

GEOMEMBRANES

ALDERPRUFE TUFLEX



Features

Excellent Barrier Properties

High Puncture Resistance

Exceptional Multiaxial Stress and Strain Properties

Good Tear Resistance

High Surface Friction

Good Low Temperature Behaviour

Low Coefficient of Thermal Expansion

Very Good Chemical Resistance

Very Good UV Resistance

Excellent Environmental Stress Crack Resistance (ESCR)

Excellent Welding Properties - Wide Seaming Temperature Window

General Description

Alderprufe Tuflex is a single layer cold applied geomembrane suitable for environmental protection to structures, containments and cut-off trenches.

Alderprufe Tuflex combines excellent chemical resistance with low flexural modulus to provide a malleable, flexible membrane suitable for non-smooth surfaces and factory prefabrication to optimise on-site installation.

Alderprufe Tuflex is the ideal membrane for building protection systems and cut-off trench containment particularly on contaminated sites which would otherwise prove too difficult or costly to develop.

Building Protection Membrane

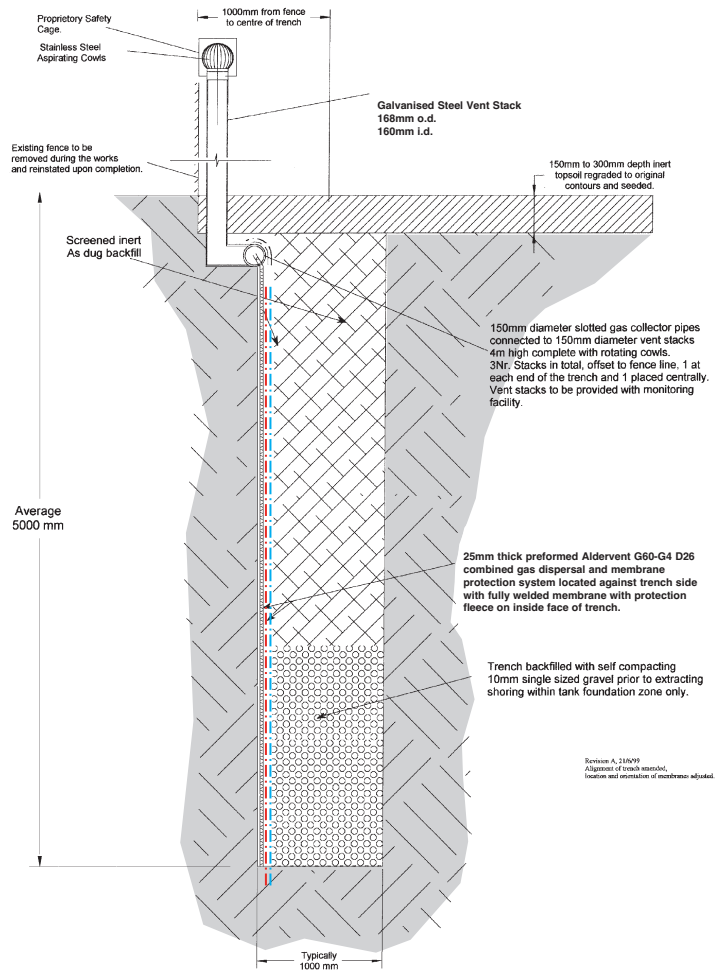
Applied as a Gas Barrier Membrane to protect the building against the ingress of all land borne gases - Methane, Carbon Dioxide and Radon. Tuflex is laid in a single layer over a prepared site. Due to its inherent weldability and on site quality assurance monitoring, the membrane is recommended to be laid by trained operatives certified for the purpose. On smaller sites factory fabricated panels can be supplied for application by others. Applied to cover the whole of the slab area above Aldervent gas ventilation system if required.

All membrane penetrations (i.e. steel stanchions and service entry points) to be sealed with factory formed units welded to the membrane on site.

At all points where the membrane passes through load bearing walls, Aldercourse Tuflex DPC or GRA DPC is installed and welded to the overlying Tuflex membrane.



Pressure testing of welded joints
(part of standard CQA procedures)



Membrane Protection

Protect finished membrane with Geotex or Alderway protection mats if following trades are erecting steel fabrication for slab reinforcement.

All punctures to be repaired by a minimum overlap of 150mm.

Cut-off Trench Containment

Alderprufe Tuflex has been successfully installed up to 8 metres deep as a vertical barrier to contain contaminants and gases on brown fields sites and around landfill.

Installed by accredited contractors.

Bespoke systems have been designed to suit site specific parameters.

Trilaminate membranes with exceptionally high puncture resistance are available.

Cut-off trenches for contaminant control, with large volume gas and liquid dispersal properties, are possible, utilising Aldervent Geogrid, Geovoid, or Geocell systems. (see separate data sheets.)



This product satisfies the criteria set out in BS 6920: Part 1: 1996 "Specification" and thus complies with the requirements of the Water Bylaws Scheme Tests of Effect on Water Quality (BS 6920: 1996). It is suitable for use with cold but not hot water.

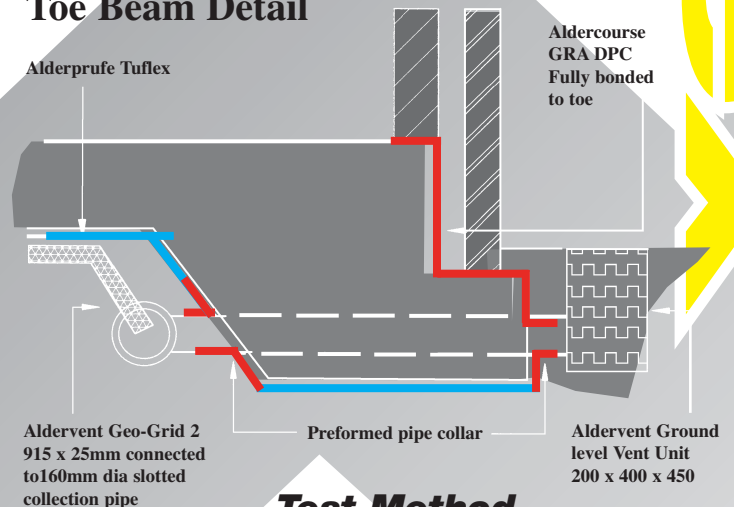
In-service performance

The demands made on Alderprufe Tuflex in landfill, water containment or pollution control are considerable. The flexibility of Alderprufe Tuflex is due to the polymeric structure of the resin. There are no plasticisers in the Alderprufe Tuflex formulation that can be leached out by exposure to chemicals or sunlight causing the membrane to become brittle.

Design and Specification

All Alderprufe Tuflex systems carry Product Guarantee Insurance including efficacy cover. Bespoke system designs with third party accreditation including P.I. cover are available to the developer to offer full security and warranties.

Toe Beam Detail



Test Method

| | | | | |
|--|-----------|--|-----------|---|
| Thickness mm +/- 10% | 0.75 | 1.0 | 1.5 | ASTM D - 751 |
| Density g/cm ³ | 0.9 | 0.9 | 0.9 | ASTM D - 792 |
| Tensile Stress @ break Min N/mm ² | 13 | 18 | 26 | ASTM D - 638 |
| Elongation @ Break % | >700 | >700 | >750 | ASTM D - 638 |
| Puncture Resistance Min N | 120 | 150 | 200 | FTMS 101C Method 2065 |
| Tear Resistance Min N | 45 | 60 | 90 | ASTM D - 1004 |
| Dimensional Stability | +/-2% | +/- 2.0 | +/-2% | ASTM D - 1204 |
| % Change Max | | | | 1 Hr @ 1000C |
| Stress Crack Resistance | 100% | 100% | 100% | ASTM 5397 |
| Volatile Loss 5% | 0.2 | 0.2 | 0.2 | ASTM D - 1203 |
| Loss Max | | | | Method A |
| Ozone Resistance | No cracks | No Cracks | No Cracks | ASTM D - 1149 |
| Carbon Black Content | 2-3% | 2 - 3% | 2-3% | ASTM 1063 |
| Moisture Vapour g/m ² /day | <0.01 | < 0.1 | <0.01 | ASTM E96 |
| Friction Angle (Non Woven Geotextile) | | 21 ^o | | Shear Box |
| Methane Permeability | 0.14 | 0.11 | 0.007 | European standard g/m ² /day/atm |
| Methane Transmission Rate | | 1.8 x 10 ⁻⁹ m ³ /m ² /s/atm | | BRE |
| Permeability Coefficient | | 1,8 x 10 ⁻¹² | | |





Alderprufe Tuflex possess exceptional flexibility, tear and puncture resistance qualities for all water containment projects, even at very low temperatures.

Ornamental ponds and water storage lakes used in landscaping and irrigation projects utilise the special attributes of the Alderprufe Tuflex geomembrane.



Alderprufe Tuflex geomembranes are used as liners and capping to contain both the gas and liquids produced by a landfill operation. The multiaxial strain qualities of Alderprufe Tuflex are so good that the geomembrane will resist out of plane forces caused by subsidence which occurs with differential waste consolidation and unstable site substrates



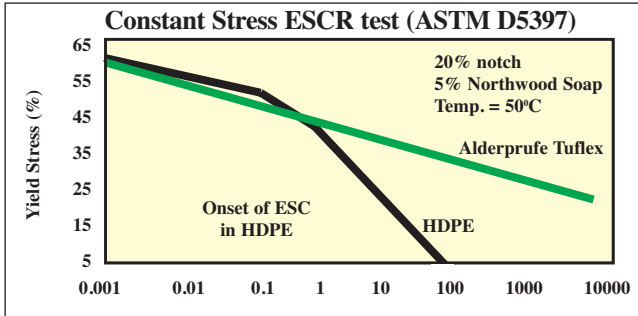


The flexibility of Alderprufe Tuflex geomembranes ensures that most ponds, ditches, lagoons, lakes and dams can be lined including those with inherently complex shapes.

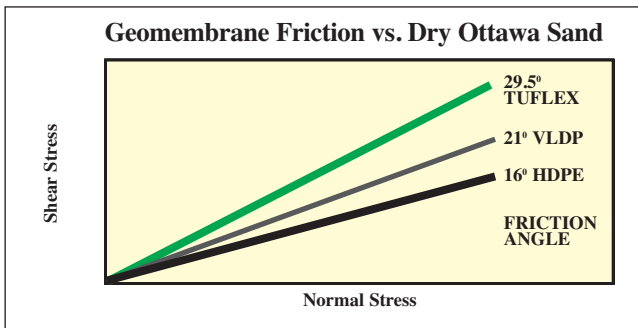


The exceptionally wide seaming temperature window ensures a reliable weld is achieved in most weather conditions. Fluctuations in temperature are not as critical as they are with other geomembranes.

Environmental Stress Crack Resistance (NCTL)



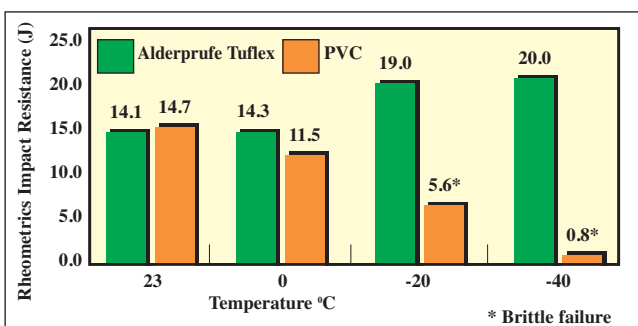
Comparative Friction Angles



Alderprufe Tuflex possesses outstanding environmental stress crack resistance compared to other materials. Alderprufe Tuflex also retains its flexibility at low temperatures and does not become brittle even at temperatures as low as -40°C. This feature is particularly important as it enables the Geomembrane to be handled or installed during severe weather conditions or at high altitude.

The friction angle of Alderprufe Tuflex measured by this method is higher than that of all the commonly used smooth geomembrane materials. This allows the construction of steeper side slopes, increasing the capacity and, in the case of landfills, speeding up waste settlement.

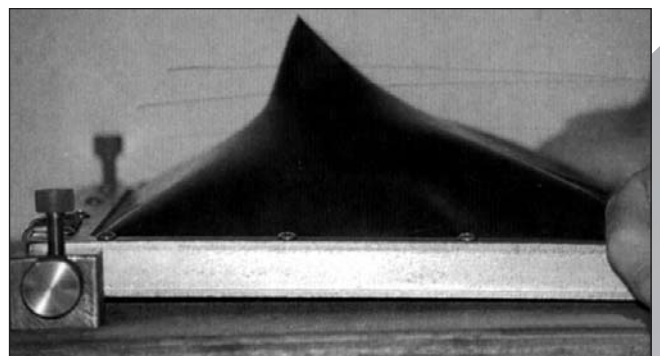
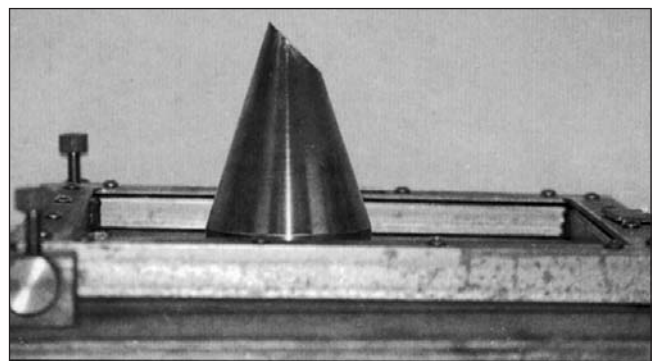
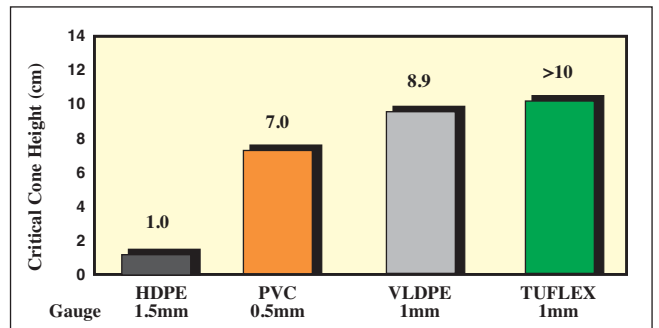
Low Temperature Impact Resistance



Puncture Resistance Truncated Cone

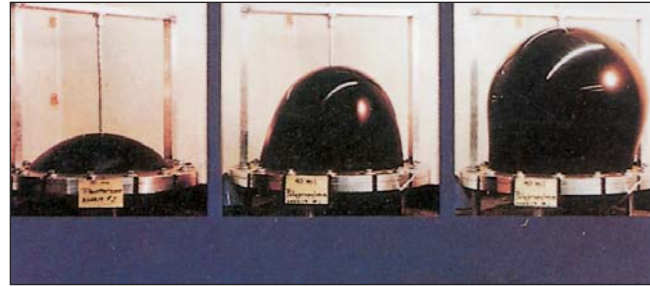
Alderprufe Tuflex, when placed under load on uneven or rocky substrates, has an exceptionally high puncture resistance. It even exceeds the specifications of GRI test method GM - 3 and possesses the highest puncture resistance of all geomembrane materials measured by this test.

Alderprufe Tuflex readily conforms to projections and deforms easily when under static load. Stresses are evenly distributed throughout the material's structure as it deforms thus allowing the membrane to maintain its "barrier" properties when subjected to both short and long term static loads.



TUFLEX

Large Scale Multiaxial Stress-Strain Test

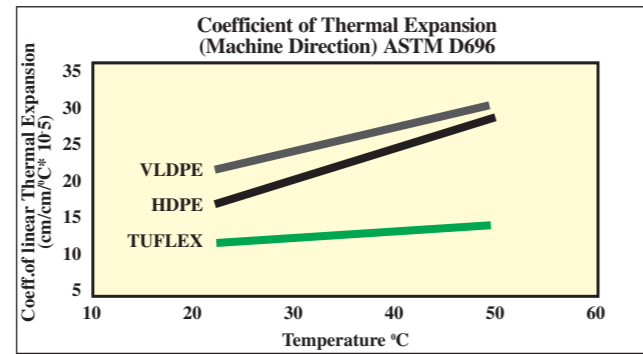


One of the most noteworthy features of Alderprufe Tuflex is the inherent ability to elongate when subjected to out of plane stresses. Localised deformation typically occurs in a landfill capping as the solid waste subsides or under slabs as piled sites are subject to ground subsidence.

The outstanding multi-axial performance of Alderprufe Tuflex is most beneficial in these applications where a high degree of subsidence is anticipated.

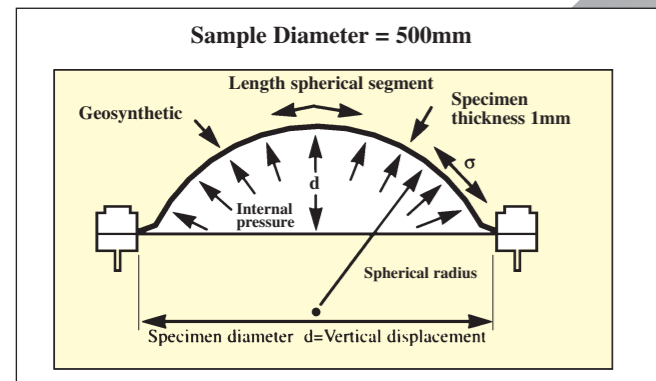
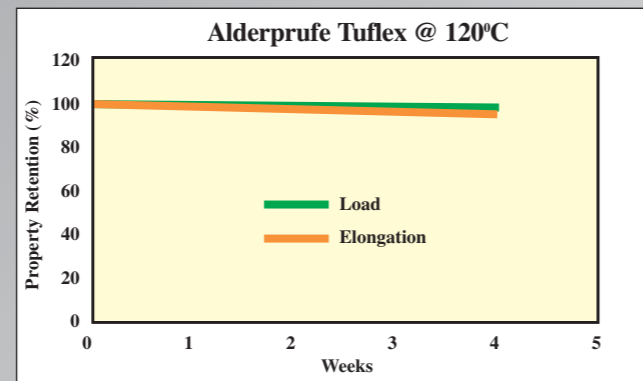
the excellent multi-axial elongation demonstrated by Alderprufe Tuflex indicates that it can accommodate more differential settlement than other membranes.

Coefficient of Thermal Expansion

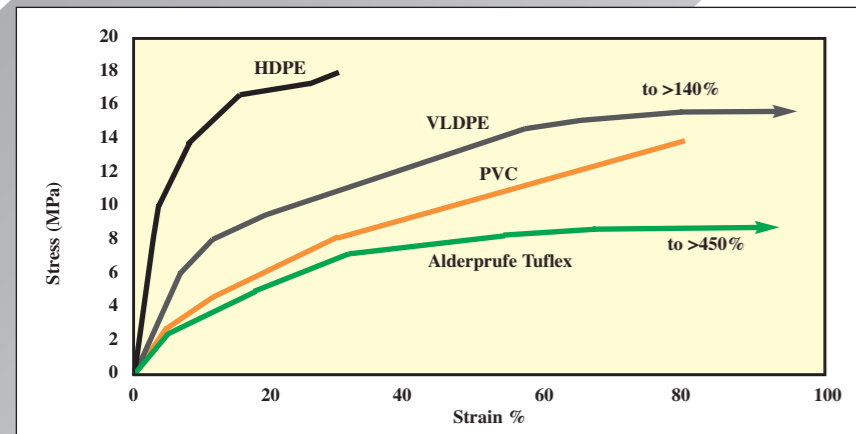


Alderprufe Tuflex has an unusually low coefficient of thermal expansion (CLTE), as little as half that of some other geomembranes. During installation, Alderprufe Tuflex geomembrane does not expand or contract as much and therefore forms fewer and smaller wrinkles. Also, placement of cover material may be simplified since the liner has a better tendency to lay flat. These factors lead to easier and higher quality installations.

Thermal Ageing tests of Alderprufe Tuflex Geomembranes



Geomembrane Multi-axial Stress-Strain Behaviour



The high melting point of Alderprufe Tuflex makes it particularly suitable for environments such as black liquor effluent ponds with operating temperatures of 70°C and solar ponds where liners must withstand temperatures fluctuating from 10° - 80°C. Alderprufe tuflex maintains its mechanical properties across an unusually broad range of temperatures.

TUFLEX-P CHEMICAL RESISTANCE

The following chemical resistance values are provided only as a guide

| Chemical | Concentration | Temperature °C | Resistant |
|----------------------------------|---------------|----------------|-----------|
| A | | | |
| Acetic acid | 100% | 50 | S |
| Acetic anhydride | 100% | 50 | S |
| Acetone | 100% | 50 | S |
| Acrylonitrile | 100% | 50 | S |
| Aluminium hydroxide | | 23 | S |
| Aluminium sulphate | 38% | 23 | S |
| Ammonia water (conc) | 100% | 30 | S |
| Ammonium chloride | 30% | 50 | S |
| Ammonium hydroxide | 100% | 23 | S |
| Ammonium nitrate | 50% | 50 | S |
| Ammonium phosphate(monobasic) | 20% | 50 | S |
| Ammonium phosphate (di-basic) | 24% | 30 | S |
| Ammonium sulphate | 43% | 30 | S |
| Amyl acetate | 100% | 30 | U |
| Amyl alcohol | | 30 | S |
| Aniline | | 30 | S |
| B | | | |
| Barium Chloride | 27% | 30 | S |
| Barium Hydroxide | 20% | 30 | S |
| Barium Sulphate | sat | 30 | S |
| Benzene | | 23 | U |
| Benzyl alcohol | | | S |
| Boric acid | 5% | 30 | S |
| N-butanol | 100% | 30 | U |
| Butyraldehyde | | | |
| C | | | |
| Calcium carbonate | sat | 50 | S |
| Calcium chloride | 50% | 30 | S |
| Calcium hydroxide | 100% | 23 | S |
| Chloroacetic | 25% | 30 | S |
| Chloroform | 100% | 23 | U |
| Chlorosulphonic acid | 98% | 30 | U |
| Chromic acid | 50% | 30 | U |
| Citric acid | 33% | 30 | S |
| Cresol (Meta) | | | U |
| Cupric chloride | sat | 30 | S |
| Cupric sulphate | sat | 50 | S |
| Cyclohexane | 100% | 30 | U |
| Cyclohexanol | | | |
| D | | | |
| Decalin | | 30 | U |
| Di-butyl phthalate | | 30 | S |
| Di-ethyl ether | | | U |
| Di-octyl phthalate | | 30 | S |
| Dimethylamine | 40% | 23 | S |
| E | | | |
| Ethanediol | 40% | 23 | S |
| Ethanol | | | |
| Ethanol | 100% | 23 | S |
| Ethyl acetate | | | |
| Ethyl acetate | 50% | 23 | S |
| Ethyl alcohol (denatured) | | | |
| Ethyl alcohol (denatured) | | 30 | S |
| Ethylene glycol | | | |
| Ethylene glycol | 100% | 23 | S |
| F | | | |
| Ferric chloride | 15% | 30 | S |
| Ferric sulphate | 17% | 30 | S |
| Formaldehyde | 37% | 23 | S |
| Formic acid | 99% | | U |
| Furfural | | 30 | S |
| G | | | |
| Gasoline | 35% | 23 | U |
| Glycerine | | 30 | S |
| H | | | |
| Hexane | 100% | 23 | U |
| Hydrochloric acid | | 30 | S |
| Hydrofluoric acid | 40% | 30 | S |
| I | | | |
| Indolene | | | U |
| Iso-butyaldehyde | | | U |
| Isoctane | | | U |
| Isopropanol | 30% | 23 | U |
| Iso-propyl ether | | | U |
| K | | | |
| Kerosene | 100% | | U |
| L | | | |
| Lactic acid | pure | 50 | S |
| Linseed oil | | | U |
| M | | | |
| Magnesium chloride | sat | 30 | S |
| Methanol | 50% | 23 | S |
| Methylene chloride | 100% | 23 | U |
| Methyl acetate | | | U |
| Methyl alcohol | | | S |
| Methyl ethyl ketone | | | U |
| Methylisobutylketone | 60% | 23 | S |
| Methyl methacrylate | | | U |
| N-methylmorpholine oxide | 60% | 23 | S |
| N | | | |
| Nickel chloride | 33% | 30 | S |
| Nickel sulphate | 50% | 30 | S |
| Nitric acid | 38% | 30 | S |
| Nitric acid | 65% | | U |

TUFLEX-P CHEMICAL RESISTANCE

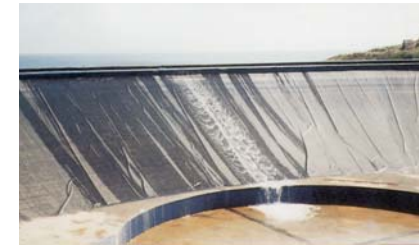
The following chemical resistance values are provided only as a guide

| Chemical | Concentration | Temperature °C | Resistant | Chemical | Concentration | Temperature °C | Resistant |
|-------------------------|---------------|----------------|-----------|------------------------------|---------------|----------------|-----------|
| Nitrobenzene | | | U | Sodium hydroxide | 50% | 23 | S |
| N-n-di-methyl formamide | | | | Sodium hydroxide | 100% | 50 | S |
| O | | | | Sodium hyperchloride | 20% | 30 | S |
| Oil ASTM 1 | pure | | U | Sodium hyperchlorite | 20% | 30 | S |
| Oil ASRM 2 | pure | | U | Sodium nitrate | 43% | 30 | S |
| Oil ASTM 3 | pure | | U | Sodium phosphate (monobasic) | 43% | 30 | S |
| Oil OB/22-AT | 35% | | U | Sodium sulphate | 40% | 30 | S |
| Oil of Linseed | pure | 30 | U | Sodium thiosulphate | 45% | 30 | S |
| Oil of olive | pure | 23 | U | Solna 100 | 30% | 23 | U |
| Oil of chicken | pure | 23 | U | Stearic acid | 100% | 50 | S |
| Oil of beef | pure | 23 | U | Sulphuric acid | 35% | 23 | S |
| Oil of pork | pure | 23 | U | Sulphuric acid | 50% | 50 | S |
| Oleum | | | U | Sulphuric acid | 96% | | U |
| Oxalic acid | 10% | 30 | S | T | | | |
| P | | | | Tannic acid | 10% | 30 | S |
| Pentane | pure | 23 | U | Tartaric acid | 20% | 30 | S |
| Phenol | sol. | 30 | S | Tetralin | 100% | 23 | U |
| Phosphoric acid | 85% | 30 | S | Tin chloride | 62% | 30 | S |
| Potassium bi-chromate | 20% | 30 | S | Toluene | pure | 50 | U |
| Potassium bromide | sat. | 23 | S | Tri-butyl phosphate | | | U |
| Potassium chloride | 27% | 30 | S | Trichloroethylene | pure | 50 | U |
| Potassium hydroxide | 50% | 30 | S | Triethanolamine | | 30 | S |
| Potassium iodide | 57% | 30 | S | V | | | |
| Potassium phosphate | 17% | 30 | S | Vaseline oil | pure | 30 | U |
| Potassium sulphate | 11% | 30 | S | W | | | |
| N-propanol | pure | 23 | S | Wine | pure | 30 | S |
| Propionic acid | 100% | 23 | S | X | | | |
| Propyl ether | | | U | Xylene | pure | 30 | U |
| N-propyl nitrate | | | U | | | | |
| Pyridine | | | U | | | | |
| S | | | | | | | |
| Sodium chloride | sat. | 23 | S | | | | |

CODE:
 S = Satisfactory
 L = Limited application possible
 U = UNSATISFACTORY
 - = Not tested

CONCENTRATION:
 Sat. sol. = Saturated aqueous solution

prepared at 20°C (68°F)
 sol = aqueous solution with concentration above 10% but below saturation level
 dil. sol = diluted aqueous solution with concentration below 10%
 cust. conc = customary service concentration



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