Technical Data Sheet

Grilon, Grilamid and Grivory – Resistance to Chemicals

Modern day life and technology is unimaginable without plastic materials. It is a prerequisite, however that for each individual application, a plastic material is selected that is not affected by the media to which it is exposed.

In general, polyamides exhibit very good resistance to all kinds of chemicals. Apart from concentrated acids, only very few reagents attack polyamides.

The information about resistance to chemicals given in this leaflet is intended to help achieve optimal material selection.

EMS-GRIVORY

Influencing factors

Within the family of engineering plastics, polyamides are characterised by very good resistance to chemicals. The chemical resistance of a plastic material is dependent on its molecular structure, the nature of the surrounding media (e.g. acidic or alkaline solutions, polar or non-polar solvents), the concentration of the reagents, the kind and duration of contact as well as the ambient temperature.

Kinds of chemical

Certain chemicals can induce physical or chemical damage to plastics. To what degree this takes place, depends amongst others on the chemical nature. Physical processes such as swelling are generally reversible whereas chemical attack can lead to irreversible changes in the material. Oxidation, for example, can cause the material to decompose.

Concentration of contact media

The higher the concentration of the active substances, the faster early fatigue of the polymeric material may occur.

Temperature

The application temperature has a direct influence on the resistance to chemicals. The higher the surrounding temperature, the greater and more rapid the effects of chemical attack are.

Types of exposure and duration

Along with the type of exposure (on one side, both sides, permanent or short-term contact) the chemical resistance of the plastic is influenced by the duration of the exposure. The longer the contact time, the stronger the effect of the chemicals on the material is.

The following table describes the resistance to chemicals of the following types of material:

Grilon	polyamide 6 and 66
Grilamid L	polyamide 12
Grilamid S	polyamide 610 and 1010
Grilamid D	polyamide 612
Grilamid TR	transparent polyamides
Grivory G	partially aromatic, amorphous polyamides, unreinforced
Grivory GV	semi-crystalline, partially aromatic polyamides, reinforced
Grivory HT	polyphthalamide

The resistance tests were carried out on ISO standard test bars which were stored in the chemicals at room temperature for up to 12 months. This means that evaluation of material resistance is based on static storage of test specimens in a stress-free state. For deviating conditions in practical use, consultation is recommended. Characteristic properties such as change in weight, length, tensile stress and elongation at break of the test bars after aging in the diverse media served as test criteria.

As resistance to chemicals is primarily dependent on the basis polymer, the information applying to unreinforced grades is also valid for reinforced material groups.

Key for qualitative evaluation of the material resistance:

●●● Resistant
No or little reversible change in weight and/or dimensions possible

●● Limited resistance
Changes in weight, dimension or even irreversible changes to property values possible after longer exposure; consultation recommended

● Not resistant
May be used under specific conditions, e.g. short-term contact

○ Strong attack or soluble

The concentration values given in the table refer to the maximum concentration of the medium at which the material was tested. It can be assumed that the same or better resistance is achieved with less concentrated reagents.
Some additives may be extracted by the media. In the case of plasticizers, the loss of flexibility is usually compensated for by uptake of the media.

Stress corrosion cracking of amorphous polyamides

Amorphous polyamides such as Grilamid TR and Grivory G can develop stress cracking when exposed to certain media. External stresses are caused by the influence of forces on the component, while internal stresses may be caused through incorrect processing.

Further information on stress corrosion cracking can be found in the corresponding product brochures. The brochure "Grilamid TR" in particular, gives details of the compatibility of different transparent material variants and their tendency to form stress cracking when in contact with specific solvents.

Hydrolysis resistance

All polyamides take up water when kept in a moist environment. At room temperature this is a physical process which is reversible. Irreversible chemical damage to the material can only be caused by water or aqueous solutions at high temperatures. This is referred to as hydrolysis.

Water uptake is mainly dependent on the amide group concentration of the individual polyamide type. For this reason, polyamide 12 is considerably more resistant to hydrolysis than polyamide 6 and polyamide 66. The Grivory grades also take up significantly less water and that more slowly than materials made of Grilon.

Medium	**Concentration**	**Resistance**						
		Grilon	Grilamid L	Grilamid S, D	Grilamid TR	Grivory G	Grivory GV	Grivory HT
Acetaldehyde	40% aqueous solution	●●	●●●	●●	●●	●●	●●	●●
Acetamide	50% aqueous solution	●●	●●●	●●●	●●●	●●●	●●●	●●●
Acetic acid	5% aqueous solution	●●	●●●	●●●	●●●	●●	●●	●●
Acetic acid	10% aqueous solution	●	●●	●●	●●	●	●	●●
Acetic acid	40% aqueous solution	○	●	●	●	○	○	●
Acetic acid	technical grade	○	●	○	○	○	○	●
Acetic anhydride	technical grade	○	●●	●●	●	●	●	●●
Acetone	technical grade	●●●	●●●	●●●	●	●●	●●	●●●
Acetonitrile	technical grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Acetophenone	technical grade	●●●	●●●	●●●	●●	●●●	●●●	●●●
Acetylene	technical grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Aliphatic hydro-carbons	technical grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Allyl alcohol	technical grade	●●	●●	●●	○	●	●●	●●
Aluminium salts	saturated, aqueous solution	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Amidosulfonic acid (descaler)	15% aqueous solution	●	●●	●●	●●	●	●	●●●
Ammoniac	10% aqueous solution	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Ammoniac	gas	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Ammonium salt	saturated, aqueous solution	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Amyl acetate	technical grade	●●●	●●●	●●	●●	●●●	●●●	●●●
Aniline	technical grade	●●	●●	●●	○	●	●●	●●
Anisole	technical grade	●●●	●●●	●●●	●●	●●	●●●	●●●
Barium salts	saturated, aqueous solution	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Beer	commercial grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Benzaldehyde	technical grade	●	●●	●●	●	●	●	●●
Benzoic acid	50%, aqueous solution	●	●●	●●	●●	●	●	●●
Benzole	technical grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Benzyl alcohol	technical grade	●	●●	●	○	●	●	●
Bio-diesel (e.g. RME, SME, B20)	commercial grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Sodium hypochlorite	13% aqueous solution	●	●	●	●	●	●	●
Boric acid	10% aqueous solution	●●	●●●	●●●	●●	●●	●●●	●●●

Medium	**Concentration**	**Resistance**						
		Grilon	Grilamid L	Grilamid S, D	Grilamid TR	Grivory G	Grivory GV	Grivory HT
Brake fluid (DOT)	commercial grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Brandy	commercial grade (~ 40%)	●●●	●●●	●●●	●●	●●	●●●	●●●
Dihydroxybenzene	6%, aqueous solution	○	●	●	○	○	●	●
Bromine, bromine water	commercial grade	○	●	●	○	●	●	●
Butane	technical grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Butanoic acid	technical grade	●●	●●●	●●	●●	●●	●●	●●
Butyl acetate	technical grade	●●●	●●●	●●●	●●	●●	●●●	●●●
Butyl alcohol	technical grade	●●	●●●	●●●	○	●	●●	●●●
Butylene glycol	technical grade	●●●	●●●	●●●	○	●	●●	●●●
Calcium chloride	10% aqueous solution	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Calcium chloride	saturated, aqueous solution	●●	●●●	●●●	●●●	●●	●●	●●●
Calcium chloride	20% alcoholic solution	●	●	●	○	○	●	●
Camphor	technical grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Carbon tetrachloride	technical grade	●●●	●●	●●	●●	●●●	●●●	●●●
Caustic potash	50% aqueous solution	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Chloracetic acid	10% aqueous solution	○	○	○	○	○	○	○
Chloramines	5% aqueous solution	●	●●	●●	●	●	●	●●
Chlorobenzene	technical grade	●●●	●●	●●	●●	●●	●●●	●●●
Chlorbromo methane	technical grade	●●	●●	●	●	●●	●●	●●
Chlorine	gas	○	○	○	○	○	○	○
Chlorine water	5% aqueous solution	●	●●	●●	●	●	●	●●
Chloroform	technical grade	●	●●	●	●	●	●	●●
Chromates	saturated, aqueous solutions	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Chrome lime	Saturated, aqueous solution	●	●	●	●	●	●	●
Chromic acid	1% aqueous solution	●	●●	●●	●	●	●	●●
Chromosulfuric acid	aqueous solution	○	○	○	○	○	○	○
Citrus acid	concentrated	●●	●●	●●	●●	●	●●	●●
Cocoa	commercial grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Coffee	commercial grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●

Medium	**Concentration**	**Resistance**						
		Grilon	Grilamid L	Grilamid S, D	Grilamid TR	Grivory G	Grivory GV	Grivory HT
Cola	commercial grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Copper salts	10% aqueous solution	●●●	●●●	●●●	●●	●●●	●●●	●●●
Cresol	technical grade	○	○	○	○	○	○	○
Cride oil	technical grade	●●●	●●●	●●●	●●	●●●	●●●	●●●
Crude oil/gas	technical grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Cyclohexane	technical grade	●●●	●●●	●●●	●●	●●●	●●●	●●●
Diesel/Heating oil	commercial grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Diethyl ether	technical grade	●●●	●●●	●●●	●●	●●	●●●	●●●
Dimethyl formamide	technical grade	●●	●●	●●	○	●	●●	●●●
Dimethyl sulfoxide	technical grade	●●	●●	●●	●	●	●●	●●
Dimethyl sulphide	technical grade	●●●	●●●	●●●	●●	●●	●●●	●●●
Dioctyl phthalate	technical grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Dioxane	technical grade	●●●	●●●	●●●	●●	●●●	●●●	●●●
Engine oil	commercial grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Ethanol	technical grade	●●	●●●	●●	●	●	●●	●●●
Ethyl acetate	technical grade	●●●	●●●	●●●	●●	●●	●●●	●●●
Ethylbenzen	technical grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Ethylene chloride	technical grade	●●●	●●	●●	●	●●	●●●	●●●
Ethylene glycol	technical grade	●●●	●●●	●●●	●●	●●	●●●	●●●
Ethylenoxide	technical grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
FAM B (FAM A and C)	technical grade	●●	●●	●●	●	●	●●	●●●
Fat/Oil	commercial grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Fluor	gas	○	○	○	○	○	○	○
Formaldehyde	40%, aqueous solution	●	●●	●●	●	●	●	●●
Formamide	technical grade	●●	●●	●●	●	●	●●	●●
Formic acid	10%, aqueous solution	●●	●●	●●	●	●	●●	●●
Formic acid	40%, aqueous solution	○	●●	●	●	●	●	●
Formic acid	85%, aqueous solution	○	●	○	○	○	○	○
Fruit juices	commercial grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Fuel C (Fuel A, B and D)	technical grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Furfural	technical grade	●●	●●	●●	●●	●●	●●	●●
Glycerine	technical grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Glycol-water	50/50 mixture	●●	●●●	●●	●●	●●	●●	●●●

Medium	Concentration	Resistance						
		Grilon	Grilamid L	Grilamid S, D	Grilamid TR	Grivory G	Grivory GV	Grivory HT
Halogenated hydrocarbons	technical grade	●●	●●	●●	●●	●●	●●	●●
Hydraulic oil	commercial grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Hydrochloric acid	1% aqueous solution	●	●●	●●	●●	●	●	●●
Hydrochloric acid	10% aqueous solution	○	●	●	●	○	●	●
Hydrochloric acid	37% aqueous solution	○	●	○	○	○	○	○
Hydrofluric acid	40% aqueous solution	○	○	○	○	○	○	○
Hydrogen peroxide	2% aqueous solution	●	●●	●●	●●	●●	●●	●●
Hydrogen peroxide	10% aqueous solution	●	●●	●	●	●	●	●
Hydrogen peroxide	30% aqueous solution	○	●	○	○	○	○	○
Hydrogen sulphide	gas (< 5%)	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Iodine tincture, alcoholic	commercial grade	○	○	○	○	○	○	○
Iron salts	20% aqueous solution, neutral	●●●	●●●	●●●	●●	●●●	●●●	●●●
Iron salts	20% aqueous solution, acidic	●	●	●	●	●	●	●●
Isopropanol	technical grade	●●	●●●	●●	○	●	●●	●●●
Kerosene	commercial grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Lactic acid	5% aqueous solution	●●●	●●●	●●●	●●●	●●	●●	●●
Lactic acid	90% aqueous solution	●●	●●	●●	●●	●	●	●●
Lead salts	saturated, aqueous solution	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Lemon juice	commercial grade (< 10%)	●●●	●●●	●●●	●●●	●●	●●●	●●●
Magnesium hydroxide	10% aqueous solution	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Magnesium salts	10% aqueous solution	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Mercury	technical grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Mercury salts	saturated, aqueous solution	●●●	●●●	●●●	●●	●●●	●●●	●●●
Methane	gas	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Methyl alcohol	technical grade	●●	●●	●	○	●	●●	●●●
Methylene chloride	technical grade	●●	●●	●	●	●●	●●	●●
Methyl ethyl ketone (MEK)	technical grade	●●●	●●●	●●●	●●	●●●	●●●	●●●
Milk	commercial grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●

Medium	Concentration	Resistance						
		Grilon	Grilamid L	Grilamid S, D	Grilamid TR	Grivory G	Grivory GV	Grivory HT
Mineral oil	commercial grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
MTBE (Methyl tert-butyl ether)	technical grade	●●●	●●●	●●●	●●	●●	●●●	●●●
Naphthalene	technical grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Nickel salts	saturated, aqueous solution	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Nitric acid	10% aqueous solution	○	●	●	●	○	●	●
Nitric acid	65% aqueous solution	○	○	○	○	○	○	○
Nitro thinner	commercial grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Nitrobenzene	technical grade	●●	●●	●●	●●	●●	●●	●●
Nitromethane	technical grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Oils (also IRM reference oils)	commercial grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Oleic acid	technical grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Oleum	technical grade	○	○	○	○	○	○	○
Oxalic acid	10% aqueous solution	●●	●●●	●●●	●●●	●●●	●●	●●
Oxygen	gas	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Ozone	gas (2 ppm)	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Peppermint oil	technical grade	●●	●●	●●	●●	●●	●●	●●
Petrol, E10	commercial grade	●●●	●●●	●●●	●	●	●●●	●●●
Petrol, E85	commercial grade	●●	●●●	●●●	○	○	●●	●●●
Petrol, lead-free	commercial grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Petroleum	technical grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Petroleum ether	technical grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Phenol	aqueous solution	●	●●	●●	●	●	●	●
Phenylethyl alcohol	technical grade	●●	●	●	●	●	●	●●
Phosphoric acid	10% aqueous solution	●	●●	●●	●●	●	●	●
Phosphoric acid	50% aqueous solution	●	●	●	●	●	●	●
Potash	aqueous solution	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Potassium chlorate	7% aqueous solution	●	●●	●	●●	●	●	●
Potassium nitrite	saturated, aqueous solution	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Potassium permanganate	1% aqueous solution	○	○	○	○	○	○	○
Propanol	technical grade	●●	●●●	●●	○	●	●●	●●●

Medium	Concentration	Resistance						
		Grilon	Grilamid L	Grilamid S, D	Grilamid TR	Grivory G	Grivory GV	Grivory HT
Pyridine	technical grade	●●●	●●●	●●●	●●	●●●	●●●	●●●
R-12 (Frigene 12, Freon 12)	technical grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
R-22 (Frigene 22, Freon 22)	technical grade	●	●	●	●	●	●	●
Resorcinol	technical grade	○	○	○	○	○	○	○
Resorcinol	alcoholic	○	○	○	○	○	○	○
Rose oil	technical grade	●●●	●●●	●●●	●	●●●	●●●	●●●
Rum	commercial grade (60%)	●●●	●●●	●●●	●●	●●	●●●	●●●
Salicylic acid	technical grade	●●●	●●●	●●●	●●	●●●	●●●	●●●
Sodium chloride	saturated, aqueous solution	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Sea water		●●●	●●●	●●●	●●●	●●●	●●●	●●●
Silicon oil	technical grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Silver salts	saturated, aqueous solution	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Soap suds	aqueous solution	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Soda (sodium carbonate)	50% aqueous solution	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Sodium bicarbonate / bisulfite	saturated, aqueous solution	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Sodium chlorite	5% aqueous solution	●	●	●	●	●	●	●
Sodium hydroxide (caustic soda)	40% aqueous solution	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Sodium hypochlorite	5% aqueous solution	●	●●	●	●	●	●	●
Sodium nitrite	5% aqueous solution	●	●●	●●	●	●	●	●
Sodium perborate	5% aqueous solution	●●	●●●	●●	●●	●●	●●	●●
Sodium salts	saturated, aqueous solution	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Starch	aqueous solution	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Stearin, stearic acid	technical grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Styrene	technical grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Sugar	aqueous solution	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Sulphuric acid	2% aqueous solution	●	●●●	●●	●●	●●	●●	●●
Sulphuric acid	10% aqueous solution	○	●●	●●	●●	●	●	●
Sulphuric acid	50% aqueous solution	○	●	○	○	○	○	○

Medium	**Concentration**	**Resistance**						
		Grilon	Grilamid L	Grilamid S, D	Grilamid TR	Grivory G	Grivory GV	Grivory HT
Sulphuric acid	96% aqueous solution	○	○	○	○	○	○	○
Sulphur dioxide	gas (< 5%)	●	●●	●●	●	●●	●●	●●
Sweat (perspiration)		●●●	●●●	●●●	●●●	●●●	●●●	●●●
Tallow	commercial grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Tartaric acid	10% aqueous solution	●●●	●●●	●●●	●●●	●●	●●●	●●●
Tea	commercial grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Tetra hydrofuran	technical grade	●●●	●●●	●●●	●●	●●●	●●●	●●●
Tetrachlorethylene	technical grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Tetralin	technical grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Thionyl chloride	technical grade	○	○	○	○	○	○	○
Toluene	technical grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Trichloroethane	technical grade	●●	●●	●●	●	●●	●●	●●
Trichloroethylene	technical grade	●●	●●	●●	●	●●	●●	●●
Triethanolamine	technical grade	●●●	●●●	●●●	●●●	●●	●●●	●●●
Trifluoroacetic acid	10% aqueous solution	○	●	●	●	○	●	●
Trifluoroacetic acid	technical grade	○	○	○	○	○	○	○
Turpentine oil	technical grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Uric acid	aqueous solution	●●	●●●	●●	●●	●●	●●	●●
Urea	20%, aqueous solution	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Urea (AdBlue®)	commercial grade 30%, aqueous solution	●●	●●●	●●	●●	●●	●●	●●●

Medium	**Concentration**	**Resistance**						
		Grilon	Grilamid L	Grilamid S, D	Grilamid TR	Grivory G	Grivory GV	Grivory HT
Uric acid	50%, aqueous solution	●●	●●●	●●	●●	●●	●●	●●
Water	technical grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Wine	commercial grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Xylene	technical grade	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Zinc chloride	10% aqueous solution	●●	●●●	●●●	●●●	●●●	●●●	●●●
Zinc chloride	50% aqueous solution	●●	●●●	●●	●●●	●●	●●	●●●
1-Pentanole	technical grade	●●●	●●●	●●●	○	●	●●●	●●●

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