# Chemical Resistance Guide

## Resin Selection for Industrial Applications

REICHHOLD

## Reliability in Tough Environments

Over many years DION® Vinyl Ester resins have shown good long term performance when used in GRP tanks and pipes as well as other structural parts made for the corrosion industry. DION® Vinyl Ester resins are known for their excellent chemical resistance and high mechanical properties in corrosive environments. More specifically, these resins have shown excellent durability within the chemical and oil/ gas industries, as well as the pulp and paper sectors.
The high resilience and water resistance of DION® Vinyl Ester resins also makes them particularly suitable for marine applications such as boat hulls and swimming pools, as well as for use in building and construction where resistance to high static and dynamic loads is required.
In applications requiring fatigue resistance and toughness, DION® Vinyl Ester resins have also proven themselves to be well suited. This includes use in the wind energy, aviation and transport sectors.

## Help to Optimize Design and Performance

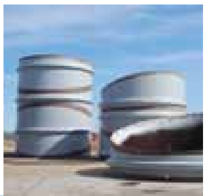
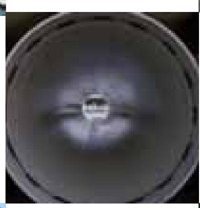
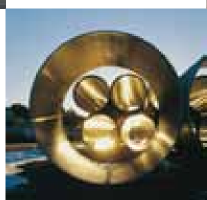
Composite material systems exhibit design freedom relating to shape, size and weight to provide technical solutions for proven long-term performance. In developing structural parts exposed in industrial environments, it is important for designers to make the correct material selection based on the required service life. This guide will help in selecting the most suitable material.

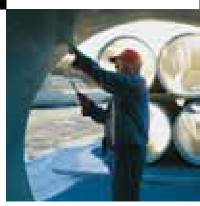
## 80 Years of Experience

As a company with a long history of technology development, Reichhold is well positioned to support with novel material systems and technical expertise. With a network of technology centres and manufacturing plants around the world, Reichhold provides the required backup and security of supply to deliver performance to end customers.

Visit our website at www.Reichhold.com or call our experts for more information.








| Content | Page |
|---|---|
| Introduction | 4 |
| Factors Affecting Structural Performance | 5 |
| Resin Selection and Description | 6-9 |
| POLYLITE® 480 Series | 6 |
| POLYLITE® 680 Series | 6 |
| POLYLITE® 720 Series | 6 |
| DION® 640 Series | 6 |
| DION® 250 Series | 6 |
| DION® 6694 | 8 |
| DION® 9100 | 8 |
| DION® 9102 | 8 |
| DION® 9160 IMPACT | 8 |
| DION® FR 9300 | 8 |
| DION® 9400 | 8 |
| DION® 9500 | 9 |
| DION® 9700 | 9 |
| DION® IMPACT | 9 |
| Reinforcement | 10 |
| Surface Veils | 10 |
| Additives | 11 |
| Laminate Construction | 11 |
| Secondary Bonding | 12 |
| Resin Curing Systems | 12-13 |
| Post-Curing | 14 |
| Laminate Quality Control | 15 |
| Selected Application Recommendations | 16-19 |
| Static Electricity | 16 |
| Abrasive Materials | 16 |
| Potable Water and Food Applications | 17 |
| Sodium Hypochlorite | 17 |
| Chlorine Dioxide | 18 |
| Gasoline/ Petrol | 18 |
| Flue Gas Scrubbers | 19 |
| Ozone | 19 |
| Pultruded Profiles | 19 |
| Using the POLYLITE® and DION® Chemical Resistance Guide | 20-21 |
| Disclaimer | 21 |
| POLYLITE® and DION® Guide | 22-36 |
| A Selection of Standards | 37 |
| Chemical Resistance Enquiry Form | 38 |

## Introduction

The chemical resistance and performance of POLYLITE® and DION® resins has been demonstrated over the past 45 years through the successful use of a variety of composite products in hundreds of different chemical environments. Practical experience has been supplemented by systematic evaluation of composites exposed to a large number of chemical environments under controlled laboratory conditions.

The diverse corrosive properties of industrial chemicals require that a number of resin formulations be employed to optimize the performance of composite materials. Basic resin types include orthophthalic, isophthalic, terephthalic, bisphenol fumarate and vinyl ester resins. Each has unique advantages and disadvantages, and consequently it is important to consider this when creating resin specifications. Reichhold can supply all of the chemical resistant types in common usage and will assist in evaluating specific requirements.

**POLYLITE® and DION® chemical resistant resins serve the needs of a wide range of industries**

Pulp and paper
Chloralkali
Power generation
Waste treatment
Petroleum
Ore process
Plating
Electronics
Water service
Agriculture
Pharmaceutical
Food process

**with end products such as:**

Chemical storage tanks
Pickling and plating vessels
Chemical piping systems
Sewer pipes/ process pipes
Cooling tower elements
Wall and roofing systems
Ducts and scrubbers
Chimney stacks and stack liners
Hoods and covers
Gratings and structural profiles
Floor coatings and mortars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## Factors Affecting Structural Performance

There are several factors affecting the performance of a structure exposed to a chemical environment. It is essential that all relevant parameters are included in the survey, in order to obtain the service requirements specified. The function of internal and external operating conditions, mechanical loads, design, installation etc. are essential factors to avoid equipment failure in the anticipated service conditions. One of the most common causes of structural failure is exposure to service conditions that are more severe than anticipated.

To obtain the anticipated lifetime of a structure, all the following parameters are important to understand and follow correctly. Selecting the correct **Resin System** plays an important role, as different resin systems have different resistance to breakdown caused by chemical exposure. Polyester resins are able to cover a wide range of chemical exposures. Vinyl Ester and Bisphenol Fumarate resins are chosen when more aggressive exposures are specified.

The type of **Reinforcement** will also influence the long-term properties of a laminate, as different glass fibres show different chemical resistance. Selecting a glass fibre type that is resistant to the chemical environment is important for long-term performance. To make a long lasting chemical resistant laminate, a well designed and manufactured chemical resistant liner is essential. **Surface Veils** made of resistant fibres are then selected. Adding fillers, pigments and/ or other **Additives** to the resin system could also negatively influence the chemical resistance, so these should be avoided when high performance laminates are to be manufactured. Correct **Laminate Construction** is essential, not only for the chemical resistant liner but also the structural laminate. Sufficient stiffness must be built into the construction to avoid high distortions during service, which may result in micro-cracks and subsequent failure.

Optimum **Secondary Bonding** between a primary and secondary laminate is essential to avoid breakdown of the overall construction. Proper laminating workmanship will secure good secondary bonding, creating an integrated and long lasting structure. **Optimum Curing** and **Post-Curing** of the chemical resistant component is of utmost importance to obtain the desired service life. Bad curing/ too low cross-linking of the resin system when put into service will reduce chemical resistance and the anticipated service life of the component.

Selecting the correct curing system and curing/ Post-Curing temperature for the resin system used is therefore essential.

## Resin Selection and Description

This chemical resistance guide lists a range of resin types to allow the appropriate selection for a given exposure. The anticipated performance limits relating to the type and concentration of chemical and the maximum operating temperature are tabulated for each type of resin.

**DION® and POLYLITE® Resins**

480 series – Orthophthalic resin
640 series – Terephthalic resin
250 series – Isophthalic NPG/ resin
680 series – Isophthalic resin
720 series – Isophthalic resin

### POLYLITE® 480 Series

is a high quality, medium reactive orthophthalic resin system with good mechanical properties. This resin is formulated to exhibit good hydrolytic stability and is resistant to neutral and acidic salts and weak non- oxidizing acids. The POLYLITE® 480-series is approved for products storing kerosene, diesel and other oil related products.

### DION® 640 Series

is a high reactive terephthalic resin giving high cross-link density and good mechanical properties. The resin offers good chemical resistance to a wide range of medium aggressive chemicals. The DION® 640-series is especially developed to be used for underground storage tanks for standard and methanol-containing petrol.

### DION® 250 Series

is a medium reactive, high quality isophthalic/ NPG resin showing very good hydrolytic stability and resistance to a wide range of acidic chemicals. The DION® 250-series shows also good adhesion to un-plasticized PVC.

### POLYLITE® 680 Series

is a reactive isophthalic resin system showing good heat resistance due to the high cross-linking density of the cured resin. The POLYLITE® 680-series shows good resistance to several chemicals, especially to organic solvents.

### POLYLITE® 720 Series

is a medium reactive isophthalic resin system showing good mechanical properties, and has good resistance to a wide range of medium aggressive chemicals. The POLYLITE® 720-series is especially developed for production of tanks, pipes etc. and is approved for carrying fuel oil/ diesel and other oil related products. Pipes constructed with the 720-series also show excellent resistance to sewage and waste water.


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The data shown in the tables is based on results determined for the base resin systems. Each of these base resins can be delivered in lower viscosity, thixotropic, pre-accelerated and LSE modifications depending on the application process used to manufacture the GRP fabrication. See the chapter, Additives, when using thixotropic and/ or LSE modifications.

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Table 1, Typical Physical Properties in Liquid State at 23 °C

| DION® | 480-series | 640-series | 250-series | 680-series | 720-series | Units |
|---|---|---|---|---|---|---|
| Density | 1.11 | 1.10 | 1.09 | 1.10 | 1.10 | g/cm$^3$ |
| Styrene Content | 34 | 39 | 43 | 34 | 34 | % |
| Brookfield Viscosity LV sp2/12 rpm | 1350 | 1100 | 1100 | 1200 | 1350 | mPa.s |
| Acid Number | 17 | 10 | 15 | 25 | 14 | g/mgKOH |
| Storage Stability | 10 | 10 | 10 | 10 | 10 | Months |
| Geltime* | 8 | 10 | 12 | 12 | 11 | Minutes |

* 1% Accelerator 9802 P + 1% NORPOL® Peroxide 1/ Butanox M-50

Table 2, Typical Clear Casting Properties

| POLYLITE® & DION® | 480-series | 640-series | 250-series | 680-series | 720-series | Units |
|---|---|---|---|---|---|---|
| Density | 1.20 | 1.19 | 1.18 | 1.19 | 1.19 | g/cm$^3$ |
| Tensile Strength | 70 | 75 | 70 | 45 | 78 | MPa |
| Tensile Elongation | 3 | 4 | 2.5 | 1.4 | 3.5 | % |
| Tensile Modulus | 3700 | 3200 | 3600 | 3800 | 3650 | MPa |
| Flexural Strength | 135 | 135 | 140 | 90 | 140 | MPa |
| Flexural Modulus | 3600 | 3100 | 3500 | 3700 | 350 | MPa |
| Heat Distortion Temperature (HDT) | 86 | 110 | 102 | 125 | 86 | °C |
| Hardness Barcol 934-1 | 40 | 40 | 40 | 45 | 40 | - |

## Resin Selection and Description

**DION® Vinyl Ester and Bisphenol Fumarate Resins**

6694 – Bisphenol Fumarate Polyester
9100 – Bisphenol Epoxy Vinyl Ester
9102 – Bisphenol Epoxy Vinyl Ester
9160 – Higher Crosslinked Bisphenol Epoxy Vinyl Ester
9300 – Fire Retardant Epoxy Vinyl Ester
9400 – Novolac Epoxy Vinyl Ester
9500 – Rubber Modified Epoxy Vinyl Ester
9700 – High Crosslink Density Vinyl Ester

### DION® 6694

is a unique chemically modified Bisphenol Fumarate resin that demonstrates excellent chemical resistance in a wide range of aggressive environments. This premium resin has been used with great success in chlorine environments, most notably in the pulp and paper industry for chlorine dioxide and sodium hypochlorite containment, and in caustic/chlorine manufacture where it is used to produce chlorine cell covers. It also provides excellent resistance to highly acidic and extremely caustic environments.

### DION® 9100

is a standard Bisphenol epoxy based Vinyl Ester resin and is the most versatile resin in the product range. It provides excellent chemical resistance in a wide variety of acidic and alkaline environments and has high mechanical properties. Combined with very good toughness and fast wetting properties of both glass, aramid and carbon fibres, this Vinyl Ester resin can be used to produce reinforced laminates with high impact and fatigue resistance. DION® 9100 is ideal for hand lay-up, filament winding and applications that require resistance to corrosive environments and thermal cycling. Due to its very low water absorption and good water ageing properties, this resin is an optimum choice when also used in a skin laminate in marine and swimming pool applications.

### DION® 9102

is a Bisphenol epoxy based Vinyl Ester resin with a lower molecular weight and thus lower viscosity. It also provides improved curing characteristics.

In the cured state it displays similar mechanical properties and chemical resistance as the DION® 9100. The low viscosity makes DION® 9102 well suited for polymer concrete applications and for production processes such as centrifugal casting, infusion and resin transfer moulding (RTM).

### DION® 9160 - IMPACT

is a higher crosslinked, Bisphenol A based epoxy VinylEster resin. The resin is low VOC and low colour with higher reactivity. DION® 9160 offers higher temperature resistance and mechanical properties when compared to DION® 9100. The resin is intended for hand lay-up/ spray-up and filament winding applications. Its excellent chemical resistance makes this resin ideal for corrosion applications.

### DION® FR 9300

is a brominated fire retardant epoxy based Vinyl Ester resin with chemical resistance similar to DION® 9100. This resin provides excellent chemical resistance in a wide variety of acidic and alkaline environments. The mechanical properties are similar to standard epoxy based Vinyl Ester resins. Even higher fire retardant characteristics can be achieved by adding 1.5 – 3% antimony trioxide.

### DION® 9400

is a Novolac epoxy based Vinyl Ester resin that has been specially modified for improved fabrication properties. This high crosslinked density Vinyl Ester resin provides excellent retention of mechanical properties at elevated temperatures, and is particularly useful in applications where resistance to solvents and chlorine is required. It also provides the combination of a high heat distortion temperature (HDT) and good tensile elongation. DION® 9400 is intended for hand lay-up and filament winding applications, and due to its high reactivity, this resin is widely used in pultrusion processes where the high temperature resistance and good electrical insulation properties are utilized.

Table 3, Typical Physical Properties in Liquid State at 23°C

| DION® | 6694 | 9100 | 9102 | 9160 | 9300 | 9400 | 9500 | 9700 | Units |
|---|---|---|---|---|---|---|---|---|---|
| Density | 1.02 | 1.04 | 1.03 | 1.04 | 1.16 | 1.08 | 1.04 | 1.06 | $g/cm^3$ |
| Styrene Content | 50 | 45 | 50 | 33 | 42 | 36 | 40 | 40 | % |
| Viscosity - Cone & Plate | 530 | 600 | 170 | 600 | 500 | 450 | 650 | 600 | mPa.s |
| Brookfield Viscosity LV sp2/12 | 500 | 570 | 160 | 570 | 450 | 430 | 620 | 570 | mPa.s |
| Acid Number | 18 | 8 | 10 | 9 | 10 | 13 | 7 | 10 | mgKOH/g |
| Storage Stability | 6 | 6 | 6 | 10 | 6 | 6 | 6 | 6 | Months |
| Geltime* | 18-24(3) | 20-30(1) | 20-30(1) | 20-30(2) | 20-30(1) | 20-30(1) | 20-30(1) | 20-30(1) | Minutes |

(1) 3% Accelerator 9802P + 2% NORPOL® Peroxide 11/ Butanox LPT
(2) 0.6% Accelerator 9802P + 2% NORPOL® Peroxide 11/ Butanox LPT
(3) 5% Accelerator 9802P + 1.5% Accelerator 9826 + 1% NORPOL® Peroxide 1/Butanox M-50


## Resin Selection and Description

**DION® 9500**

is a rubber modified epoxy Vinyl Ester resin with high tensile elongation and good impact resistance. In addition, this resin offers many unique properties such as low shrinkage, low peak exotherm and especially good adhesion to glass, aramid and carbon fibres, PVC foam, steel and concrete. These properties combined with excellent water resistance and good chemical resistance, make this Vinyl Ester resin well suited for structures exposed to dynamic loads and for use as a primer.

**DION® 9700**

is a special Bisphenol epoxy based Vinyl Ester resin that features additional cross-linking sites on the polymer chain and in the monomer system. The high crosslink density yields a resin with a very high heat distortion temperature, excellent resistance to solvents and acidic environments, and very good retention of physical properties at elevated temperatures. DION® 9700 is the ideal resin choice in the construction of scrubbers and flue gas ducting.

**Table 4, Typical Clear Casting Mechanical properties**

| DION® | 6694 | 9100 | 9102 | 9160 | 9300 | 9400 | 9500 | 9700 | UNITS |
|---|---|---|---|---|---|---|---|---|---|
| Density | 1.12 | 1.12 | 1.11 | 1.12 | 1.25 | 1.16 | 1.12 | 1.10 | $g/cm^3$ |
| Tensile Strength | 55 | 80 | 78 | 85 | 76 | 72 | 70 | 73 | MPa |
| Tensile Elongation | 2.1 | 5 | 4.5 | 5 | 4 | 3 | 9 | 3.3 | % |
| Tensile Modulus | 3400 | 3400 | 3400 | 3250 | 3500 | 3700 | 3100 | 3358 | MPa |
| Flexural Strength | 95 | 145 | 142 | 155 | 145 | 125 | 135 | 146 | MPa |
| Flexural Modulus | 3300 | 3200 | 3300 | 3500 | 3400 | 3600 | 3000 | 3459 | MPa |
| Heat Distortion Temperature (HDT) | 145 | 100 | 100 | 115 | 110 | 135 | 86 | 160 | °C |

DION® IMPACT Vinyl Ester Resins

DION® IMPACT 9100 – Bisphenol Epoxy Vinyl Ester
DION® IMPACT 9102 – Bisphenol Epoxy Vinyl Ester
DION® IMPACT 9160 – Higher Crosslinked Bisphenol Epoxy Vinyl Ester
DION® IMPACT 9400 – Novolac Epoxy Vinyl Ester

**DION® IMPACT**

is the next generation of Vinyl Ester resins with lighter colour, higher reactivity and increased storage stability. DION® IMPACT Vinyl Ester resins have the same chemical backbone and identical chemical resistance and mechanical properties as the current DION® VE resins.

The DION® and DION® IMPACT Vinyl Ester product range is designed to cover a wide range of application requirements. Depending on the application method used and the customer requirements, the epoxy Vinyl Ester resins can be delivered in modifications (minimum order sizes apply).

## Reinforcement and Surface Veils

### Reinforcement

The type of reinforcement used in a laminate will have an influence on both the short and long-term properties. Glass reinforcements are delivered with a variety of sizings and binders, and the glass itself can vary between suppliers. These differences can manifest themselves in the ease of wet out, chemical resistance and physical properties.

The type and amount of reinforcement primarily guides the short term properties (e.g. mechanical and physical). According to the product specifications and requirements only reinforcements providing the required properties must be selected. It is especially important to reinforce according to the stiffness requirements, in order to avoid failures due to possible fatigue and high loading factors.

The long-term properties, in this case the chemical resistance, are also influenced by the reinforcement selection. Chopped strand mats, gun rovings, woven rovings/ multiaxials and continuous filament rovings are all delivered in different qualities. The importance of correct selection should not be overlooked. Glass fibre suppliers have developed special grades for chemical resistant laminates, where the glass composition and sizing systems have been optimized.

If an unsuitable glass reinforcement system is selected, a faster degradation of properties is likely to occur. In service, the resin/glass interface, and the glass itself, are likely to decompose or break-down more quickly.

### Surface Veils

A well-constructed chemical resistant barrier utilizing surface veils is required for any polymer composite that is intended for chemical resistant service. There are surface veils based on C-glass and synthetic fibres available. C-glass veils are widely used as they easily conform to complex shapes, are easy to wet out and provide excellent overall chemical resistance.

Synthetic veils are harder to set in place and wet out, but can provide thicker and more resin-rich chemical resistant liners. Synthetic veils based on polyester fibres are normally recommended. There are different types of synthetic veils to choose from, and it is recommended that these are used in specific environments (see notes in the tables).

Please also consult your veil supplier for special recommendations to veil quality, as different chemical environments may require special synthetic fibres.


## Additives and Laminate Construction

### Additives

Any additive added to the resin could reduce chemical resistance. Thixotropic resin systems have a tendency to marginally show reduced chemical resistance, meaning that if operating conditions are very close to the limits stated in this guide, a non-thixotropic resin should be used.

This would also be valid for LSE resin systems.

Other fillers mixed into the resin could be catastrophic to the chemical resistance of the laminate, and should always be avoided.

For special application processes, such as pultrusion, the use of the Low Profile (LP) resin systems can be used.

Note: LP Additives used in such cases (normally Polyvinyl Acetate) will reduce the chemical resistance.

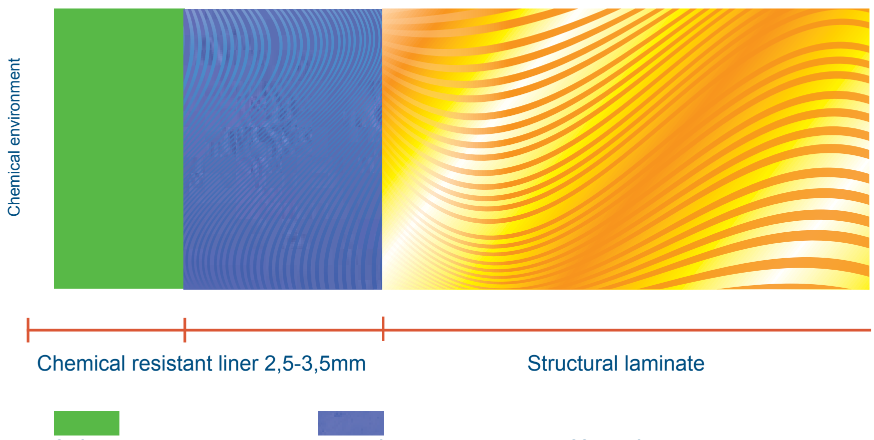
### Laminate Construction

In order to ensure a good corrosion barrier between the structural laminate and the corrosive medium, it is always recommended to build a laminate with a chemical resistant liner. A well-constructed corrosion barrier utilizing surface veil is required for any polymer composite intended for corrosion service. A surface veil based on C-glass or on synthetic polyester fibres is recommended.

Impregnating either one or two layers of veil with approximately 90% resin is a general industry practice, followed by a minimum 2 plies of 450 g/m$^2$ powder bonded chopped strand mat impregnated with approximately 70% resin. Behind this chemical resistant liner, the load-carrying laminate is constructed.

Reinforcement types and amount must be selected to meet the final mechanical properties required. The laminate is preferably made with the same type of resin used for the chemical resistant liner. However, it is a well-accepted practice to build the main part of the structural laminate with a less chemically resistant resin system. Normally an isophthalic resin with an acceptable Heat Distortion Temperature is used.

Chemical Resistant Liner
Figure 1




Surface veil impregnated with 90-95% resin. C-glass or alternatively synthetic veil

2 piles of powder bonded 450g/m2 CSM, preferably with 20 tex strands. Alternatively silan-sized chopped roving impregnated with 70-80% resin. British Standard BS 4994-87 recommends a minimum of 1200g/m2 CSM

# Secondary Bonding and Resin Curing Systems

## Secondary Bonding

One of the most common locations for failure is at the secondary bond, for example where manholes and fittings are laminated to the main construction, and/ or where construction parts are laminated together. In such cases, the total construction is regarded as one integrated part, so if a failure in these areas occurs due to poor inter-laminar bonding, a total breakdown of the construction is likely to occur.

To ensure a successful secondary bond, the composite substrate must either have a tacky, air-inhibited surface or it must be specially prepared. Composites with a fully cured surface may be prepared for secondary bonding by grinding the raminate down to exposed glass prior to applying a new laminate.

Note: a primary laminate must always be finished with chopped fibres/ chopped strand mat or spray roving, and always begun with chopped fibres for the secondary laminate. If a woven roving ends the primary laminate, or starts the secondary laminate, the dangers of delamination failures are greater.

When laminating parts together, be aware of the laminating/ joining rules described in standards (such as BS 4994-87), regarding necessary grinding, tapering and overlap widths.

## Resin Curing Systems

One of the most important factors governing the chemical resistance of composites is the degree of cure of the resin system.

An unsaturated polyester resin/ Vinyl Ester resin contains unsaturated groups in the polymer backbone, which copolymerize with styrene monomer during the curing process, and form a stable three-dimensional polymer network.

This three-dimensional network should be complete; meaning that all-reactive bonds in the polymer chain should be crosslinked with styrene monomer.

If incomplete cross-linking has occurred, the state of cure is not optimum and the resin system is likely to degrade faster when exposed to chemicals. It is therefore essential that good curing systems are used, often tailor made for the different resin types.

POLYLITE® and DION® resins can be delivered as non-accelerated versions and pre-accelerated versions. The pre-accelerated versions contain an optimized accelerator system, giving good cure/cross-linking with recommended peroxides.

Please refer to the Technical Datasheet for the recommended MEK peroxide.

For non-accelerated versions, a good accelerator system should be used together with the peroxide. In order to secure good curing/ cross-linking, one of the special accelerators could be used.

The base range DION® epoxy Vinyl Esters (as they are non-accelerated) require the addition of both accelerators and peroxides to give controlled geltime and cure rates.

The selection criteria of the curing system and the levels of accelerator and peroxide depend on many factors such as the desired Geltime, temperature of both resin and work shop, laminate thickness applied, humidity, possible impurities and post curing. In any case, curing temperatures below 18 ℃ should be avoided to ensure complete cure.

Resin supplier's instructions should always be followed or consult your Reichhold Technical Support Office/ Lab for recommendations.



### Resin Curing Systems

The recommended room temperature curing systems for the POLYLITE® and DION® Polyester resins are:

- Cobalt Octoate/ MEK Peroxide – Co/MEKP
- Cobalt Octoate/ tert.Amine/ MEK Peroxide – Co/ DEA/ MEKP

Cobalt Octoate or Cobalt/ Amine Accelerators, in combination with standard MEK Peroxides, are normally used for Polyester resins.

Typical recommended curing systems for non-accelerated modifications are 1-2% Accelerator 9802P + 1-2% NORPOL® Peroxide 1/ Butanox M-50. For pre-accelerated modifications 1-2% NORPOL® Peroxide 1/ Butanox M-50 is recommended.

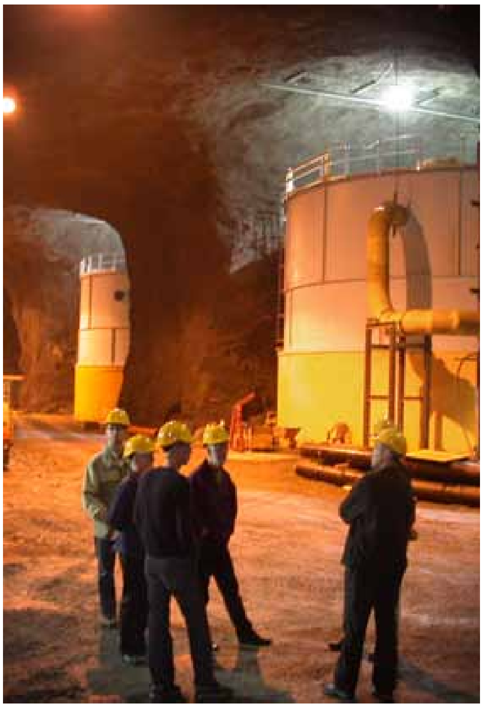
The recommended room temperature curing systems for the DION® epoxy Vinyl Esters are:

- Cobalt Octoate/ Dimethylaniline/ MEK Peroxide – Co/ DMA/ MEKP
- Cobalt Octoate/ Dimethylaniline/ Cumene Hydroperoxide – Co/DMA/CuHP
- Dimethylaniline /Dibenzoylperoxide – DMA/BPO

Standard MEK peroxides used in epoxy Vinyl Esters will cause foaming. Special types have therefore been developed for reduced foaming, types like NORPOL® Peroxide 11/ Butanox LPT and Norox MEKP-925H. Cumene Hydroperoxide does not create foaming in DION® epoxy vinyl esters, and is therefore also well suited for RTM applications. Suitable types are NORPOL® Peroxide 24/ Trigonox 239/ Andonox CHM-50.

For the modified Bisphenol Fumarate polyester resins, standard MEK peroxides are the recommended room temperature curing systems, as they do not create foaming prior to cure.

- Cobalt Octoate/ Dimethylaniline/ MEK Peroxide – Co/ DMA/ MEKP
- Dimethylaniline/ Dibenzoylperoxide – DMA/ BPO



## Post-Curing

Post-Curing at elevated temperatures can enhance the performance of a composite product in most environments. Post-Curing of composites provides two benefits. Firstly the the curing reaction is driven to completion which maximizes the crosslink density of the resin system, and thus eliminating unreacted cross-linking sites in the resin. This improves both chemical resistance and physical properties. Thorough and even Post-Curing for an extended period of time can also relieve stresses formed in the laminate during cure, thus reducing the likelihood of warping during normal thermal cycling/ operation.

In general, one can relate the recommended Post-Curing temperatures to the chemistry of the matrix resin used in the construction - this mostly relates to the HDT of the resin.

It is recommended that the construction is kept for 16-24 hours at room temperature (>18 °C) before Post-Curing at elevated temperature starts. Increasing and decreasing temperature should be done stepwise to avoid possible thermal shock, and consequent possible built-in stresses.

**Typical recommended Post-Curing temperatures and times for different resins, related to their HDT, are given in the following table:**

Table 5

| Post-Curing, hours | | | | |
|---|---|---|---|---|
| Post-Curing | HDT of the resin, °C | | | |
| Temp °C | 65 | 85 | 100 | 130 |
| 40 | 24 | 48 | 96 | 120 |
| 50 | 12 | 24 | 48 | 92 |
| 60 | 6 | 12 | 18 | 24 |
| 70 | 3 | 6 | 9 | 12 |
| 80 | 1.5 | 3 | 4 | 6 |


## Laminate Quality Control

The long-term properties of a composite part are dependent on both the raw material selection and the quality of the fabrication. Possible defects in the laminate could jeopardize the long-term properties, especially for chemical resistance, so the importance of visual inspection and control of the fabrication process are of great importance.

Internal and external porosity should be avoided by good fabrication technique, and must in all cases be below the acceptance criteria in actual standards. Repair and rectification should be carried out where possible.

Reinforcement not properly wet-out, (particularly the surface veil) should be avoided, and must be repaired before going into service.

Internal and external cracks should be looked for and repaired before being put into service.

Well known standards for chemical resistant equip-ment will describe in detail the allowable defects and how to correct them. It is essential for the long-term performance of the structure that these requirements are followed.

State of cure is, as previously mentioned, an important factor also governing the long-term performance. A suitable control of the state of cure is often necessary to secure the performance requirements. Several ways are possible; the easiest is Barcol Hardness readings on the surface.


The average reading from the laminate should, as a minimum, be equal to the figure quoted for the fully cured, un-reinforced casting.

More sophisticated measuring methods are available, such as measurement of the residual styrene content and/ or measurements of the residual reactivity, but these are tests that have to be carried out on a representative piece of laminate by a well equipped laboratory.

Consult local technical staff for further recommendations.

## Selected Application Recommendations

### Static Electricity

Resin/ glass composites are non-conductive materials, and high static electricity charges can develop in ducting, piping etc. Static build-up can be reduced by using conductive fillers, graphite veils or continuous carbon filaments in the surface layer. This must also be taken into consideration in respect to the possible influence on chemical resistance. Consult local technical staff for further recommendations.

### Abrasive Materials

Composite pipes and ducting can offer significantly better air and fluid flow compared to conventional materials because of their smooth internal surfaces. For products designed to carry abrasive slurries and coarse particulates, the effect of abrasion should be considered during the design process. Resistance to abrasion can be enhanced by using synthetic veils or, for extreme cases, by using silicon carbide ceramic beads as a filler in the surface layer. Resilient liners based on elastomer-modified epoxy vinyl ester resins can also be effective in some cases.

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## Selected Application Recommendations

### Potable Water and Food Applications

Products used to store or carry potable water and other food-stuffs, must meet provisions set forward by national and/or international standards/ approval bodies. These specify limits on the quantity and type of extractable chemicals from the laminate surface, including non-reacted styrene. Therefore, thorough washing and cleaning of the laminate surface, as well as proper Post-Curing, is essential. The Post-Curing temperatures and times given in the Post-Curing chapter are in these cases normally not sufficient, as the requirements for minimum residual styrene contents are more stringent. Longer times and/ or higher temperatures are then necessary.

### Sodium Hypochlorite

can be an unstable substance that decomposes. The decomposition products aggressively attack composites through surface oxidation. Decomposition of Sodium Hypochlorite can be caused by excessive temperature, low pH and/ or UV radiation. Also, certain impurities in the laminate surface can cause decomposition. For optimum stability, Sodium Hypochlorite solutions should be maintained at no greater than 50 ˚C and pH of 10.5 or higher. Higher temperatures and/ or lower pH will cause gradual Sodium Hypochlorite decomposition and subsequent attack on the surface of a composite structure.

DION® resins can withstand Sodium Hypochlorite solutions at temperatures greater than 50 ˚C and lower pH than 10.5 but reduced service life should be expected.

Over-chlorinating during manufacture of Sodium Hypochlorite will produce a solution that is very aggressive towards composites. When over-chlorinating occurs, temperature and pH are difficult to control, which can drastically reduce the service life of composite hypochlorite generators and may result in structural failure.

Exposure to ultraviolet light will also decompose Sodium Hypochlorite. Fortunately, this is easy to prevent, and structures intended for outdoor service should contain a UV absorber and a light-coloured pigmented topcoat surface to shield the hypochlorite solution from exposure.

Thixotropic agents based on silica should never be used in the construction of composite structures or in the topcoat layer intended for contact with hypochlorite. Attack is very severe when these additives are used, consequently a thixotropic resin version should never be used.


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## Selected Application Recommendations

### Chlorine Dioxide

has been used for years for bleaching wood pulp and for disinfecting water. Composites made with high-performance resins have been used with great success in structures designed for chlorine dioxide services.

Chlorine dioxide in 6-12% brown stock can be serviced at up to 70 °C by composites fabricated with high performance resins. Under these conditions the resin surface may slowly oxidize, and the surface oxidation is indicated by the formation of a soft yellowish layer. In some cases this layer will form a protective shielding of the under-lying resin from attack. Due to possible erosion, however, this layer can be removed, exposing the composite surface to further attack.

At temperatures above 70 °C composite structures can also withstand chlorine dioxide attack, but reduced service life should be expected.

Extensive in-plant evaluations have demonstrated that structures made with DION® 6694 modified Bisphenol Fumarate resin are highly resistant to chlorine dioxide attack, so this is the resin of choice for such applications.

Chlorine dioxide tank installed in 1966

### Gasoline/ Petrol

For several years, composites have successfully been used for aboveground and underground petrol storage tanks. However, the composition of petrol has been changing in response to demand for cleaner-burning fuels. Elimination of tetra-ethyl lead caused an increase in the proportion of aromatics in the petrol formulation. Use of Tertiary-Butyl Ether (TBE) and other oxygenated additives such as ethanol, methanol and Tertiary-Amyl Methyl Ether (TAME) may increase in the future.

The use of oxygenates and increased levels of aromatics have required resins that provide improved chemical resistance over isophthalic resins, which were once used exclusively. Methanol resistance has been highlighted in recent years, as methanol containing petrol has increased, and thus, must be taken into account when manufacturing petrol storage tanks. Of the numerous polyester and epoxy vinyl ester resins evaluated according to the different standards and performance tests, highly cross-linked terephthalic resins like the DION® 640-series have been shown to offer cost-effective solutions.


## Selected Application Recommendations

### Flue Gas Scrubbers

Composites have been used extensively in ducts, scrubbers and chimney liners exposed to sulphur dioxide and sulphur trioxide. Resins with high temperature properties are usually selected to accommodate uncontrolled temperature peaks that can occur if there is loss of quenching water under the start-up sequence. If an uncontrolled temperature increase occurs, however, internal surface cracks can occur due to the large difference in thermal expansion of the inner liner and the rest of the composite construction. Therefore, carefully controlling and adjusting the temperature exposures during start-up and service is important, as well as frequent surface inspections. Relining may be necessary if conditions have created internal cracks.

Properly designed composite structures can withstand brief temperature peaks of up to 175 °C without serious impairment of the structural properties, and may operate at up to 140 °C on a continuous basis.

### Ozone

is used commercially to treat water containing sewage or chemical waste. It is also used in bleaching and selective delignification of pulp. In this context, ozone is regarded as environmentally friendly, and its use is expected to increase.

The oxidation potential of ozone is very high, making it one of the most powerful oxidizing agents known. Even at concentrations of less than 4 ppm in water, ozone is highly active and can attack the surface of composites leading to gradual degradation.

While experience with active ozone levels at 4 ppm indicates that a reasonable service life can be expected for epoxy Vinyl Esters at higher concentrations, serious surface oxidation and erosion may occur rapidly, requiring frequent inspection and eventual relining. Ozone is also very active in gaseous form. In a vessel where ozone containing water is stored, the evaporation of ozone might cause severe corrosion in the parts that are not filled with water.

It is therefore important to ensure that the ozone concentration in the atmosphere inside a vessel is kept as low as possible. Standard POLYLITE® and DION® resins are not recommended for applications where ozone is involved.

### Pultruded Profiles

For pultruded products, or other moulded products using high filler loadings and/ or glass reinforcement levels, it is not possible to provide a generalized prediction of composite behaviour in aggressive chemical environments. This is also the case for any other fabrication that does not employ a resin-rich chemical resistant surface.

Please contact your nearest Technical Support Office/ Lab for specific recommendations.

## Using the POLYLITE® and DION® Chemical Resistance Guide

The chemical resistant performance of POLYLITE® and DION® has been demonstrated in a variety of composite products over the past 30-40 years through successful use in hundreds of different chemical environments. Practical experience has been supplemented by systematic evaluation of composites exposed to a large number of corrosive environments under controlled laboratory conditions.

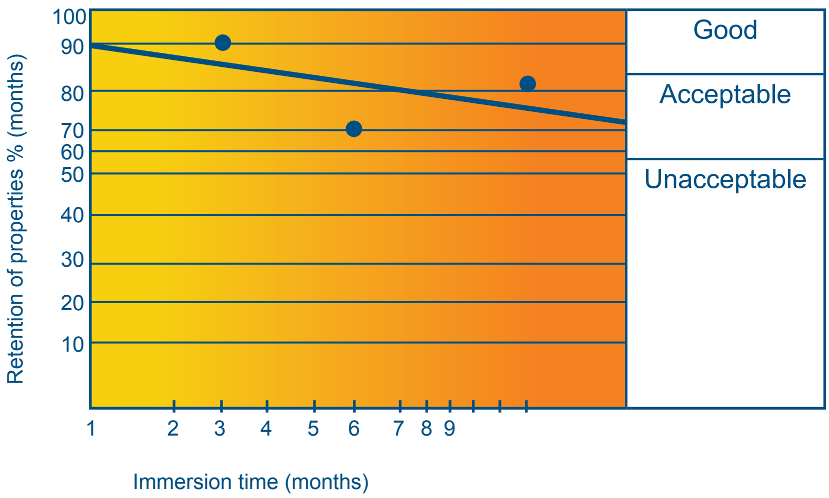
ASTM C 581 has been developed to assist in determining if there is deterioration of a thermoset resin when a laminate is immersed in a corrosive medium. Long-term exposure and experience supports the data that has been obtained from laboratory tests carried out in accordance with ASTM C581.

The rate at which the mechanical properties are reduced decreases over time (approximated to an almost logarithmic function). Once the first retention data have been plotted, a straight line may be drawn to predict the retention of the mechanical properties over time.

All of the listed maximum service temperatures assume that laminates and resin rich liners are fully cured and fabricated to industrial quality standards. In many service conditions, occasional temperature excursions above the listed recommended maximum temperatures may be acceptable, depending on the nature of the chemical environment.

When designing for exposure to hot and relatively non-aggressive vapours, such as in ducting, hoods or stack linings, temperature extremes above those recommended may be feasible. However extensive testing is strongly urged whenever recommended temperatures are exceeded. Factors such as laminate thickness, thermal conductivity, structural design performance and the effect of condensation must be taken into account when designing composite products for extreme temperature performance.

How Loss of Properties over a One-Year Period Predicts the Long-term Resistance



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### Material Safety and Technical Product Datasheets

Material safety data and technical product data sheets are available for all the POLYLITE® and DION® products listed in this brochure. Please request the appropriate datasheets before handling, storing or using any product.

### How to Read the Following Data

The data shown in the following Chemical Resistance Guide is based on results for the base and diluted resin systems. Each of these resins, however, can be delivered diluted, thixotropic, pre-accelerated and in LSE modifications, depending on the application process used to manufacture the GRP fabrications.

### Changes

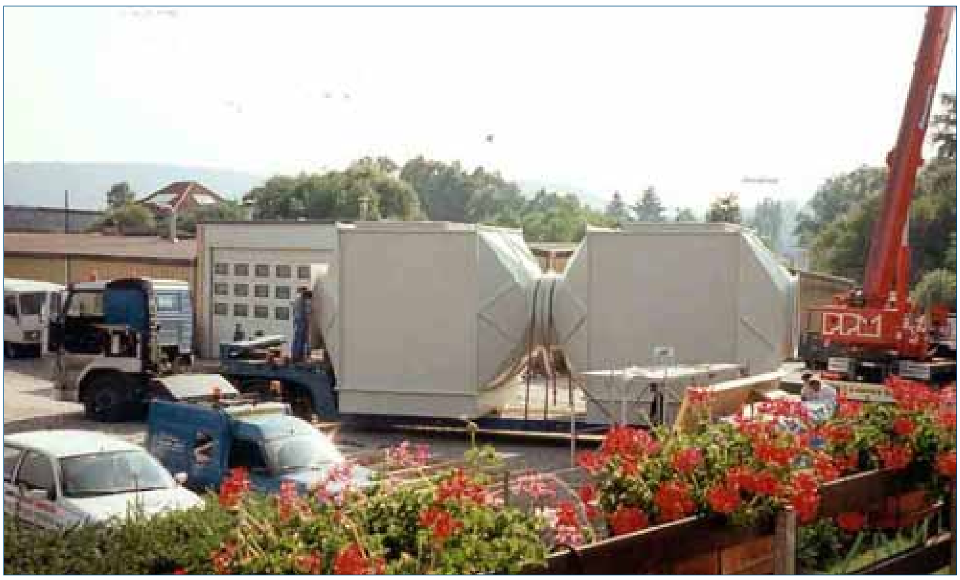
This chemical resistance guide is subject to change without notice in an effort to provide the most up-to-date data. Changes may affect suggested temperature or concentration limitations.

### Disclaimer

The content of this Chemical Resistance Guide provides general guidelines intended to assist customers in determining whether POLYLITE® or DION® resins are suitable for their applications. All Reichhold products are intended for sale to knowledgeable industrial and commercial customers. Customers are required to inspect and test products before use and satisfy themselves as to the suitability for their specific end-use.

These general guidelines are not intended to be a substitute for customer testing.

Reichhold warrants that its products will meet its standard written specifications. Nothing contained in these guidelines shall substitute any other warranty, expressed or implied, including any warranty of merchantability or fitness for a particular purpose, nor is any protection from any law or patent to be inferred. All patent rights are reserved. The exclusive remedy for all proven claims is limited to replacement of our materials and in no event shall Reichhold be liable for any incidental or consequential damages.



| Chemical Environment | Conc. % | POLYLITE® 480-000 482-000 | DION® 640-000 | DION® 250-000 | POLYLITE® 680-000 | POLYLITE® 720-000 721-000 | DION® 6694 | DION® 9100 9102 9300 | DION® 9160 | DION® 9400 | DION® 9700 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | | | | | | | | | | | |
| Acetaldehyde | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Acetic Acid | 0-25 | NR | 25 | 50 | 30 | 25 | 100 | 100 | 100 | 100 | 100 |
| Acetic Acid | 25-50 | NR | 25 | 50 | 30 | 25 | 80 | 80 | 80 | 80 | 80 |
| Acetic Acid | 50-75 | NR | NR | 25 | NR | NR | 60 | 60 | 60 | 60 | 60 |
| Acetic Acid, Glacial | 100 | NR | NR | NR | NR | NR | NR | NR | NR | 30 | NR |
| Acetone | 10 | NR | NR | NR | NR | NR | 80 | NR | 80 | 80 | 80 |
| Acetone | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Acetonitrile | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Acetophenone | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NRt | NR |
| Acetyl Chloride | ALL | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Acrylic Acid | 0-25 | | | | | | 45 | 40 | 40 | 40 | 45 |
| Acrylic Latex | ALL | | | | | | 65 | 50 | 70 | 70 | 70 |
| Acrylonitrile | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Acrylonitrile Latex | ALL | | | | | | 65 | | | | |
| Alkyl Benzene Sulfonic Acid | 92 | | | | | | 65 | 50 | 60 | 60 | |
| Alkyl Benzene C10-C12 | 100 | | | | | | 65 | | 65 | | |
| Allyl Alcohol | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | |
| Allyl Cloride | ALL | NR | NR | NR | NR | NR | NR | NR | 27 | 27 | |
| Alpha Methyl Styrene | 100 | NR | NR | NR | NR | NR | NR | NR | 25 | 30 | |
| Alpha Olefin Sulfates | 100 | | | | | | 50 | 50 | 50 | 50 | 50 |
| Alum | ALL | | | | | | 120 | 80 | 100 | 120 | 120 |
| Aluminum Chloride | ALL | 40 | 50 | 70 | 60 | 50 | 120 | 100 | 110 | 120 | 120 |
| Aluminum Chlorohydrate | ALL | | | 40 | | | 120 | 100 | 100 | 100 | 120 |
| Aluminum Citrate | ALL | | | 50 | | | 120 | 100 | 110 | 120 | 120 |
| Aliminum Fluoride [2] | ALL | NR | NR | 25 | NR | NR | 50 | 27 | 27 | 27 | 27 |
| Aluminum Hydroxide [2] | ALL | | | | | | 100 | 80 | 80 | 90 | 90 |
| Aluminum Nitrate | ALL | | | 50 | | | 80 | 80 | 80 | 80 | 80 |
| Aluminum Potassium Sulfate | ALL | | | 60 | | | 120 | 100 | 110 | 120 | 120 |
| Aluminum Sulfate | ALL | 40 | 50 | 70 | 60 | 50 | 120 | 100 | 110 | 120 | 120 |
| Amino Acids | ALL | | | NR | | | 40 | 40 | 40 | 40 | |
| Ammonia, Liquified | ALL | NR | NR | NR | NR | NR | NR | NR | NR | 27 | NR |
| Ammonia, Aqueous | ( See Ammonium Hydroxide) | | | | | | | | | | |
| Ammonia (Dry Gas) | ALL | NR | NR | NR | NR | NR | 90 | 40 | 40 | 40 | 80 |
| Ammonium Acetate | 65 | | | | | | 45 | 40 | 45 | 45 | 40 |
| Ammonium Benzoate | ALL | | | | | | 80 | 80 | 80 | 80 | 80 |
| Ammonium Bicarbonate | 50 | | | 35 | | | 75 | 70 | 70 | 70 | |
| Ammonium Bisulfite(Black Liguor) | | | | | | | 100 | 80 | 80 | 80 | 80 |
| Ammonium Bromate | 40 | | | 40 | | | 70 | 70 | 70 | 70 | |
| Ammonium Bromide | 40 | | | 40 | | | 70 | 70 | 70 | 70 | |
| Ammonium Carbonate [2] | ALL | | | 30 | | | 65 | 65 | 65 | 65 | 65 |
| Ammonium Chloride | ALL | 40 | 50 | 50 | 50 | 50 | 100 | 100 | 100 | 100 | 100 |
| Ammonium Citrate | ALL | | | 30 | | | 75 | 70 | 70 | 70 | 70 |
| Ammonium Fluoride [2] | ALL | | | | | | 65 | 65 | 65 | 65 | 65 |
| Ammonium Hydroxide [2,5] | 1 | NR | NR | 25 | NR | NR | 90 | 90 | 90 | 90 | 100 |

NR – Not recommended
1 – DMA/ BPO curing system recommended
2 – Double synthetic veil recommended in the inner layer
3 – Double C-glass veil recommended in the inner layer


| Chemical Environment | Conc. % | POLYLITE® 480-000 482-000 | DION® 640-000 | DION® 250-000 | POLYLITE® 680-000 | POLYLITE® 720-000 721-000 | DION® 6694 | DION® 9100 9102 9300 | DION® 9160 | DION® 9400 | DION® 9700 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | | | | | | | | | | | |
| Ammonium Hydroxide 2,5 | 5 | NR | NR | NR | NR | NR | 80 | 80 | 80 | 80 | 80 |
| Ammonium Hydroxide 2,5 | 10 | NR | NR | NR | NR | NR | 75 | 65 | 65 | 65 | 75 |
| Ammonium Hydroxide 2,5 | 20 | NR | NR | NR | NR | NR | 65 | 65 | 65 | 40 | 65 |
| Ammonium Hydroxide 2,5 | 29 | NR | NR | NR | NR | NR | 40 | 40 | 40 | 40 | 40 |
| Ammonium Lauryl Sulfate | 30 | | | | | | 50 | 50 | 50 | 50 | 50 |
| Ammonium Ligno Sulfonate | 50 | | | | | | 80 | 70 | 80 | 80 | |
| Ammonium Nitrate | ALL | | | 50 | | | 120 | 90 | 65 | 65 | |
| Ammonium Persulfate | ALL | | | 25 | | | 100 | 80 | 100 | 100 | 80 |
| Ammonium Phosphate | ALL | | | 50 | | | 100 | 100 | 100 | 100 | 100 |
| (Mono or Di Basic) | | | | | | | | | | | |
| Ammonium Sulfate | ALL | 25 | 50 | 60 | 60 | 50 | 120 | 100 | 110 | 120 | 100 |
| Ammonium Sulfide (Bisulfide) | ALL | | | NR | | | 45 | 50 | 50 | 50 | 50 |
| Ammonium Sulfite | ALL | | | | | | 65 | 65 | 65 | 65 | 65 |
| Ammonium Thiocyanate | 20 | | | 40 | | | 120 | 100 | 100 | 100 | |
| Ammonium Thiocyanate | 50 | | | | | | 65 | 45 | 45 | 45 | |
| Ammonium Thiosulfate | 60 | | | | | | 65 | 40 | 50 | 50 | 40 |
| Amyl Acetate | ALL | NR | NR | NR | NR | NR | | NR | 40 | 50 | NR |
| Amyl Alcohol (Vapor) | | | 35 | 40 | 40 | 35 | 100 | 65 | 70 | 70 | 100 |
| Amyl Alcohol | ALL | NR | 25 | 30 | 30 | 25 | 100 | 50 | 60 | 65 | 80 |
| Amyl Chloride | ALL | | | | | | | 50 | 50 | 50 | 50 |
| Aniline | ALL | NR | NR | NR | NR | NR | NR | NR | NR | 20 | NR |
| Aniline Hydrochloride | ALL | | | | | | 80 | 80 | 80 | 80 | |
| Aniline Sulfate | Sat'd | | 30 | 50 | | 30 | 120 | 100 | 100 | 100 | 100 |
| Aqua Regia (3:1 HCI-HNO3) | ALL | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Arsenic Acid | 80 | | | | | | 45 | 45 | 60 | 60 | |
| Arsenious Acid | 20 | | | 25 | | | 80 | 80 | 80 | 80 | 80 |
| **B** | | | | | | | | | | | |
| Barium Acetate | ALL | | | | | | 80 | 80 | 80 | 80 | 80 |
| Barium Bromide | ALL | | | | | | 100 | 100 | 100 | 100 | |
| Barium Carbonate [2] | ALL | NR | NR | 25 | NR | NR | 120 | 80 | 80 | 80 | |
| Barium Chloride | ALL | 40 | 50 | 70 | 60 | 50 | 120 | 100 | 100 | 100 | 100 |
| Barium Cyanide | ALL | | | | | | 65 | 65 | 65 | 65 | |
| Barium Hydroxide [2] | ALL | | | 25 | | | 75 | 65 | 65 | 65 | |
| Barium Sulfate | ALL | | | 60 | | | 80 | 80 | 100 | 120 | 80 |
| Barium Sulfide | ALL | | | 40 | | | 80 | 80 | 80 | 80 | 80 |
| Beer | | | | 25 | | | | 50 | 50 | | |
| Beet Sugar Liquor | ALL | | | 30 | | | 80 | 80 | 80 | 80 | |
| Benzaldehyde | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | |
| Benzene | 100 | NR | NR | NR | NR | NR | NR | NR | NR | 40 | NR |
| Benzene, HCl (wet) | ALL | NR | NR | NR | NR | NR | NR | NR | NR | 40 | |
| Benzene Sulfonic Acid | 30 | | | | | | 80 | 65 | 65 | 65 | 65 |
| Benzene (Vapor) | ALL | NR | NR | NR | NR | NR | NR | NR | NR | 40 | |
| Benzoic Acid | ALL | 25 | 40 | 60 | 60 | 40 | 120 | 100 | 100 | 100 | 100 |
| Benzoquinones | ALL | | | | | | 80 | 65 | 70 | 80 | 80 |

4 – C-glass veil and 5 mm liner recommended
5 – DION® 9100 or 6694 is preferred
6 – Check with Technical Support Lab. for recommendations

| | Chemical Environment | Conc. % | POLYLITE® 480-000 482-000 | DION® 640-000 | DION® 250-000 | POLYLITE® 680-000 | POLYLITE® 720-000 721-000 | DION® 6694 | DION® 9100 9102 9300 | DION® 9160 | DION® 9400 | DION® 9700 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B | Benzyl Alcohol | ALL | | | 25 | | | 30 | NR | 40 | 40 | NR |
| | Benzyl Chloride | ALL | | | NR | | | NR | NR | NR | 27 | |
| | Black Liquor (pulp mill) | ALL | | | | | | 100 | 80 | 80 | 80 | |
| | Bleach Solutions | | | | | | | | | | | |
| | Calcium Hypochlorite 1,2,5 | ALL | | | | | | 100 | 80 | 80 | 40 | |
| | Chlorine Dioxide 1,2,5 | | NR | NR | NR | NR | NR | 70 | 70 | 70 | 70 | 80 |
| | Chlorine Water 1,2,5 | ALL | NR | NR | NR | NR | NR | 100 | 80 | 80 | 80 | 100 |
| | Chlorite | 50 | | | | | | 45 | 40 | 40 | 40 | |
| | Hydrosulfite | | | | | | | 90 | 80 | 80 | 80 | 80 |
| | Sodium Hypochlorite 1,2,5 | 0-15 | NR | NR | NR | NR | NR | 50 | 50 | 60 | 50 | 50 |
| | Borax | ALL | | | 50 | | | 100 | 100 | 100 | 100 | 100 |
| | Boric Acid | ALL | 40 | 50 | 60 | 60 | 50 | 120 | 100 | 100 | 100 | 100 |
| | Brake Fluid | | | | | | | 45 | 45 | 45 | 45 | |
| | Brine, Salt | ALL | 35 | 40 | 60 | 40 | 40 | 115 | 100 | 100 | 100 | 100 |
| | Bromine | Liquid | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| | Bromine, gas | 100 | | | | | | | 35 | 35 | 35 | |
| | Brown Stock (pulp mill) | | | | | | | 80 | 80 | 80 | 80 | |
| | Bunker C Fuel Oil | 100 | 25 | 35 | 60 | 40 | 35 | 120 | 100 | 100 | 80 | 100 |
| | Butanol | ALL | | 25 | 25 | | 25 | 65 | 50 | 50 | 50 | |
| | Butanol, Tertiary | ALL | | | | | | 45 | | NR | | |
| | Butyl Acetate | 100 | NR | NR | NR | NR | NR | NR | NR | 20 | 27 | NR |
| | Butyl Acrylate | 100 | NR | NR | NR | NR | NR | NR | NR | NR | 27 | |
| | Butyl Amine | ALL | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| | Butyl Benzoate | 100 | | | | | | | | | 27 | |
| | Butyl Benzyl Phthalate | 100 | | | 30 | | | 100 | 80 | 80 | 80 | 65 |
| | Butyl Carbitol | 100 | | | | | | 40 | 40 | | 40 | 40 |
| | Butyl Cellosolve | 100 | | | | | | 50 | 40 | 40 | 40 | 40 |
| | Butylene Glycol | 100 | | | 30 | | | 90 | 70 | 80 | 80 | 80 |
| | Butylene Oxide | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| | Butyraldehyde | 100 | NR | NR | NR | NR | NR | NR | NR | NR | 27 | NR |
| | Butyric Acid | 50 | NR | NR | 25 | NR | NR | 100 | 100 | 100 | 100 | 100 |
| | Butyric Acid | 85 | NR | NR | 25 | NR | NR | 45 | 27 | 35 | 40 | |
| C | Cadmium Chloride | ALL | | | 40 | | | 90 | 80 | 80 | 80 | 80 |
| | Calcium Bisulfite | ALL | | | 40 | | | 90 | 80 | 80 | 80 | 80 |
| | Calcium Bromide | ALL | | | | | | 120 | 90 | 90 | 90 | |
| | Calcium Carbonate [2] | ALL | | | 30 | | | 120 | 80 | 80 | 80 | 90 |
| | Calcium Chlorate [2] | ALL | 40 | 50 | 60 | 50 | 50 | 120 | 100 | 100 | 120 | 100 |
| | Calcium Chloride | Sat'd | 40 | 50 | 70 | 60 | 50 | 115 | 100 | 110 | 120 | 100 |
| | Calcium Hydroxide [2] | ALL | NR | 25 | 35 | 25 | 25 | 100 | 80 | 80 | 80 | 100 |
| | Calcium Hypochlorite 1,2,5 | ALL | NR | NR | NR | NR | NR | 100 | 80 | 80 | 40 | |
| | Calcium Nitrate | ALL | | 40 | 70 | | 40 | 120 | 100 | 100 | 100 | 100 |
| | Calcium Sulfate | ALL | | 40 | 70 | | 40 | 115 | 100 | 100 | 100 | 100 |
| | Calcium Sulfite | ALL | | | | | | 90 | 80 | 80 | 80 | 80 |

NR – Not recommended
1 – DMA/ BPO curing system recommended
2 – Double synthetic veil recommended in the inner layer
3 – Double C-glass veil recommended in the inner layer


## C

| Chemical Environment | Conc. % | POLYLITE® 480-000 482-000 | DION® 640-000 | DION® 250-000 | POLYLITE® 680-000 | POLYLITE® 720-000 721-000 | DION® 6694 | DION® 9100 9102 9300 | DION® 9160 | DION® 9400 | DION® 9700 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Cane Sugar Liquor/Sweet Water | ALL | | | 30 | | | 80 | 80 | 80 | | |
| Capric Acid | ALL | | | | | | 100 | 80 | 80 | 80 | |
| Caprylic Acid (Octanoic Acid) | ALL | | | | | | 100 | 80 | 90 | 100 | 100 |
| Carbon Disulfide | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Carbon Tetrachloride | 100 | NR | NR | NR | NR | NR | 40 | 40 | 50 | 65 | 65 |
| Carbowax | 100 | | | | | | 40 | 40 | 45 | 50 | |
| Carbowax Polyethylene Glycols | ALL | | | | | | | 65 | 70 | 80 | |
| Carboxyethyl Cellulose | 10 | | | | | | 80 | 65 | 65 | 65 | |
| Carboxymethyl Cellulose | ALL | | | | | | 70 | 45 | 45 | 45 | |
| Cashew Nut Oil | ALL | | | | | | 50 | | 60 | | |
| Castor Oil | ALL | | | 25 | | | 70 | 70 | 70 | 70 | 50 |
| Chlorinated Pulp | | | | | | | 90 | 80 | 80 | 80 | |
| Chlorination Washer Hoods/Ducts | | | | | | | 90 | 80 | 80 | 80 | |
| Chlorinated Waxes | ALL | | | 30 | | | 80 | 80 | 80 | 80 | 80 |
| Chlorine (liquid) | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Chlorine Dioxide 1,2,5 | | | | | | | 70 | 70 | 70 | 70 | 80 |
| Chlorine Gas (wet or dry) 4 | | NR | NR | 25 | NR | NR | 100 | 100 | 100 | 100 | 100 |
| Chlorine Water 1,2,5 | ALL | | | | | | 100 | 80 | 80 | 80 | 100 |
| Chloroacetic Acid | 25 | NR | NR | 25 | NR | NR | 70 | 40 | 40 | 50 | |
| Chloroacetic Acid | 50 | | | 25 | | | 50 | 35 | 35 | 40 | |
| Chloroacetic Acid | 80 | | NR | NR | | | 25 | 25 | 25 | 25 | |
| Chloroacetic Acid | 100 | NR | 25 | NR | NR | NR | NR | NR | NR | NR | NR |
| Chlorobenzene | 100 | NR | NR | NR | NR | NR | NR | NR | NR | 27 | |
| Chloroform | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Chloropyridine | 100 | NR | NR | NR | NR | NR | NR | NR | NR | 27 | |
| Chlorosulfonic Acid | ALL | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Chlorotoluene | 100 | NR | NR | NR | NR | NR | NR | NR | NR | 27 | |
| Chrome Plating Solution | | | | | | | 55 | 50 | 50 | 50 | |
| Chromic Acid | 5 | NR | NR | 25 | NR | NR | 50 | 45 | 50 | 50 | 45 |
| Chromic Acid | 20 | NR | NR | NR | NR | NR | 40 | 27 | 40 | 45 | 45 |
| Chromium Sulfate | ALL | | | | | | 80 | 65 | 80 | 80 | 80 |
| Chromous Sulfate | ALL | | 30 | 40 | | 30 | 80 | 80 | 80 | 80 | 80 |
| Citric Acid | ALL | 25 | 50 | 60 | 60 | 50 | 120 | 100 | 100 | 100 | 100 |
| Cobalt Chloride | ALL | | 40 | 50 | | 40 | 80 | 80 | 80 | 80 | |
| Cobalt Citrate | ALL | | | | | | | 80 | 80 | 80 | |
| Cobalt Naphthenate | ALL | | | | | | 65 | 65 | 65 | 65 | |
| Cobalt Nitrate | 15 | | | 60 | | | 80 | 50 | 80 | 80 | |
| Cobalt Octoate | ALL | | | | | | 65 | 65 | 65 | 65 | |
| Coconut Oil | ALL | | | 30 | | 30 | 120 | 80 | 90 | 90 | 100 |
| Copper Acetate | ALL | | | 30 | | | 120 | 100 | 100 | | 100 |
| Copper Chloride | ALL | 40 | 50 | 70 | 60 | 50 | 120 | 100 | 110 | 120 | 100 |
| Copper Cyanide | ALL | 25 | 40 | 60 | 40 | 40 | 120 | 100 | 100 | 100 | 100 |
| Copper Fluoride ² | ALL | | | | | | 100 | 80 | | | 100 |
| Copper Nitrate | ALL | | 40 | 60 | | 40 | 120 | 100 | 100 | 100 | 100 |

4 – C-glass veil and 5 mm liner recommended
5 – DION® 9100 or 6694 is preferred
6 – Check with Technical Support Lab. for recommendations

| Chemical Environment | Conc. % | POLYLITE® 480-000 482-000 | DION® 640-000 | DION® 250-000 | POLYLITE® 680-000 | POLYLITE® 720-000 721-000 | DION® 6694 | DION® 9100 9102 9300 | DION® 9160 | DION® 9400 | DION® 9700 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **C** | | | | | | | | | | | |
| Copper Sulfate | ALL | 40 | 50 | 70 | 60 | 50 | 115 | 100 | 110 | 120 | 100 |
| Corn Oil | ALL | | | 30 | | | 90 | 80 | 90 | 90 | |
| Corn Starch | ALL | | | | | | 100 | 100 | 100 | | |
| Corn Sugar | ALL | | | | | | 100 | 80 | 80 | | |
| Cottonseed Oil | ALL | | | 30 | | 30 | 90 | 100 | 100 | 100 | |
| Cresylic Acids | ALL | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Crude Oil, Sour or Sweet | 100 | 30 | 50 | 70 | 60 | 50 | 100 | 100 | 110 | 120 | 100 |
| Cyclohexane | 100 | | | 30 | | | 50 | 50 | 65 | 65 | 65 |
| Cyclohexanone | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | 50 |
| **D** | | | | | | | | | | | |
| Decanol | 100 | | | 25 | | | 80 | 50 | 65 | 80 | |
| Dechlorinated Brine Storage | ALL | | | | | | 80 | 80 | 80 | 80 | 80 |
| Deionized Water | | 35 | 50 | 60 | 40 | 50 | 100 | 80 | 80 | 90 | 80 |
| Demineralized Water | | 35 | 50 | 60 | 40 | 50 | 100 | 80 | 80 | 90 | 80 |
| Detergents, Organic | 100 | | | 25 | | | 80 | 70 | 70 | 70 | |
| Detergents, Sulfonated | ALL | | | 30 | | | 100 | 90 | 90 | 90 | 90 |
| Diallylphthalate | ALL | | | 30 | | | 100 | 80 | 90 | 100 | |
| Diammonium Phosphate | 65 | | | 30 | | | 100 | 100 | 100 | 100 | 100 |
| Dibromophenol | | NR | NR | NR | NR | NR | | NR | 27 | 27 | |
| Dibromopropanol | ALL | NR | NR | NR | NR | NR | | NR | NR | 40 | |
| Dibutyl Ether | 100 | | | | | | 45 | 27 | 45 | 65 | 50 |
| Dibutylphthalate | 100 | 25 | 50 | 60 | 50 | 50 | 90 | 80 | 80 | 90 | 80 |
| Dibutyl Sebacate | ALL | | | | | | 100 | 65 | 65 | 65 | |
| Dichlorobenzene | 100 | NR | NR | NR | NR | NR | NR | NR | 27 | 40 | 40 |
| Dichloroethane | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Dichloroethylene | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Dichloromethane (Methylene Chloride) | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Dichloropropane | 100 | NR | NR | NR | NR | NR | NR | NR | NR | 40 | |
| Dichloropropene | 100 | NR | NR | NR | NR | NR | NR | NR | NR | 27 | |
| Dichloropropionic Acid | 100 | NR | NR | NR | NR | NR | NR | NR | NR | 27 | |
| Diesel Fuel | ALL | 25 | 35 | 60 | 40 | 35 | 100 | 80 | 100 | 100 | 90 |
| Diethanolamine | 100 | | | | | | 45 | 27 | 45 | 45 | 50 |
| Diethyl Amine | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Diethyl Ether (Ethyl Ether) | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Diethyl Formamide | 100 | NR | NR | NR | NR | NR | NR | NR | NR | 27 | |
| Dietyl Ketone | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | |
| Diethyl Maleate | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | |
| Di 2-Ethyl Hexyl Phosphate | 100 | | | | | | 100 | | 70 | | |
| Diethylenetriamine (DETA) | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | |
| Diethylene Glycol | 100 | 40 | 50 | 70 | 70 | 50 | 120 | 80 | 90 | 100 | 90 |
| Diisobutyl Ketone | 100 | NR | NR | NR | NR | NR | NR | NR | 27 | 40 | |
| Diisobutyl Phthalate | 100 | | | 30 | | | 80 | 50 | 65 | 65 | |
| Diisobutylene | 100 | | | | | | | 27 | 40 | 40 | |

NR – Not recommended
1 – DMA/ BPO curing system recommended
2 – Double synthetic veil recommended in the inner layer
3 – Double C-glass veil recommended in the inner layer


D

| Chemical Environment | Conc. % | POLYLITE® 480-000 482-000 | DION® 640-000 | DION® 250-000 | POLYLITE® 680-000 | POLYLITE® 720-000 721-000 | DION® 6694 | DION® 9100 9102 9300 | DION® 9160 | DION® 9400 | DION® 9700 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Diisopropanolamine | 100 | | | | | | 40 | 45 | 45 | 50 | |
| Dimethyl Formamide | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | |
| Dimethyl Phthalate | 100 | 25 | 50 | 60 | 50 | 50 | 75 | 65 | 75 | 75 | 80 |
| Dioctyl Phthalate | 100 | | | 60 | | | 100 | 80 | 90 | 90 | 80 |
| Dioxane | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | |
| Diphenyl Ether | 100 | | | | | | 60 | 27 | 40 | 50 | 50 |
| Dipiperazine Sulfate Solution | ALL | | | | | | | | 27 | | |
| Dipropylene Glycol | ALL | 40 | 50 | 60 | 50 | 50 | 120 | 90 | 90 | 100 | |
| Distilled Water | 100 | 35 | 50 | 60 | 40 | 50 | 100 | 80 | 80 | 80 | 80 |
| Divinyl Benzene | 100 | NR | NR | NR | NR | NR | NR | | 40 | 40 | |

E

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Embalming Fluid | ALL | | | | | | 45 | 45 | 45 | 45 | |
| Epichlorohydrin | 100 | | | NR | | | NR | NR | NR | NR | NR |
| Epoxidized Soybean Oil | ALL | | | | | | 80 | 65 | 65 | 65 | |
| Esters of Fatty Acids | 100 | | | 40 | | | 100 | 80 | 80 | 80 | 80 |
| Ethanolamine | 100 | NR | NR | NR | NR | NR | NR | NR | NR | 27 | |
| Ethyl Acetate | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Ethyl Acrylate | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Ethyl Alcohol (Ethanol) | 10 | 25 | 30 | 40 | | 25 | 65 | 50 | 60 | 65 | 65 |
| Ethyl Alcohol (Ethanol) | 50 | | 25 | 40 | | 25 | 50 | 40 | 40 | 50 | |
| Ethyl Alcohol (Ethanol) | 95-96 | NR | 25 | 40 | 30 | 25 | 50 | 27 | 27 | 40 | |
| Ethyl Benzene | 100 | NR | NR | NR | NR | NR | | NR | NR | 40 | |
| Ethyl Benzene/Benzene Blends | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | |
| Ethyl Bromide | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | |
| Ethyl Chloride | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | |
| Ethyl Ether (Diethyl Ether) | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | |
| Ethylene Chloride | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | |
| Ethylene Chloroformate | 100 | | | | | | NR | NR | NR | NR | |
| Ethylene Chlorohydrin | 100 | | | | | | 45 | 40 | 40 | 40 | 40 |
| Ethylene Diamine | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | |
| Ethylene Dibromide | ALL | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Ethylene Dichloride | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | |
| Ethylene Glykol | ALL | 40 | 50 | 70 | 60 | 50 | 120 | 90 | 100 | 100 | 100 |
| Ethylene Glykol Monobutyl Ether | 100 | | | | | | 40 | 40 | 40 | 40 | |
| Ethylene Diamine Tetra Acetic Acid | 100 | | | | | | 45 | 40 | 40 | 40 | |
| Ethylene Oxide | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | |
| Eucalyptus Oil | 100 | | | | | | 60 | 60 | 60 | 60 | |

F

| Chemical Environment | Conc. % | POLYLITE® 480-000 482-000 | DION® 640-000 | DION® 250-000 | POLYLITE® 680-000 | POLYLITE® 720-000 721-000 | DION® 6694 | DION® 9100 9102 9300 | DION® 9160 | DION® 9400 | DION® 9700 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fatty Acids | ALL | 25 | 50 | 70 | 60 | 50 | 120 | 100 | 110 | 120 | 100 |
| Ferric Acetate | ALL | | | | | | 80 | 80 | 80 | 80 | |
| Ferric Chloride | ALL | 40 | 50 | 70 | 60 | 50 | 120 | 100 | 100 | 100 | 100 |
| Ferric Nitrate | ALL | 30 | 40 | 70 | 60 | 40 | 120 | 100 | 100 | 100 | 100 |
| Ferric Sulfate | ALL | 40 | 50 | 70 | 60 | 50 | 120 | 100 | 100 | 100 | 100 |

4 – C-glass veil and 5 mm liner recommended
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6 – Check with Technical Support Lab. for recommendations

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|---|---|---|---|---|---|---|---|---|---|---|---|
| **F** | | | | | | | | | | | |
| Ferrous Chloride | ALL | 30 | 40 | 70 | 60 | 40 | 120 | 100 | 100 | 100 | 100 |
| Ferrous Nitrate | ALL | 30 | 40 | 70 | 60 | 40 | 120 | 100 | 100 | 100 | 100 |
| Ferrous Sulfate | ALL | 40 | 50 | 70 | 60 | 50 | 120 | 100 | 100 | 100 | 100 |
| Fertilizer, 8,8,8 | | | | | | | 50 | 50 | 50 | 50 | 50 |
| Fertilizer, URAN | | | | | | | 50 | 50 | 50 | 50 | 50 |
| Fluoboric Acid ² | 10 | | | 25 | | | 120 | 100 | 110 | 120 | 100 |
| Fluoboric Acid ² | 15 | | | NR | | | 70 | 60 | 80 | 100 | |
| Fluoride Salts & HCl ² | 30:10 | | | | | | | 50 | 50 | 50 | |
| Fluosilicic Acid ² | 10 | | | | | | 65 | 65 | 65 | 65 | 65 |
| Fluosilicic Acid ² | 35 | | | | | | 40 | 40 | 40 | 40 | 40 |
| Fluosilicic Acid ² | Fumes | | | | | | 80 | 80 | 80 | 80 | |
| Fly Ash Slurry | | | | | | | | | 80 | | |
| Formaldehyde | 25-56 | | | 50 | | | 65 | 65 | 65 | 65 | 65 |
| Formic Acid | 10 | NR | NR | 30 | | NR | 65 | 80 | 80 | 80 | 65 |
| Formic Acid | 50 | NR | NR | NR | | NR | 40 | 40 | 40 | 40 | 40 |
| Formic Acid | 85 | | | | | | | | 25 | 35 | |
| Fuel Oil | 100 | 25 | 35 | 60 | 40 | 35 | 100 | 80 | 100 | 100 | 90 |
| Furfural | 10 | | | | | | 65 | 40 | 45 | 50 | 50 |
| Furfural | 50-100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | |
| **G** | | | | | | | | | | | |
| Gallic Acid | Sat'd | | | | | | 40 | 40 | 40 | 40 | |
| Gasoline, Regular Leaded | 100 | 25 | 25 | 40 | 35 | 25 | 45 | 45 | 45 | 45 | |
| Gasoline, Regular Unleaded | 100 | 25 | 25 | 40 | 35 | 25 | | 27 | 35 | 40 | |
| Gasoline, Alcohol Containing | 100 | | 25 | | | | | | | 30 | |
| Gluconic Acid | 50 | | | 30 | | | 80 | 80 | 80 | 80 | 80 |
| Glucose | ALL | | | 50 | | | 100 | 100 | 100 | 100 | 100 |
| Glutaric Acid | 50 | | | | | | 50 | 50 | 50 | 50 | |
| Glycerine | 100 | | | | | | 50 | 50 | 50 | 50 | |
| Glycolic Acid (Hydroxyacetic Acid) | 10 | | | 40 | | | 90 | 80 | 90 | 90 | 90 |
| Glycolic Acid (Hydroxyacetic Acid) | 35 | | | | | | 60 | 60 | 60 | 60 | 65 |
| Glycolic Acid (Hydroxyacetic Acid) | 70 | | | | | | 40 | 27 | 40 | 40 | 40 |
| Glyoxal | 40 | | | | | | 45 | 40 | 40 | 40 | |
| Green Liqour (pulp mill) | | | | | | | 100 | 80 | 80 | 80 | 90 |
| **H** | | | | | | | | | | | |
| Heptane | 100 | 25 | 25 | 60 | 35 | 25 | 100 | 90 | 100 | 100 | 100 |
| Hexachlorocyclopentadiene | 100 | | | | | | 45 | | 45 | 45 | |
| Hexamethylenetetramine | 65 | | | | | | | | 45 | 50 | |
| Hexane | 100 | | | 30 | | | 65 | 65 | 65 | 65 | 65 |
| Hydraulic Fluid | 100 | | | | | | 80 | 65 | 80 | 80 | 80 |
| Hydrazine | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | |
| Hydrobromic Acid | 18 | | | 25 | | | 100 | 80 | 80 | 80 | 90 |
| Hydrobromic Acid | 48 | | | | | | 75 | 65 | 65 | 65 | 80 |
| Hydrochloric Acid | 10 | 30 | 40 | 70 | 50 | 40 | 100 | 100 | 110 | 120 | 100 |
| Hydrochloric Acid | 15 | 25 | 30 | 50 | 35 | 30 | 100 | 80 | 100 | 110 | 100 |

NR – Not recommended
1 – DMA/ BPO curing system recommended
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3 – Double C-glass veil recommended in the inner layer


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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| H | Hydrochloric Acid | 25 | | | 25 | | | 65 | 70 | 70 | 80 | 70 |
| | Hydrochloric Acid | 37 | NR | NR | 25 | NR | NR | 45 | 40 | 45 | 45 | 60 |
| | Hydrochloric Acid & Organics 4 | | NR | NR | 25 | NR | NR | NR | NR | NR | 60 | |
| | Hydrocyanic Acid | 10 | | | 25 | | | 100 | 80 | 80 | 80 | 80 |
| | Hydrofluoric Acid ² | 1 | | | NR | | | 50 | 50 | 50 | 50 | 65 |
| | Hydrofluoric Acid ² | 10 | NR | NR | NR | NR | NR | 50 | 50 | 50 | 50 | 65 |
| | Hydrofluoric Acid ² | 20 | NR | NR | NR | NR | NR | 40 | 40 | 40 | 40 | 40 |
| | Hydrofluosilicic Acid ² | 10 | | | NR | | | 65 | 65 | 65 | 65 | 65 |
| | Hydrofluosilicic Acid ² | 35 | | | NR | | | 40 | 40 | 40 | 40 | 40 |
| | Hydrogen Bromide, gas | ALL | | | 25 | | | 100 | 80 | 80 | 80 | 80 |
| | Hydrogen Chloride, dry gas | 100 | | | 40 | | | 120 | 100 | 110 | 120 | 100 |
| | Hydrogen Fluoride, gas ² | ALL | | | | | | 80 | 65 | 65 | 65 | 80 |
| | Hydrogen Peroxide (storage) | 5 | NR | NR | 25 | NR | NR | 65 | 65 | 65 | 65 | 65 |
| | Hydrogen Peroxide (storage) | 30 | NR | NR | NR | NR | NR | 40 | 40 | 40 | 40 | 40 |
| | Hydrogen Sulfide, gas | ALL | NR | NR | 30 | NR | NR | 115 | 100 | 100 | 100 | 100 |
| | Hydriodic Acid | 10 | | | | | | 65 | 65 | | 65 | 65 |
| | Hypophosphorus Acid | 50 | | | | | | | 50 | 50 | 50 | |
| I | Iodine, Solid | ALL | | | | | | 75 | 65 | 65 | 65 | 65 |
| | Isoamyl Alcohol | 100 | | 25 | | | 25 | 50 | 50 | 50 | 50 | |
| | Isobutyl Alcohol | ALL | | 25 | | | 25 | 50 | 50 | 50 | 50 | |
| | Isodecanol | ALL | | 25 | | | 25 | 80 | 50 | 65 | 80 | |
| | Isononyl Alcohol | 100 | | 25 | | | 25 | 50 | | 60 | 60 | |
| | Isooctyl Adipate | 100 | | | | | | | 50 | 50 | 65 | |
| | Isooctyl Alcohol | 100 | | 25 | 35 | 30 | 25 | 65 | | 60 | 60 | |
| | Isopropyl Alcohol | ALL | NR | 25 | 35 | 30 | 25 | 50 | 50 | 50 | 50 | 50 |
| | Isopropyl Amine | 50 | | | | | | 50 | 40 | 40 | 50 | 50 |
| | Isopropyl Myristate | ALL | | | | | | 100 | 90 | 90 | 90 | |
| | Isopropyl Palmitate | ALL | | | | | | 100 | 90 | 100 | 100 | 100 |
| | Itaconic Acid | 40 | | | | | | 50 | 50 | 50 | 50 | |
| J | Jet Fuel | | 20 | 30 | 35 | 30 | 30 | 100 | 80 | 80 | 80 | 80 |
| | Jojoba Oil | 100 | | | | | | 80 | 80 | 80 | 80 | |
| K | Kerosene | 100 | NR | 25 | 50 | 40 | 25 | 100 | 80 | 80 | 80 | 80 |
| L | Lactic Acid | ALL | 25 | 30 | 40 | 30 | 30 | 120 | 100 | 100 | 100 | 100 |
| | Latex | ALL | | | | | | 65 | 50 | 50 | 50 | 50 |
| | Lauric Acid | ALL | | | | | | 100 | 100 | 100 | 100 | |
| | Lauryl Alcohol | 100 | | | | | 30 | 80 | 65 | 70 | 80 | |
| | Lauryl Mercaptan | ALL | | | | | | 65 | | 65 | 65 | |
| | Lead Acetate | ALL | 30 | 40 | 50 | 40 | 40 | 120 | 100 | 110 | 120 | 100 |
| | Lead Chloride | ALL | | | 50 | | | 100 | 90 | 110 | 120 | |
| | Lead Nitrate | ALL | | | 70 | | | 120 | 100 | 110 | 120 | 100 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L | Levulinic Acid | ALL | | | | | | 100 | 100 | 110 | 120 | 100 |
| | Lime Slurry | ALL | | | 30 | | | 100 | 80 | 80 | 80 | 100 |
| | Linseed Oil | ALL | 40 | 60 | 70 | 100 | 60 | 120 | 100 | 110 | 120 | 100 |
| | Lithium Bromide | ALL | | | 30 | | | 120 | 100 | 110 | 120 | 100 |
| | Lithium Carbonate [2] | ALL | | | | | | | | 65 | 65 | |
| | Lithium Chloride | ALL | | | 50 | | | 120 | 100 | 100 | 100 | 100 |
| | Lithium Sulfate | ALL | | | 50 | | | 100 | 100 | 100 | 100 | 100 |
| M | Magnesium Bicarbonate | ALL | | | | | | 100 | 80 | 80 | 80 | 90 |
| | Magnesium Bisulfite | ALL | | | | | | 80 | 80 | 80 | 80 | 80 |
| | Magnesium Carbonate | 15 | 25 | 35 | 50 | 35 | 35 | 100 | 80 | 80 | 80 | 90 |
| | Magnesium Chloride | ALL | 40 | 50 | 70 | 60 | 50 | 120 | 100 | 110 | 120 | 100 |
| | Magnesium Hydroxide | ALL | | | | | | 90 | 100 | 100 | 100 | 100 |
| | Magnesium Nitrate | ALL | 30 | 40 | 60 | 40 | 40 | 120 | 100 | 100 | 100 | 100 |
| | Magnesium Sulfate | ALL | 40 | 50 | 70 | 60 | 50 | 100 | 100 | 110 | 120 | 100 |
| | Maleic Acid | ALL | | | 50 | | | 100 | 90 | 110 | 120 | |
| | Maleic Anhydride | 100 | | | 50 | | | 100 | 90 | 100 | 100 | 100 |
| | Manganese Chloride | ALL | | | 60 | | | 120 | 100 | 100 | 100 | |
| | Manganese Sulfate | ALL | | | 60 | | | 100 | 100 | 100 | 100 | |
| | Mercuric Chloride | ALL | 40 | 50 | 70 | 60 | 50 | 120 | 100 | 100 | 100 | 100 |
| | Mercurous Chloride | ALL | 40 | 50 | 70 | 60 | 50 | 120 | 100 | 100 | 100 | 100 |
| | Mercury | | | | 70 | | | 120 | 100 | 110 | 120 | 100 |
| | Methyl Alcohol (Methanol) | 100 | NR | NR | NR | NR | NR | 45 | NR | NR | 30 | 27 |
| | Methyl Ethyl Ketone | ALL | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| | Methyl Isobuthyl Ketone | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | |
| | Methyl Methacrylate | ALL | NR | NR | NR | NR | NR | NR | NR | NR | NR | |
| | Methyl Styrene | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | |
| | Methylene Chloride | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| | Milk and Milk Products | ALL | 25 | 25 | 35 | | 25 | | | | | |
| | Mineral Oils | 100 | 30 | 50 | 70 | 60 | 50 | 120 | 100 | 110 | 120 | 100 |
| | Molasses and Invert Molasses | ALL | | | | | | 45 | | 45 | 45 | |
| | Molybdenum Disulfide | ALL | | | | | | | 90 | | | 90 |
| | Molybdic Acid | 25 | | | | | | 65 | | 65 | 65 | |
| | Monochloroacetic Acid | 50 | NR | NR | 25 | NR | NR | 50 | 35 | 35 | 40 | |
| | Monochlorobenzene | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| | Monoethanolamine | 100 | NR | NR | NR | NR | NR | NR | NR | NR | 27 | |
| | Monomethylhydrazine | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | |
| | Morpholine | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | |
| | Motor Oil | 100 | 30 | 50 | 60 | 50 | 50 | 120 | 100 | 110 | 120 | 100 |
| | Mustard | ALL | | 30 | | | 30 | | | | | |
| | Myristic Acid | ALL | | | | | | 100 | 100 | 100 | 100 | |
| N | Naphta, Aliphatic | 100 | NR | 25 | 40 | 30 | 25 | 80 | 80 | 90 | 90 | |
| | Naphta, Aromatic | 100 | | | | | | | | 45 | 50 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | Naphtalene | ALL | 30 | 40 | 60 | 50 | 40 | 120 | 80 | 90 | 90 | 90 |
| | Nickel Chloride | ALL | 40 | 50 | 70 | 60 | 50 | 120 | 100 | 100 | 100 | 100 |
| | Nickel Nitrate | ALL | 40 | 50 | 70 | 60 | 50 | 120 | 100 | 100 | 100 | 100 |
| | Nickel Sulfate | ALL | 40 | 50 | 70 | 60 | 50 | 120 | 100 | 100 | 100 | 100 |
| | Nitric Acid | 2 | NR | NR | 40 | NR | NR | 100 | 70 | 80 | 80 | |
| | Nitric Acid | 5 | NR | NR | 30 | NR | NR | 80 | 65 | 70 | 70 | |
| | Nitric Acid | 15 | NR | NR | NR | NR | NR | 65 | 50 | 50 | 55 | |
| | Nitric Acid | 35 | NR | NR | NR | NR | NR | 60 | 25 | 30 | 40 | |
| | Nitric Acid | 50 | NR | NR | NR | NR | NR | 45 | NR | NR | 27 | NR |
| | Nitric Acid | Fumes | | | | | | 80 | 80 | 80 | 80 | 80 |
| | Nitrobenzene | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | |
| | Nitrogen Tetroxide | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | |
| O | Octanic Acid (Caprylic Acid) | ALL | | | | | | 100 | 80 | 90 | 90 | 100 |
| | Octylamine, Tertiary | 100 | 30 | 50 | 60 | 50 | 50 | 45 | | 45 | 45 | |
| | Oil, Sweet or Sour Crude | 100 | 30 | 50 | 60 | 50 | 70 | 120 | 100 | 110 | 120 | 100 |
| | Oleic Acid | ALL | 40 | 50 | 60 | 50 | 50 | 120 | 100 | 100 | 100 | 100 |
| | Oleum (Fuming Sulfuric Acid) | | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| | Olive Oil | 100 | | | 60 | | | 120 | 100 | 110 | 120 | 100 |
| | Orange Oil (limonene) | 100 | | | 60 | | | 120 | 100 | 100 | 100 | |
| | Organic Detergents, pH<12 | ALL | | | 25 | | | 80 | 70 | 70 | 70 | |
| | Oxalic Acid | 100 | NR | 30 | 50 | 40 | 30 | 100 | 100 | 100 | 100 | |
| | Ozone (< 4 ppm in water phase) | | | | | | | 27 | 27 | 27 | | |
| P | Palm Oil | 100 | | | 50 | | | 90 | 80 | 80 | 80 | |
| | Palmitic Acid | 100 | | | 60 | | | 100 | 100 | 100 | 110 | |
| | Pentasodium Tripoly Phosphate | 10 | | | 40 | | | 100 | 100 | 100 | 100 | 100 |
| | Perchloroethylene | 100 | | | NR | | | 45 | 40 | 40 | 45 | 40 |
| | Perchloric Acid | 10 | NR | NR | NR | NR | NR | 65 | 60 | 65 | 65 | 65 |
| | Perchloric Acid | 30 | NR | NR | NR | NR | NR | 40 | 40 | 40 | 40 | 40 |
| | Phenol (Carbolic Acid) | 5 | | | NR | | | 45 | NR | NR | NR | NR |
| | Phenol (Carbolic Acid) | >5 | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| | Phenol Formaldehyde Resin | ALL | | | | | | 50 | 40 | 50 | 50 | |
| | Phosphoric Acid | 80 | NR | 30 | 50 | NR | 25 | 100 | 100 | 100 | 100 | 100 |
| | Phosphoric Acid Vapor & Condensate | | | | 50 | | | 100 | 100 | 100 | 110 | 120 |
| | Phosphorous Trichloride | | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| | Phthalic Acid | 100 | | | 60 | | | 100 | 100 | 100 | 100 | 100 |
| | Phthalic Anhydride | 100 | 30 | 40 | 70 | 50 | 40 | 100 | 100 | 100 | 100 | 100 |
| | Picric Acid (Alcoholic) | 10 | | | 25 | | | 45 | NR | NR | 45 | |
| | Pine Oil | 100 | | | | | | 65 | 65 | 65 | 65 | |
| | Pine Oil Disinfectant | ALL | | | | | | 50 | | | | |
| | Piperazine Monohydrochloride | | | | | | | 40 | | | | |

4 – C-glass veil and 5 mm liner recommended
5 – DION® 9100 or 6694 is preferred
6 – Check with Technical Support Lab. for recommendations

| | Chemical Environment | Conc. % | POLYLITE® 480-000 482-000 | DION® 640-000 | DION® 250-000 | POLYLITE® 680-000 | POLYLITE® 720-000 721-000 | DION® 6694 | DION® 9100 9102 9300 | DION® 9160 | DION® 9400 | DION® 9700 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P | Plating Solutions, Cadmium Cyanide | | | | | | | 100 | 80 | 80 | 80 | |
| | Plating Solutions, Chrome | | | | | | | 55 | 50 | 50 | 50 | |
| | Plating Solutions, Gold | | | | | | | 100 | 40 | 40 | 40 | |
| | Plating Solutions, Lead | | | | | | | 100 | 80 | 90 | 90 | |
| | Plating Solutions, Nickel | | | | | | | 100 | 80 | 80 | 80 | 80 |
| | Plating Solutions, Platinum | | | | | | | 80 | 80 | 80 | 80 | |
| | Plating Solutions, Silver | | | | | | | 100 | 80 | 90 | 80 | |
| | Plating Solutions, Tin Fluoborate | | | | | | | 100 | 90 | 90 | 100 | 90 |
| | Plating Solutions, Zinc Fluoborate | | | | | | | 100 | 80 | 80 | 80 | 90 |
| | Polyphosphoric Acid (115%) | | | | 30 | | | 100 | 100 | 100 | 100 | |
| | Polyvinyl Acetate Adhesive | ALL | | | | | | 50 | | 40 | 50 | |
| | Polyvinyl Acetate Emulsion | ALL | | | 25 | | | 60 | 50 | 60 | 60 | 60 |
| | Polyvinyl Alcohol | ALL | | | 25 | | | 65 | 50 | 50 | 50 | 50 |
| | Potassium Aluminum Sulfate | ALL | | | 50 | | | 100 | 100 | 110 | 110 | 120 |
| | Potassium Amyl Xanthate | 5 | | | | | | 65 | | | | |
| | Potassium Bicarbonate [2] | 10 | 25 | 40 | 60 | 40 | 40 | 75 | 65 | 70 | 70 | 70 |
| | Potassium Bicarbonate [2] | 50 | 25 | 40 | 60 | 40 | 40 | 60 | 60 | 70 | 70 | 70 |
| | Potassium Bromide | ALL | | | 60 | | | 100 | 100 | 90 | 90 | 100 |
| | Potassium Carbonate [2] | 10 | NR | NR | 25 | NR | NR | 80 | 65 | 65 | 65 | 70 |
| | Potassium Carbonate [2] | 50 | | | | | | 60 | 60 | 60 | 60 | 65 |
| | Potassium Chloride | ALL | 40 | 50 | 70 | 60 | 50 | 120 | 100 | 100 | 100 | 100 |
| | Potassium Dichromate | ALL | 25 | 25 | 35 | 25 | 25 | 120 | 100 | 100 | 100 | 100 |
| | Potassium Ferricyanide | ALL | 40 | 50 | 60 | 50 | 50 | 120 | 100 | 100 | 100 | 100 |
| | Potassium Ferrocyanide | ALL | 40 | 50 | 60 | 50 | 50 | 120 | 100 | 100 | 100 | 100 |
| | Potassium Hydroxide 2,5 | 10 | NR | NR | NR | NR | NR | 65 | 65 | 65 | 65 | |
| | Potassium Hydroxide 2,5 | 25 | | | | | | 60 | 45 | 45 | 45 | 60 |
| | Potassium Iodide | ALL | | | 25 | | | 65 | | 65 | 65 | |
| | Potassium Nitrate | ALL | 40 | 50 | 70 | 60 | 50 | 120 | 100 | 100 | 100 | 100 |
| | Potassium Permanganate | ALL | NR | NR | 30 | NR | NR | 100 | 100 | 100 | 100 | 100 |
| | Potassium Persulfate | ALL | | | 25 | | | 100 | 100 | 100 | 100 | 100 |
| | Potassium Pyrophosphate | 60 | | | | | | 65 | | 65 | 65 | |
| | Potassium Sulfate | ALL | 40 | 50 | 70 | 60 | 50 | 120 | 100 | 100 | 100 | 100 |
| | Propionic Acid | 20 | | | | | | | 90 | 90 | 90 | 90 |
| | Propionic Acid | 50 | | | | | | 80 | 80 | 80 | 80 | 80 |
| | Propylene Glycol | ALL | 40 | 50 | 70 | 60 | 50 | 120 | 100 | 100 | 100 | 100 |
| | Isopropyl Palmitate | ALL | | | | | | 100 | | 90 | 100 | |
| | Pyridine | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | |
| Q | Quaternary Ammonium Salts | ALL | | | | | | 65 | | 65 | 65 | |
| R | Rayon Spin Bath | | | | | | | 60 | | 65 | 65 | 65 |

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2 – Double synthetic veil recommended in the inner layer
3 – Double C-glass veil recommended in the inner layer


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|---|---|---|---|---|---|---|---|---|---|---|---|
| **S** | | | | | | | | | | | |
| Salicylic Acid | ALL | | | 25 | | | 65 | 60 | 65 | 70 | |
| Sea Water | | | | 60 | | | 100 | 100 | 100 | 100 | 100 |
| Sebacic Acid | ALL | | | | | | | 100 | 100 | 100 | 100 |
| Selenious Acid | ALL | | | | | | 100 | 100 | 80 | 100 | 100 |
| Silicic Acid (hydrated silica) | ALL | | | 40 | | | 120 | 120 | 120 | 120 | |
| Silver Cyanide | ALL | | | | | | 100 | 90 | 90 | 90 | |
| Silver Nitrate | ALL | NR | 25 | 50 | 30 | 25 | 120 | 100 | 100 | 100 | 100 |
| Sodium Acetate | ALL | 40 | 50 | 70 | 60 | 50 | 120 | 100 | 100 | 100 | 100 |
| Sodium Alkyl Aryl Sulfonates | ALL | | | | | | 100 | 80 | 80 | 80 | |
| Sodium Aluminate | ALL | | | | | | 65 | 50 | 65 | 70 | |
| Sodium Benzoate | ALL | | | 50 | | | 80 | 80 | 80 | 80 | 100 |
| Sodium Bicarbonate [2] | ALL | 30 | 50 | 60 | 50 | 50 | 100 | 80 | 80 | 80 | 80 |
| Sodium Bifluoride [2] | 100 | | | | | | | 50 | | | 50 |
| Sodium Bisulfate | ALL | 30 | 50 | 60 | 40 | 50 | 120 | 100 | 100 | 100 | 100 |
| Sodium Borate | ALL | | | 70 | | | 120 | 100 | 100 | 100 | 100 |
| Sodium Bromate | 5 | | | 60 | | | 45 | | 45 | 45 | |
| Sodium Bromide | ALL | | | 70 | | | 100 | 100 | 100 | 100 | 100 |
| Sodium Carbonate (Soda Ash) [2] | 10 | NR | NR | 30 | NR | NR | 80 | 80 | 80 | 80 | 80 |
| Sodium Carbonate (Soda Ash) [2] | 35 | NR | NR | NR | NR | NR | 70 | 70 | 70 | 70 | 80 |
| Sodium Chlorate | ALL | | | 30 | | | 100 | 100 | 100 | 100 | 100 |
| Sodium Chloride | ALL | | | 50 | | | 120 | 100 | 100 | 100 | 100 |
| Sodium Chlorite | 10 | | | NR | | | 70 | 70 | 70 | 70 | 65 |
| Sodium Chlorite | 50 | | | NR | | | 45 | 40 | 45 | 45 | |
| Sodium Chromate | 50 | | | | | | 120 | 100 | 100 | 100 | 100 |
| Sodium Cyanide | 5 | NR | 25 | 40 | 25 | 25 | 120 | 100 | 100 | 100 | 100 |
| Sodium Cyanide | 15 | NR | 25 | 35 | 25 | 25 | | | 65 | 100 | 100 |
| Sodium Dichromate | ALL | | | 40 | | | 120 | 100 | 100 | 100 | 100 |
| Sodium Diphosphate | 100 | | | 50 | | | 100 | 100 | 100 | 100 | 100 |
| Sodium Dodecyl Benzene Sul-fonate | ALL | | | | | | 100 | | | | |
| Sodium Ethyl Xanthate | 5 | | | | | | 65 | 65 | 65 | 65 | |
| Sodium Ferricyanide | ALL | | | 40 | | | 120 | 100 | 100 | 100 | 100 |
| Sodium Ferrocyanide | ALL | | | 40 | | | 120 | 100 | 100 | 100 | 100 |
| Sodium Fluoride [2] | ALL | | | 30 | | | 80 | 80 | 80 | 80 | 80 |
| Sodium Fluorosilicate [2] | ALL | | | | | | 50 | 50 | 50 | 50 | 65 |
| Sodium Hexametaphosphate | 10 | | | | | | 65 | 65 | 65 | 50 | |
| Sodium Hydrosulfide | 20 | | | | | | 80 | 70 | 80 | 80 | 80 |
| Sodium Hydroxide 2,5 | 1 | NR | NR | NR | NR | NR | 100 | 65 | 65 | 65 | |
| Sodium Hydroxide 2,5 | 5 | NR | NR | NR | NR | NR | 70 | 65 | 65 | 65 | |
| Sodium Hydroxide 2,5 | 10 | NR | NR | NR | NR | NR | 70 | 65 | 65 | 50 | |
| Sodium Hydroxide 2,5 | 25 | NR | NR | NR | NR | NR | 70 | 65 | 65 | 65 | |
| Sodium Hydroxide 2,5 | 50 | NR | NR | NR | NR | NR | 100 | 90 | 90 | 80 | |
| Sodium Hypochlorite 1,2,5 | 15 | NR | NR | NR | NR | NR | 50 | 50 | 50 | 50 | 50 |
| Sodium Hyposulfite | 20 | | | 30 | | | 80 | 70 | 70 | 80 | 80 |

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6 – Check with Technical Support Lab. for recommendations

S

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Sodium Lauryl Sulfate | ALL | | | | | | 90 | 80 | 80 | 80 | 80 |
| Sodium Monophosphate | ALL | | | 60 | | | 100 | 100 | 100 | 100 | 100 |
| Sodium Nitrate | ALL | 40 | 50 | 70 | 60 | 50 | 120 | 100 | 100 | 100 | 100 |
| Sodium Nitrite | ALL | | | 50 | | | 120 | 100 | 100 | 100 | 100 |
| Sodium Oxalate | ALL | | | | | | 90 | 80 | 80 | 80 | |
| Sodium Persulfate | 20 | | | | | | | 55 | 55 | | 55 |
| Sodium Polyacrylate | ALL | | | | | | 65 | 65 | 65 | 65 | |
| Sodium Silicate, pH<12 | 100 | NR | NR | 25 | NR | NR | 100 | 100 | 100 | 100 | 100 |
| Sodium Silicate, pH>12 | 100 | NR | NR | NR | NR | NR | 90 | 100 | 100 | 100 | 100 |
| Sodium Sulfate | ALL | 40 | 50 | 70 | 60 | 50 | 120 | 100 | 100 | 100 | 100 |
| Sodium Sulfide | ALL | NR | NR | 30 | NR | NR | 120 | 100 | 100 | 100 | 100 |
| Sodium Sulfite | ALL | NR | NR | 30 | NR | NR | 120 | 100 | 100 | 100 | 100 |
| Sodium Tetraborate | ALL | | | 40 | | | 100 | 90 | 80 | 80 | 90 |
| Sodium Thiocyanate | 57 | | | | | | 80 | 80 | 80 | 80 | 80 |
| Sodium Thiosulfate | ALL | | | | | | 65 | 80 | 80 | 80 | 80 |
| Sodium Triphosphate | ALL | | | 30 | | | 100 | 100 | 100 | 100 | 100 |
| Sodium Xylene Sulfonate | 40 | | | | | | | | 60 | | |
| Sorbitol | ALL | | | | | | 90 | 80 | 80 | 80 | 90 |
| Soybean Oil | ALL | | | 50 | | | 120 | 100 | 100 | 100 | 100 |
| Spearmint Oil | ALL | | | | | | 65 | 40 | 40 | 65 | |
| Stannic Chloride | ALL | 40 | 50 | 70 | 60 | 50 | 120 | 100 | 100 | 100 | 100 |
| Stannous Chloride | ALL | 40 | 50 | 70 | 60 | 50 | 120 | 100 | 100 | 100 | 100 |
| Stearic Acid | ALL | 25 | 40 | 70 | 55 | 40 | 120 | 100 | 100 | 100 | 100 |
| Styrene | 100 | NR | NR | NR | NR | NR | NR | NR | NR | 27 | NR |
| Styrene Acrylic Emulsion | ALL | | | | | | 50 | 50 | 50 | 50 | |
| Styrene Butadiene Latex | ALL | | | | | | 50 | 50 | 50 | 50 | |
| Succinonnitrile, Aqueous | ALL | | | | | | 45 | 40 | 40 | 40 | 40 |
| Sucrose | ALL | | | 60 | | | 100 | 100 | 100 | 100 | 100 |
| Sulfamic Acid | 10 | | | 40 | | | 100 | 100 | 100 | 100 | |
| Sulfamic Acid | 25 | | | 25 | | | 65 | 65 | 65 | 65 | |
| Sulfanilic Acid | ALL | | | | | | 80 | 100 | 100 | 100 | 100 |
| Sulfite/Sulfate Liquors (pulp mill) | | | | | | | 100 | 90 | 90 | 90 | |
| Sulfonated Animal Fats | 100 | | | | | | 80 | | | | |
| Sulfonyl Chloride, Aromatic | | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Sulfur Dichloride | | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Sulfur, Molten | | | | | | | 120 | | 65 | | |
| Sulfuric Acid | 0-25 | 25 | 45 | 70 | 60 | 45 | 120 | 100 | 100 | 100 | 100 |
| Sulfuric Acid | 26-50 | 25 | 40 | 60 | 40 | 40 | 120 | 80 | 80 | 80 | 80 |
| Sulfuric Acid | 51-70 | NR | NR | 30 | NR | NR | 80 | 80 | 80 | 80 | 80 |
| Sulfuric Acid | 71-75 | NR | NR | NR | NR | NR | 50 | 50 | 50 | 50 | 50 |
| Sulfuric Acid | 76-93 | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Sulfuric Acid | Fumes | | | | | | 120 | 100 | 90 | 90 | 100 |
| Sulfuric Acid/Ferrous Sulfate | 10/Sat'd | | | | | | 100 | 90 | 90 | 90 | |
| Sulfuric Acid/Phosphoric Acid | 10:20 | | | | | | 80 | 80 | 80 | 80 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| **S** | | | | | | | | | | | |
| Sulfuryl Chloride | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | |
| Superphosphoric Acid (105%$H_3PO_4$) | 100 | | | | | | 100 | 100 | 100 | 100 | |
| **T** | | | | | | | | | | | |
| Tall Oil | ALL | | | | | | 70 | 65 | 80 | 90 | 65 |
| Tannic Acid | ALL | 35 | 40 | 70 | 60 | 40 | 120 | 100 | 100 | 100 | 100 |
| Tartaric Acid | ALL | | | 60 | | | 120 | 100 | 100 | 100 | 100 |
| Tetrachloroethane | 100 | NR | NR | NR | NR | NR | | | 35 | 45 | |
| Tetrachloroethylene | 100 | NR | | 50 | NR | NR | NR | NR | 30 | 35 | |
| Tetrachloropentane | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | |
| Tetrachloropyridine | | NR | NR | NR | NR | NR | NR | NR | 30 | 35 | |
| Tetrapotassium Pyrophosphate | 60 | | | | | | 65 | 50 | 50 | 50 | 60 |
| Tetrasodium Ethylenediamine Tetracetic Acid Salts [2] | ALL | | | | | | | 60 | 70 | 65 | |
| Tetrasodium Pyrophosphate | 5 | | | | | | 100 | | 80 | 80 | |
| Tetrasodium Pyrophosphate | 60 | | | | | | 65 | 50 | 50 | 60 | |
| Textone | | | | | | | | 90 | 100 | 100 | 100 |
| Thioglycolic Acid | 10 | | | NR | | | 60 | 40 | 50 | 40 | 40 |
| Thionyl Chloride | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Tobias Acid (2-Naphthylamine Sulfonic Acid) | | | | | | | | 100 | 80 | 100 | |
| Toluene | 100 | NR | NR | 25 | 25 | NR | NR | NR | 35 | 40 | 27 |
| Toluene Diisocyanate (TDI) | 100 | NR | NR | NR | NR | NR | NR | NR | NR | | |
| Toluene Diisocyanate (TDI) | Fumes | NR | NR | NR | NR | NR | | 27 | | | 27 |
| Toluene Sulfonic Acid | ALL | | | 25 | | | 120 | 80 | 95 | 100 | 100 |
| Transformer Oils | 100 | | | | | | 100 | 100 | 100 | 100 | 100 |
| Tributyl Phosphate | 100 | | | | | | 60 | 45 | 55 | 55 | |
| Trichloroacetic Acid | 50 | | | 25 | | | 120 | 80 | 90 | 90 | 100 |
| Trichloroethane | 100 | NR | NR | NR | NR | NR | NR | 27 | 45 | 45 | 27 |
| Trichloroethylene | | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Trichloromonofluoromethane [2] | ALL | | | | | | 40 | 27 | 40 | 40 | 40 |
| Trichlorophenol | 100 | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Tridecylbenzene | ALL | | | | | | | | 50 | 50 | |
| Tridecylbenzene Sulfonate | ALL | | | | | | 100 | 80 | 90 | 90 | 100 |
| Triethanolamine | ALL | | | 25 | | | | 40 | 50 | 50 | 50 |
| Triethanolamine Lauryl Sulfate | ALL | | | | | | | | 45 | | |
| Triethylamine | ALL | NR | NR | | NR | NR | | | 50 | 50 | |
| Triethylene Glycol | 100 | | | 30 | | | 100 | 80 | 100 | 100 | 100 |
| Trimethylamine Chlorobromide | | NR | NR | NR | NR | NR | NR | NR | NR | 30 | |
| Trimethylamine Hydrochloride | ALL | | | | | | 55 | 55 | 55 | 55 | 55 |
| Triphenyl Phosphite | ALL | NR | NR | | NR | NR | 40 | | | | |
| Tripropylene Glycol | 100 | | | | | | | | 80 | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T | Trisodium Phosphate | 50 | NR | NR | 30 | NR | NR | 80 | 80 | 90 | 90 | 90 |
| | Turpentine | | | | 30 | | | 65 | 65 | 80 | 80 | 65 |
| U | Uranium Extraction | | | | | | | | | 80 | 80 | |
| | Urea | 50 | | 25 | 40 | | | 75 | 65 | 65 | 65 | 65 |
| V | Vegetable Oils | ALL | | | 40 | 30 | | 120 | 80 | 80 | 80 | 80 |
| | Vinegar | ALL | | | 35 | | | 100 | 100 | 100 | 100 | 100 |
| | Vinyl Acetate | 20 | NR | NR | NR | NR | NR | NR | NR | 30 | 30 | |
| | Vinyl Toluene | 100 | NR | NR | NR | NR | NR | | 27 | 40 | 40 | |
| W | Water, Deionized | ALL | 45 | 50 | 60 | 50 | 50 | 100 | 80 | 80 | 80 | 90 |
| | Water, Destilled | ALL | 40 | 50 | 60 | 50 | 50 | 100 | 80 | 80 | 80 | 80 |
| | Water, Sea | ALL | 50 | 60 | 60 | 60 | 60 | 100 | 80 | 80 | 80 | 90 |
| | White Liquor (pulp mill) | ALL | NR | NR | | NR | NR | | 80 | 80 | 40 | 80 |
| | Wine | ALL | | | 25 | | | | | | | |
| X | Xylene | ALL | NR | 25 | 30 | 30 | 25 | NR | NR | NR | 40 | 40 |
| Z | Zinc Chlorate | ALL | | | 50 | | | 100 | 100 | 100 | 100 | 100 |
| | Zinc Chloride | ALL | 40 | 50 | 70 | 60 | 50 | 100 | 100 | 100 | 100 | 100 |
| | Zinc Cyanide | ALL | | | | | | 80 | | | 70 | |
| | Zinc Nitrate | ALL | 40 | 50 | 70 | 50 | 50 | 120 | 100 | 100 | 100 | 100 |
| | Zinc Sulfate | ALL | 40 | 50 | 70 | 50 | 50 | 120 | 100 | 100 | 100 | 100 |
| | Zinc Sulfite | ALL | | 25 | 60 | | 25 | 120 | 100 | 100 | 100 | 100 |

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1 – DMA/ BPO curing system recommended
2 – Double synthetic veil recommended in the inner layer
3 – Double C-glass veil recommended in the inner layer


## A Selection of Standards

There are a number of industry standards referring to the design, strength and construction of GRP.

| | |
|---|---|
| ASME B31.3 | Chemical Plants and Petroleum Refinery Piping |
| ASME Section X | Pressure Vessel Code - Fiberglass-reinforced Plastic Pressure Vessels |
| ASTM D 2563-87 | Classifying Visual Defects in Glass Reinforced Plastic Laminate Parts |
| ASTM D 3299-81 | Filament Wound Glass Fiber Reinforced Thermoset Resin Chemical Resistant Tanks |
| BS 4994-1987 | Design and Construction of Vessels and Tanks in Reinforced Plastics |
| BS 6464-1984 | Reinforced Plastics Pipes, Fittings and Joints for Process Plants |
| BS 6374-1984 | Linings of Equipment with Polymeric Materials for the Process Industries Part 4 |
| BS 7159-1989 | Design and Construction of Glass Reinforced Plastics (GRP) Piping Systems for Individual Plants or Sites |
| AD-Merkblatt N1 | Druckbehalter aus Textilglasverstarkten duroplastischen Kunststoffen (GFK) |
| DIN 16965 | Rohre aus glasfaserverstärkten Polysterharzen (UP-GF) |
| EN 976-1997 | Underground Tanks of Glass-Reinforced Plastics (GRP) Horizontal Cylindrical Tanks for the Non-pressure Storage of Liquid Petroleum Based Fuels.<br>Part 1 – Requirements and Test Methods for Single wall Tanks.<br>Part 2 – Transport, Handling, Storage and Installation of Single Wall Tanks |
| EN 977-1997 | Underground Tanks of Glass-reinforced plastics (GRP). Method for One Side Exposure to Fluids |
| EN 14364-2006 | Plastics Piping Systems for Drainage and Sewage With or Without Pressure. Glass Reinforced Plastics (GRP) Based on Unsaturated Polyester Resin (UP). Specifications for Pipes, Fittings and Joints |
| EN 13121-2003 | GRP tanks and vessels for use above ground.<br>Part 1 – Raw Materials – Specification Conditions and Acceptance<br>Part 2 – Composite Materials – Chemical Resistance.<br>Part 3 – Design and Workmanship.<br>Part 4 – Delivery, Installation and Maintenance |
| NS 1545-1993 | Horizontal Cylindrical Glass Fibre Reinforced Polyester. Petroleum Storage Tanks |
| PLN 83 | Plastkärlsnormer 1983 |
| PRN 88 | Plastrorledningsnormer 1988 |
| NORSOK M-621 | GRP Piping Materials |
| UKOOA-94 | Specification and Recommended Practice for the Use of GRP Piping Offshore |

## Chemical Resistance Enquriy Form

Please send this enquiry form to your contact at Reichhold

**To:**

Reichhold ______________________ Fax: ______________________

**From:**

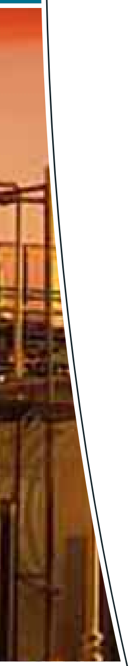
Company: ______________________

Name: ______________________

Phone/ E-mail: ______________________

Subject: ______________________

Date: ______________________



**Operating Conditions**

| Please list all chemicals: | | Concentration Min. | Normal | Max. |
|---|---|---|---|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |
| 7 | | | | |

Design temp., °C: ______________________

Operating temp. short term °C: ______________________

Max operating temp., °C: ______________________

pH: ______________________

If short term exposure, time in hours: ______________________

Pressure/ Vacuum: ______________________

Further comments: ______________________

______________________

______________________

**End product:**

Type of structure: ______________________

Manufacturing process: ______________________

Laminate thickness- wet on wet: ______________________

Required geltime: ______________________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PRIUSKA

REICHHOLD is the world's largest suppler of unsaturated polyester resins for composites and a leading supplier of coating resins for a wide variety of markets and applications.

With its world headquarters in North Carolina, USA, and 19 manufacturing sites and 4 technology centres spread around the world, Reichhold has the widest global reach of any resin supplier today.

For contact information to our sales offices and distributors in Europe, Middle East, Africa and India please see under Composites on our website www.Reichhold.com.

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