

## Physical Properties

The following table displays physical properties of 3mm (0.12 inch) PALSUN and PALTUF sheets.

| Property                                | Method**    | Conditions<br>(U.S. Customary)* | Units - SI<br>(U.S. Customary)*         | Value<br>(U.S. Customary)* |
|---|-------------|---------------------------------|---|----------------------------|
| <b>Physical</b>                         |             |                                 |   |                            |
| Density                                 | D-792       |                                 | g/cm <sup>3</sup> (lb/ft <sup>3</sup> ) | 1.2 (75)                   |
| Water Absorption                        | D-570       | 24 hr. @ 23°C                   | %                                       | 0.15                       |
| <b>Mechanical</b>                       |             |                                 |   |                            |
| Tensile strength at yield               | D-638       | 10 mm/min (0.4 in./min)         | MPa (psi)                               | 62.3 (9,100)               |
| Tensile strength at break               | D-638       | 10 mm/min (0.4 in./min)         | MPa (psi)                               | 65 (9,500)                 |
| Elongation at yield                     | D-638       | 10 mm/min (0.4 in./min)         | %                                       | 6                          |
| Elongation at break                     | D-638       | 10 mm/min (0.4 in./min)         | %                                       | >80                        |
| Tensile Modulus of Elasticity           | D-638       | 1 mm/min (0.4 in./min)          | MPa (psi)                               | 2,300 (290,000)            |
| <b>Flexural Modulus</b>                 |             |                                 |   |                            |
| Flexural Strength at Yield              | D-790       | 1.3 mm/min (0.052 in./min)      | MPa (psi)                               | 93 (13,600)                |
| Notched Impact Strength (Iod)           | D-256       | 23°C (73°F)                     | J/m (ft lbf/in)                         | 800 (15)                   |
| Notched Impact Strength (Charpy)        | D-256       | 23°C (73°F)                     | J/m (ft lbf/in)                         | 800 (15)                   |
| Impact Falling Weight                   | ISO-6603/1b |                                 | J (ft lbf)                              | 158 (117)                  |
| Rockwell Hardness                       | D-785       |                                 | R scale / M scale                       | 125 / 75                   |
| <b>Thermal</b>                          |             |                                 |   |                            |
| Long Term Service Temperature           |             |                                 | °C (°F)                                 | -50 to +100 (-175 to +212) |
| Short Term Service Temperature          |             |                                 | °C (°F)                                 | -50 to +120 (-175 to +250) |
| Heat Deflection Temperature             | D-648       | Load: 1.82 MPa (264 psi)        | °C (°F)                                 | 135 (275)                  |
| Vicat Softening Temperature             | D-1525      | Load: 1 kg (2.2 lb)             | °C (°F)                                 | 150 (300)                  |
| Coefficient of Linear Thermal Expansion | D-696       |                                 | mm/m °C (in./in. °F)                    | 0.065 (0.036)              |
| Thermal Conductivity                    | C-177       |                                 | W/m·K (Btu·in./h·ft <sup>2</sup> ·°F)   | 0.21 (1.46)                |
| Specific Heat Capacity                  | C-351       |                                 | J/kg·°K (Btu/lb·°F)                     | 1.26 (0.31)                |
| <b>Optical</b>                          |             |                                 |   |                            |
| Haze                                    | D-1003      | Clear Sheet                     | %                                       | <0.5                       |
| Light Transmission                      | D-1003      | Clear Sheet                     | %                                       | 89                         |
| Refractive Index                        | D-542       | Clear Sheet                     |   | 1.586                      |
| Yellowness Index                        | D-1925      | Clear Sheet                     |   | <1                         |
| <b>Electrical</b>                       |             |                                 |   |                            |
| Dielectric Constant                     | D-150       | 50 Hz                           |   | 3.0                        |
|   | D-150       | 1 MHz                           |   | 2.9                        |
| Dissipation Factor                      | D-150       | 1 kHz                           |   | 0.001                      |
|   | D-150       | 1 MHz                           |   | 0.001                      |
| Dielectric Strength (Short Time)        | D-149       | 500 V/s                         | kV/mm (V/mil)                           | >30 (>770)                 |
| Surface Resistivity                     | D-257       | Kerihley                        | ohm·cm                                  | 10 <sup>11</sup>           |
| Volume Resistance                       | D-257       | Kerihley                        | ohm·cm                                  | 10 <sup>11</sup>           |

\*Conditions, units and values in U.S. Customary units are presented in the table within parentheses.

\*\*ASTM except where noted otherwise.

## Chemical Resistance

PALSUN sheets are compatible with many materials and chemicals, show limited resistance to others, and are incompatible with a third group, with which contact may be devastating. The mechanism of chemical attack on polycarbonate sheets differs significantly from the mechanism of corrosion of metals. Corrosion of metals results in a gradual loss of surface material as a result of electrolytic action by the relevant chemicals. In the cases where chemical attack on polycarbonate sheet occurs, all or a portion of a range of effects can be observed. Ethylene chloride, chloroform, tetrachloroethane, m-cresol, pyridine and other chemicals can cause partial dissolution of polycarbonate. Swelling agents include benzene, chlorobenzene, tetralin, acetone, ethyl acetate, acetonitrile and carbontetrachloride. Additional effects include color change and/or whitening. These effects may not always lead to product failure, especially for non-loaded sheets. Nevertheless, the level of measured mechanical properties will be reduced. The most critical effect of chemical attack is stress cracking or crazing, which may range in size from being visible to the naked eye to being only observable under a microscope. Stress cracks will always result in sheet failure which will emanate from areas of greatest stress (screws, fixings, bends, etc.).

Polycarbonate sheets are generally not recommended for use with acetone, ketones, ethers, and aromatic and chlorinated hydrocarbons in addition to aqueous or alcoholic alkaline solutions, ammonia gas and its solutions and amines.

Polycarbonate is resistant to mineral acids, many organic acids, oxidizing and reducing agents, neutral and acid salt solutions, many greases, waxes and oils, saturated, aliphatic and cycloaliphatic hydrocarbons and alcohols, with the exception of methanol. The resistance of polycarbonate to water may be described as good up to approximately 60 °C. At higher temperatures, degradation occurs, the extent of which depends on time and temperature. Polycarbonate should therefore not be exposed for long periods of time to hot water. However, brief contact with hot water has no effect. For example, polycarbonate tableware can be washed over 1000 times in a dish washing machine with no adverse effects being observed.

The table that appears on the following pages lists the resistance of polycarbonate sheet to a number of commonly encountered chemicals and other corrosive media at room temperature. (Information on chemical resistance at higher temperatures will be supplied upon request). Where the chemical resistance varies with concentration, the results of tests at different concentrations is presented. The information on chemical resistance is based on our research and experience. (Note that information on compatible adhesives and sealants can be found in a separate leaflet which will be supplied upon request) It serves as a basis for recommendation. PALRAM Industries does not guarantee chemical resistance unless specific separate documentation is supplied.

For chemicals and corrosive media not indicated in the list, please contact your PALRAM representative. He will place you in contact with the PALRAM R&D & Technology Department.

**The table on the following pages uses the following key:**

R - Resistant

LR - Limited Resistance (gradual attack over time may occur)

N - Not Resistant (rapid attack or attack over short time period will occur)

### Chemical Resistance of PALSUN® Sheets at Room Temperature

The chemical resistance of PALSUN & PALTUF sheets, specified in the following pages, has been demonstrated in actual installations and/or laboratory tests. The information in the table is based on our research and experience. It should be considered solely as a basis for recommendation, but not as a guarantee, unless specifically stated in separate documentation supplied by PALRAM Industries.

| Chemical                               | Concentration %*  | Resistance | Chemical                             | Concentration %* | Resistance |
|--|-------------------|------------|--------------------------------------|------------------|------------|
| Acetaldehyde                           |                   | N          | Butane                               |                  | R          |
| Acetic Acid                            | 10                | R          | Butes                                |                  | R          |
| Acetic Acid                            | 25 (concentrated) | LR (H)     | Butyl Acetate                        |                  | N          |
| Acetone                                |                   | N          | Butyl Alcohol (Butanol)              |                  | R          |
| Acetylene                              |                   | R          | Butylene Glycol                      |                  | R          |
| Acrylonitrile                          |                   | N          | Butyric Acid                         |                  | N          |
| Ajax Detergent                         |                   | R          | Calcium Chloride                     | Saturated        | R          |
| Allhlice                               |                   | N          | Calcium Hydrochloride                |                  | R          |
| Allyl Alcohol                          |                   | LR         | Calcium Nitrate                      |                  | R          |
| Alum (Aluminum Ammonium Sulfate)       |                   | R          | Castor Soap Fat                      |                  | R          |
| Aluminum Chloride                      | Saturated         | R          | Camphor Oil                          |                  | N          |
| Aluminum Oxalate                       |                   | R          | Carbonic Acid                        |                  | N          |
| Aluminum Sulfate                       | Saturated         | R          | Carbon Bisulfite                     |                  | N          |
| Ammonia (Gas)                          |                   | N          | Carbon Dioxide Gas (Moist)           |                  | R          |
| Ammonia (Aqueous)                      |                   | N          | Carbon Disulfide                     |                  | N          |
| Ammonium Carbamate                     |                   | LR         | Carbon Monoxide                      |                  | R          |
| Ammonium Chloride                      |                   | R          | Carbon Tetrachloride                 |                  | N          |
| Ammonium Fluoride                      |                   | N          | Castor Oil                           |                  | R          |
| Ammonium Hydroxide                     |                   | N          | Catsup (Ketchup)                     |                  | R          |
| Ammonium Nitrate                       |                   | R          | Caustic Potash (Potassium Hydroxide) |                  | N          |
| Ammonium Sulfate                       | Saturated         | R          | Caustic Soda (Sodium Hydroxide)      |                  | N          |
| Ammonium Sulfide                       |                   | N          | Chlorine Gas (Dry)                   |                  | LR         |
| Amyl Acetate                           |                   | N          | Chlorine Gas (Wet)                   |                  | N          |
| Amyl Alcohol                           |                   | LR         | Chlorobenzene                        |                  | N          |
| Aniline                                |                   | N          | Chloroform                           |                  | N          |
| Antimony Trichloride                   | Saturated         | R          | Chocolate                            |                  | R          |
| Aqua Regia (3 parts HCl / 1 part HNO3) |                   | LR         | Chromic Alum                         | Saturated        | R          |
| Asetic Acid                            | 20                | R          | Chromic Acid                         | 20               | R          |
| Automatic Switch Grease                |                   | R          | Cinnamon                             |                  | R          |
| Automotive Waxes                       |                   | LR         | Citric Acid                          | 10               | R          |
| Baby Lotion                            |                   | R          | Cloves                               |                  | N          |
| Bacon Fat                              |                   | R          | Coal Gas                             |                  | R          |
| Barium Chloride                        |                   | R          | Coza Cola                            |                  | LR         |
| Battery Acid                           |                   | R          | Cooper                               |                  | LR         |
| Beer                                   |                   | R          | Cod Liver Oil                        |                  | R          |
| Beer Syrup                             |                   | R          | Coffee                               |                  | LR         |
| Benzaldehyde                           |                   | R          | Cooking Oil                          |                  | R          |
| Benzene                                |                   | N          | Copper Sulfate                       | Saturated        | R          |
| Benzoic Acid                           |                   | N          | <b>Cresol</b>                        |                  | R          |
| Benzyl Alcohol                         |                   | R          | Cupric Chloride                      | Saturated        | R          |
| Betadine                               |                   | R          | Cuprous Chloride                     | Saturated        | R          |
| Bleach (Clorox)                        |                   | R          | Cyclohexane                          |                  | R          |
| Blood and Blood Plasma                 |                   | R          | Cyclohexanol                         |                  | LR         |
| Borax                                  |                   | R          | Cyclohexanone                        |                  | N          |
| Boric Acid                             |                   | R          | CS2                                  |                  | R          |
| Brake Fluid                            |                   | N          | DeKalin                              |                  | R          |
| Bromine                                |                   | R          | Detergent (most)                     |                  | R or R     |
| Bromobenzene                           |                   | R          | Developing Solutions                 |                  | N or LR    |

Entries indicate the following: R - resistant; LR - limited resistance; N - not resistant

\*Concentration of aqueous solution except where noted.

| Chemical                          | Concentration %*  | Resistance | Chemical                      | Concentration %*  | Resistance |
|-----------------------------------|-------------------|------------|-------------------------------|-------------------|------------|
| Dibutyl Phthalate                 |                   | N          | Linseed Oil                   |                   | R          |
| Diesel Fuel                       |                   | R          | Lactic Acid                   | 20                | R          |
| Diethyl Ether (Ethyl Ether)       |                   | N          | Lacquers and Thinners         |                   | R          |
| Dimethyl Formaldehyde (DMF)       |                   | N          | Laundry Detergents (Most)     |                   | R          |
| Dimethyl Sulfoxide (DMSO)         |                   | N          | Ligroin (Hydrocarbon Mixture) |                   | R          |
| Dinonyl Phthalate (plasticizer)   |                   | LR         | Urine Solution (2%) or paste  |                   | R          |
| Dioctyl Phthalate (plasticizer)   |                   | LR         | Liquors or Liquorics          |                   | R          |
| Dioxane                           |                   | N          | Linseed Oil                   |                   | R          |
| Dipht 5.3                         |                   | LR         | Loctite                       |                   | R          |
| Ethanol (Ethyl Alcohol and Water) | 95                | R          | Lubricating Oils (Most)       |                   | R          |
| Ethanol (Ethyl Alcohol)           | Pure              | LR         | Machinist Oils (Most)         |                   | R          |
| Ethyl Amine                       |                   | N          | Magnesium Chloride            | Saturated         | R          |
| Ethyl Acetate                     |                   | N          | Magnesium Sulfate             | Saturated         | R          |
| Ethyl Bromide                     |                   | N          | Manganese Sulfide             | Saturated         | R          |
| Ethylene Chloride                 |                   | N          | Margarine                     |                   | R          |
| Ethylene Chlorohydrin             |                   | N          | Mayonnaise                    |                   | R          |
| Ethylene Dichloride               |                   | N          | Meat                          |                   | R          |
| Ethylene Glycol (Antifreeze)      |                   | LR         | Mercuric Chloride             | Saturated         | R          |
| Ferric Chloride                   | Saturated         | R          | Melting                       |                   | R          |
| Ferrous Sulfate                   |                   | R          | Methane                       |                   | R          |
| Fish and Fish Oils                |                   | R          | Methanol (Methyl Alcohol)     | Pure              | LR         |
| Floor Polish                      |                   | R          | Methylamine                   |                   | R          |
| Formalin                          | 10%               | R          | Methylcellulose               |                   | R          |
| Formic Acid                       | 10% (30%)         | R (LR)     | Methylene Chloride            |                   | R          |
| Fipronil                          |                   | R          | Methyl Ethyl Ketone (MEK)     |                   | R          |
| Freon (all others)                |                   | N          | Methylmethacrylate            |                   | R          |
| Fruit Juices and Pulp             |                   | R          | <b>Milk</b>                   |                   | R          |
| Gasoline                          |                   | N          | Mineral Oil                   |                   | R          |
| Gear Oil                          |                   | R          | Motor Oils (Most)             |                   | R          |
| Glacis Putty                      |                   | R          | Mustard                       |                   | R          |
| Glucose                           |                   | R          | Naphtha (Stamrol)             |                   | R          |
| Glycerine                         |                   | R          | Nickel Sulfate                |                   | N          |
| Glycerol                          |                   | R          | Nitric Acid                   | 20                | R          |
| Glycols                           |                   | R          | Nitrobenzene                  |                   | R          |
| Glyoxaldehyde                     | 50%               | R          | Nitropropane                  |                   | R          |
| Grease, Automotive (Moly)         |                   | R          | Nitrous Oxide                 |                   | R          |
| Heptane                           |                   | R          | Nutmeg                        |                   | N          |
| Hexane                            |                   | R          | Oleic Acid                    |                   | R          |
| Hydrazine                         |                   | N          | Oxides                        |                   | R          |
| Hydrochloric Acid                 | 20 (Concentrated) | R (N)      | Oxalic Acid                   | 15                | R          |
| Hydrofluoric Acid                 | 20                | R          | Oxygen                        |                   | R          |
| Hydrogen Peroxide                 | 30                | R          | Ozone                         |                   | R          |
| Hydrogen Sulfide                  |                   | R          | Paprika                       |                   | R          |
| Iodine (aqueous solution)         | 5                 | R          | Paraffin                      |                   | R          |
| Iodine                            |                   | N          | Pentane                       |                   | LR         |
| <b>Inks (Most)</b>                |                   | R          | Pepper                        |                   | LR         |
| Izolanol Alcohol                  |                   | LR         | Perchloric Acid               | 1% (concentrated) | N          |
| Isopropyl Alcohol                 |                   | R          | Perchloroethylene             |                   | R          |

Entries indicate the following: R - resistant; LR - limited resistance; N - not resistant  
 \*Concentration of aqueous solution except where noted.

| Chemical                        | Concentration %* | Resistance | Chemical                          | Concentration %* | Resistance |
|---------------------------------|------------------|------------|-----------------------------------|------------------|------------|
| Petroleum                       |                  | LR         | Sodium Sulfide                    |                  | R          |
| Petroleum Ether                 |                  | LR         | Sodium Thiosulfate                |                  | R          |
| Petroleum Oil (Kerosene)        |                  | R          | Spindle Oil                       |                  | R          |
| Phenol                          |                  | R          | Stannous Chloride                 |                  | R          |
| Phosphoric Acid                 | 10               | R          | Starch                            |                  | R          |
| Phosphorous Dichloride          |                  | R          | Styrene                           |                  | N          |
| <b>Phosphorous Pentoxide</b>    | <b>25</b>        | <b>LR</b>  | <b>Sugar</b>                      | Saturated        | R          |
| <b>Phosphorous Trichloride</b>  |                  | <b>N</b>   | <b>Sulfur Dioxide (Gas)</b>       |                  | R          |
| Polyethylene                    |                  | R          | Sulfuric Acid                     | <50 (50-70)      | R (LR)     |
| Polyethylene Glycol             |                  | R          | Sulfurous Acid                    | 10               | N          |
| Potassium Acetate               |                  | LR         | Sulfuryl Chloride                 |                  | N          |
| Potassium Aluminum Alum Sulfate | Saturated        | R          | Tapping Oil                       |                  | R          |
| Potassium Bichromate            |                  | R          | Tartaric Acid                     | 30               | R          |
| Potassium Borate                |                  | <b>R</b>   | Tear Gas (Chloroacetophenone)     |                  | LR         |
| Potassium Bromide               |                  | R          | Terpeneol                         |                  | N          |
| Potassium Chloride              | Saturated        | R          | Tetrahydrofuran                   |                  | N          |
| Potassium Cyanide               |                  | N          | Tetraol                           |                  | N          |
| Potassium Dichromate            | Saturated        | R          | Thiophene                         |                  | N          |
| Potassium Hydroxide             |                  | N          | Thyme                             |                  | R          |
| Potassium Metabisulfite         | 4                | R          | Titanium Tetrachloride            |                  | R          |
| Potassium Nitrate               | Saturated        | R          | Tobacco                           |                  | R          |
| Potassium Perchlorate           | 10               | R          | Toluene                           |                  | N          |
| Potassium Permanganate          | 10               | R          | Transfer Oil                      |                  | R          |
| Potassium Persulfate            | 10               | R          | Transmission Fluid                |                  | R          |
| Potassium Rhodizide             | Saturated        | R          | Trichloroacetic Acid              | 20               | LR         |
| Potassium Sulfate               | Saturated        | R          | Trichloroethylamine               |                  | N          |
| Propane                         |                  | R          | Trichloroethylene                 |                  | N          |
| Propargyl Alcohol               |                  | R          | Trichloroethylphosphate           |                  | LR         |
| Propionic Acid                  | 20               | R          | Triethylphosphite                 |                  | N          |
| Propionic Acid                  | Concentrated     | N          | Trisodium Phosphate               |                  | R          |
| Propyl Alcohol (1-Propanol)     |                  | R          | Turpentine                        |                  | LR         |
| Pyridine                        |                  | N          | Urea                              |                  | R          |
| Salad Oil                       |                  | R          | Vacuum Pump Oil                   |                  | R          |
| Salt                            |                  | R          | Vanilla                           |                  | R          |
| Sulfuric Acid                   | 30               | R          | Vanillin                          |                  | R          |
| Silicone Grease                 |                  | R          | Varnish                           |                  | N          |
| Silicone Oil                    |                  | R          | Vaseline                          |                  | R          |
| Silver Nitrate                  |                  | R          | Vegetable Juices                  |                  | R          |
| Soap (Hard)                     |                  | R          | Vegetable Oil                     |                  | R          |
| Sodium Bicarbonate              | Saturated        | R          | Vinagar                           |                  | R          |
| Sodium Bisulfite                | Saturated        | R          | Water (Deionized or Soft)         |                  | R          |
| Sodium Bisulfate                | Saturated        | R          | White Spirit                      |                  | N          |
| Sodium Carbonate                | Saturated        | R          | Wine, Whiskey, Vodka, Rum, Cognac |                  | R          |
| Sodium Chloride                 | Saturated        | R          | Witch Hazel                       |                  | R          |
| Sodium Chromate                 |                  | R          | Worcester Sauce                   |                  | R          |
| Sodium Hydroxide                |                  | N          | Xylene                            |                  | N          |
| Sodium Hypochlorite             | 5% Chlorine      | R          | Zinc Chloride                     |                  | R          |
| Sodium Nitrate                  |                  | N          | Zinc Oxide                        |                  | R          |
| Sodium Nitrite                  |                  | N          | Zinc Sulfate                      |                  | R          |
| Sodium Sulfate                  | Saturated        | R          | Zinc Sulfate                      |                  | R          |

Entries indicate the following: R - resistant, LR - limited resistance, N - not resistant. \* Concentration of aqueous solution except where noted. The chemical resistance information in this table is based on our research and experience and may be considered solely as a basis for recommendations, but not as a guaranteed, one is specifically furnished as such by Palram.