CHEMICAL PRODUCTS RESISTANCE GUIDE: SPECIFIC NOTES

(A) INTRODUCTION

AkzoNobel provides guidance on the resistance of tank linings to those products which are commonly stored in bulk quantities.

Maximum Temperature + Notation = storage of product subject to the conditions of the specific cargo notes itemized e.g , 50°C (122ºF) / Notation 1,4 = Recommended for a maximum storage temperature of 50°C (122ºF), provided the requirements of Notes 1 and 4 are met.

NR = Not recommended for this service

NT = Testing is required to determine if this product is suitable for this service.

Recommendations are based on laboratory test data, field service and/or practical experience.

For optimum performance, the coating systems included in the Chemical Resistance Guide should only be applied in accordance with the product technical datasheet (TDS) and Application Guideline.

Products in this guide are listed alphabetically except where prefixed by a numeric which then takes precedence.

All concentrations listed are aqueous, unless otherwise noted.

(B) PRIMERS

The resistance quoted in the guide refers to the coating system being applied directly to steel that has been prepared to the standard quoted on the product data sheet or over an approved primer. For any other standard of surface preparation, substrate or use of primers, consult AkzoNobel.

(C) PRODUCT STORAGE TEMPERATURE

Products which are viscous liquids or semi-solids at normal temperatures, and which are heated to facilitate loading and unloading, have been examined at elevated temperatures.

“Recommended storage products, Unrestricted” products of this type can be stored under normal product handling conditions.

In tanks where heating coils are fitted, the heating coil brackets should be of stainless steel. The heating coils must be electrically insulated from the brackets to avoid any electrolytic action which would give rise to bi-metallic corrosion.

Actual loading and unloading may be carried out at temperatures 10°C (18ºF) higher than the storage temperature. However, the time at these higher temperatures should be kept as short as possible and should not, in any case, exceed 48 hours. AkzoNobel should be consulted when storage/handling at higher temperatures than those indicated is required.

(D) BEVERAGES AND POTABLE LIQUIDS

The coating systems itemised in this Product Resistance Guide are resistant to many of this group of products, However, AkzoNobel does not accept responsibility for any taste or odour imparted to stored products from the coatings or any products retained within the coatings unless specifically certified for use.

Drinking water accreditation is available for specific applications.

Since regulatory approvals for food/water contact vary by country and region, please consult AkzoNobel for the status of approvals in your area of use.

(E) COATING DISCOLOURATION

Some stored products, such as crude chemicals and carbon containing materials, may cause discolouration or staining of the surface of the coating under certain storage conditions. Coatings may also become discoloured by dyes etc. which are added to products (e.g., to petroleum products for tax exemption purposes). Whatever the cause, this colour change does not normally affect the chemical resistance properties of the coating. Cleaning of the discoloration or staining may be difficult if not impossible.

Cleaning chemicals which are available may remove surface discolouration; however, thorough cleaning, after chemical cleaning of the surface may be required to minimise any effect this may have on subsequent product storage.

AkzoNobel does not accept responsibility for discolouration of the coating caused by product storage or the effect of this on subsequent products.

(F) TANK CLEANING

AkzoNobel does not advise on methods of tank cleaning, except where cleaning methods may cause damage to the coating. Expert advice should be sought from one of the specialist tank cleaning companies.

Before use, any cleaning chemicals should be tested to determine if they have any detrimental effect on the lining material.

(G) HIGH TEMPERATURE PRODUCT STORAGE

Care must be taken when storing high temperature cargoes. Where large temperature differentials exist between the cargo and external tank wall there is a danger of the tank coating system being adversely affected due to cold wall thermal shock. If temperature differences are in excess of 30ºC (54°F), it is recommended that the tank is insulated to reduce thermal gradient.

(H) CURING OF TANK COATING SYSTEMS

In order to ensure maximum chemical resistance properties, all tank coating systems must be cured under good conditions. Curing is a complex process involving both release of solvent, then chemical reaction. It is particularly sensitive to both substrate temperature and ventilation rate. The time/temperature relationships for cure and chemical resistance, which are given in the AkzoNobel product data sheets and application procedures, assume a high level of vigorous ventilation. Proper ventilation during application and cure of tank linings is absolutely critical. Ventilation must be forced (mechanical) in nature and must be configured to exhaust heavier than air solvent vapours from the lowest area. Improper ventilation during application and cure will adversely affect the performance and service life of the coating system.

It should be noted that failure to observe the specified curing conditions prior to cargo immersion may have a permanent adverse affect on the resistance

(I) STORAGE OF MONOMERS

For the purposes of this guide, it is assumed that all monomers that are being stored are inhibited.

(J) STORAGE OF JET FUELS

The Resistance Guides lists products that have been found to be chemically resistant to jet fuels. However, the use of a lining inside a jet fuel storage tank may require a specific approval from a military or commercial organization. Please consult AkzoNobel for the latest information on Jet Fuel approvals.

(K) METHANOL AND ETHANOL STORAGE

Methanol and ethanol products must be pure, (contamination with acetaldehyde, formaldehyde, formic acid, acetone and acetic acid should be below 100ppm per content). The pH of ethanol should be between 4 and 7 (for zinc silicate lined tanks the pH should be between 5.5 and 7).

The maximum permissible water content in methanol is 0.10% or 1000ppm.

CHEMICAL PRODUCTS RESISTANCE GUIDE: PRODUCT NOTES

1. WATER MISCIBLE CARGOES

These must only be stored in perfectly dry tanks and no water must be present in the storage product.

This is an additional recommendation for all lining opportunities requiring zinc silicate linings.

2. VEGETABLE AND ANIMAL OILS AND FATS

This note and the associated acid values refers solely to cargoes of vegetable and animal oils origin containing natural blends of oils and fatty acids. For pure fatty acid cargoes e.g. octanoic/caprylic acid please refer to the resistance guidance notation for the specific cargo.

Maximum free fatty acid content is 10% (27 mgKOHg-1) unless otherwise stated in the table below.

Product	Notation	Max Storage Temperature (°C)	Max Acid Value ($mgKOHg^{-1}$) (ISO 3682-1983(E))	Max Free Fatty Acid (% Wt)
Interline 984/984C	2	50	137 $mgKOHg^{-1}$	50%
		71	27 $mgKOHg^{-1}$	10%
Interline 994	2	71	No Limit	100%
Enviroline 405HTR	2	71	137 $mgKOHg^{-1}$	50%
		82	7 $mgKOHg^{-1}$	2.5%
Ceilcote 232, 282HB.	2	82	No Limit	100%
Ceilcote 242HB.	2	60	No Limit	100%

When oils and fats are contaminated with water they become much more aggressive due to an increase in FFA content. For this reason, the moisture and insolubles/impurities content should not exceed 1.0% for organic epoxy based systems, this does not apply the Vinyl Ester and Novolac Vinyl Ester products.
Oils and fats must be free of any mineral acid for organic epoxy based systems.

Loading and unloading may be carried out at a temperature of up to 10°C higher than the specified maximum storage temperature. The time at the higher temperature should be kept as short as possible and must not exceed 48 hours for each operation.

Free fatty acid content of a product may increase on ageing or moisture contamination. Elevated storage temperatures also increase free fatty acid content, especially for lard and tallow. It is advisable to check the pH of such materials before storage in zinc silicate lined tanks. A pH range of 5.5 to 10 is acceptable.

If zinc silicates are considered it is advisable to check the pH of such materials before storage in zinc silicate lined tanks - pH range of 5.5 to 10 is acceptable and acid values below 1.5-2.5% ($5mgKOHg^{-1}$).

3. CAUSTIC PRODUCTS

Dilute caustic solutions can be very aggressive towards tank linings.

Tanks/vessels must be cleaned thoroughly after the storage of caustic products. Dilute residues must not be left in the tank after cleaning has been completed. The pH of the final rinse water must be in the range of 6.8 to 7.2.

Ceilcrete and Coroline products require a carbon filler for hot (>49ºC [120ºF]) caustic service. Flakeline products may require a resin topcoat or graphite filler for caustic service. Ceilcote Lining series require a synthetic veil.

4. HYDROLYSABLE PRODUCTS

These products are susceptible to hydrolysis in the presence of water to form acidic compounds which are potentially damaging to the coating. Esters and chlorinated compounds must be stabilized and be kept free of moisture contamination. Moisture content must not exceed 0.01% (100ppm).

These products are only acceptable if they are pure, essentially neutral and are carried under completely dry conditions.

These products must only be stored in perfectly dry tanks.

5. CARGO CONTAMINATION

The use of zinc silicate tank lining may present “zinc” pick up problems (metallic zinc) and care is necessary, in particular when foodstuffs and aviation fuel products are to be stored.

Curing, ventilation and washing methods, as detailed in the specific tank lining Application Guideline must be followed to prevent unwanted contaminants leaching into the stored product.

6. CRUDE OILS AND DERIVATIVES

Where hydrogen sulphide levels exceed 300 ppm and high neutralization numbers (>0.4) are present, please consult AkzoNobel technical department for further advice

7. AMINES

These amines can be stored when free from moisture. If water is present, the alkalinity may increase to a pH higher than 10. The maximum water content is 0.05% (500ppm). To prevent contamination by water, both the product and the tank must be completely dry at the time of loading and the product should preferably be stored under a dry nitrogen gas-blanket.

8. IMMERSION AT TEMPERATURES EXCEEDING 200ºF (93ºC)

This product has been demonstrated to be suitable in this service at temperatures exceeding 93ºC (200ºF). Since high temperature service resistance is dependent on the very specific immersion, temperature and pressure conditions, please consult AkzoNobel regarding the suitability for your particular service conditions.

9. MOLASSES AND OTHER SUGARY SOLUTIONS IN ORGANIC LININGS

Dilute solutions of molasses and other sugary solutions may ferment leading to the formation of acids. In order to prevent coating attack, these residues must be diluted to a neutral pH (6.8 – 7.2) and removed from the tank within 24 hours.

This process is faster at elevated temperature.

The cargo can be carried provided the following:

- The pH is higher than 4.0.
- The temperature does not exceed 50ºC (122ºF).

10. POST CURING

For highly aggressive products and service environments identified with a “10” notation in the Cargo Resistance Guide, post curing is mandatory in order to achieve the degree of chemical resistance required.

Before beginning the post cure process, a minimum coating cure period is required at the ambient temperature prevailing. Details of time requirements can be found in the specific tank lining Application Guidelines.

It is recommended that post curing is carried out as soon as possible after application and within a maximum period of 3 months.

11. GENERICALLY IDENTIFIED MATERIALS

These products are believed to be suitable for storage in the indicated tank lining since they seem to be generically similar to products successfully stored. Since the composition may vary, a detailed specification for the product to be stored must be supplied to AkzoNobel – a recommendation on the product notation can usually be made without testing, however in some cases confirming tests may be required.

12. METHANOL AND ETHANOL STORAGE

Methanol and ethanol products must be pure, (contamination with acetaldehyde, formaldehyde, formic acid, acetone and acetic acid should be below 100ppm per content). The pH of ethanol should be between 4 and 7 (for zinc silicate lined tanks the pH should be between 5.5 and 7).

The maximum permissible water content in methanol is 0.10% (1000ppm).

13. ORGANIC FATTY ACIDS

Organic fatty acids hydrolyze in the presence of water to form very aggressive acidic by-products. Products such as tall oil fatty acid, palm oil fatty acid etc must be kept stabilized and moisture free. The water content must be limited to 1% (10,000ppm). No traces of inorganic (mineral) acids are allowed.

14. HYDROFLUORIC ACID, FLUORIDES AND HYPOCHLORITES

These chemicals will attack fibreglass and silica fillers synthetic veils, carbon fillers or resin topcoats may be required for protection. Consult AkzoNobel for options.

15. DISCOLOURATION OF ACIDS ON STORAGE

Certain acids, such as concentrated hydrochloric, sulphuric and phosphoric acid may darken in colour when stored in contact with a lining for long periods of time. The level of discoloration will depend on the age of the lining, concentration and storage temperature of the acid, the frequency of loading/unloading the storage vessel and the duration of storage.

16. BIODIESEL (FATTY ACID METHYL ESTER/FAME)

Biodiesel must comply with ASTM D6751 or EN14214. Water content must be less than 0.05% by volume (ASTMD2709) or 500 mg/kg (EN ISO 12937). Acid value must be less than 0.5 mgKOH/g (ASTM D664 or EN 14104) and methanol content must be less than 0.2% (EN 14110).

17. ACID CHEMICALS

Certain substances such as crude methanol and fermentation ethyl alcohol may contain acidic impurities which may damage linings. Pitting corrosion and iron pick up of the cargo may occur if the lining is damaged.

- Organic chemicals with acidic impurities should be avoided as a cargo.
- Possible coating damage/defects should be repaired to avoid pitting corrosion and iron pick up.

Aqueous products (eg fruit juices) may contain high amount of acid. These acids may be aggressive towards the lining. Pitting corrosion may occur and the quality of the cargo maybe affected (eg off taste due to iron pick up) if the coating is damaged.

18. STORAGE OF FOODSTUFFS AND POTABLE LIQUIDS

When using linings in contact with food and potable liquids (including vegetable oils, corn syrup and alcoholic beverages) additional procedures will be required before returning to service to ensure that the risk of tainting is reduced. For Interline 994 and Interline 850 it is recommended that the tank is fully ventilated with warm air prior to service. An additional warm water soak may also be necessary. Whilst Ceilcote 242 has been tested in liquid foodstuffs - there is a risk of tainting due to retention of small amounts of monomeric styrene - for this reason it is not recommended to use this material in contact with potable liquids.

19. HIGH TEMPERATURE BRINE IMMERSION

It is strongly recommended that vessels operating at such high temperatures are fitted with appropriate insulation. For such environments, surface cleanliness prior to product application is critical. A maximum soluble salts level of 2.5µg/cm2 should be achieved.

20. Terephthalic Acid

Restrictions apply to the transportation of (Purified) Terephthalic Acid due to the possibility of aggressive contaminants from production such as acetic acid and other catalysts. A maximum loading temperature of 60°C (140°F) must be observed and levels of impurities must not exceed the following:

I. **Levels of unreacted catalyst and acetic acid must not exceed 0.4%**
II. **Levels of volatile content including water must not exceed 0.4%.**

21. MAXIMUM DFT

For service in this cargo, this lining should be restricted to a maximum DFT of 500µm (20mils) - please consult your regional linings technical representative.

22. MINIMUM DFT

For service in this cargo, this lining should be restricted to a minimum DFT of 2000µm (79mils) - please consult your regional linings technical representative.

IMPORTANT NOTES

In accordance with our policy of continuous product development the information in this document may be modified from time to time and you should check with your local AkzoNobel representative that you have the most up-to date version.

The latest version can also be downloaded from our website: www.International-pc.com.

Failure to comply with the requirements of the latest version of this chemical product resistance guide that apply to the products to be stored will invalidate any guarantee given by AkzoNobel for the coating system as applied to the storage tank or vessel.

Subject to the above, all products supplied and technical advice given, are subject to AkzoNobel's standard conditions of sale.