 70°C and then add to Phase A with high-shear mixing.
3. Stir slowly while cooling.

## Typical properties / additional information

Suggestions for adjusting the formulation:

- To improve color: Incorporate XIAMETER™ PMX-200 Silicone Fluid, 12,500 cSt, at 0.4%
- To improve durability: Incorporate DOWSIL™ RSN-9118 Resin or XIAMETER™ OFX-8630 Fluid at 1.0%



# Prototype formulation for automotive wax

## Auto care formulation information

### Hard wax

Formulation reference: PW-320



### Description

This is a traditional product for the preservation of new and good-condition paintwork. The formulation provides shine and ease of use due to its thin consistency.

Ingredient	Weight (%)	Supplier
<b>Phase A</b>		
1. Low aromatic solvent 160/190°C	85.7	Odorless mineral spirits
2. Low aromatic solvent 200/250°C	10.0	Low odor base solvent or #460 solvent
<b>Phase B</b>		
3. Carnauba Wax	0.5	
4. DOWSIL™ 2-5088 Wax	1.0	Dow
5. XIAMETER™ PMX-200 Silicone Fluid, 350 cSt	0.5	Dow
6. XIAMETER™ PMX-200 Silicone Fluid, 12,500 cSt	0.3	Dow
7. DOWSIL™ 593 Fluid	1.0	Dow
8. DOWSIL™ RSN-9118 Resin	1.0	Dow

### Procedure

1. Add ingredients 1-4 to the vessel and heat to 85°C with low-speed stirring until the waxes have dissolved.
2. Start cooling and add ingredients 5-8 with continuous stirring.

### Typical properties / additional information

Suggestions for adjusting the formulation:

- To improve gloss: Incorporate 0.5-1.0% XIAMETER™ PMX-200 Silicone Fluid, 1,000 cSt
- To improve ease of use: Increase level of XIAMETER™ PMX-200 Silicone Fluid, 350 cSt, to 1.0%
- To improve durability: Increase levels of DOWSIL™ RSN-9118 Resin and DOWSIL™ 2-5088 Wax to 2.0% or incorporate XIAMETER™ OFX-0536 Fluid at 1.0%
- If a single silicone resin is desired, choose either DOWSIL™ 593 Fluid or DOWSIL™ RSN-9118 Resin. Look for the product that provides the best leveling and durability.

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# Prototype formulation for automotive wax

Auto care formulation information

## Wax conditioner

Formulation reference: PW-390



## Description

This formulation produces a traditional high-wax-content polish, typically used by classic car owners. This polish is suitable for cleaned paintwork, but also can be used on wood dashboards and chrome bumpers. The silicone wax contributes to durability of the product, with the silicone resin aiding leveling characteristics.

Ingredient	Weight (%)	Supplier
<b>Phase A</b>		
1. Low aromatic solvent 160/190°C	52.5	Odorless mineral spirits
2. Low aromatic solvent 200/250°C	18.6	Low-odor base solvent or #460 solvent
3. Carnauba Wax	6.4	
<b>4. DOWSIL™ 2-5088 Wax</b>	<b>4.9</b>	<b>Dow</b>
5. Rocsol C wax	2.0	Croda Ltd.
6. Polyethylene wax AC 629	1.7	Allied Corp. Int.
<b>7. DOWSIL™ 593 Fluid</b>	<b>1.4</b>	<b>Dow</b>

## Procedure

1. Add all products to a vessel and heat to 110°C with slow-speed stirring. Mix until uniform.
2. Cool to filling temperature.

## Typical properties / additional information

Suggestions for adjusting the formulation:

- To improve gloss: Incorporate XIAMETER™ PMX-200 Silicone Fluid, 1,000 cSt, instead of DOWSIL™ 593 Fluid
- To improve ease of use: Incorporate 1-3.0% XIAMETER™ PMX-200 Silicone Fluid, 350 cSt, or increase level of DOWSIL™ 593 Fluid
- To improve color intensity: Incorporate 0.5-1.0% XIAMETER™ PMX-200 Silicone Fluid, 12,500 cSt
- To improve durability: Increase level of DOWSIL™ 2-5088 Wax, reducing the level of the paraffin wax by the same amount, or incorporate XIAMETER™ OFX-0536 Fluid or DOWSIL™ RSN-9118 Resin as a replacement for DOWSIL™ 593 Fluid

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# Prototype formulation for low-VOC polish

Auto care formulation information

## Low-VOC polish

Formulation reference: PW-400



## Description

This polish is a detergent-resistant cleaner designed for automotive surfaces. The product exhibits little phase separation and provides easy rub-out, excellent gloss, very good durability and resistance to detergent washings.

Solvent was replaced with a VOC-exempt silicone solvent, XIAMETER™ PMX-0245 Cyclopentasiloxane, to target a VOC level of 14% for this formula as defined by California A.R.B.

This formula passes five cycles of freeze/thaw stability testing.

Ingredient	Weight (%)	Supplier
<b>Phase A</b>		
1. DI water	59.0	
2. KAOPOLITE XDA	6.6	Kaopolite, Inc.
3. KAOPOLITE 1152	3.4	Kaopolite, Inc.
4. Amadol (Witcamide) WE	1.0	Akzo Nobel
5. Kerosene/mineral spirits	3.5	
<b>6. XIAMETER™ PMX-0245 Cyclopentasiloxane (VOC-exempt)</b>	<b>11.0</b>	<b>Dow</b>
7. Sodium chloride	1.0	
<b>Phase B</b>		
8. Kerosene/mineral spirits	7.24	
9. BENTONE 38 Thickener	0.6	Rheox, Inc.
<b>Phase C</b>		
<b>10. XIAMETER™ OFX-0531 Fluid</b>	<b>5.5</b>	<b>Dow</b>
<b>11. XIAMETER™ OFX-0536 Fluid</b>	<b>1.0</b>	<b>Dow</b>
12. Isopropanol	0.15	

## Procedure

1. Load Phase A ingredients in the order shown into a vessel and mix well.
2. Mix Phase B ingredients in a separate container.
3. Add Phase B to the production vessel and mix well.
4. Add Phase C ingredients to the production vessel and mix well.

## Typical properties / additional information

- After Phase A mixing, the material forms a thick paste emulsion.
- After Phase B mixing, the material is a similar thick paste emulsion.
- After Phase C mixing, the alcohols activate Bentone 38 Thickener. Polish continues to thicken over several days.
- Ensure high-flow (turnover) mixing exists to prevent the abrasive from settling at the vessel bottom. If agitation is stopped on the mixing vessel during Phase A or Phase B, KAOPOLITE XDA Abrasive will settle to the bottom.

Observe precautions for handling XIAMETER™ products as indicated on the safety data sheets.



# Prototype formulation for car polish

Auto care formulation information

## Paintable polish

Formulation reference: PP-930



## Description

This paintable polish is specifically formulated for use in garages and body shops where polydimethylsiloxanes could give rise to recoatability problems.

Ingredient	Weight (%)	Supplier
<b>Phase A</b>		
1. Low aromatic solvent 160/190°C	30.0	Exxon Chemicals Ltd./Shell Chemicals Ltd.
2. Paraffin wax	0.5	Suter & Co Ltd.
<b>3. DOWSIL™ 2-5088 Wax</b>	<b>3.0</b>	<b>Dow</b>
4. Alkamuls SMO UNBL	0.4	Solvay
<b>5. XIAMETER™ OFX-0203 Fluid</b>	<b>0.5</b>	<b>Dow</b>
<b>Phase B</b>		
6. Water	50.6	
7. SILLITIN Z.86	5.0	Hoffmann Minerals
8. Alcan SF7	7.0	Alcan Chemicals
9. Alkamuls PSMO 20	1.1	Solvay
<b>Phase C</b>		
10. Cellulose thickener	0.9	Hercules Ltd.

## Procedure

1. Heat ingredients 1-3 to 70°C in an auxiliary vessel to dissolve the wax with low-speed stirring.
2. Add ingredients 4 and 5.
3. In the main vessel, mix Phase B ingredients while heating to 70°C.
4. Add Phase A to Phase B with high shear, then start to cool.
5. Add Phase C ingredient under low shear.

## Typical properties / additional information

Suggestions for adjusting the formulation:

- To improve ease of use: Increase XIAMETER™ OFX-0203 Fluid to 1.0%
- To improve durability: Increase DOWSIL™ 2-5088 Wax to 4.0%
- Alcan SF7 can be replaced by other aluminum trihydroxides such as Almatis Hydral 710.



# Prototype formulation for car polish

Auto care formulation information

## Spray-and-wipe polish

Formulation reference: PW-306



## Description

This is a no-wax spray-and-wipe polish formulation designed to provide good gloss to an automotive surface. The product has good application ease and rub-out with limited durability.

Ingredient	Weight (%)	Supplier
<b>Phase A</b>		
1. XIAMETER™ MEM-0349 Emulsion or XIAMETER™ MEM-0346 Emulsion	6.0	Dow
<b>Phase B</b>		
2. Water	90.0	
3. VEEGUM Pro	0.8	R.T. Vanderbilt Co.
4. KAOPOLITE AB	0.2	Kaopolite, Inc.
<b>Phase C</b>		
5. KAOPOLITE SF	3.0	Kaopolite, Inc.

## Procedure

1. Blend Phase B ingredients (thickening water first) until uniform.
2. Add Phase A ingredients and mix until uniform.
3. Add Phase C ingredient and mix lightly until uniform.

## Typical properties/additional information

- To improve durability, add XIAMETER™ MEM-8035 Emulsion at 2–3%.
- Other gum thickeners may be used.



# Prototype formulation for car polish

Auto care formulation information

## Instant car polish

Formulation reference: PW-330



## Description

The blend of fluids in this formulation yields high gloss in an easy-touse product form.

Ingredient	Weight (%)	Supplier
<b>Phase A</b>		
1. Low aromatic solvent 160/190°C	25.0	Exxon Chemicals Ltd./ Shell Chemicals Ltd.
2. XIAMETER™ PMX-200 Silicone Fluid, 350 cSt	1.4	Dow
3. XIAMETER™ PMX-200 Silicone Fluid, 1,000 cSt	1.0	Dow
4. DOWSIL™ 5200 Formulation Aid	2.0	Dow
<b>Phase B</b>		
5. Water	57.6	
6. Sillikolloid P.87	8.5	Hoffmann Minerals
7. Wax Emulsion 7619 <sup>1</sup>	2.5	Marlin Chemicals
8. 50% sodium citrate in water	2.0	

<sup>1</sup>Wax Emulsion – 35% active blend of soft/hard waxes

## Procedure

1. Blend Phase A ingredients in the main vessel under low shear.
2. In the auxiliary vessel, add Phase B ingredients in the order listed. Mix with low shear.
3. Add Phase B to Phase A very slowly under high shear until the emulsion begins to form. The remainder of Phase B can then be added at a faster rate.
4. When addition is complete, mix with high shear.

## Typical properties/additional information

Suggestions for adjusting the formulation:

- To improve color: Incorporate XIAMETER™ PMX-200 Silicone Fluid, 12,500 cSt, at 0.4%
- To improve durability: Incorporate DOWSIL™ 3527 Release Agent or XIAMETER™ OFX-0531 Fluid at 1.0% and reduce the level of the XIAMETER™ PMX-200 Silicone Fluids by 0.5%
- The low aromatic solvent can be partially replaced with XIAMETER™ PMX-0245 Cyclopentasiloxane to comply with California Air Resources Board regulations



# Prototype formulation for car polish

Auto care formulation information

## Low-solvent liquid polish

Formulation reference: PW-340



## Description

This low-solvent liquid polish uses a blend of silicone fluids to achieve shine and ease of use. The silicone resin helps to improve water repellency.

Ingredient	Weight (%)	Supplier
<b>Phase A</b>		
1. Low aromatic solvent 200/250°C	9.0	Exxon Chemicals Ltd./Shell Chemicals Ltd.
2. DOWSIL™ 2-5088 Wax	1.5	Dow
3. XIAMETER™ PMX-200 Silicone Fluid, 350 cSt	1.5	Dow
4. XIAMETER™ PMX-200 Silicone Fluid, 1,000 cSt	0.5	Dow
5. XIAMETER™ PMX-200 Silicone Fluid, 12,500 cSt	0.5	Dow
6. DOWSIL™ 593 Fluid	1.5	Dow
7. Alkamuls SMO UNBL	0.3	Solvay
<b>Phase B</b>		
8. Water	71.3	Hoffmann Minerals
9. KAOPOLITE SF	11.6	Alcan Chemicals
10. Alkamuls PSMO 20	0.9	Solvay
11. Acrylic thickener	0.2	Dow
<b>Phase C</b>		
12. Triethanolamine	0.2	Dow

## Procedure

1. Mix phase A ingredients with heat to 70°C in an auxiliary vessel using low shear.
2. Mix phase B ingredients in the main vessel at 70°C with low shear.
3. Add phase A to phase B under high shear and cool.
4. Add phase C ingredient with low shear.

## Typical properties/additional information

Suggestions for adjusting the formulation:

- To improve durability: Replace DOWSIL™ 593 Fluid with DOWSIL™ RSN-9118 Resin at 2.0% or XIAMETER™ OFX-8630 Fluid at 1.0%





# Prototype formulation for car polish

Auto care formulation information

## Polish

Formulation reference: PW-350



## Description

The combination of silicone fluids and a silicone resin gives an easy-to-use polish product that resists weathering. This product also features excellent gloss and color.

Ingredient	Weight (%)	Supplier
<b>Phase A</b>		
1. Low aromatic solvent 160/190°C	14.0	Exxon Chemicals Ltd./ Shell Chemicals Ltd.
2. Low aromatic solvent 200/250°C	10.0	Exxon Chemicals Ltd./ Shell Chemicals Ltd.
3. XIAMETER™ PMX-200 Silicone Fluid, 350 cSt	1.2	Dow
4. XIAMETER™ PMX-200 Silicone Fluid, 1,000 cSt	0.6	Dow
5. DOWSIL™ 3527 Release Agent	1.6	Dow
6. DOWSIL™ 2-5088 Wax	1.5	Dow
<b>Phase B</b>		
7. Water	57.0	
8. ALCAN SF7	12.4	Alcan Chemicals
9. CRODAMET T8	1.3	Croda Ltd.
10. Cellulose thickener	0.9	Hercules Ltd.

## Procedure

1. Heat Phase A ingredients to 70°C in an auxiliary vessel using low shear.
2. Add ingredients 7-9 to the main vessel, heating to 70°C with low shear.
3. Slowly add ingredient 10 and stir until dispersed.
4. Add Phase A and Phase B with high shear.
5. Cool to ambient temperature.

## Typical properties/additional information

Suggestions for adjusting the formulation:

- To improve gloss: Increase XIAMETER™ PMX-200 Silicone Fluid, 1,000 cSt, to 1.0%.
- To improve color: Incorporate XIAMETER™ PMX-200 Silicone Fluid, 12,500 cSt, at 0.5%.
- To improve durability: Incorporate DOWSIL™ RSN-9118 Resin at 2.0% instead of DOWSIL™ 3527 Release Agent.
- ALCAN SF7 can be replaced by other aluminum trihydroxides such as Almatris Hydral 710.



# Prototype formulation for shampoo

Auto care formulation information

## Standard shampoo

Formulation reference: CW-101



## Description

The silicone surfactant provides wetting effects, while the amino-functional silicone can deposit onto the surface to enhance the polish film for gloss/water repellency.

Ingredient	Weight (%)	Supplier
<b>Phase A</b>		
1. Sodium lauryl ethoxy sulfate	10.0	Rhodapex ESB 70 FEA/ Rhodia Inc or Calfoam ES-702 / Pilot Chemical
2. Soft water	78.7	
<b>Phase B</b>		
3. <b>TERGITOL™ 15-S-12 Surfactant</b> or MAKON TD-12	5.5	<b>Dow</b> Stepan Co.
4. Coconut diethanolamide	3.5	NINOL 49-CE Stepan Co.
5. <b>XIAMETER™ MEM-8035 Emulsion</b>	<b>1.5</b>	<b>Dow</b>
6. <b>XIAMETER™ OFX-0193 Fluid</b>	<b>0.3</b>	<b>Dow</b>
<b>Phase C</b>		
7. Hydroxyethyl cellulose thickener	0.5	Ashland Inc.

## Procedure

1. Dissolve ingredient 1 in ingredient 2. Add Phase B ingredients with low-speed mixing until fully dispersed.
2. Sprinkle in the Phase C ingredient and mix until completely dissolved, approximately 60 minutes.
3. Pour down and package appropriately.

## Typical properties / additional information

Suggestions for adjusting the formulation:

- To improve gloss and color, add DOWSIL™ HV 496 Emulsion at 1.0%.



# Prototype formulation for shampoo

Auto care formulation information

## Protective shampoo

Formulation reference: CW-102



## Description

This formulation produces a product that is an intermediate between a standard shampoo and a polish that enhances gloss and provides a longer-lasting protective silicone film. The product can be applied the same as normal shampoo, or it can be poured directly onto a water-soaked sponge and wiped over a surface.

Ingredient	Weight (%)	Supplier
<b>Phase A</b>		
1. Water	60.0	
2. ECOSURF™ EH-9 Surfactant or BIO-SOFT N1-7	1.0	Dow Stepan Co.
3. XIAMETER™ MEM-8035 Emulsion	2.5	Dow
<b>Phase B</b>		
4. Low aromatic solvent 160/190°C Exxsol D40	30.0	Exxon Chemicals Ltd.
5. Carnauba Wax	1.5	
6. XIAMETER™ PMX-200 Silicone Fluid, 350 cSt	1.0	Dow
7. Pine oil	1.0	
<b>Phase C</b>		
8. Hydroxyethyl cellulose thickener	0.8	Ashland Inc.

## Procedure

1. Put Phase A ingredients into the main vessel. Heat to 70°C with low-shear mixing.
2. In a separate vessel, load ingredients 4 and 5. Heat to 70°C, then add ingredients 6 and 7 while mixing at low shear.
3. Add Phase B to Phase A with high shear. Start cooling to room temperature.
4. Add the Phase C ingredient slowly and mix until dissolved, approximately 45 minutes.

## Typical properties / additional information

Suggestions for adjusting the formulation:

- To improve color, incorporate XIAMETER™ PMX-200 Silicone Fluid, 12,500 cSt, at 0.5%.
- To improve gloss, substitute XIAMETER™ PMX-200 Silicone Fluid, 1,000 cSt, for XIAMETER™ PMX-200 Silicone Fluid, 350 cSt.
- To improve durability, reduce the level of XIAMETER™ PMX-200 Silicone Fluid, 350 cSt, to 0.6% and the emulsifier level to 0.8%

### Disclaimer:

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# Prototype formulation for shampoo

Auto care formulation information

## Protective shampoo

Formulation reference: CW-120



## Description

This formulation produces a product that is an intermediate between a standard shampoo and a polish that enhances gloss and provides a longer-lasting protective silicone film. The product can be applied the same as normal shampoos, or it can be poured directly onto a water-soaked sponge and wiped over a surface.

Ingredient	Weight (%)	Supplier
<b>Phase A</b>		
1. Water	60.0	
2. Crodamet T8	1.0	Croda Ltd.
<b>Phase B</b>		
3. Low aromatic solvent 160/190°C	30.0	Exxon Chemicals Ltd./ Shell Chemicals Ltd.
4. DOWSIL™ 2-5088 Wax	1.5	Dow
5. XIAMETER™ PMX-200 Silicone Fluid, 350 cSt	1.0	Dow
6. Pine oil	1.0	
7. XIAMETER™ OFX-8630 Fluid	2.5	Dow
<b>Phase C</b>		
8. Cellulose thickener	0.8	Hercules-Aqualon

## Procedure

1. Add ingredient 2 to ingredient 1 with low-speed stirring in the main vessel, heating to 70°C.
2. In phase B, add ingredients 3 and 4 to an auxiliary vessel, heat to 70°C, and add ingredients 5 – 7 with low-speed stirring.
3. Add phase B to phase A with high shear. Start cooling.
4. Add the phase C ingredient slowly and mix until dissolved.

## Typical properties / additional information

Suggestions for adjusting the formulation:

- To improve color: Incorporate XIAMETER™ PMX-200 Silicone Fluid, 12,500 cSt, at 0.5%
- To improve gloss: Substitute XIAMETER™ PMX-200 Silicone Fluid, 1,000 cSt, for XIAMETER™ PMX-200 Silicone Fluid, 350 cSt
- To improve durability: Reduce the level of XIAMETER™ PMX-200 Silicone Fluid, 350 cSt, to 0.6% and the emulsifier level to 0.8%



# Prototype formulation for dry washer

Auto care formulation information

## Dry washer

Formulation reference: CW-140



## Description

This formulation exhibits the dual function of cleaning and adding shine to automotive metallic surfaces. XIAMETER™ MEM-0039 Emulsion provides gloss and XIAMETER™ OFS-6124 Silane ensures an excellent adherence factor, making it more resistant and shiny and providing surface cleaning with no water.

Ingredient	Weight (%)	Supplier
1. Water	90.2	
2. KELTROL F	0.5	CP Kelco
<b>3. XIAMETER™ MEM-0039 Emulsion</b>	<b>3.0</b>	<b>Dow</b>
4. Ethanol	3.0	
5. Sodium ricinoleate at 35%	2.0	
<b>6. XIAMETER™ OFS-6124 Silane</b>	<b>1.0</b>	<b>Dow</b>
7. Aluminum silicate 500 #	0.2	
8. Glutaraldehyde	0.1	

## Procedure

1. Add ingredient 2 to ingredient 1 in the main vessel.
2. When completely dispersed, add ingredient 3 and stir for 10 minutes.
3. Add ingredients 4 and 5 and stir for 10 minutes.
4. Add ingredient 6 and stir for 10 minutes.
5. Add ingredient 7 and stir for 10 minutes.
6. Add ingredient 8 and stir for 10 minutes.

## Typical properties / additional information

**Directions:** Apply the final product with a soft cloth or cotton wool over dust or grime with circular movements, one small area at a time. Remove the product with a dry and clean cloth.

Do not apply this product over sand-covered surfaces.

The ethanol helps to clean the surface and ensures the compatibility of XIAMETER™ OFS-6124 Silane in the formulation.

The ethanol may be replaced by isopropanol.

The final formulation will have a pH between 8.0-9.5 because of the presence of the sodium ricinoleate. The xanthan gum helps to stabilize the formulation



# Prototype formulation for shampoo

Auto care formulation information

## Shampoo for use in professional detailing

Formulation reference: CW-150



## Description

This is an automotive shampoo that stands out among similar products because XIAMETER™ OFS-6124 Silane, in addition to providing excellent grime and grease removal, imparts shine and adheres to metal surfaces.

Ingredient	Weight (%)	Supplier
1. Water	88.4	
<b>2. CELLOSIZETM QP-100M-H Hydroxyethyl Cellulose</b>	<b>0.4</b>	<b>Dow</b>
3. Sulfonic acid	5.0	
4. Sodium hydroxide at 50%	0.6	
<b>5. Triethanolamine</b>	<b>0.5</b>	<b>Dow</b>
6. Cocamide DEA	1.0	
7. Dioctyl succinate at 70%	2.0	
8. Isopropanol	1.0	
<b>9. XIAMETER™ OFS-6124 Silane</b>	<b>1.0</b>	<b>Dow</b>
10. Glutaraldehyde	0.1	
pH at 10% dilution: 6.5-7.5		

## Procedure

1. Add ingredient 2 to ingredient 1 in the main vessel and stir until the solution is transparent and viscous.
2. Add ingredient 3 and stir for 10 minutes.
3. Slowly add ingredient 4 and stir for 10 minutes.
4. Add ingredients 5 and 6 and stir for 20 minutes.
5. Check the pH. It should be between 6.5 and 7.5. Use ingredient 3 or 4 to correct the pH, if necessary.
6. Add ingredient 7 and stir for 10 minutes.
7. Add ingredients 8 and 9 and stir for 15 minutes.
8. Add ingredient 10 and stir for 10 minutes more.

## Typical properties / additional information

**Directions:** In a shaded area, apply a 10% dilution of the final product on a cold metallic surface with a soft sponge. The resulting foam should be left for 2 minutes and then removed with water. Dry the vehicle with a soft towel.





# Prototype formulation for tunnel wash wax/sealant

Auto care formulation information

## Concentrated Wax/Sealant

Formulation reference: USL-CW-200



## Description

This wax sealant is designed for Tunnel Car Wash applications. It provides gloss and water beading properties. NOTE: A version of this formulation can be incorporated into a rinse aid formulation for excellent water break and gloss effect.

Ingredient	Weight (%)	Supplier
1. XIAMETER™ OFX-0536 Fluid	12.5	Dow
2. Accoquat CS 4000	10.0	Abitec
3. TERGITOL™ 15-S-7 Surfactant	7.0	Dow
4. TERGITOL™ 15-S-3 Surfactant	7.0	Dow
5. Glycol Ether EB	11.0	Eastman
6. Water	52.5	

Application notes: For tunnel wash applications dilution ratio is 1000:1 as the most ideal but can go as high as 2000:1

## Procedure

Slowly mix in the listed order until homogeneous. After that, adjust pH to 5.9 using glacial acetic acid which will clear the solution.

## Typical properties / additional information

Application notes: For tunnel wash applications dilution ratio is 1000:1 as the most ideal but can go as high as 2000:1.



# Prototype formulation Concentrated Wax/Sealant featuring DOWSIL™ 3055 Resin

Auto care formulation information

## Concentrated Wax/Sealant

Formulation reference: [USL-CW-210](#)



## Description

This wax/sealant concentrate provides high durability with very good water beading.

Ingredient	Weight (%)	Supplier
1. XIAMETER™ OFX-0536 Fluid	2.0	Dow
2. DOWSIL™ 3055 Resin	4.2	Dow
3. Accoquat CS 4000	8.8	Abitec
4. Glycol Ether EB	13.3	Eastman
5. Water	71.7	

Adjust pH with glacial acetic acid to pH 5.9 to clear.

## Procedure

Divide the water in three equal parts. Add and mix until homogeneous the first 4 ingredients with one part of water. Add the second part of water and then add 5, keep mixing and then add the third part of water. After that, adjust pH to 5.9 using glacial acetic acid which will clear the solution.

## Typical properties / additional information

Application notes: For tunnel wash applications dilution ratio is 300-500:1. 300:1 is most ideal.



# Prototype formulation for drying agent

Auto care formulation information

## Final Rinse Formula for Automatic Car Wash (Concentrate)

Formulation reference: RA-210



### Description

This formulation can be used for the final rinse cycle for automatic car wash systems. The silicone ingredient provides water sheeting and quicker runoff. A dilute solution is sprayed on the vehicle after cleaning, with blowers aiding removal of water droplets.

The concentrate product is diluted with water 50:1 at the car wash facility. The product/water mixture is diluted further 6:1 to 10:1 while spraying through the car wash machinery.

Ingredient	Weight (%)	Supplier
<b>Phase A</b>		
1. XIAMETER™ PMX-0245 Cyclopentasiloxane	10.0	Dow
2. DOWANOL™ DPnP Glycol Ether	10.0	Dow
3. XIAMETER™ OFX-3667 Fluid	10.0	Dow
4. Tomamine Emulsifier Four <sup>1</sup> or Accoquat CS-4000	20.0	Air Products, Inc. Abitec
<b>Phase B</b>		
5. Water	50.0	

<sup>1</sup>Contact Air Products, Inc., ([www.airproducts.com](http://www.airproducts.com)) to obtain information on this product.

### Procedure

1. Add Phase A ingredients in the order shown under low-shear mixing.
2. Add water under low shear. The final mixture should be transparent.



# Prototype formulation for durable polish

Auto care formulation information

## Automotive cream wax – durable polish

Formulation reference: PW-301



## Description

This automotive cream wax was created and balanced with XIAMETER™ silicone fluids, resulting in a high-gloss and easy-to-apply product. The XIAMETER™ silicone fluids leave a soft film on a metallic surface. XIAMETER™ OFX-0531 Fluid adds long-lasting protection to the wax film. This wax is appropriate for consumers and professionals.

Ingredient	Weight (%)	Supplier
1. Water	62.0	
2. Xanthan gum	0.3	
3. Stearic acid	2.0	
4. Polyethylene glycol stearate PEG 6000 or <b>CARBOWAX™ PEG-6000</b>	1.0	Cutina DSP 6B/Cognis <b>Dow</b>
5. Sodium hydroxide at 50%	0.4	
6. Kerosene	15.0	
7. Citric fragrance	0.2	D-Limonene
8. Carnauba wax – emulsion at 50%	4.0	
<b>9. XIAMETER™ PMX-200 Silicone Fluid, 100 cSt</b>	<b>4.0</b>	<b>Dow</b>
<b>10. XIAMETER™ PMX-200 Silicone Fluid, 1,000 cSt</b>	<b>2.0</b>	<b>Dow</b>
<b>11. XIAMETER™ OFX-0531 Fluid</b>	<b>1.0</b>	<b>Dow</b>
12. Silicon dioxide 300# <sup>1</sup>	8.0	
<b>13. Glutaraldehyde</b>	<b>0.1</b>	<b>Dow</b>

<sup>1</sup>The silicon dioxide can be replaced with aluminum silicate 350# or 500# for better cleaning properties.

## Procedure

1. Place ingredient 1 in a vessel.
2. Add ingredient 2 to the main vessel at room temperature and stir until uniform.
3. Add ingredients 3 and 4 and heat to 65°C to reach the melting point.
4. Add ingredient 5 under agitation and cool to 35°C
5. Add ingredient 6 and stir for 10 minutes.
6. Add ingredients 7-12 under agitation in the listed order one at a time until uniform.
7. Add ingredient 13 and stir for 10 minutes more.

## Typical properties / additional information

- The fragrance provides a pleasant citric odor.
- For good results, apply the product in circles. Do one section at a time. When haze appears, buff with a soft and clean cloth or cotton.
- If paste-like consistency is required, the xanthan gum can be replaced with acrylic polymer Carbopol 941 from Lubrizol (Noveon division or Dow's Acusol, consult with Dow Technical Service).

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# Prototype formulation for automotive wax

## Auto care formulation information

### Automotive cream wax

Formulation reference: PW-303



### Description

This automotive cream wax was created and balanced with XIAMETER™ silicone fluids, resulting in a high-gloss and easy-to-apply product. In addition, this product exhibits cleaning and high wetting properties, leaving a soft film on the metallic surface. XIAMETER™ OFX-0531 Fluid adds long-lasting protection to the wax film. This wax is appropriate for consumers and professionals.

Ingredient	Weight (%)	Supplier
1. Water	62.0	
2. Xanthan gum	0.3	
3. Stearic acid	2.0	
4. HallStar PEG 6000 DS	1.0	Hallstar
5. Sodium hydroxide at 50%	0.4	
6. Kerosene	15.0	
7. Fragrance	0.2	D-Limonene
8. Carnauba wax emulsion at 35%	4.0	
9. XIAMETER™ PMX-200 Silicone Fluid, 100 cSt	4.0	Dow
10. XIAMETER™ PMX-200 Silicone Fluid, 1,000 cSt	2.0	Dow
11. XIAMETER™ OFX-0531 Fluid	1.0	Dow
12. KAOPOLITE 1152	8.0	Kaopolite, Inc.
13. KATHON LX	0.1	DuPont

### Procedure

1. Place ingredient 1 in a vessel.
2. Add ingredient 2 to the main vessel at room temperature and stir until uniform.
3. Add ingredients 3 and 4 and heat to 65°C to reach the melting point.
4. Add ingredient 5 under agitation and cool to 35°C.
5. Add ingredient 6 and stir for 10 minutes.
6. Add ingredients 7-12 under agitation in the listed order one at a time until uniform.
7. Add ingredient 13 and stir for 10 minutes more.

### Typical properties / additional information

- For good results, apply the product in circles. Do one section at a time. When haze appears, buff with a soft and clean cloth or cotton.
- If paste-like consistency is required, the xanthan gum can be replaced with acrylic polymer Carbopol 941 from Lubrizol (Noveon division)

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# Prototype formulation for durable polish

Auto care formulation information

## High-gloss automotive cream wax for professional detailing

Formulation reference: PW-304

### Description

This automotive cream wax was created and balanced with XIAMETER™ silicone fluids resulting in a high-gloss, durable, and easy-to-apply wax. In addition, this product exhibits cleaning and high-wetting properties leaving a soft film on a metallic surface. XIAMETER™ OFX-0531 Fluid adds long-lasting protection to the wax film. DOWSIL™ 3037 Intermediate is a phenyl resin that provides outstanding and persistent shine. This formula is appropriate for professionals.



Ingredient	Weight (%)	Supplier
1. Water	62.2	
2. KELTROL F	0.3	CP Kelco
3. Stearic acid	2.0	
4. HallStar PEG 6000 DS	1.0	Hallstar
5. Sodium hydroxide at 50%	0.4	
6. Kerosene	15.0	
7. Carnauba wax emulsion at 35%	4.0	
8. XIAMETER™ PMX-200 Silicone Fluid, 100 cSt	4.0	Dow
9. DOWSIL™ 3037 Intermediate	2.0	Dow
10. XIAMETER™ OFX-0531 Fluid	1.0	Dow
11. KAOPOLITE 1152	8.0	Kaopolite, Inc.
12. KATHON LX	0.1	DuPont

### Procedure

1. Place ingredient 1 in a vessel.
2. Add ingredient 2 to the vessel at room temperature and stir until uniform.
3. Add ingredients 3 and 4 and heat to 65°C to reach the melting point.
4. Add ingredient 5 under agitation and cool to 35°C.
5. Add ingredient 6 and stir for 10 minutes.
6. Add ingredients 7–11 under agitation in the listed order one at a time until uniform.
7. Add ingredient 12 and stir for 10 minutes more.

### Typical properties / additional information

- For good results, apply the product in circles. Do one section at a time. When haze appears, buff with a soft and clean cloth or cotton.
- If paste-like consistency is required, the xanthan gum can be replaced with acrylic polymer Carbopol 941 from Lubrizol (Noveon division).

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# Prototype formulation for durable polish

Auto care formulation information

## Automotive cream wax for professional detailing

Formulation reference: PW-305



## Description

This colored, automotive cream wax was created and balanced with XIAMETER™ silicone fluids resulting in a high-gloss, durable, and easy-to-apply wax. In addition, this product exhibits cleaning and high wetting properties, leaving a soft film on the metallic surface. XIAMETER™ OFX-0531 Fluid adds long-lasting protection to the wax film. XIAMETER™ OFS-6124 Silane is added to fix the pigment on the metallic surface. This wax is appropriate for professionals.

Ingredient	Weight (%)	Supplier
1. Water	62.0	
2. KETROL F	0.3	CP Kelco
3. Stearic acid	2.0	
4. HallStar PEG 6000 DS	1.0	Hallstar
5. Sodium hydroxide at 50%	0.4	
6. Kerosene	15.0	
7. Carnauba wax emulsion at 35%	4.0	
8. XIAMETER™ PMX-200 Silicone Fluid, 100 cSt	4.0	Dow
9. XIAMETER™ PMX-200 Silicone Fluid, 1,000 cSt	2.0	Dow
10. XIAMETER™ OFX-0531 Fluid	1.0	Dow
11. XIAMETER™ OFX-6124 Silane	1.0	Dow
12. KAOPOLITE 1152	5.5	Kaopolite, Inc.
13. Pigment	0.1	
14. Titanium dioxide	1.6	
15. KATHON LX	0.1	DuPont

## Procedure

1. Place ingredient 1 in a vessel.
2. Add ingredient 2 to the main vessel at room temperature and stir until uniform.
3. Add ingredients 3 and 4 and heat to 65°C to reach the melting point.
4. Add ingredient 5 under agitation and cool to 35°C.
5. Add ingredient 6 and stir for 10 minutes.
6. Add ingredients 7–11 under agitation in the listed order one at a time until uniform.
7. Add ingredients 12–14 under agitation until uniform.
8. Add ingredient 15 and stir for 10 minutes.

## Typical properties / additional information

This formulation was developed with the purpose to cover scratches on metallic surfaces.

- For good results, apply the product in circles. Do one section at a time. When haze appears, buff with a soft and clean cloth or cotton.
- If paste-like consistency is required, the xanthan gum can be replaced with acrylic polymer Carbopol 941 from Lubrizol (Noveon division).

### Disclaimer:

The formulation provided herein is made available by Dow in good faith, by mere liberality, and portrays a combination of ingredients commonly used in the industry, based on Dow's experience. Considering that the recipient of it might use such formulation to different applications and in different conditions, being subject to different regulations, which may differ from one location to another and may change over time, the recipient is responsible for determining whether such formulation is appropriate and applicable to the recipient's specific needs. Dow does not guarantee, implicitly or explicitly, that such formulation is correct, adequate, complete or fits any specific use, thus assuming no obligation or responsibility arising from the use of such formulation by anyone. The suggested formulation contains a Brazilian genetic resource product, named "carnauba". Such species is endemic from Brazil and part of the Brazilian genetic heritage and therefore, the use of it might be under the scope of Law No. 13.123/2015. The recipient of such formulation shall evaluate the applicability of such law to the activities to be performed using the formulation. The recipient shall be exclusively liable to guarantee its product compliance with applicable access and benefit sharing regulation. Dow has already complied with applicable law, registering the formulation before SISGEN and does not assume any liability resulting from recipient's failure to comply with any applicable access and benefit sharing regulation. For further information please contact [flarps@dow.com](mailto:flarps@dow.com).



# Prototype formulation for durable polish

Auto care formulation information

## Durable, high-gloss paste polish

Formulation reference: PW-307

## Description

This formulation is for a detergent-resistant cleaner paste polish, designed for automotive surfaces. This formulation provides a product with improved application ease and rub-out, as well as excellent gloss, due to the use of a silicone emulsifier. The product also exhibits very good durability and resistance to multiple detergent washings.



Ingredient	Weight (%)	Supplier
<b>Phase A</b>		
1. Odorless mineral spirits	9.5	
2. DOWSIL™ 5225C Formulation Aid	7.5	Dow
<b>Phase B</b>		
3. XIAMETER™ OFX-0536 Fluid	1.0	Dow
4. XIAMETER™ OFX-0531 Fluid	6.0	Dow
<b>Phase C</b>		
5. Water	58.0	
6. Kaopolite SF	15.0	Kaopolite, Inc.
<b>Phase D</b>		
7. Tween 20	1.0	Croda/Uniqema
<b>Phase E</b>		
8. 50% solution of sodium citrate in water	2.0	

## Procedure

1. Place Phases A and B into a mixing vessel. Start agitation. Mix until uniform.
2. Separately blend Phase C and add it to the top of the vessel with turbulent mixing.
3. Add Phases D and E.
4. Upon complete addition, begin high-speed mixing with a shear blade.
5. Continue shearing the product until the desired consistency is achieved. Package.

## Typical properties / additional information

1. The order of addition is critical. Ensure the water phase is added to the top of the oil phase under turbulent mixing followed by shearing. Variations to this procedure may yield a thin, unstable product because the emulsion may not invert to a water-in-oil form.
2. The use of a high-shear homogenizer may improve product consistency and stability.
3. Many alternative solvents to mineral spirits are acceptable.
4. A reduced level of the polishing agent (Kaopolite SF) may be desirable for use on clearcoat finishes and may improve application ease and rub-out.



# Prototype formulation for durable polish

## Auto care formulation information

### Detergent-resistant cleaner paste polish

Formulation reference: PW-308

### Description

This formulation is for a detergent-resistant cleaner paste polish designed for automotive surfaces. This formulation provides exceptional application ease and rub-out, as well as excellent gloss, due to the use of a silicone emulsifier with the resin/dimethyl fluid blend. The use of volatile silicones improves wet-out, as well as the application ease of the material. The presence of the amine-functional material and the resin/dimethyl fluid blend provides excellent durability and resistance to multiple detergent washings.



Ingredient	Weight (%)	Supplier
<b>Phase A</b>		
1. XIAMETER™ PMX-0345 Cyclosiloxane Blend	12.5	Dow
2. DOWSIL™ 5225C Formulation Aid	7.5	Dow
<b>Phase B</b>		
3. DOWSIL™ 2-1912 Fluid	3.0	Dow
4. XIAMETER™ OFX-0536 Fluid	1.0	Dow
<b>Phase C</b>		
5. Water	58.0	
6. Kaopolite SF	15.0	Kaopolite, Inc.
<b>Phase D</b>		
7. Tween 20	1.0	Croda/Uniqema
<b>Phase E</b>		
8. 50% solution of sodium citrate in water	2.0	

### Procedure

1. Place Phases A and B into a mixing vessel. Start agitation. Mix until uniform.
2. Separately blend Phase C and add it to the top of the vessel with turbulent mixing.
3. Add Phases D and E.
4. Upon complete addition, begin high-shear mixing.
5. Continue high-shear mixing until the desired consistency is achieved. Package.



# Prototype formulation for durable polish

Auto care formulation information

## Extremely Durable Liquid Polish

Formulation reference: PW-520



## Description

Formulation APF 320 is an extremely durable, detergent-resistant cleaner polish for automotive surfaces. The product provides very good gloss while the resin improves durability and resistance to multiple detergent washings. This product may be more difficult to rub out.

Ingredient	Weight (%)	Supplier
<b>Phase A</b>		
1. Water	60.00	
2. Kaopolite SF	10.00	Kaopolite, Inc.
<b>Phase B</b>		
3. WITCAMIDE 511	1.00	Witco Chemical Corp.
4. Odorless Mineral Spirits	19.25	
<b>Phase C</b>		
5. XIAMETER™ OFX-0536 Fluid	6.00	Dow
6. XIAMETER™ OFX-531 Fluid	1.00	Dow
<b>Phase D</b>		
7. DOWSIL™ RSN-6018 Resin Intermediate	0.50	Dow
8. Anhydrous Ethyl Alcohol	1.50	
<b>Phase E</b>		
9. BENTONE 38	0.50	Rheox Corp.
<b>Phase F</b>		
10. Anhydrous Isopropyl Alcohol	0.24	

## Procedure

1. Add Phase A, with agitation, into mixing vessel.
2. Add Phase B.
3. When mixture is uniform, add Phase C.
4. Premix Phase D in ethyl alcohol until resin is soluble. Add to formulation.
5. Mix until creamy. Add Phase E.
6. When the above mixture is blended, add Phase F.
7. Mix until uniform. Package.

## Typical properties / additional information

1. High shear mixing equipment will provide a thicker cream with less phase separation.
2. Allow sufficient time for DOWSIL™ RSN-6018 Resin Intermediate. Resin to dissolve. Heating the premix will reduce time needed to dissolve resin, but use caution due to flash point limitations of alcohol.
3. Use of dimethyl fluid with this formulation may improve rub-out and gloss.
4. BENTONE 38 may be more easily incorporated into the system through the use of a sifter or screen, particularly with low shear equipment.
5. Lower levels of the polishing agent (KAOPOLITE SF) may be desirable for clear coat systems.
6. Alternative solvents to the mineral spirits may be considered.



# Prototype formulation for durable polish

Auto care formulation information

## Hybrid Ceramic Sealant/Wax

Formulation reference: USL-PW-500



## Description

This hybrid ceramic sealant provides a durable highly hydrophobic protective finish with a high degree of depth of gloss. The finish can last for many months!

Ingredient	Weight (%)	Supplier
<b>Phase A</b>		
1. TERGITOL™ 15-S-7 Surfactant	1.1	Dow
2. TERGITOL™ 15-S-3 Surfactant	0.2	Dow
3. XIAMETER™ OFX-0536 Fluid	2.3	Dow
4. Water	40.3	
<b>Phase B</b>		
1. TERGITOL™ 15-S-7 Surfactant	6.2	Dow
2. TERGITOL™ 15-S-3 Surfactant	5.7	Dow
3. DOWSIL™ 2-1912 Fluid	3.4	Dow
4. DOWSIL™ RSN-9118 Resin	3.0	Dow
5. Water	37.8	

## Procedure

### Phase A:

1. Blend the first 3 components using normal shear or mixing.
2. Slowly add water until thoroughly mixed. (Slight milky appearance).

### Phase B:

1. Mix DOWSIL™ 2-1912 Fluid with the DOWSIL™ RSN 9118 Resin under normal shear.
2. Add TERGITOL™ 15-S-3 Surfactant under normal shear.
3. Add TERGITOL™ 15-S-7 Surfactant under normal shear.
4. Under high shear add Phase A slowly to above DOWSIL™ 2-1912/9118/ TERGITOL™ 15-S mixture.
5. Slowly add remaining water in Phase B under high shear until a homogenous mixture is obtained.

## Typical properties / additional information

### Benefits:

- Ease of application: To a washed & rinsed vehicle (do not dry), use a quarter to half dollar sized amount of Hybrid Ceramic Wax/Sealant on a micro-fiber cloth or applicator pad and apply onto all surfaces of a quarter panel of the vehicle (NOTE: Keep surface wet with mist of water if it should go dry during app.) Buff dry completely until glossy & free of smears. Continue this process on all surfaces of the vehicle.
- Long lasting protection.
- High depth of gloss.
- Can re-apply for future applications without affecting gloss .
- Can be applied over all vehicle surfaces, including glass, without streaking or smearing.

Courtesy of Univar Solutions Inc.



# Prototype formulation for durable polish

Auto care formulation information

## Hybrid Ceramic Sealant/Wax

Formulation reference: USL-PW-510



## Description

This hybrid ceramic sealant provides a durable highly hydrophobic protective finish with a high degree of depth of gloss. The finish can last for many months!

Ingredient	Weight (%)	Supplier
<b>Phase A</b>		
1. TERGITOL™ 15-S-7 Surfactant	1.1	Dow
2. TERGITOL™ 15-S-3 Surfactant	0.2	Dow
3. XIAMETER™ OFX-0536 Fluid	2.3	Dow
4. Water	40.3	
<b>Phase B</b>		
1. TERGITOL™ 15-S-7 Surfactant	5.7	Dow
2. TERGITOL™ 15-S-3 Surfactant	5.2	Dow
3. DOWSIL™ 2-1912 Solid Resin	3.4	Dow
4. DOWSIL™ MQ 1600 Solid Resin	1.5	Dow
5. Water	40.3	

## Procedure

### Phase A:

1. Blend the first 3 components using normal shear or mixing.
2. Slowly add water until thoroughly mixed. (Slight milky appearance).

### Phase B:

1. Mix DOWSIL™ 2-1912 with the DOWSIL™ MQ1600 under high shear to help solvate.
2. Add TERGITOL™ 15-S-3 Surfactant under high shear to continue to break down DOWSIL™ MQ 1600.
3. Add TERGITOL™15-S-7 Surfact under high shear.
4. Under high shear add Phase A slowly to above DOWSIL™ 2-1912 Solid Resin / DOWSIL™ MQ 1600 Solid Resin.
5. Add remaining water in Phase B under high shear until a homogenous mixture is obtained. Filter final mixture.

## Typical properties / additional information

### Benefits:

- Ease of application: To a washed & rinsed vehicle (do not dry), use a quarter to half dollar sized amount of Hybrid Ceramic Wax/Sealant on a micro-fiber cloth or applicator pad and apply onto all surfaces of a quarter panel of the vehicle (NOTE: Keep surface wet with mist of water if it should go dry during app.) Buff dry completely until glossy & free of smears. Continue this process on all surfaces of the vehicle.
- Long lasting protection.
- High depth of gloss.
- Can re-apply for future applications without affecting gloss.
- Can be applied over all vehicle surfaces, including glass, without streaking or smearing.

Courtesy of Univar Solutions Inc.





# Prototype formulation for exterior trim protection

Auto care formulation information

## Exterior plastic / rubber enhancers – liquid

Formulation reference: EP-403



## Description

The combination of an amino-functional silicone fluid and a high-viscosity silicone fluid gives a durable film to restore faded bumpers and other trim. Reducing the thickener level enables the product to be packaged in a spray dispenser.

Ingredient	Weight (%)	Supplier
1. Water	83.3	
2. XIAMETER™ MEM-8035 Emulsion	5.7	Dow
3. DOWSIL™ HV 496 Emulsion	10.0	Dow
4. Cellulose thickener	1.0	Ashland Inc.

## Procedure

1. Add ingredients 1–3 in the order listed to an appropriate vessel, while mixing at low speed.
2. Slowly add ingredient 4 to the vessel. Mix for 30 minutes, or until the product is completely dissolved and no lumps are present.

## Typical properties / additional information

Suggestions for adjusting the formulation:

- To improve leveling, add XIAMETER MEM-0062 Emulsion PS or XIAMETER™ MEM-0349 Emulsion or XIAMETER™ MEM-0346 Emulsion.
- To improve wetting, add 0.5% of XIAMETER™ OFX-5211 Superwetting Agent or XIAMETER™ OFX-0309 Fluid.



# Prototype formulation for exterior trim protection

Auto care formulation information

## Exterior plastic / rubber enhancers – sheen finish

Formulation reference: EP-404



## Description

This product provides a matte, leather-like appearance to exterior surfaces. Incorporation of a wax emulsion will promote uneven reflection of light, giving a perceived lower gloss finish. An emulsion of a lower viscosity polydimethylsiloxane base polymer will give less color intensity.

Ingredient	Weight (%)	Supplier
1. Water	80.4	
2. XIAMETER™ MEM-8035 Emulsion	5.0	Dow
3. XIAMETER™ MEM-0062 Emulsion PS	8.0	Dow
4. Michem Lube 155	6.0	Michelman Inc.
5. Acrylic thickener	0.4	Consult with Dow on ACUSOL™ PRO Polymer and other Acrylic thickeners
6. Triethanolamine	0.2	Dow

## Procedure

1. Add ingredients 1–4 into an appropriate vessel. Mix at low speed.
2. Slowly add ingredients 5 and 6. Mix until product is homogeneous.

## Typical properties / additional information

Suggestions for adjusting the formulation:

- To lower the color intensity, substitute XIAMETER™ MEM-0349 Emulsion or XIAMETER™ MEM-0346 Emulsion for XIAMETER™ MEM-0062 Emulsion PS.
- To give a lower gloss finish, partially replace XIAMETER™ MEM-0062 Emulsion PS with wax emulsion.
- To improve durability, increase the level of XIAMETER™ MEM-8035 Emulsion and decrease the level of XIAMETER™ MEM-0062 Emulsion PS.



# Prototype formulation for exterior trim protection

Auto care formulation information

## Exterior plastic / rubber enhancers – aerosol product

Formulation reference: EP-410



## Description

Blending a silicone fluid with a silicone resin shows excellent gloss/color with durability. Spray application makes for a very quick process.

Ingredient	Weight (%)	Supplier
1. Low aromatic solvent 160/190°C	10.0	Exxon Chemicals Ltd. / Shell Chemicals Ltd.
2. Heptane	62.5	Exxon Chemicals Ltd. / Shell Chemicals Ltd.
3. XIAMETER™ PMX-200 Silicone Fluid, 60,000 cSt	10.0	Dow
4. DOWSIL™ RSN-9118 Resin	2.5	Dow
5. Isopar G	15.0	Exxon Chemicals Ltd.

Please read *Guidance for Aerosol Applications of Silicone-Based Materials* from the Silicones Environmental, Health and Safety Council of North America (SEHSC) at [sehsc.com/science.asp](http://sehsc.com/science.asp).

## Procedure

Mix the ingredients listed with low-speed stirring.

## Typical properties / additional information

Approximately 70% by weight of this formulation would be used in an aerosol with the remaining 30% serving as propellant.

- To improve durability, increase the level of DOWSIL™ RSN-9118 Resin.
- Replace DOWSIL™ RSN-9118 Resin with DOWSIL™ 2-1912 Fluid



# Prototype formulation for exterior trim protection

Auto care formulation information

## Exterior plastic / rubber enhancers – gel

Formulation reference: EP-420



## Description

The thick gel consistency of this formulation enables accurate application to trim areas only. The silicone fluid gives excellent gloss and color, while the amino-functional silicone fluid provides durability.

Ingredient	Weight (%)	Supplier
1. Low aromatic solvent 160/190°C	83.3	Exxon Chemicals Ltd. / Shell Chemicals Ltd.
2. CAB-O-SIL EH-5	8.7	Cabot Corp.
3. XIAMETER™ PMX-200 Silicone Fluid, 12,500 cSt	6.0	Dow
4. XIAMETER™ OFX-0536 Fluid	2.0	Dow

## Procedure

Mix the ingredients in the order listed above with low-shear stirring.

## Typical properties / additional information

Suggestions for adjusting the formulation:

- To increase the color intensity, substitute XIAMETER™ PMX-200 Silicone Fluid, 60,000 cSt, for XIAMETER™ PMX-200 Silicone Fluid, 12,500 cSt.
- To improve durability, increase the level of XIAMETER™ OFX-0536 Fluid and/or incorporate DOWSIL™ RSN-9118 Resin.



# Prototype formulation for exterior trim protection

Auto care formulation information

## Premium protectant lotion (Low odor)

Formulation reference: IP-590

## Description

This formula is a water-based protectant lotion that is California A.R.B. compliant. The combination of XIAMETER™ MEM-0349 Emulsion with XIAMETER™ MEM-0037 Emulsion provides high gloss to interior dashboards, plastic, rubber, interior leather and tire surfaces and is low odor when applied to surfaces. An easy-to-disperse thickener that maintains low odor was selected to create this lotion.



Ingredient	Weight (%)	Supplier
<b>Phase A</b>		
1. DI or soft water	45.00	
2. Carbopol EZ-2	0.70	Lubrizol/Noveon
<b>Phase B</b>		
3. Preservative	q.s.	Dow
4. XIAMETER™ MEM-0349 Emulsion	15.00	Dow
5. XIAMETER™ MEM-0037 Emulsion	15.00	Dow
<b>Separate Phase C (Premix) Target pH = 8.0–9.0</b>		
6. DI water	24.00	
7. 20% sodium hydroxide solution	q.s. <sup>1</sup>	

<sup>1</sup>Start with 0.010%

## Procedure

Use a mixer with multiple impellers to give high turnover flow at sides and bottom of container.

1. Use enough phase A water to reach the effective mixing zone of the vessel.
2. Add Carbopol EZ-2 thickener and disperse under moderate shear (minimum 20 minutes).
3. Add phase B ingredients and mix under moderate shear (minimum 20 minutes). A large increase in thickness will occur.
4. Put phase C DI water in a separate container for the phase C premix.
5. Add 20% sodium hydroxide solution to achieve a pH of 8.0–9.0 for phase C as measured by a digital pH meter.
6. Add phase C to the formula and continue mixing (minimum of 20 minutes). Lotion will thin during this step.

## Typical properties / additional information

DI water or softened water is recommended for this formula. Adjust the amount of 20% sodium hydroxide solution to achieve the target pH. The amount of thickener can be adjusted to modify the formula from a thin lotion to a thick gel if desired.



# Prototype formulation for glass cleaner

Auto care formulation information

## Glass care – screenwash

Formulation reference: GL-802



## Description

This silicone surfactant enables rapid coverage of the windshield promoting contact between road traffic film and the solution.

Ingredient	Weight (%)	Supplier
1. Water	68.5	
2. Crodasinic LS35	0.5	Croda, Inc.
3. DOWANOL™ DPM Glycol Ether	2.0	Dow
4. DOWANOL™ PM Glycol Ether	3.0	Dow
5. Propylene glycol	5.0	Dow
6. XIAMETER™ OFX-0193 Fluid	1.0	Dow
7. Isopropanol	20.0	

## Procedure

Mix the ingredients in the order listed with low-speed stirring.

## Typical properties / additional information

Suggestions for adjusting the formulation:

- The level of XIAMETER™ OFX-0193 Fluid should be adjusted depending on the dilution ratio recommended for the product to optimize wetting.





# Prototype formulation for glass cleaner

Auto care formulation information

## Glass care – cleaner

Formulation reference: GL-810



## Description

This is a cleaning product for removing grease and dirt from windows. The silicone surfactant aids spreadability and also provides temporary anti-mist properties without smearing.

Ingredient	Weight (%)	Supplier
1. Water	84.7	
2. <b>DOWANOL™ DPM Glycol Ether</b>	<b>5.0</b>	<b>Dow</b>
3. <b>XIAMETER™ OFX-0193 Fluid</b>	<b>0.3</b>	<b>Dow</b>
4. Isopropanol	10.0	

## Procedure

Mix the ingredients in the order listed with low-speed stirring.

## Typical properties / additional information

Suggestions for adjusting the formulation:

- At higher levels of incorporation, XIAMETER™ OFX-0193 Fluid can provide an anti-mist property.



# Prototype formulation for glass cleaner

Auto care formulation information

## Glass cleaner with ammonia and citric glass cleaner

Formulation reference: GL-840



## Description

These automotive glass cleaners are easy to wipe off because of the lubricity provided by XIAMETER™ OFX-0193 Fluid.

Ingredient	Weight (%)	Supplier
<b>Phase A</b>		
1. Water	66.2	
2. Isopropanol	10.0	
3. Ethanol	20.0	
4. DOWANOL™ PnB Glycol Ether	3.0	Dow
5. XIAMETER™ OFX-0193 Fluid	0.5	Dow
6. Ammonia	0.3	
<b>Phase B</b>		
1. Water	66.3	
2. Isopropanol	10.0	
3. Ethanol	20.0	
4. DOWANOL™ PnB Glycol Ether	3.0	Dow
5. XIAMETER™ OFX-0193 Fluid	0.5	Dow
6. D-Limonene	0.2	

## Procedure

Mix the ingredients in the order listed with low-speed stirring.

## Typical properties / additional information

- The ammonia in formulation **A** acts as a degreaser and the D-Limonene in formulation **B** adds a pleasant citric odor.



# Prototype formulation for glass cleaner

Auto care formulation information

## Anti-fog glass cleaner

Formulation reference: GL-860



## Description

This is a glass cleaner formulation that is excellent for cleaning automobile windshields, household windows, refrigerators, stove tops and kitchen counter surfaces. It removes grease and dirt and is easy to wipe off because of the lubricity provided by the silicone fluid. This formulation also provides anti-fog properties.

Ingredient	Weight (%)	Supplier
<b>Phase A</b>		
1. XIAMETER™ OFX-0193 Fluid	0.5	Dow
2. XIAMETER™ OFX-5211 Fluid	1.0	Dow
3. DOWANOL™ PnB Glycol Ether	4.0	Dow
4. Isopropanol	10.0	
<b>Phase B</b>		
5. Deionized Water	84.5	

## Procedure

1. Mix Phase A ingredients until uniform.
2. Add this solution to Phase B.

## Typical properties / additional information

- The grease-removing power of this product may be slightly improved by adding a small amount of organic surfactant.



# Prototype formulation for interior protection

Auto care formulation information

## Cockpit enhancers – aerosol product

Formulation reference: IP-501



## Description

This formulation provides an easy-to-apply product featuring silicones that give good gloss/color and that help mask light scratches.

Ingredient	Weight (%)	Supplier
1. Exxon D40	10.0	Exxon Chemical Co.
2. KELTROL F	68.0	CP Kelco
3. XIAMETER™ PMX-200 Silicone Fluid, 350 cSt	3.5	Dow
4. XIAMETER™ PMX-200 Silicone Fluid, 1,000 cSt	3.5	Dow
5. Isopar G	15.0	Exxon Chemical Co.

Please read *Guidance for Aerosol Applications of Silicone-Based Materials* from the Silicones Environmental, Health and Safety Council of North America (SEHSC) at [sehsc.com/science.asp](http://sehsc.com/science.asp).

## Procedure

Mix the ingredients in the order listed with-low speed stirring. Approximately 70% by weight of this formulation would be used in an aerosol with the remaining 30% being propellant.

## Typical properties / additional information

Suggestion for adjusting the formulation:

- To increase the gloss/color, increase ratio of XIAMETER™ PMX-200 Silicone Fluid, 1,000 cSt to XIAMETER™ PMX-200 Silicone Fluid, 350 cSt; or incorporate 2% XIAMETER™ PMX-200 Silicone Fluid, 12,500 cSt.
- To provide a drier film, incorporate 3% DOWSIL™ 2-1912 Fluid or DOWSIL™ RSN-9118 Resin and reduce level of other silicones by 1% each.



# Prototype formulation for interior protection

Auto care formulation information

## Cockpit enhancers – liquid

Formulation reference: IP-502



## Description

This product is an emulsion form of a solventless product formulated to provide shine to interior surfaces.

Ingredient	Weight (%)	Supplier
1. Water	85.0	
2. XIAMETER™ MEM-0349 Emulsion or XIAMETER™ MEM-0346 Emulsion	7.0	Dow
3. XIAMETER™ MEM-0062 Emulsion PS	7.0	Dow
4. Hydroxyethyl cellulose thickener	1.0	Ashland Inc.

## Procedure

1. Put ingredients 1–3 into an appropriate vessel and mix at low speed.
2. Slowly add ingredient 4 while mixing at low speed. Continue to mix for 30 minutes, or until all thickener is dissolved and the product is homogeneous.

## Typical properties / additional information

Suggestions for adjusting the formulation:

- To increase the gloss/color: Incorporate 2% DOWSIL™ HV 496 Emulsion and reduce the level of other silicones by 1% each.



# Prototype formulation for interior protection

Auto care formulation information

## Cockpit enhancers – sheen finish

Formulation reference: IP-503



## Description

Lowering the silicone level and using a wax emulsion of larger particle size promotes uneven light reflection, giving a perceived lower gloss finish (as a new look) with reduced glare.

Ingredient	Weight (%)	Supplier
1. Water	87.3	
2. Carbopol Ultrez	0.5	Lubrizol
<b>3. XIAMETER™ MEM-0349 Emulsion or XIAMETER™ MEM-0346 Emulsion</b>	<b>6.0</b>	<b>Dow</b>
4. Michem Lube 155	5.0	Michelman Inc.
<b>5. Triethanolamine</b>	<b>1.0</b>	<b>Dow</b>
6. Preservative	0.2	

## Procedure

1. Put ingredient 1 into the main vessel. Sift in ingredient 2. Mix for 20 minutes at low speed.
2. Add ingredients 3 and 4 to the main vessel. Mix 10 minutes.
3. Add ingredients 5 and 6 to the main vessel. Mix 30 minutes. Pour down and package.

## Typical properties / additional information

Suggestions for adjusting the formulation:

- To give a more sheen or matte finish: Increase ratio of wax emulsion to XIAMETER™ MEM-0349 Emulsion or XIAMETER™ MEM-0346 Emulsion





# Prototype formulation for interior protection

Auto care formulation information

## Leather conditioner lotion

Formulation Reference: IP-540  
Croda derived formulation



## Description

This gel product uses a combination of materials to keep leather supple by replacing lost natural oils. The silicone wax helps to protect the leather, while the silicone fluid aids application.

Ingredient	Weight (%)	Supplier
<b>Phase A</b>		
1. DOWSIL™ 2-5088 Wax	2.0	Dow
2. SynCroWax ERL	2.0	Croda Ltd.
3. SynCroWax AWI	2.0	Croda Ltd.
4. Lanolin	2.0	
5. VOLPO L4	2.5	Croda Ltd.
6. XIAMETER™ PMX-200 Silicone Fluid, 350 cSt	1.0	Dow
7. Pine Oil	1.0	
8. Triethanolamine	0.5	Dow
<b>Phase B</b>		
9. Water	37.0	
<b>Phase C</b>		
10. Acrylic thickener (2%) solution	15.0	Consult with Dow on ACUSOL™ PRO Polymer and other Acrylic thickeners
11. Water	30.0	
12. Isopropanol	5.0	

## Procedure

1. Mix ingredients 1-8 in the main vessel and heat to 70°C.
2. Heat ingredient 9 to 70°C and add to Phase A under high shear.
3. Prepare a solution of acrylic thickener and water and add this to the main vessel.
4. Add isopropanol and mix for 5 minutes under high shear, then use low-speed mixer.

## Typical properties / additional information

- To increase the gloss or color: Replace XIAMETER™ PMX-200 Silicone Fluid, 350 cSt, with XIAMETER™ PMX-200 Silicone Fluid, 1,000 cSt.
- To reduce the gloss: Replace XIAMETER™ PMX-200 Silicone Fluid, 350 cSt, with XIAMETER™ PMX-200 Silicone Fluid, 100 cSt.
- To improve water repellency: Replace XIAMETER™ PMX-200 Silicone Fluid, 350 cSt, with DOWSIL™ RSN-9118 Resin.
- To give a drier film: Replace XIAMETER™ PMX-200 Silicone Fluid, 350 cSt, with DOWSIL™ 593 Fluid, DOWSIL™ 3527 Release Agent or DOWSIL™ RSN-9118 Resin.



# Prototype formulation for interior protection

Auto care formulation information

## Vinyl protectant

Formulation reference: IP-550



## Description

This formulation is a vinyl surface protectant that may be used on various soft surfaces such as vinyl, leather, rubber, and plastics to impart gloss.

Ingredient	Weight (%)	Supplier
1. Water	79.1	
2. <b>CELLOSIZETM QP-4400H</b> Hydroxyethyl cellulose	<b>0.8</b>	<b>Dow</b>
3. <b>XIAMETERTM MEM-0039 Emulsion</b>	<b>20.0</b>	<b>Dow</b>
4. KATHON LX	0.1	DuPont

## Procedure

1. Add ingredient 2 to ingredient 1 and stir to achieve a transparent solution.
2. Add ingredient 3 and stir for 10 minutes.
3. Add ingredient 4 and stir for 10 minutes more.

## Typical properties / additional information

Directions: The final product can be applied by spray or with a damp cloth. This product should not be applied on floors or on vehicle controls.



# Prototype formulation for interior protection

Auto care formulation information

## Creamy vinyl surface protectant

Formulation reference: IP-560



## Description

This is a creamy vinyl and leather cleaner and protectant. It provides excellent gloss and easy application.

Ingredient	Weight (%)	Supplier
<b>Phase A</b>		
1. DOWSIL™ 5225C Formulation Aid	7.5	Dow
2. XIAMETER™ PMX-200 Silicone Fluid, 1,000 cSt	5.0	Dow
3. XIAMETER™ PMX-0245 Cyclopentasiloxane	12.5	Dow
<b>Phase B</b>		
4. Water	73.9	
5. Tween 20	1.0	Croda/Uniqema
6. Sodium chloride	0.1	

## Procedure

1. Blend Phases A and B separately.
2. Add Phase B to the top of Phase A with turbulent mixing.
3. Once the addition is complete, shear mix to the desired consistency.

## Typical properties / additional information

- Durability may be improved with the addition of XIAMETER™ OFX-0531 Fluid in Phase A.
- Witcamide 511 may be used as an alternative emulsifier
- Other electrolytes may be substituted for sodium chloride

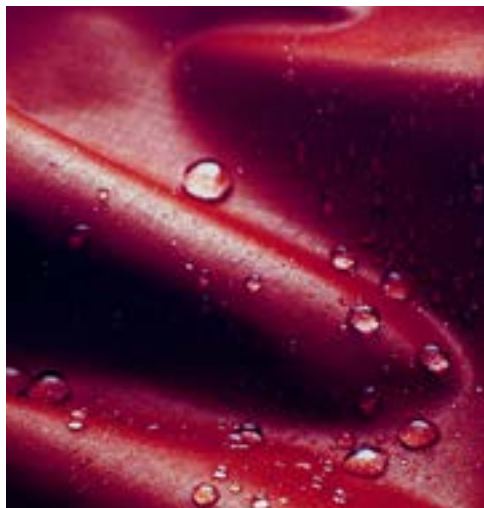


# Prototype formulation for interior protection

Auto care formulation information

## Fabric water repellent

Formulation reference: IP-570



## Description

This formulation is an excellent water repellent treatment for items such as automotive upholstery and carpet. It may also be used to treat rainwear, snowsuits, mittens, footwear and upholstery materials.

Ingredient	Weight (%)	Supplier
1. DOWSIL™ FBL-0563 Formulated Blend	5.0	Dow
2. Isopar G Solvent	95.0	Exxon Corp.

Please read **Guidance for Aerosol Applications of Silicone-Based Materials** from the Silicones Environmental, Health and Safety Council of North America (SEHSC) at [sehsc.com/science.asp](http://sehsc.com/science.asp).

## Procedure

Blend water repellent with solvent.

## Typical properties / additional information

- This product could also serve as a concentrate for an aerosol and be used at a level of 80% with 20% propellant.
- Solvents should be free of moisture to ensure maximum shelf life.
- Alternative solvents, such as aliphatic hydrocarbons, may be used.



# Prototype formulation for interior protection

Auto care formulation information

## Multi-surface medium shine dressing

Formulation reference: IP-580



**XIAMETER™ MEM-0349 Emulsion and XIAMETER™ MEM-0346 Emulsion are 60% polydimethyl-siloxane emulsions with nonionic surfactants.**

## Description

This formulation is a water-based protectant that is California A.R.B. compliant. The formula provides gloss to interior dashboards, plastic, rubber, interior leather, and tire surfaces. The thickener provides vertical cling when the formula is sprayed.

Ingredient	Weight (%)	Supplier
<b>Phase A</b>		
1. Water	30-40	
2. XIAMETER™ MEM-0349 Emulsion or XIAMETER™ MEM-0346 Emulsion	34.0	Dow
3. Acrylic thickener: Alco gum L-12 or ACUSOL™ 820 Polymer	1.5 1.0	Alco Chemical Dow
4. Preservative	q.s.	Dow
<b>Phase B</b>		
5. Additional water to total 63% water	33-23	
6. Triethanolamine	1.4	Dow

## Procedure

Use a mixer that gives adequate turn over flow at the sides of the bottom of the container.

1. Load enough water to reach the effective mixing zone of the container.
2. Add the remaining phase A ingredients and mix until uniformly dispersed (minimum 20 minutes).
3. Premix phase B ingredients and then add to phase A.
4. Mix until thickener is fully activated (minimum 20 minutes).
5. Check the formula pH and verify it is in the correct range.

## Additional information to optimize formula

First, adjust the targeted amount of triethanolamine to obtain a final pH of 8.0–9.5 to correctly activate the thickener. This compensates for variations in the source water pH. If desired, adjust the level of acrylic thickener to modify the formula viscosity for best performance with your spray bottle.

See Auto Care Raw Material Supplier Reference Sheet for the role of the raw material and supplier information.



# Prototype formulation for interior protection

Auto care formulation information

## Premium protectant lotion (Low odor)

Formulation reference: IP-590

## Description

This formulation is a water-based protectant lotion that is California A.R.B. compliant. The combination of XIAMETER™ MEM-0349 Emulsion with XIAMETER™ MEM-0037 Emulsion provides high gloss to interior dashboards, plastic, rubber, interior leather and tire surfaces and is low odor when applied to surfaces. An easy-to-disperse thickener that maintains low odor was selected to create this lotion.



Ingredient	Weight (%)	Supplier
<b>Phase A</b>		
1. DI or soft water	45.0	
2. Carbopol EZ-2	0.70	Lubrizol (Noveon division)
<b>Phase B</b>		
3. Preservative	q.s.	Dow
4. XIAMETER™ MEM-0349 Emulsion	15.0	Dow
5. XIAMETER™ MEM-0037 Emulsion	15.0	Dow
<b>Separate Phase C (Premix) Target pH = 8.0–9.0</b>		
6. DI water	24.0	Lubrizol
7. 20% sodium hydroxide solution	q.s. <sup>1</sup>	

<sup>1</sup>Start with 0.010%.

## Procedure

Use a mixer with multiple impellers to give high turnover flow at the sides and bottom of the container.

1. Load enough water to reach the effective mixing zone of the container.
2. Add Carbopol EZ-2 thickener and disperse under moderate shear (minimum 20 minutes).
3. Add phase B ingredients and mix under moderate shear (minimum 20 minutes). A large increase in thickness will occur.
4. In a separate container, load DI water for the phase C premix.
5. Add 20% sodium hydroxide solution to achieve a pH of 8.0–9.0 for phase C as measured by a digital pH meter.
6. Add phase C to formula and continue mixing (minimum of 20 minutes). Lotion will thin during this step.

## Additional information to optimize formula

DI water or softened water is recommended for this formula. Adjust the amount of 20% sodium hydroxide solution to achieve the target pH. The amount of thickener can be adjusted to modify the formula from a thin lotion to a thick gel if desired.





# Prototype formulation for leather conditioner

## Auto care formulation information

### Leather conditioner lotion

Formulation Reference: IP-600 with DOWSIL™ 2-5088 Wax



### Additional Information

Sodium Chloride is a freeze-thaw stabilizer. XIAMETER™ PMX-0245 Cyclopentasiloxane promotes good spreading of all actives.

### Description

A creamy lotion for conditioning leather that appeals to the senses. The formula gives a high shine during initial application that slowly transforms to a surface with medium shine that feels dry. DOWSIL™ 2-5088 Wax thickens the formula and provides a dry protective film to the leather. DOWSIL™ 5200 Formulation Aid is an excellent emulsifier for economical formulas with a high water content where the oil phase is the continuous phase of the emulsion. The formula VOC content is less than 0.5 wt %. Contains natural Lanolin Oil for conditioning.

Ingredient	Weight (%)	Supplier
<b>Water Phase</b>		
1. DI Water	72.0	
2. Sodium Chloride	1.0	
<b>Oil Phase</b>		
3. Isoparaffin (Isopar M) (VOC exempt)	17.0	Exxon Mobil or equivalent
4. XIAMETER™ PMX-0245 Cyclopentasiloxane	2.0	Dow
5. Lanolin Oil	2.0	Various
6. White Mineral Oil	1.0	Various
7. DOWSIL™ 5200 Formulation Aid (emulsifier)	3.0	Dow
8. DOWSIL™ 2-5088 Wax	2.0	Dow

### Procedure

1. In a separate container suitable for heating, add all oil phase ingredients in the order shown.
2. Heat the oil phase slowly to 72°C in a closed container to melt the wax (for example, in a large oven).
3. Load hot DI Water at 60°C into the mixing vessel.
4. Add Sodium Chloride and dissolve the salt.
5. Ensure mixing vessel equipment and Water Phase are between 60-65°C prior to adding oil phase.
6. Add hot Oil Phase (72°C) to mixing vessel while mixing.
7. Allow the formula to begin cooling under moderate shear.
8. When the liquid cools below 55°C, the material will change to an “oil out” emulsion and will thicken dramatically.
9. Continue to mix until formula has cooled below 40°C.



# Prototype formulation for sheen finish cockpit enhancer

Auto care formulation information

## Cockpit enhancers – sheen finish **Description**

Formulation reference: IP-610

This cockpit enhancer uses a silicone emulsion at low dosage. It incorporates a wax emulsion with large particle size, which gives uneven light reflection. The result is a perceived lower gloss finish. This is important for light reflection control on treated surfaces, e.g., dashboards, that can distract the driver from the road.



Ingredient	Weight (%)	Supplier
1. Water	88.0	
<b>2. XIAMETER™ MEM-1473 Emulsion</b>	<b>6.0</b>	<b>Dow</b>
3. Microspersion 250	5.0	Kromachem Ltd.
4. Cellulose thickener	1.0	Dow

## **Procedure**

Mix the ingredients in the order listed at low stirring speed.



# Prototype formulation for polymer sealant

Auto care formulation information

## Polymer sealant liquid

Formulation reference: PW-360



## Description

This polymer sealant liquid polish features an amino-functional silicone that gives long-lasting protection with good color and gloss. Full protection is developed 24 hours after application of the polish.

Ingredient	Weight (%)	Supplier
<b>Phase A</b>		
1. Low aromatic solvent 160/190°C	10.0	Exxon Chemicals Ltd. Shell Chemicals Ltd.
2. Low aromatic solvent 200/250°C	12.0	Exxon Chemicals Ltd. Shell Chemicals Ltd.
3. Oleic acid	1.4	
4. Dimethylamino ethanol	1.3	
<b>Phase B</b>		
5. XIAMETER™ OFX-0536 Fluid	2.0	Dow
6. XIAMETER™ OFX-0531 Fluid	3.0	Dow
<b>Phase C</b>		
7. Water	55.1	
8. Cellulose thickener	0.8	Ashland Inc.
9. Kaopolite SF	10.0	Kaopolite, Inc.
10. Dimethylamino ethanol	0.1	
<b>Phase D</b>		
11. Wax emulsion	4.3	

## Procedure

1. Mix phase A ingredients until uniform using low shear in an auxiliary vessel.
2. Add phase B ingredients to phase A with low shear.
3. Add phase C ingredients to the main vessel with low-speed stirring until fully dispersed.
4. Add the contents of the auxiliary vessel to the main vessel under high shear.
5. Add phase D ingredient to the main vessel with low-speed stirring.

## Typical properties / additional information

A method used to improve the corrosion resistance of a polish is to react XIAMETER™ OFX-0536 Fluid with lauric acid. In the example above, the XIAMETER™ OFX-0536 Fluid and lauric acid only would be added to the solvents (ratio 0.3 acid to 1.0 XIAMETER™ OFX-0536 Fluid) and this heated to 45°C for 5 minutes. Components 3 and 4 would then be added and the polish completed as before.

Suggestions for adjusting the formulation:

- To improve gloss: Incorporate 0.5–1.0% XIAMETER™ PMX-200 Silicone Fluid, 1,000 cSt.
- To improve ease of use/leveling: Incorporate 0.5–1.0% XIAMETER™ PMX-200 Silicone Fluid, 350 cSt, or DOWSIL™ 593 Fluid.
- To improve color intensity: Incorporate 0.2–0.5% XIAMETER™ PMX-200 Silicone Fluid, 12,500 cSt.
- To improve gloss, ease of use and color: Incorporate XIAMETER™ PMX-200 Silicone Fluid, 350 cSt; XIAMETER™ P MX-200 Silicone Fluid, 1,000 cSt; XIAMETER™ PMX-200 Silicone Fluid, 12,500 cSt in a ratio of 3:1:1 at 1% total level.

See Auto Care Raw Material Supplier Reference Sheet for the role of the raw material and supplier information.



# Prototype formulation for polymer sealant

Auto care formulation information

## Pre-softened polymer sealant paste

Formulation reference: PW-370



## Description

This product is formulated to give good detergent resistance by incorporation of amino-functional silicones and wax. The silicone fluid aids application characteristics.

Ingredient	Weight (%)	Supplier
<b>Phase A</b>		
1. Low aromatic solvent 160/190°C	10.0	Exxon Chemicals Ltd. Shell Chemicals Ltd.
2. Low aromatic solvent 200/250°C	12.0	Exxon Chemicals Ltd. Shell Chemicals Ltd.
<b>3. DOWSIL™ 2-5088 Wax</b>	<b>3.0</b>	<b>Dow</b>
<b>4. XIAMETER™ OFX-0536 Fluid</b>	<b>2.0</b>	<b>Dow</b>
<b>5. XIAMETER™ OFX-0531 Fluid</b>	<b>3.0</b>	<b>Dow</b>
<b>6. XIAMETER™ PMX-200 Silicone Fluid, 350 cSt</b>	<b>0.8</b>	<b>Dow</b>
<b>Phase B</b>		
7. Water	54.5	
8. Alcan SF7	8.0	Alcan Chemicals
9. Diafil 830	4.2	Microfine Minerals Ltd.
10. Crodamet T8	1.5	Croda Ltd.
11. Cellulose thickener	1.0	Ashland Inc.

## Procedure

- Place ingredients 1–3 into an auxiliary vessel and heat to 45°C with low-shear mixing. Maintain the temperature at 40–45°C and add ingredients 4–6 with low shear.
- In the main vessel, add ingredients 8 and 9 to ingredient 7 with low shear until dispersed while heating to 50°C.
- Add ingredients 10 and 11 under low shear.
- Add phase A and phase B under high shear.
- Cool to filling temperature.

## Typical properties / additional information

Suggestions for adjusting the formulation:

- To improve gloss: Incorporate 0.5–1.0% XIAMETER™ PMX-200 Silicone Fluid, 1,000 cSt.
- To improve ease of use: Increase level of XIAMETER™ PMX-200 Silicone Fluid, 350 cSt, to 1.5%.
- To improve color intensity: Incorporate 0.2–0.5% XIAMETER™ PMX-200 Silicone Fluid, 12,500 cSt.
- To improve gloss, ease of use, and color: Incorporate XIAMETER™ PMX-200 Silicone Fluid, 350 cSt; XIAMETER™ PMX-200 Silicone Fluid, 1,000 cSt; and XIAMETER™ PMX-200 Silicone Fluid, 12,500 cSt in a ratio of 3:1:1 at 1% total level.

See Auto Care Raw Material Supplier Reference Sheet for the role of the raw material and supplier information.



# Prototype formulation for polymer sealant

Auto care formulation information

## Pre-softened polymer sealant paste

Formulation reference: PW-375



## Description

This formulation gives good detergent resistance by incorporation of amino-functional silicones and wax, while the fluid aids application characteristics.

Ingredient	Weight (%)	Supplier
<b>Phase A</b>		
1. Low aromatic solvent 160/190°C	10.0	Exxsol D40/Exxon Chemical Co.
2. Low aromatic solvent 200/250°C	12.0	Exxsol D40/Exxon Chemical Co.
3. Carnauba Wax	3.0	
4. XIAMETER™ OFX-0536 Fluid	2.0	Dow
5. XIAMETER™ OFX-0531 Fluid	3.0	Dow
6. XIAMETER™ PMX-200 Silicone Fluid, 350 cSt	0.8	Dow
<b>Phase B</b>		
7. Water	54.4	
8. Alcan SF7	8.0	Alcan Inc.
9. Celite Super Floss	4.2	Celite Corp.
10. ECOSURF™ EH-9 Surfactant or BIO-SOFT N1-7	1.5	Dow Stepan Co.
11. Hydroxyethyl cellulose thickener	1.0	Ashland Inc.

## Procedure

- Place ingredients 1–3 into an appropriate vessel and heat to 45°C with low-shear mixing. Maintain the temperature at 40–45°C and add ingredients 4–6.
- In the main vessel, add ingredients 7–9 and mix with low shear until dispersed while heating to 50°C.
- Add ingredients 10 and 11 under low shear. Mix until all ingredients are dispersed, approximately 45 minutes.
- Add Phase A to Phase B under high shear. Cool to filling temperature.

## Typical properties / additional information

Suggestions for adjusting the formulation:

- To improve gloss, incorporate 0.5–1.0% XIAMETER™ PMX-200 Silicone Fluid, 1,000 cSt.
- To improve ease of use, increase level of XIAMETER™ PMX-200 Silicone Fluid, 350 cSt, to 1.5%.
- To improve color intensity, incorporate 0.2–0.5% XIAMETER™ PMX-200 Silicone Fluid, 12,500 cSt.
- To improve gloss, ease of use, and color, incorporate XIAMETER™ PMX-200 Silicone Fluid, 350 cSt; XIAMETER™ PMX-200 Silicone Fluid, 1,000 cSt; and XIAMETER™ PMX-200 Silicone Fluid, 12,500 cSt in a ratio of 3:1:1 at 1% total level.

### Disclaimer:

The formulation provided herein is made available by Dow in good faith, by mere liberality, and portrays a combination of ingredients commonly used in the industry, based on Dow's experience. Considering that the recipient of it might use such formulation to different applications and in different conditions, being subject to different regulations, which may differ from one location to another and may change over time, the recipient is responsible for determining whether such formulation is appropriate and applicable to the recipient's specific needs. Dow does not guarantee, implicitly or explicitly, that such formulation is correct, adequate, complete or fits any specific use, thus assuming no obligation or responsibility arising from the use of such formulation by anyone. The suggested formulation contains a Brazilian genetic resource product, named "carnauba". Such species is endemic from Brazil and part of the Brazilian genetic heritage and therefore, the use of it might be under the scope of Law No. 13.123/2015. The recipient of such formulation shall evaluate the applicability of such law to the activities to be performed using the formulation. The recipient shall be exclusively liable to guarantee its product compliance with applicable access and benefit sharing regulation. Dow has already complied with applicable law, registering the formulation before SIGEN and does not assume any liability resulting from recipient's failure to comply with any applicable access and benefit sharing regulation. For further information please contact [flarprs@dow.com](mailto:flarprs@dow.com).



# Prototype formulation for scratch concealer

Auto care formulation information

## Scratch concealer

Formulation reference: SC-100

## Description

DOWSIL™ 3527 Release Agent is easy to apply and provides a durable, smooth, glossy coating that penetrates imperfections.

Hydral 710 Abrasive works well with polish formulas with a high water content. Both Kaopolite 1152 and Hydral 710 Abrasives are relatively mild and prevent additional scratches to auto clear coats.

Isopar M is an organic Isopar affinal solvent that is VOC-exempt, very slow to dry and aids with film formation of active ingredients in the formula.

This formula passes five cycles of freeze/thaw stability testing.



Ingredient	Weight (%)	Supplier
<b>Phase A</b>		
1. DI water	68.45	
2. Alcoa Hydral 710 Abrasive	3.0	Alcoa Inc.
3. Kaopolite 1152 Abrasive	5.0	Kaopolite, Inc.
4. Amadol (Witcamide) WE	2.0	Akzo Nobel
5. Sodium chloride salt	1.0	
6. Stoddard solvent	10.50	Chemcentral or Ashland
<b>Phase B</b>		
7. Isopar M (Isoparaffin)	1.00	Exxon Chemicals Ltd.
8. Stoddard solvent	3.0	Chemcentral or Ashland
9. Bentone 38	0.7	Rheox, Inc.
<b>Phase C</b>		
10. DOWSIL™ 3527 Release Agent	5.0	Dow
11. Isopropanol	0.35	

## Procedure

1. Load phase A ingredients in the order shown into a vessel and mix well.
2. Mix phase B ingredients in a separate container.
3. Add phase B to the production vessel and mix well.
4. Add phase C ingredients to the production vessel in the order shown and mix well.

## Typical properties / additional information

- Formulas with a water content greater than 75% are problematic (poor emulsification and do not thicken to a paste) and are not recommended with this combination of abrasives and emulsifier.

Observe precautions for handling DOWSIL™ products as indicated on the safety data sheets.

See Auto Care Raw Material Supplier Reference Sheet for the role of the raw material and supplier information.





# Prototype formulation for solvent-free polish

Auto care formulation information

## Solvent-free polish

Formulation reference: PW-385



## Description

This formulation incorporates a range of silicone emulsions of fluid/amino/wax to provide properties that were achievable historically with solvent-based technologies.

Ingredient	Weight (%)	Supplier
1. Water	60.0	
2. ECOSURF™ EH-9 Surfactant BIO-SOFT N1-7	1.0	Dow Stepan Co.
3. XIAMETER™ PMX-0246 Cyclohexasiloxane	2.5	Dow
4. Water	30.0	
5. XIAMETER™ MEM-0349 Emulsion or XIAMETER™ MEM-0346 Emulsion	1.5	Dow
6. XIAMETER™ MEM-8035 Emulsion	1.0	Dow
7. Wax emulsion	1.0	Michem Lube 155 / Michelman Inc.
8. Hydroxyethyl Cellulose Thickener	0.8	Ashland Inc.
9. Celite Super Floss	1.0	Celite Corporation
10. Alcan SF7	0.8	Ashland Inc.

## Procedure

1. Mix ingredients 1–4 in an appropriate vessel under high shear.
2. Add ingredients 5–7 to the vessel with high shear.
3. Slowly add ingredient 8 while mixing. Continue to mix for 30 minutes; or until the thickener is dissolved and the product is uniform.
4. Add ingredients 9 and 10 to the above, continuing to mix for an additional 10 minutes.

## Typical properties / additional information

Suggestions for adjusting the formulation:

- To improve gloss, incorporate XIAMETER™ MEM-0062 Emulsion PS at 0.5%; reduce XIAMETER™ MEM-0349 Emulsion or XIAMETER™ MEM-0346 Emulsion to 0.5%.
- To improve durability, increase XIAMETER™ MEM-8035 Emulsion to 2.0% and the wax emulsion to 5.1%.





# Prototype formulation for tire care

Auto care formulation information

## Tire enhancer foam spray

Formulation reference: TP-701



## Description

This formulation gives a “new” rather than painted appearance to the tire. The high-viscosity fluid emulsion increases gloss, while the amino-functional silicone promotes durability.

Ingredient	Weight (%)	Supplier
1. Water	68.15	
2. Polyoxyethylene (20) sorbitan monooleate	0.7	Alkamuls PSMO 20 / Solvay
3. Sorbitan trioleate	0.5	Alkamuls SMO UNBL / Solvay
4. Propylene glycol	2.0	Dow
5. DOWSIL™ HV 496 Emulsion	20.0	Dow
6. XIAMETER™ MEM-8035 Emulsion	8.3	Dow
7. Sodium benzoate - rust inhibitor	0.2	
8. XIAMETER™ AFE-2210 Antifoam Emulsion	0.15	Dow

## Procedure

Mix the ingredients in the order listed with low-speed stirring. Approximately 85% by weight of this formulation will be used in an aerosol fitted with a foaming valve, with the remaining 15% used in propellant.

## Typical properties / additional information

Suggestions for adjusting the formulation:

- To improve durability, increase ratio of XIAMETER™ MEM-8035 Emulsion to DOWSIL™ HV 496 Emulsion.

See Auto Care Raw Material Supplier Reference Sheet for the role of the raw material and supplier information.



# Prototype formulation for tire care

Auto care formulation information

## Solvent-based liquid tire surface protectant

Formulation reference: TP-720



### Description

This tire dressing protectant is designed to impart high gloss to the surfaces of tires.

Ingredient	Weight (%)	Supplier
1. Oderless mineral spirits	85.0	
2. XIAMETER™ PMX-200 Silicone Fluid, 10,000 cSt	15.0	Dow

### Procedure

Blend ingredients until uniform. Ensure adequate mixing at the bottom of the blending container.

### Additional information to optimize formula

Suggestions for adjusting the formulation:

- Solvent choice may vary with specific application needs and desired drying time.
- Additional durability and gloss can be achieved by raising amount of XIAMETER™ PMX-200 Silicone Fluid, 10,000 cSt. Suggested range in formulation is 10–20 wt %.

See Auto Care Raw Material Supplier Reference Sheet for the role of the raw material and supplier information.



# Prototype formulation for water-based tire dressing

Auto care formulation information

## Tire dressing

(Lot Number 16788-73) Formulation  
reference: TP-730



## Description

This formulation is based in XIAMETER™ MEM-1101 Emulsion adds shine, while XIAMETER™ MEM-8035 Emulsion increases durability.

## Procedure

Ingredient	Weight (%)	Supplier
1. XIAMETER™ MEM-0349 Emulsion	16.0	Dow
1. XIAMETER™ MEM-0037 Emulsion	16.0	Dow
2. XIAMETER™ MEM-1101 Emulsion	4.0	Dow
3. XIAMETER™ MEM-8035 Emulsion	3.5	Dow
4. Water	60.5	
5. KATHON LX	0.05	DuPont

Mix the ingredients in the order listed with low stirring and add them slowly.

## Typical properties / additional information

- To improve gloss, add more XIAMETER™ MEM-1101 Emulsion.
- Explore different levels of gloss by using XIAMETER™ MEM-1664 Emulsion with XIAMETER™ MEM-1101 Emulsion.



# Prototype formulation for tire care

## Auto care formulation information

### Cream tire dressing

(Lot Number 16788-75) Formulation reference: TP-740



### Description

This formulation produces a thick cream tire dressing. XIAMETER™ MEM-1101 Emulsion adds shine, while XIAMETER™ MEM-8035 Emulsion improves durability.

Ingredient	Weight (%)	Supplier
1. Water	58.85	
2. Carbopol Ultrez 10	0.60	Lubrizol
3. XIAMETER™ MEM-0349 Emulsion	16.0	Dow
4. XIAMETER™ MEM-0037 Emulsion	16.0	Dow
5. XIAMETER™ MEM-1101 Emulsion	4.0	Dow
6. XIAMETER™ MEM-8035 Emulsion	3.5	Dow
7. Triethanolamine	1.1	Dow
8. KATHON LX	0.05	DuPont

### Procedure

1. Put the water into the main vessel and begin mixing at low speed. Slowly add the carbomer and mix under high shear until all powder has been wetted, approximately 30 minutes. Add the carbomer slowly to avoid the formation of lumps.
2. When all the carbomer has been hydrated, add XIAMETER™ MEM-0349 Emulsion, XIAMETER™ MEM-0037, XIAMETER™ MEM-1101 Emulsion and XIAMETER™ MEM-8035 Emulsion to the main vessel while mixing.
3. Add the triethanolamine and preservative. Stir for another 30 minutes.
4. Pour down and package.

### Typical properties / additional information

- To improve gloss, increase the amount of XIAMETER™ MEM-1101 Emulsion.
- Explore different levels of gloss using DOWSIL™ HV 496 Emulsion with XIAMETER™ MEM-1101 Emulsion.



# Prototype formulation for tire care

Auto care formulation information

## Fast dry premium shine tire dressing

Formulation reference: TP-750



### DOWSIL™ OS-2 Silicone Cleaner and Solvent is:

- VOC-exempt
- Non-allergenic
- Low in toxicity
- Safe on plastics; non-corrosive to metals



15 Minutes after application



30 Minutes after application



Dried appearance

## Description

This formulation is a “spray and walk away” tire dressing that dries extremely fast and is California A.R.B compliant. The formulation provides premium shine and premium darkening/color enhancement of tires. Treated tires have a glossy, dark “car show” appearance.

Ingredient	Weight (%)	Supplier
<b>Phase A</b>		
1. DOWSIL™ OS-2 Silicone Cleaner and Solvent	50.0	Dow
2. XIAMETER™ PMX-200 Silicone Fluid, 1,000 cSt	10.0	Dow
3. XIAMETER™ PMX-200 Silicone Fluid, 10,000 cSt	20.0	Dow
<b>Phase B</b>		
4. VOC-exempt aliphatic hydrocarbon solvent (isoparaffin)	20.0	CPChem Soltrol 220 or Exxon Isopar M

## Procedure

1. Add the Phase A ingredients in the order shown into a mixing vessel suitable for handling flammable liquids and vapors. Use a mixing impeller with adequate turnover flow at the bottom of the container. Rinse the load lines and any additional containers with the Phase B ingredient while adding it to the mixing vessel.

## Typical properties / additional information

DOWSIL™ OS-2 Silicone Cleaner and Solvent is flammable. Review the Safety Data Sheet and use appropriate cautions during use. The above formulation is flammable (flash point = 27°F). Follow the appropriate labeling and shipping of packages containing this formula.

Including the isoparaffin solvent prevents the formula from drying before the gloss agents cover the tire uniformly and also lowers the formula cost.

## Formulation performance review results:

- Uniform appearance while drying
- Amount of slippery residue on the ground is four times less than with formulation TP-770
- Reduced streaks/drips at the tire bottom while drying
- High level of color enhancement and gloss compared to TP-770

Formula was sprayed on the tire surface with no wiping.



# Prototype formulation for tire care

Auto care formulation information

## Spray and walk away tire dressing

Formulation reference: TP-760



### XIAMETER™ PMX-0245 Cyclopentasiloxane is:

- VOC-exempt
- Low in toxicity
- Safe on most plastics or metals

## Description

This formulation is a “spray and walk away” tire dressing that is California A.R.B. compliant. XIAMETER™ PMX-0245 Cyclopentasiloxane improves the spreading of gloss agents so no wiping is needed. The formulation gives premium shine and premium darkening/color enhancement of tires. Treated tires have a glossy, dark “car show” appearance.

Ingredient	Weight (%)	Supplier
<b>Phase A</b>		
1. XIAMETER™ PMX-0245 Cyclopentasiloxane	37.0	Dow
2. XIAMETER™ PMX-200 Silicone Fluid, 1,000 cSt	5.0	Dow
3. XIAMETER™ PMX-200 Silicone Fluid, 10,000 cSt	20.0	Dow
<b>Phase B</b>		
4. VOC-exempt aliphatic hydrocarbon solvent (isoparaffin)	38.0	CPChem Soltrol 220 or Exxon Isopar M

## Procedure

Add the Phase A ingredients in the order shown into a mixing vessel. Use a mixing impeller with adequate turnover flow at the bottom of the container. Rinse the load lines and any additional containers with the Phase B ingredient while adding it to the mixing vessel.

## Typical properties / additional information

If the amount of XIAMETER™ PMX-0245 Cyclopentasiloxane is significantly reduced, then wiping the formula after spraying will be necessary.

Increasing the ratio of XIAMETER™ PMX-0245 Cyclopentasiloxane to isoparaffin solvent in the formula will continue to improve the spreading properties.

## Formulation performance review

### Results:

- Uniform appearance while drying
- Amount of slippery residue on the ground is two times less than with formulation TP-770
- Reduced streaks/drips at the tire bottom while drying
- High level of color enhancement and gloss compared to TP-770



# Prototype formulation for tire care

Auto care formulation information

## Spray and wipe low-cost tire dressing

Formulation reference: TP-770

## Description

This formulation is a “spray and wipe” tire dressing that is California A.R.B. compliant and low in cost. Wiping after application to the tires is necessary to improve the uniformity of shine and to prevent residue on the floor. The blend of XIAMETER™ PMX-200 Silicone Fluid, 1,000 cSt, and XIAMETER™ PMX-200 Silicone Fluid 10,000 cSt gives high shine.



Ingredient	Weight (%)	Supplier
<b>Phase A</b>		
1. VOC-exempt aliphatic hydrocarbon solvent (isoparaffin)	70.0	CPChem Soltrol 220 or Exxon Isopar M
2. XIAMETER™ PMX-200 Silicone Fluid, 1,000 cSt	5.0	Dow
3. XIAMETER™ PMX-200 Silicone Fluid, 10,000 cSt	20.0	Dow
<b>Phase B</b>		
4. VOC-exempt aliphatic hydrocarbon solvent (isoparaffin)	5.0	CPChem Soltrol 220 or Exxon Isopar M

## Procedure

Place the Phase A ingredients in the order shown into a mixing vessel. Use a mixing impeller with adequate turnover flow at the bottom of the container. Rinse the load lines and any additional containers with the Phase B ingredient while adding it to the mixing vessel.

## Typical properties / additional information

The VOC-exempt isoparaffin solvent is very slow to dry compared to volatile methylsiloxane fluids from Dow. Wipe the tire after treatment to avoid dripping and residue on the floor.

## Formulation performance review

### Results:

- Streaky appearance while drying
- Streaks and drips at the tire bottom while drying
- Low level of color enhancement and gloss compared to TP-750 or TP-760

Formula was sprayed on the tire surface with no wiping.

See Auto Care Raw Material Supplier Reference Sheet (Form No. 26-1064) for the role of the raw material and supplier information.



Untreated tire



15 Minutes after application



30 Minutes after application



Dried appearance





# Prototype formulation for tire care

Auto care formulation information

## Water-based tire shine

Formulation reference: TP-780



## Description

The formulation is a water-based tire shine.

Ingredient	Weight (%)	Supplier
1. Water	67.95	
2. Alkamuls PSMO 20	0.70	Solvay
3. Alkamuls SMO UNBL	0.50	Solvay
4. Propylene glycol	4.00	Dow
5. <b>XIAMETER™ MEM-0062 Emulsion PS</b>	<b>18.00</b>	<b>Dow</b>
6. <b>XIAMETER™ MEM-8035 Emulsion</b>	<b>1.00</b>	<b>Dow</b>
7. Sodium benzoate	0.20	
8. <b>XIAMETER™ AFE-2210 Antifoam Emulsion</b>	<b>0.15</b>	<b>Dow</b>
9. <b>DOWSIL™ HV 496 Emulsion</b>	<b>7.00</b>	<b>Dow</b>
10. <b>XIAMETER™ OFX-0309 Fluid</b>	<b>0.50</b>	<b>Dow</b>

## Procedure

Mix the ingredients in the order listed with low-speed stirring.

# Learn more

Whether you need industry-leading innovation or greater cost efficiency, Dow can help. Solutions by Dow are dedicated to meeting your needs for specialty materials, collaborative problem-solving and innovation support. Learn how we can help you at [www.dow.com/autocare](http://www.dow.com/autocare).

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