ELASTOMER SELECTION GUIDE

Elastomer Properties and Limitations

	COMPOUND	PURCHASE PRICE	FLEX LIFE	ABBRASION RESISTANCE	CHEMICAL RESISTANCE	CHEMICAL RESISTANCE/APPLICATIONS						TEMP LIMITATIONS	TEMPERATURE RANGE
						KETONES & ALDEHYDES	ACETATES	AROMATIC HYDROCARBONS	CHLORINATED HYDROCARBONS	OIL & GAS	WATER & WASTEWATER		(MIN / MAX)
THERMOPLASTIC	SANTOPRENE ® (TPO)	A	A	A	A	YES	YES	N/R	N/R	N/R	YES	A	-40 TO 225 F (-40 TO 107 C)
THERMOPLASTIC	HYREL ™ (TPE/TPEE)	B	B	A	B	N/R	N/R	YES	N/R	N/R	N/R	B	-20 TO 220 F (-29 TO 104 C
PTFE	TEFLON ® (PTFE)	D	A	B	A	YES	YES	YES	YES	YES	YES	A	40 TO 220 F (-4 TO 104 C)
RUBBER	NEOPRENE ™ (CR)	A	B	C	D	N/R	N/R	N/R	N/R	N/R	YES	C	0 TO 200 F (-18 TO 93 C)
RUBBER	BUNA-N (NBR)	A	C	C	C	N/R	N/R	N/R	N/R	YES	N/R	C	10 TO 180 F (-12 TO 82 C)
RUBBER	NORDEL ™ (EPDM)	B	B	C	B	YES	YES	N/R	N/R	N/R	N/R	B	-60 TO 280 F (-51 TO 138C)
RUBBER	VITON ® (FPM/FKM)	F	C	C	A	N/R	N/R	YES	YES	YES	N/R	A	-40 TO 350 F (-40 TO 177 C)

- Always use best matched materials – “A” Ratings over “B” and “C” Ratings whenever possible.
- The customer will have to give Iwaki AIR written or verbal approval if they decide they want to use anything below our “A” recommendation if there are exceptions where fluids are highly specialized or processed under extreme conditions
- Cost may be the deciding factor when two “”A” Rated materials can meet the specifications of the application. The maximum fluid temperature should be kept as close to the mid-point of the temperature range as possible.
- Other considerations – fluids used to clean the pump, the selected pump’s hardware, intermittent or continuous duty of the pump, and frequency of diaphragm replacement (Less than 3 months longevity may suggest a material issue to be reviewed)
- Recommendations for Solvents (Ketones, Acetates and Aromatic/Chlorinated Hydrocarbons) are listed below.

Elastomer Selection Recommendations for Solvents

FLUID CLASSIFICATION	EXAMPLE FLUIDS	ELASTOMER SELECTION
KEYTONES AND ALDEHYDES	METHYL ETHYL KETONE	SANTOPRENE (TPO) NORDEL (EPDM) TEFLON (PTFE)
	METHYLACETONE	
	ACETONE	
	FORMALGEHYDE	
ACETONES	ETHYL ACETATE	SANTOPRENE (TPO) NORDEL (EPDM) TEFLON (PTFE)
	ISOPROPYL ACETATE	
	AMYL ACETATE	
	BUTYL ACETATE	
AROMATIC HYDROCARBONS	BENZENE	VITON (FPM/FKM) TEFLON (PTFE)
	TOLUOL (TOLUENE)	
	XYLENE (XYOL)	
	BENZOL	
	HEXANE	
	CYCLOHEXANE	
	NAPTHALENE	
CHLORINATED HYDROCARBONS	CARBON TETRACHLORINE	VITON (FPM/FKM) TEFLON (PTFE)
	TRICHLORETHELENE	
	ETHYLENE DICHLORIDE	
	METHYL CHLORIDE	
	PROPYL CHLORIDE	
	CHLOROFORM	
	DICHLORETHYLENE	
NOTE: FLUID LISTED ABOVE TYPICALLY CANNOT BE USED WITH NEOPRENE (CR) OR BUNA-N (NBR) AND MAY REQUIRE THE ELASTOMER RECOMMENDATION LISTED.		

Elastomer Selection Criteria

It is very an important part of the pump selection process to consider diaphragms for the application based on safety, efficiency and reliability. Several factors should be considered when selecting the correct diaphragm materials of the application: previous experience (with existing applications), understanding the application (new installation) and advice from the Iwaki AIR customer service team in order to select the correct materials for the application. There are several factors to review when selecting a diaphragm for an application:

- **Chemical resistance –** Compatibility with the fluid being pumped. The spectrum of fluids pumped can range from water to aggressive acids and caustics. Each diaphragm material has been tested to measure its compatibility against many chemicals. The operator should evaluate the pumped fluid against published chemical compatibility guides.
- **Temperature ranges –** Capability to remain flexible in low temperatures and not deteriorate in high temperatures. Temperature is a very critical factor, and the working range available in diaphragm materials varies greatly. The type of fluid can also affect the working temperature range of the material.
- **Abrasion resistance –** Ability to withstand wear and friction from contact with solids and particles in the fluid being pumped. Diaphragms are available to handle fluids ranging from clear to heavy slurries to dry bulk pumping.
- **Sanitary standards –** Requirements that the diaphragm comply with hygienic or sanitary standards. Applications in the food and beverage industry must utilize diaphragms that comply with U.S. Food and Drug Administration (FDA) 21 CFR 177 standards. Diaphragms used in the pharmaceutical industry must comply with United States Pharmacopeia Convention (USP) Class VI standards.
- **Inlet condition (flooded suction and suction lift) –** Capacity to pump fluid from one location to another. For different pumping configurations and conditions, certain diaphragm materials are more efficient and longer

lasting than others. Outside advice from an expert such as a Wilden distributor can assist in determining the optimum material for specific applications.

- **Flex life –** Expected longevity of the diaphragm before requiring replacement. Achieving maximum mean time between repairs (MTBR) is a key goal in selecting a diaphragm. However, some materials have inherently shorter flex lives than others even under ideal conditions.
- **Cost –** Total cost of ownership determined by multiple factors such as initial price, rated flex life for the application and costs of downtime and diaphragm replacement labor. Because of the many variables involved, advice from an outside expert such as a Wilden distributor can greatly assist in selecting the best performing, most cost-effective option for individual applications.

Types of Elastomer Materials, Details and Applications

Over the years, a number of materials have been tested extensively for use in diaphragms in AODD pumps. These materials can be grouped into three primary families: Rubber, TPE (thermoplastic elastomer) and PTFE (Polytetrafluoroethylene or Teflon®). Each family and the materials within each family offer properties and attributes that make them suitable for different applications.

Rubber Diaphragms

Rubber diaphragms are made by compressing synthetic rubber in a mold with a mesh in the center of the rubber material to improve flex life. Below are the most common rubber materials used for elastomers:

- **Neoprene™ (CR)** Low-cost, general purpose elastomer. Applications include non-aggressive chemical applications such as water-based slurries, well water or seawater. It provides good flex life and abrasion resistance.
- **Buna-N (NBR)** Excellent performance in applications involving petroleum/oil-based fluids such as leaded gasoline, fuel oils, kerosene, turpentine and motor oils. Buna-N is also referred to as nitrile and provides moderate flex life and moderate abrasion resistance.
- **NORDEL™ (EPDM)** Excellent material for extremely cold temperatures and is an economical alternative when pumping dilute acids or caustics. Exhibits good flex life and moderate abrasion resistance. EPDM is also a good choice where statically dissipative materials are required.
- **Viton® (FPM/FKM)** Excellent for extremely hot temperatures and provides exceptional performance with aggressive fluids such as aromatic/chlorinated hydrocarbons and strong, aggressive acids. Almost exclusively suitable for applications where harsh chemicals are used because of its high temperature limit and chemical resiliency. It provides moderate flex life and moderate abrasion resistance.

Thermoplastic Elastomer (TPE) Diaphragms

TPE diaphragms are made by the process of injection molding. These elastomers do not require mesh like rubber diaphragms due to strength and their ability to hold their shape. Below are the most common rubber materials used for elastomers:

- **Santoprene ® (TPO)** Low-cost alternative to PTFE with a cost comparable to Neoprene. Ideal for use with acidic and caustic fluids such as sodium hydroxide, sulfuric or hydrochloric acids. Excellent flex life, abrasion resistance, temperature range and durability.

- **Hytrel ™ (TPE/TPEE)** Exhibits good flex life and excellent abrasion resistance. Offers superior sealing or seal energizing due to its low compression set characteristics.

Polytetrafluoroethylene (PTFE) Diaphragms

PTFE can be used with an extremely wide range of fluids because it is one of the most chemically inert compounds available. Branded as Teflon®, it is excellent for highly aggressive fluids such as aromatic or chlorinated hydrocarbons, acids, caustics, ketones and acetates. Its properties provide excellent flex life and moderate abrasion resistance. Because PTFE is non-elastic, a backup diaphragm of a different material must be used to provide flexibility and memory.

Wetted Pump Materials

- **Polypropylene (Pure and Glass-filled)** Good general purpose plastic material used in a wide variety of pumping applications. Available in both Pure Poly and Glass-filled Polypropylene (Glass fillers can attack hydrofluoric acid and similar chemicals). Temperature range 32 to 150F. Pure Polypropylene needs to be protected from direct sunlight as it will allow light to pass through to the fluid being pumped (i.e. UV sensitive paints or inks).
- **PVDF (Polyvinylidene Fluoride)** Plastic material in the fluoropolymer family and is used generally in applications requiring high purity, strength, resistance to solvents, acids, and bases. Temperature range 10 to 200F.
- **Aluminum** Light weight metal used for non-corrosive chemicals, oils and solvents. Temperature limit of 212F.
- **Stainless Steel** is used on moderately corrosive liquids and has excellent abrasion resistance. Temperature limit of 212F.

Wetted Material Compatibility Guide by Fluid Type

FLUID TYPE	pH LEVEL (*)	MATERIAL SELECTION
ALKALINE	14	STAINLESS STEEL
	13	
	12	
CAUSTIC	11	
BASIC	10	CAST IRON
	9	
NEUTRAL	8	ALUMINUM
	7	
	6	
ACID	5	CAST IRON
	4	
	3	STAINLESS STEEL
	2	
	1	
	0	
(*) pH is the measure of Hydrogen-Ion concentration		

Chemical Groups

- **Solvents -** Common solvents include paint thinners (toluene, turpentine), glue solvents (acetone, methyl acetate and ethyl acetate), spot removers (e.g. hexane, petrol ether), liquid detergents (citrus terpenes) and perfumes (ethanol). Standard recommendation for solvent transfer application is the use of groundable acetal and/or stainless steel wetted materials.
- **Liquid hydrocarbons –** Includes petroleum based fluids such as mineral oil, gasoline and diesel fuel.
- **Caustic fluids –** Fluids such as nitric acid, hydrochloric acid, sulfuric acid, hydroxides and ammonia. Material recommendation would include Stainless Steel, PVDF, Hastelloy-C, Teflon (PTFE) and/or Viton.