



Liquiwaxes™

Novel High Molecular Weight Esters



**Arch Personal
Care Products, L.P.**

BROOKS

AT THE LEADING EDGE OF COSMETIC TECHNOLOGY

Product Application Guide

Liquiwax™	Lipstick	Foundations	Mascara	Powder Products	Suncare	Skincare	Haircare
IPL	Excellent	Good	Excellent	Fair	Excellent	Excellent	Good
DIEFA	Excellent	Excellent	Excellent	Fair	Excellent	Excellent	Fair
DIADD	Fair	Excellent	Good	Excellent	Excellent	Excellent	Excellent
DISA	Good	Fair	Good	Excellent	Excellent	Excellent	Good
DICDD	Excellent	Excellent	Good	Excellent	Excellent	Excellent	Excellent
Poly EFA	Excellent	Excellent	Excellent	Good	Excellent	Excellent	Fair

Background

Emollience is a term that we often see used in connection with cosmetics, particularly creams and lotions. Emollience is a difficult word to define and qualify but generally, the understanding is that it refers to something that imparts smoothness to the skin, a general, overall feeling of healthy moisturized skin. It has been shown that traditional emollients may even plump the skin cells acting to smooth and diminish the appearance of fine lines.

There is a laundry list of emollients that have been used traditionally in cosmetic formulations with varying viscosities, melting points and overall cosmetic quality. The most popular, from a formulation perspective, are the water-soluble emollients including, glycerin, propylene glycol and various ethoxylated derivatives of lipids. Oil soluble emollients exist including, silicone oils, vegetable oils and fats and alkyl esters, however these may tend to leave an oily residue or greasy appearance on the skin.

Lanolin was considered once to be an extremely desirable emollient. However, research as of late has shown lanolin to be a primary skin sensitizer.¹ This, in conjunction with the industry's move toward non-animal derived products, has led to the development of non-animal lanolin replacements.

The alkyl esters represent a range of interesting emollients. They range from lactates, oleates and myristates to adipates and linoleates with the possibility of straight-chained, branch-chained, saturated and unsaturated precursors. Some are almost water thin liquids that virtually disappear into the skin while others are waxy solids that melt with body heat.

The chemical characteristics of such esters are what give them their identity and lend to the types of formulations in which they perform best. The thicker, heavier esters are ideal for thick creams and lotions while the thinner esters shine in light lotions and lipsticks.

Introduction

The **Liquiwax™** line of cosmetic esters was conceived to address the current trend toward multifunctional ingredients. **Liquiwaxes™** combine the emolliency of traditional esters with skin conditioning functionality. The esters' high molecular weight, in conjunction with their characteristic shape, limit penetration through the stratum corneum. Surface deposition of the **Liquiwax™** provides a consumer perceivable softening and lubrication as well as enhanced barrier function for excellent moisture retention.

The range of **Liquiwax™** products can serve a variety of functions for use in a multitude of different applications. They can be replacements for traditional lanolin alcohols and derivatives, mineral oil and the like. The **Liquiwaxes™** can be used to adjust the "rub-in" of a formulation as well as the after-feel, for thickening, viscosity control and pigment dispersion.

Products

Liquiwax™ DIEFA

Based on essential fatty acids

INCI Name	Dioctyldodecyl Dimer Dilinoleate
Appearance	Clear liquid
Molecular Weight	1120
Empirical Formula	C ₇₆ H ₁₄₄ O ₄

Liquiwax™ DIEFA contains essential fatty acids (*specifically omega-6-linoleic acid*) for their ability to help normalize and promote the formation of normal, healthy skin.

Liquiwax™ DIEFA was designed to capitalize on the conditioning benefits of omega-6-linoleic acid while retaining the aesthetic properties of an ester. The ester is a clear, high viscosity, pale yellow liquid. **Liquiwax™ DIEFA** provides superior emolliency and cushion.

Liquiwax™ DIEFA represents a superior vehicle for the delivery of active topical ingredients. It may be used to replace mineral oil partially or totally in formulations where its improved tactile properties will be of benefit. It is a good skin lubricant with enhanced refatting characteristics. **Liquiwax™ DIEFA** is highly recommended for use in creams, lotions, makeup bases and sunscreens.

Liquiwax™ DIADD

High viscosity liquid wax emollient

INCI Name	Dioctyldodecyl Dodecanedioate
Appearance	Clear liquid
Molecular Weight	790
Empirical Formula	C ₅₂ H ₁₀₂ O ₄

Liquiwax™ DIADD is a liquid emollient of medium viscosity with a feel like that of heavy mineral oil but without the greasiness and oiliness usually associated. It can be used to make elegant cosmetic formulations giving them excellent cushion and emollient after-feel on the skin. **Liquiwax™ DIADD** lends itself to leaving a protective, though not totally occlusive, film on the skin due to its multiple ester linkages.

Liquiwax™ DIADD is a medium molecular weight diester that can be characterized as a “liquid” wax with a low freeze point. The ester has novel dispersing and emollient qualities, which suggest its use in special cleansing and rich creams. The novel solvency properties make it have excellent compatibility with most of the waxes commonly used in lipsticks, this, coupled with its pigment dispersing properties, suggest its use in both stick and liquid makeup foundations.

Liquiwax™ DICDD

Medium viscosity liquid wax emollient

INCI Name	Diisocetyl Dodecanedioate
Appearance	Clear liquid
Molecular Weight	678
Empirical Formula	C ₄₄ H ₈₆ O ₄

Liquiwax™ DICDD is a medium viscosity liquid emollient with a feel reminiscent of a medium viscosity mineral oil but without the greasiness and oiliness usually associated. It makes an acceptable replacement. **Liquiwax™ DICDD** is characterized as dry, providing a light cushion on the skin. A clear liquid of medium viscosity, **Liquiwax™ DICDD** is an excellent addition to formulas that are looking to provide an elegant non-oily feel. The product can reduce the greasiness of finished products while providing skin conditioning benefits.

Liquiwax™ DICDD is a clear, almost colorless, odorless and tasteless liquid with a low freeze point. It shows excellent spreadability and lubrication. This ester is recommended for creams and lotions as well as makeup foundation. **Liquiwax™ DICDD** has excellent dispersing properties for pigments and excellent compatibility with waxes making it ideal for the formulation of long-lasting, creamy lipsticks.

Liquiwax™ DISA

INCI Name	Diisostearyl Adipate
Appearance	Clear liquid
Molecular Weight	650
Empirical Formula	C ₄₂ H ₈₂ O ₄

Liquiwax™ DISA is a totally saturated, high molecular weight moderate viscosity branched chain liquid ester. It provides barrier properties without a greasy feel. It also provides cushioning in emulsions leaving a lubricious, silky after-feel on the skin. **Liquiwax™ DISA** has good pigment dispersing properties and has makeup removing properties as a result.

Liquiwax™ IPL

INCI Name	Dicetearyl Dimer Dilinoleate
Appearance	Buttery yellow solid
Molecular Weight	1036
Empirical Formula	C ₇₀ H ₁₃₂ O ₄

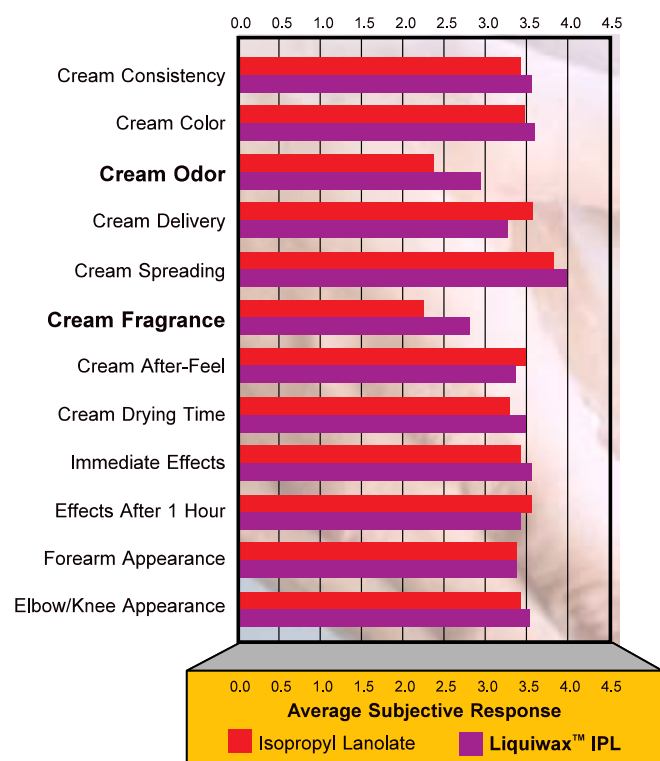
Liquiwax™ IPL is a soft, buttery solid ester with no odor and a low melting point. It is a synthetic replacement for isopropyl lanolate. It provides conditioning, emolliency and cushion to the skin.

A twelve-person panel *in vivo* cream study was conducted using two identical creams in which one ingredient was varied. The varied ingredients included isopropyl lanolate, a common cream moisturization aid, and **Liquiwax™ IPL**. The creams were formulated without fragrance. The panelists were asked to stop using their personal moisturizing products for a four-day normalization period. The panelists were then asked to apply one cream labeled “Right” (*containing*

isopropyl lanolate) to their right volar forearm, elbow and knee and one cream labeled "Left" (containing **Liquiwax™ IPL**) to their left volar forearm, elbow and knee, respectively, for a period of two weeks. The panelists did not know the ingredients of either skin cream.

At the end of the study, the panelists were provided with a questionnaire and asked to grade the products on a scale of 1 to 5 with 5 being the best. The results indicate that the two creams appear to offer comparable consumer perceived levels of cream appearance, application ease and skin moisturization effects. However, the study clearly indicates a consumer preference for the odor of the **Liquiwax™ IPL** over the isopropyl lanolate in skin cream products made with each ingredient.

IPL Skin Lotion Study



Liquiwax™ PolyEFA

Proposed INCI Name	Octyldodecyl PPG-3 Myristyl Ether Dimer Dilinoleate
Appearance	Clear liquid
Molecular Weight	1210
Empirical Formula	C ₇₉ H ₁₅₀ O ₇

Liquiwax™ PolyEFA is a polymeric liquid emollient containing essential fatty acids. This patent-pending technology provides the conditioning effects of omega-6-linoleic acid in a high molecular weight, moderate viscosity polymeric ester. **Liquiwax™ PolyEFA's** high refractive index imparts gloss to various formulations. It has excellent pigment dispersing properties in makeup and sunscreen products and enhances makeup removal in skin cleansers.

As additives to a multitude of formulation types, the **Liquiwaxes™** can be used to lend "gloss" or shine. The following chart of refractive indices illustrates the glossing ability of the **Liquiwaxes™** as compared to some commonly used shining agents.

Refractive Indices

Castor Oil	1.4800
Liquiwax™ IPL	1.4720
Liquiwax™ DIEFA	1.4697
Liquiwax™ PolyEFA	1.4660
Mineral Oil	1.4646
Phenyltrimethicone	1.4629
Liquiwax™ DIADD	1.4608
Liquiwax™ DICDD	1.4575
Liquiwax™ DISA	1.4570
Caprylic/Capric Triglycerides	1.4500
Ethylhexyl Palmitate	1.4482
Isopropyl Palmitate	1.4393
Dimethicone (20 cst)	1.4037
Cyclomethicone	1.3991

Technical Data

It is important to understand the functionality of specific materials in a formulation when choosing the proper ingredients. The following two charts outline the ability of the **Liquiwaxes™** to disperse or solubilize certain materials

Solubilizing Ability

Liquiwax™	Ratio of Liquiwax™ needed to co-solubilize equal amounts of Mineral and Castor Oil (Mineral Oil: Castor Oil: Liquiwax™)
IPL*	1:1:1
DIEFA	1:1:14.1
DIADD	1:1:2.6
DISA	1:1:1.2
DICDD	1:1:1
PolyEFA	1:1:2.3

Solubilities

Materials	Liquiwax™ IPL		Liquiwax™ DIEFA		Liquiwax™ DIADD		Liquiwax™ DISA		Liquiwax™ DICDD		Liquiwax™ Poly EFA	
	A	B	A	B	A	B	A	B	A	B	A	B
Oleyl Alcohol	D	D	S	S	S	S	S	S	S	S	S	S
Squalane	D	D	S	S	S	S	S	S	S	S	S	S
Dimethicone	D	IS	IS	IS	D	IS	IS	IS	IS	IS	IS	IS
Cyclomethicone	D	IS	S	S	S	S	S	S	S	S	S	S
Phenyltrimethicone	D	D	S	S	S	S	S	S	S	S	S	S
Ethanol	D	IS	IS	IS	IS	IS	IS	IS	IS	IS	IS	IS
Acetone	D	IS	S	IS	S	S	S	S	S	S	S	IS
Mineral Oil	IS	D	S	S	S	S	S	S	S	S	S	S
C ₁₂₋₁₅ Alkyl Benzoate	D	IS	S	S	S	S	S	S	S	S	S	S
Castor Oil	D	D	S	S	S	S	S	S	S	S	S	S
Sunflower Seed Oil	D	D	S	S	S	S	S	S	S	S	S	S
Isododecane	D	IS	S	S	S	S	S	S	S	S	S	S
Oleic Acid	D	IS	S	S	S	S	S	S	S	S	S	S
Glycerin	D	IS	S	IS	IS	IS	IS	IS	IS	IS	IS	IS
Propylene Glycol	D	IS	IS	IS	IS	IS	IS	IS	IS	IS	IS	IS
PEG-400	D	IS	IS	IS	IS	IS	IS	IS	IS	IS	IS	S
Caprylic/Capric Triglyceride	D	D	S	S	S	S	S	S	S	S	S	S

A = 10% Solvent: 90% **Liquiwax™**
 B = 90% Solvent: 10% **Liquiwax™**

D = Dispersible (hazy)
 S = Soluble
 IS = Insoluble

Test Procedure

Equal amounts of Mineral Oil and Castor Oil are added to a mixing vessel at room temperature and continuously stirred. This solution appears hazy. For each trial, a **Liquiwax™** is metered into the vessel until the mixture becomes clear. At this point, the **Liquiwax™** has effectively co-solubilized the Mineral and Castor Oils.

*Because of **Liquiwax™** IPL's semi-solid consistency, it and the two oils were heated to 50°C, allowed to cool to room temperature and a determination was performed for uniformity. At room temperature, product is a soft gel with a uniform appearance.

Pigment Dispersing Capabilities

In order to assess the pigment dispersing abilities of the **Liquiwax™** range of products, two studies were designed to look at both organic and inorganic pigment dispersion as compared to some popular, widely used dispersants. The following data is a good indicator of how particular products would behave when used in color cosmetics such as foundations and lipsticks.

Organic Pigments - Procedure:

The dispersant and pigment are added together and mixed using homogenizing agitation at 9000 rpm for exactly 15 minutes. The dispersion is evaluated on a grind gauge and if the pigment is not fully dispersed, the mixture is homogenized at 9000 rpm for another 15 minutes. The dispersion is allowed to stand at room temperature for 24 hours before a viscosity reading is taken.

Organic Pigment Dispersion Study Results

38 grams of pigment/100 grams dispersant

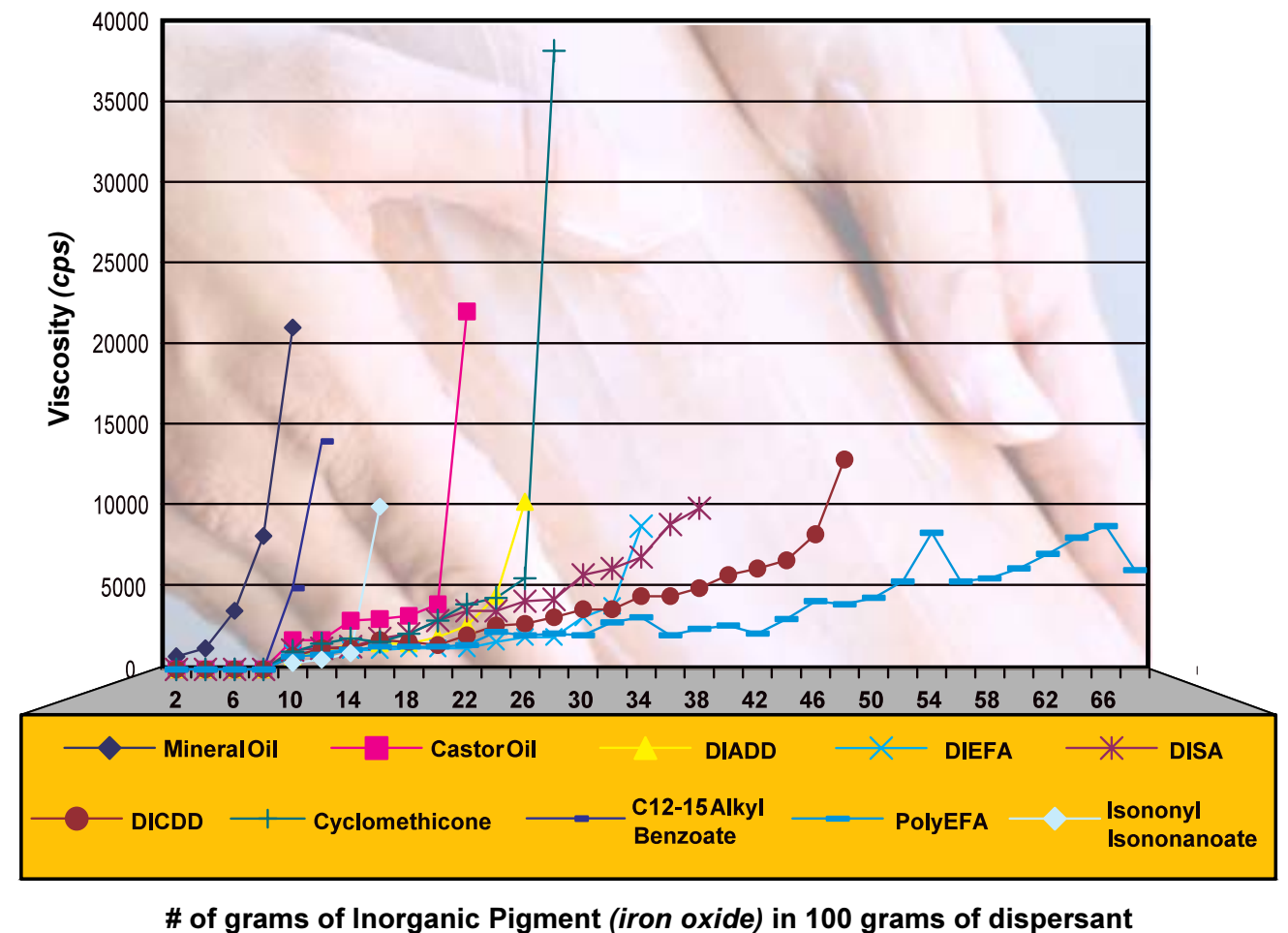
Dispersant	D+C Red #6 Barium Lake*	D+C Red #7 Calcium Lake*
Mineral Oil	5200	2700
Castor Oil	17,500	13,000
Liquiwax™ DISA	4800	3000
Liquiwax™ DICDD	6000	1900
Liquiwax™ DIADD	4000	1400
Liquiwax™ PolyEFA	4900	1700
Liquiwax™ DIEFA	3600	2400

*(cps)

Inorganic Pigments - Procedure:

Add 10 grams of Yellow Iron Oxide to 90 grams of dispersant, put into a beaker. Use a Silverson Mixer and mix at 9000 rpm for exactly 15 minutes. Place a sample of the batch on a grind gauge and determine if the pigment is fully dispersed. If dispersed, cool the mixture to room temperature and take a viscosity measurement. Add in 2 gram increments of the Yellow Iron Oxide and use the same procedure as above to mix, check with grind gauge, cool to room temperature, and take viscosity measurement. When the viscosity reaches 10,000 cps or streaking is observed with the grind gauge, discontinue any further addition of pigment and record all results.

Liquiwax™ Inorganic Pigment Dispersion Study



Conclusion

As the cosmetic industry continues its move away from animal-sourced active ingredients, technology and innovation provide more effective raw materials to achieve the desired characteristics in cosmetic formulations. The **Liquiwaxes™** are a perfect example of such ingredients.

The **Liquiwaxes™** can not only enhance the feel and aesthetics of a formulation; they

can increase the shine or gloss, improve the dispersion of pigments in color cosmetics and provide the desired functionality that may be lacking from a formulation.

As simple additions to new or existing formulations, the **Liquiwaxes™** can maximize the performance of virtually any product ranging from lipsticks and skin creams to makeup foundations and sunscreens.

Prelude to a Kiss

This semi-permanent lip color is one of a two-part system for all day (*and all night*) glossy color! With **Gel Base I** and **Liquiwax™ DIADD**, you get rich solid color that dries quickly to last and last.

Ingredient	INCI Nomenclature	Source	%
Bentone Gel ISD	Isododecane & Quaternium-18		
	Hectorite & Propylene Carbonate	2	52.11
SR-1000	Trimethylsiloxysilicate	3	29.00
Gel Base I	Isododecane & Butylene/Ethylene/Propylene Copolymer	1	12.00
D&C Red 7 Calcium Lake	Red 7 Lake	4	1.11
D&C Red 6 Barium Lake	Red 6 Lake	4	0.55
Liquiwax™ DIADD	Diocetyldodecyl Dodecanediote	1	3.00
TRES BN Boron Nitride Powder	Boron Nitrate	5	2.23

Procedure:

1. Disperse Red 7 Lake and Red 6 Lake in **Liquiwax™ DIADD**.
2. Add Bentone Gel ISD and Gel Base I. Mix until homogenous.
3. Add Trimethylsiloxysilicate and mix until homogenous.
4. Add Tres BN Boron Nitride and mix until homogenous.

Sources:

1. Arch Personal Care Products
2. Rheox
3. GE/Kobo
4. Hilton Davis
5. Saint-Gobain

The Sequel

This glossing stick is one of a two-part system for all day (*and all night*) glossy lip color! With **Gel Base BSM 5**, **Liquiwaxes™ IPL & DIADD**, and **Shea and Cocoa Butter**, you get a bright shiny gloss to refresh your lips throughout the day and night. The Sequel is a perfect companion to Prelude to a Kiss!

Ingredient	INCI Nomenclature	Source	%
Ozokerite 170	Ozokerite	2	4.00
Candelila Wax SP75	Candelila Wax	3	8.40
Liquiwax™ DIADD	Diocetyldodecyl Dodecanedioate	1	25.80
Liquiwax™ IPL	Di-tearyl Dimer Dilinoleate	1	30.00
NF Yellow Beeswax	Beeswax	2	8.00
Cocoa Butter	Cocoa Butter	1	1.00
Shea Butter BKN64	Shea Butter	1	1.00
Gel Base BSM 5	Cyclomethicone & Dimethicone & Phenyl Trimethicone	1	6.00
Ivarbase 101	Mineral Oil & Lanolin Alcohol	1	5.00
Allantoin	Allantoin	4	0.10
Propyl Paraben NF	Propylparaben	5	0.20
Vitamin E Acetate	Tocopheryl Acetate	6	0.50
Indopol H-10	Polybutene	7	10.00

Procedure:

1. Warm out all of the above ingredients.
2. Heat to 85° C. Homogenize for one minute.
3. At 85° C, stir until uniform. Add TRF dispersion at 60° C and homogenize for 1 minute.
4. Pour into molds at 50° C.

Sources:

1. Arch Personal Care Products
2. Koster Keunen Inc.
3. Stahl & Pitche
4. Sutton
5. Jeen Chemicals
6. BASF
7. Amoco Chemical

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¹ Takano, S; Yamanaka, M; Okamoto, K; Saito, F. Allergens of lanolin. Isolation and identification of the allergens of hydrogenated lanolin. Journal of the Society of Cosmetic Chemists, Vol. 34, No. Mar-Apr 1983, pp. 99-125.

Liquid Make-up

Ingredient	INCI Nomenclature	Source	%
Permethyl 99AD	Isododecane	2	10.00
SF 1528	Cyclopentasiloxane (and) Dimethicone Copolyol	3	5.00
Abil WE-09	Polyglyceryl-4 Isostearate & Cetyl Dimethicone Copolyol & Hexyl Laurate	4	4.00
Bentone Gel VS-5	Cylcomethicone & Qauternium-18		
	Hectorite & SD Alcohol 40	5	1.50
Liquiwax™ DIADD	Diocetyldodecyl Dodecaneodioate	1	2.00
Gel Base I	Isododecane & Ethylene Mixed Copolymer	1	4.00
Water	Demineralized Water		59.00
Butylene Glycol	Butylene Glycol		2.50
Sodium Chloride	Sodium Chloride		1.00
SP-500	Nylon-12	6	1.00
TiO ₂ SI	Titanium Dioxide & Silicone	7	7.00
Yellow Iron Oxide SI	Iron Oxide & Silicone	7	1.50
Red Iron Oxide SI	Iron Oxide & Silicone	7	0.25
Black Iron Oxide SI	Iron Oxide & Silicone	7	0.25
Germaben II	Propylene Glycol & Diazolidinyl Urea & Methylparaben & Propylparaben	8	1.00

Specifications: pH: *N/A*

Viscosity: **22,000 – 28,000 cps**

Procedure:

- Using a homogenzier in the main tank, pre-mix Permethyl and Gel Base until smooth. Add GE SF1528, Abil WE-09, Bentone Gel, and **Liquiwax™ DIADD**. Mix for 15 minutes.
- In a side tank, pre-blend Nylon, TiO₂ and Iron Oxides. Add to main tank and mix for 45 minutes. Switch agitation to prop mixing.
- In a side tank, pre-blend Water, Butylene Glycol, Germaben II and Sodium Chloride. Slowly add Water phase to the Oil phase. Mix for a minimum of 15 minutes.

Sources:

- Arch Personal Care Products**
- Presperse
- GE
- Goldschmidt
- Rheox
- Kobo
- Cardre Inc.
- ISP

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