

### ● RUBBERS:

#### CR (chloroprene)

Principally used in refrigeration systems (Freon 22) as an external seal. Neoprene is also utilized for oxygen service. Suitable for alcohol, mild acids, water, air, ammonia, argon gas and other gases. It has a temperature range of -20°C to +90°C.

#### CSM (chlorosulfonated polyethylene)

Used to handle strong oxidizing fluids, edible liquids, many chemicals, etc. Not recommended for aromatic or chlorinated hydrocarbons. It has a temperature range of -40°C to +120°C.

Hypalon® is an example for CSM, it is part of the family of elastomers.

*(Hypalon® is a registered trademark of Dupont Performance Elastomers)*

#### EPDM (ethylene-propylene)

Suitable for temperatures somewhat above the NBR range (i.e. excellent for phosphate ester type fluids and poor on petroleum base types), except ethylene-propylene has a somewhat higher temperature range than NBR. On this basis, ethylene-propylene has served to replace the formerly used NBR. Useful as "O" ring gaskets on steam valves due to low compression set. Ethylene-propylene is generally suitable for most photographic solutions as well as numerous chemical solutions.

Ethylene-propylene is selected for applications which have a wider temperature range than the NBR temperature range, such as handling hot water and steam. Ethylene-propylene has an extremely wide range of fluid compatibility but has the distinct disadvantage that it cannot be used with petroleum-based fluids or fluids so contaminated (such as lubricated air). It has a temperature range of -20°C to +180°C.

#### FFPM (perfluoroelastomer)

Elastomer used in the manufacture of joints and seals, combining resistance to aggressive chemical environments, swelling and high temperatures. Particularly suitable for pharmaceutical applications requiring extreme conditions of cleanliness.

Kalrez® is an example for FFPM, it is part of the family of elastomers.

*(Kalrez® is a registered trademark of Dupont Performance Elastomers)*

#### FPM (fluoroelastomer)

Suitable for temperatures somewhat above the NBR range. Excellent resistance to many petroleum oils, gasoline, dry-cleaning fluids and jet fuels. Not good for ketones, halogenated hydrocarbons and freons.

FPM is a fluorocarbon elastomer which was primarily developed for handling hydrocarbons such as jet fuels, gasolines, solvent, etc., which normally caused detrimental swelling to NBR. FPM has a high temperature range similar to ethylene-propylene but has the advantage of being somewhat more resistant to "dry heat". FPM has a rather wide range of chemical compatibility. It has a temperature range of -40°C to +190°C. Viton® is an example for FPM, it is part of the family of elastomers.

*(Viton® is a registered trademark of Dupont Performance Elastomers)*

#### FVMQ (fluorosilicone)

A silicone with a trifluoropropyl group on each siloxane unit. Good resistance to heat and most solvents. Good low temperature characteristics.

#### NBR (nitrile)

Standard compound for service in petroleum oils, air, water, mild acids, acetylene, kerosene, lime solutions, liquified petroleum gases and turpentine. Not recommended for highly aromatic gasolines or acids.

NBR is commonly referred to as a nitrile rubber and is a standard synthetic elastomer for accomplishing resilient-type seating or sealing in most valves. It has excellent compatibility for most air, water and light oil applications. It has a temperature range of -20°C to +90°C.

Buna® is an example for NBR, it is part of the family of elastomers.

*(Buna® is a registered trademark of DuPont de Nemours and Company or its affiliates)*

#### SBR (styrene butadiene)

Polymer use in the manufacture of seals. Good resistance to swelling in acids, non-organic and organic bases, alcohols and water.

#### UR (urethane)

Used for water, air at normal ambient temperatures, alcohol, non-aromatic compounds, ether, edible fats and oils and hydraulic fluids. Its principal asset is high strength, excellent abrasion resistance. It is not recommended for ketones and strong oxidizing agents. It has a temperature range of -30°C to +40°C.

#### VMQ (silicone)

Known as the only elastomer which, under certain conditions, can be utilized for both high and low temperature, which is its principal use. Also handles hydrogen peroxide and some acids. Not good for steam; poor disc life. Fluorosilicone compounds are noted to have better fuel resistance.

### Note:

Temperature limitations for elastomers are somewhat dependent on their specific functional usage in a valve.

Obviously, a diaphragm which stiffens at low temperature is objectionable while an "O" ring gasket of similar material which stiffens at low temperature may still be performing its sealing function.

Generally, temperatures down to -20°C can be considered tolerable and special elastomers such as silicone and low temperature NBR must be selected for use below this temperature.

These elastomers can extend the lower limit to approximately minus 40°C (-40°C) depending on specific usage. The upper limit for elastomers is generally around +100°C, except FPM, EPDM and VMQ which can, on specific applications, be utilized up to +190°C.

PTFE (see following page) is a commonly used gasket or disc material not considered an elastomer. This unique chemical-resistant material can be used from -270°C to +250°C with proper design limitations.

### ● PLASTICS:

#### PA (polyamide)

A polyamide resin known to be very durable and also resistant to many chemicals. A heat resistant type polyamide is always used in ASCO valves.

#### PARA (polyarylamide)

Aromatic polyamide in which at least one monomer contains a benzene ring, giving it improved mechanical, thermal and chemical resistance.

IXEF® is an example for polyarylamide, it is part of the family of thermoplastics.

*(Ixef® is a registered trademark of Solvay S.A.)*

#### PC (polycarbonate)

Good with polar solvents, salt solutions and water applications. Not recommended for non-polar solvents. A polycarbonate type thermoplastic known for having high impact strength and good resistance to inorganic acids and aliphatic hydrocarbons. Not suitable for use with air containing phosphate esters (found in synthetic oils).

#### PE (polyethylene)

A family of plastics varying from low melting point to high heat distortion temperature; and from flexible to rigid. Although somewhat soft, they offer good electrical, chemical and moisture resistance and physical properties.

**PEEK (polyetheretherketone)**

High performance thermoplastic with exceptional resistance to a wide range of chemical environments including at high temperatures.

**PEI (polyetherimide)**

This resin has good heat deflection characteristics. Good chemical resistance to non-oxidizing acids and polar solvents. Questionable usage on alkaline solutions. Ultem® is an example for PEI, it is part of the family of plastics. *(Ultem® is a registered trademark of General Electric Company)*

**POM (polyacetal or polyoxymethylene)**

Acetal resin type thermoplastics are extremely rigid but not brittle. They provide good toughness, tensile strength, stiffness and long life. They are odourless, tasteless, non-toxic and resistant to most solvents. Delrin® is an example for polyacetal, it is part of the family of plastics. *(Delrin® is a registered trademark of DuPont de Nemours and Company or its affiliates)*

**PP (polypropylene)**

A thermoplastic known to have excellent resistance to inorganic salts, mineral acids and gases. It offers good resistance to photographic solutions and is one of the few plastics that has the ability to withstand steam sterilization.

**PPS (polyphenylene sulfide)**

This resin has outstanding chemical resistance and no known solvents below 200°C. It has low friction, good wear resistance and high tensile strength. Ryton® is an example for PPS, it is part of the family of plastics. *(Ryton® is a registered trademark of Chevron Phillips Chemical Company)*

**PSU (polysulfone)**

Known as one of the most heat resistant of the thermoplastics. It has excellent chemical resistance when used for inorganic acids, alkalies and aliphatic hydrocarbons.

**PTFE (polytetrafluoroethylene)**

A fluorocarbon resin known to be suitable for disc material where all other synthetic materials have failed. Teflon® is not easily fabricated and is known to have objectionable "cold flow" characteristics. Teflon® is an example for PTFE, it is part of the family of plastics. *(Teflon® is a registered trademark of DuPont de Nemours and Company or its affiliates)*

**PTFE Reinforced**

PTFE reinforced is a form of PTFE having fillers which have been added for improved mechanical properties. PTFE and TPE with fillers are considered more of a plastic than a resilient-type material. They are virtually unattacked by any fluid. Their temperature usage ranges from discs for cryogenic valves to discs for steam valves. The "cold flow" characteristics may contribute to leakage particularly on gases. They have a temperature range of -270°C to +250°C. Rulon® is an example for reinforced PTFE, it is part of the family of plastics. *(Rulon® is a registered trademark of Saint Gobain Performance Plastics Corporation)*

**PUR (polyurethane)**

Polyurethane is a multipurpose, robust product. It has good adhesion to a variety of substrates, providing resistance to humidity and impact strength.

**PVC (polyvinyl chloride)**

Known for its chemical inertness but has somewhat less temperature resistance than most other plastics. PVC has excellent resistance to strong alkalies, mineral acids, salts and many chemicals corrosive to conventional materials.

**PVDF (polyvinylidene fluoride)**

Polymer resistant to atmospheric agents and the majority of chemical products at ambient temperature. High purity PVDF compounds are particularly recommended for medical applications.

**TPE (thermoplastic polyester elastomer)**

Used in some diaphragm applications. HYT elastomers show high strength in tension, compression and flex. They are superior to polyurethane rubbers in load-bearing capacity. Hytrel® (HYT) is an example for a polyester elastomer, it is part of the family of plastics. *(Hytrel® is a registered trademark of DuPont)*

**● METALS:**
**Ag (silver)**

Shading coil material for stainless steel valves.

**Al (aluminum)**

Shading coil material for special fluids or for making washers, etc. Die cast aluminum is generally used for bodies for low pressure gas valves and can only be used with "water free" systems. It can be noted that die cast aluminum is successfully used in oil and gasoline applications.

**Cu (copper)**

Primarily used for shading coil.

**CU Sn (bronze)**

Casting bronze is used for body forging. Good sealing and casting properties, resistant to abrasion.

**Cu Zn Pb (brass)**

Forging brass is used in our body forgings. Forging brass has a composition of 59% copper, 2% lead and 39% zinc.

**Fe Cr Ni (stainless steel AISI 303 or 304)**

One of the most widely used steels containing 18% chromium and 8% nickel. Used for valve bodies, springs and internal parts. Known as stainless steel type 303 or 304.

**Fe Cr Ni Mo (stainless steel AISI 316)**

Alloy containing approx 17 % chromium, 12% nickel and 2 % molybdenum. Highly corrosion resistant.

**Fe Cr Ni Mo (stainless AISI 316L)**

Alloy containing 16 to 18% chromium, 11 to 14% nickel and 2,5 to 3% molybdenum. Valve bodies made from this material provide excellent resistance to particularly aggressive fluids.

**Ni Fe (nickel iron)**

Core material for low temperature fluids (below -100°C) particularly for "long stroke" solenoids.

**Pb (lead)**

Gaskets - sometimes - lead-clad copper gaskets.

**Zamak**

Zinc alloy containing approx. 4% aluminium, 0,04% magnesium and 1% copper. Used, for example, for the bodies of air treatment equipment .