Chemical compatibility table

TÜV CERT
ISO 9001 Certification

INDUSTRIAL PUMPS

DEBEM

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Chemical compatibility table

NB

The information contained herein is only to be used with regard to the initial choice of pump construction materials.

We have obtained this information from reliable sources. Debem has not performed any form of testing in this regard and therefore accepts no liability for the accuracy of the details provided.

Each application has its own specific set of parameters as regards stress, exposure time, chemical concentration and temperature. Debem recommends practical testing of materials coming into contact with chemical substances.

NOTE REGARDING HALOGENATED SOLVENTS

In certain cases, the corrosive action of halogenated solvents coming into contact with aluminium or galvanised materials could cause an explosion. To avoid any form of danger, when transferring halogenated solvents, the use of steel or PVDF pumps is recommended

Summary of the plastic and rubber materials

CODE/TRADE NAME	MATERIAL	COMPOSITION	DEBEM CODE
NBR (PERBUNAN®)	Nitrile rubber	Acrylonitrile-Butadiene	N
EPDM (DUTRAL®)	Ethylene Propylene Rubber	Ethylene Propylene Terpolymer	D
PVDF (KYNAR®)	PVDF	Polyvinylidene Fluoride	F
ECTFE (HALAR®)	ECTFE	Poly(Ethylene Chlorotrifluoroethylene)	E
PP	Polypropylene	Polypropylene	P
PPS (RYTON®)	PPS	Polyphenylene Sulfide	R
PTFE (TEFLON®)	PTFE	Polytetrafluoroethylene	T
FPM (VITON®)	Fluorocarbon Rubber	Fluoro-Elastomer	V
SANTOPRENE®	Thermosplastic rubber	Thermoplastic Elastomer	M
HMWHDPE (POLIZENE®)	High Molecular Weight High Density Polyethylene	Ethylene polymer	I
HYTREL ®	Fluoro-Elastomer	Polyester Elastomer	H

NITRILE RUBBER (NBR)

Excellent resistance to mineral, vegetal and animal oils and greases, to aliphatic hydrocarbons.
Resistant to alkalis. Not recommended for use with amines, chetons, benzene, ethers, chlorated solvents and concentrated acids.

APPLICATIONS: Oil splash guards, O-rings, seals.

Temperature of use: from -40°C to 120°C

POLYPROPYLENE (PP)

The mechanical resistance values of PP are higher than those of the PE. Alkali and acid resistance makes it suitable in the chemical industry for items subject to relatively weak strains.

ADVANTAGES
- high chemical resistance
- resistance to tensile strength, high values as regards polyolefins
- Low specific weight
- Easily machinable by machines or for welding

DRAWBACKS

Low mechanical resistance compared to technopolymers: tensile, flexural, compression, and others as well as thermal stress. Stiffer and less resistant to impacts than PE.

APPLICATIONS
Mechanical: also used for mechanical items in corrosive environments; compared to high molecular weight polyethylenes, PP has a higher tensile strength than PE HMW

Food: physiologically inert if of natural color, it is approved for use in contact with food.

Electrical: good dielectric characteristics. Stability to bad weather makes it useful for this sector.
Chemical: PP is typically used by the chemical industry because of its high acid and alkali resistance and because it is much more resistant to heat than PVC. Used for components by the galvanic chemical and petrochemical industry to male valves, flanges, gears and others. Not recommended for use with highly concentrated oxidizing acids.

Temperature of use: from 4°C to 70°C.

PVDF

This a new fluoro-polymer. As in the case of the fluoro-materials, chemical strength is its most interesting asset. Compared to PTFE, mechanical characteristics are much higher besides not being subject to deformation under load.

ADVANTAGES
High chemical strength typical of fluoro-materials
Compared to PTFE higher mechanical strength such ach as tensile and compression.
Excellent resistance to both low and high temperatures up to 160°C, as well as to UV beams.
Very good dimensional stability.
Good wear strength.

DRAWBACKS
Lower resistance to high temperature (160°C) compared to PTFE
Rather high linear thermal expansion coefficient. Only partially compatible with chetons, esters, ethers, organic bases and alkaline solutions.

APPLICATIONS
Chemical: the fluoro-polymers are typically very resistant to acids and alkali. Used to make components for the petrochemical and chemical industries.
Food: physiologically inert if of natural color, it is approved by various bodies for use in contact with food. Because of these characteristics, this material is often used in the construction of food machines, pumps for food liquids and others.
Electrical: because of its excellent dielectric characteristics, self-extinguishing capabilities without adding halogens and stability to bad weather, its use din this sector is incrqasing.

Mechanical: low friction coefficient makes it suitable for bearings even if they work in water.

Temperature of use: from -40° to 160°C.

ECTFE

Ethylene Chlorotrifluoroethylene copolymer with excellent chemical resistance and mechanical performances higher than PTFE

ADVANTAGES
Features the high chemical strength typical of fluoro materials
Compared to PTFE, features higher mechanical strength including tensile and compression
Excellent resistance to both low and high temperatures up to 160°C, as well as to UV beams.
Very good dimensional stability.
Low flammability
Good wear resistance and excellent resistance to alkaline agents

DRAWBACKS
Lower temperature resistance than PTFE (160°C)
Rather high linear thermal expansion coefficient. Only partially compatible with chetons, esters, ethers and organic bases

APPLICATIONS
(please see PVDF)

PTFE

Fluoro material widely used for its excellent chemical strength but with weak mechanical properties.
Deformation even under very small loads represents a useful feature to make seals.

ADVANTAGES
High chemical resistance
Excellent resistance to both low and high temperatures up to 260°C
Low flammability
Low friction coefficient

DRAWBACKS
Mechanical strength values such as tensile and compression are very low and in particular deformation strength under load is scarse.

APPLICATIONS
Mechanical: because of its low friction coefficient, PTFE can be used to make bearings as long as these are meant to support a weak load.
Food: physiologically inert, some bodies have it approved for applications in contact with food; however some nations have doubts as whether it can be used with food.
Electrical: excellent dielectric characteristics, self-extinguishing capabilities and stability to bad weather have increased its use in this sector.
Chemical: very high chemical resistance to acids and alkalis is typical of the fluoro-polymers. Used to make components of the petrochemical and chemical industries.

Temperature of use: from 4°C to 260°C.

EPDM

Excellent resistance to heat and to atmospheric agents and good service life length. Excellent compatibility with acids, alcohols and esters. Poor resistance to mineral oils and greases.

APPLICATIONS: sections and technical articles for the automotive industry, seals, items for anti-acid protection.

Temperature of use: from -40°C to 140°C

UMWHDPE POLYETHYLENE

High molecular weight polyethylene (> 1.000.000) with excellent impact strength. Compared to the PE's with lower molecular weights, this type of material is less stiff and more resistant to impact, which makes it more suitable for applications involving repeated shocks.

ADVANTAGES
Good impact strength even at low temperatures, high chemical strength typical of the polyolefin materials, high abrasion strength, low friction coefficient.

DRAW BACK
Compared to technopolymers, mechanical strength values are low: tensile, flexural, compression, thermal and others. Less stiff than the PE's with lower molecular weight.

APPLICATIONS

Mechanical: because of its low friction coefficient, its high wear strength and its lack of hygroscopicity, it is suitable for bearing or other weak load mechanical parts even if they work in the water.

Food: physiologically inert and approved by various bodies for use in contact with food.
Because of this feature, this material is often used in the construction of food processing machines, pumps for food liquids, and others.
Electrical: because of its excellent dielectric characteristics and weather stability is is being increasingly used in this sector.
Chemical: high resistance to solvents, greases, oils, paraffins, acids and alkalis. Used to make components for the chemical industry.

Temperature of use: from -50°C to 120°C

THERMOPLASTIC ELASTOMERS (Santoprene ®)

The thermoplastic elastomers (commonly known as M) are the link between vulcanized rubber and thermoplastic polymers; The M materials permit to obtain elastic and rubber-like characteristics often similar to those of vulcanized rubber but, on the other had, can be transformed by means of the normal technologies applied to thermoplastic materials (injection molding, extrusion, blowing, etc.) besides permitting to recover processing scraps.

Santoprene@ resists to ozone, solar beams, water, acids, bases, oily liquids and greases. It can be sterilized through vapor or through ethylene oxide.
It also maintains its properties even after hours of work under repeated deflection.

Temperature of use: from -40°C to +120°C

General guide to product and its properties

HYTREL is the trademark registered by Du Pont for its range of engineered thermoplastic elastomers

Properties and characteristics

HYTREL is a thermoplastic elastomer for engineering applications that combines several of the best features of high-performance elastomers and flexible thermoplastics. HYTREL boasts exceptional toughness and elastic flow, high creep, impact and flexural fatigue strength and excellent low-temperature flexibility, whilst also maintaining its properties at high temperatures to a large extent. It also resists the attack of many industrial chemicals, oils and solvents.i.

High-performance engineering resin

INTRODUCTION

Polyphenylene sulphide (PPS) is an engineering resin for high-temperature technological applications. Marked by excellent processability, this family of resins behaves very similarly to reinforced thermosets, since when combined with various fillers (fibreglass, mineral fillers, pigments), it boasts exceptional mechanical, chemical and self-extinguishing properties. As can be seen from the table, PPS has a unique set of characteristics.

CHEMICAL FEATURES

PPS in an aromatic crystalline thermoplastic polymer with a straight-chain structure consisting of para-substituted benzene rings and sulphur atoms.
The polymerisation process was perfected by Phillips Petroleum Company (USA) and consists of a reaction between p-dichlorobenzol and sodium sulphide in a polar solvent. PPS obtained from polymerisation is a fine white powder with a melting point of around 288°C.
When heated to a sufficiently high temperature in the presence of air, this polymer's molecular chains undergo elongation and a cross-linking process, giving them excellent mechanical properties.

RESISTANCE TO CHEMICAL AGENTS

A feature of PPS is its excellent resistance to chemical agents: in particular, it is insoluble in all solvents below 200°C. PPS has exceptional chemical resistance, as demonstrated by the immutability of tensile strength values following exposure at 93°C for a period of up to 3 months. In any event, PPS may be attacked by certain classes of chemical substances such as: oxidising agents, strong acids, halogens, amines and certain chlorinated hydrocarbons. Water absorption by PPS is very low (< 0,05%) and it also offers good hydrolysis resistance in hot water.

CHARACTERISTICS OF ELASTOMER COMPOSITES:

NON-PROPRIETARY NAME: **Nitrile rubber, NBR**

COMMERCIAL NAME: **Perbunan N, Europrene N**.

A butadiene-acrylonitrile copolymer whose ACN content can range from 18% to 50%.

CHARACTERISTICS

- Good mechanical properties
- Good compression set resistance
- Good impermeability to air and gases
- Good colourability
- Poor UV-radiation resistance
- Poor dielectric properties
- No flame resistance

CHEMICAL COMPATIBILITY AND BEHAVIOUR

Good resistance:

- Mineral oils and greases
- Light fuel oils, gas oil
- Aliphatic hydrocarbons
- Vegetable and animal oils and fats
- Hot water (100°C), seawater, salt solutions

Medium resistance:

- High-aromatic-content fuels
- Some types of Freon
- Dilute acid solutions
- Petroleum-based hydraulic fluids
- Diester-based synthetic lubricants

Poor resistance:

- Benzene and chlorinated hydrocarbons
- Aromatic hydrocarbons (benzol)
- Phosphoric-ester-based hydraulic fluids
- Glycol-based brake fluids

EPDM (e.g. DUTRAL®)

Excellent ozone and oxygen resistance. Articles manufactured from EPDM rubbers can tolerate the action of oxidising agents under both static and dynamic conditions. There is no need to add antiozonants or antioxidants in order to obtain this behaviour.

Excellent resistance to degradation caused by weathering.

Good high-temperature resistance (up to 150°C) in both dry and wet atmospheres (protected compounds).

Good low-temperature resistance: flexibility is maintained up to -55°C.

Excellent dielectric properties.

High compression set resistance.

High mechanical and elastic properties remaining constant over time.

Good resistance to numerous chemicals (organic and inorganic acids, alcohols, amines, phosphoric esters, hydraulic fluids, antifreeze and brine solutions, bleaching agents, biodegradable and non-biodegradable detergents, vegetable oils and fats) and polar solvents of low molecular weight (alkalis, ethers, ketones, glycols). Resistance to hydrocarbon solvents and mineral oils is poor.

Poor resistance to flame spread unless suitably formulated.

High water impermeability

APPLICATIONS

Fluoroelastomers notable resistance to heat and chemical agents has improved the performance of various auto and aircraft components and many types of industrial equipment. These mean that the industry can be supplied with items such as O-rings, diaphragms, coatings, rubberised fabrics, piping and a huge variety of special parts for use under an exceptionally-large range of operating conditions.

RESISTANCE TO OILS, FATS AND CHEMICAL AGENTS

The performance of fluorocarbon rubber in contact with fuels, oils, solvents and chemical agents cannot be equalled by any other type of synthetic rubber. It also offers excellent resistance to lubricants, most mineral acids and many aliphatic and aromatic hydrocarbons such as carbon tetrachloride, toluene, benzene and xylene.