



SELECTION OF MATERIALS FOR PHE GASKETS





1. Removable Plate Heat Exchanger (PHE) Gasket Type

- Structure: PHE Gaskets Type Categorized By Assembling Method

Glue Type, Clip Type, Snap Type and so on.

- Material: Rubber, Non Rubber.

Rubber Types and Properties

Rubber Types Once Used:

NBR, EPDM, SBR, CR, HR, IIR, Q.

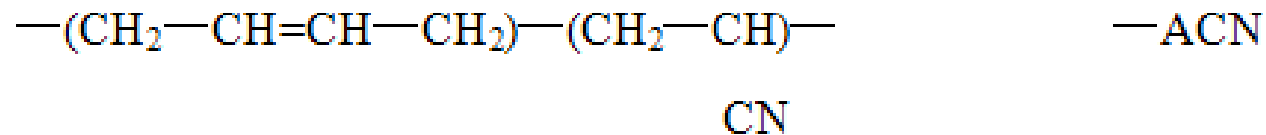
Non Rubber Once Used:

Asbestos Slate, PTFE, Graphite Products



1. Removable Plate Heat Exchanger (PHE) Gasket Type

- Widely used Type At Present: NBR, EPDM, FKM
- NBR—Most Consumable Rubber Type.
- Polymer Molecule Structure Sketch:



1. Removable Plate Heat Exchanger (PHE) Gasket Type

- Characteristic of NBR: Polar Polymer, Non-polar Compound Resistant. The Performance Quality is Determined by ACN (acrylonitrile) Content.
- High ACN Content With Good Oil Resistance, High Temperature Resistance; But Poor Elasticity (High Compression set) and Poor Processability.
- There are many suppliers for crude rubber polymer, the famous companies are Bayer, Zeonex, and JSR.



1. Removable Plate Heat Exchanger (PHE) Gasket Type

- **Characteristic of HNBR: The Saturation determines the temperature and chemical resistance.**
- **There are only two companies Bayer and Zeonex can supply the fully developed HNBR.**
- **This rubber is made by increasing the saturation of NBR with hydrogenated method. Therefore, the saturation determines the temperature and chemical resistance of HNBR.**
- **The higher the saturation the higher the temperature resistance and the chemical resistance is better; on the contrary the properties are closer to NBR.**

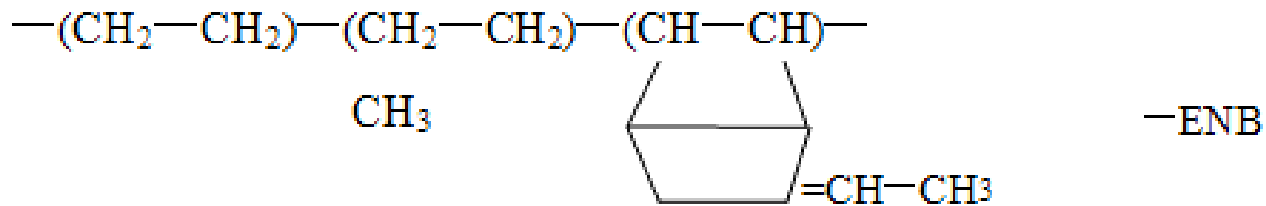


LIANYI PHE GASKET COMPOUNDS (NBR)

TYPE	CURING SYSTEM	APPLICABLE TEMPERATURE		APPLICABLE MEDIUM	GL NO.	AL GRADE & COLOR MARK	
		MIN.	MAX.				
NBR	GENERAL	sulfuret	-25°C	110°C	Hydrocarbon of methane series, olefin and so on non-polar medium; light and heavy fuel oil and all kinds of mineral oil; lubricating oil; animal and vegetable oils; hot water; brine (salt water) and so on. comply with FDA.	63614	NBR B 2 blue
	NHT	peroxide	-25°C	130°C	Same as above but with higher applicable temperature.	63749,	NBR P 1blue
	FOODNF	peroxide	-15°C	135°C	Suitable for high temperature vegetable oil, comply with FDA	63812, 63830	NBR F 3blue
	NLT	peroxide	-40°C	70°C	F12, F22, F113 and so on, suitable for low temperature and compressor oil resistance working condition.	63802	NBR LT 1blue+1yellow
	LH	sulfuret	-25°C	110°C	The medium and temperature are same as NG; comply with FDA. Suitable for large scale PHE single unit with plates above 350pcs.	63614	NBR LH 1blue+1white
HNBR	peroxide	-5°C	150°C	Crude oil; sour product (sulfur-bearing oils) and sulfur-containing organic compound; part of conduction oil (heat transfer oil); novel cryogen 134a(new type refrigerant); ozone surroundings.	63805	HNBR 1blue+1red	

1. Removable Plate Heat Exchanger (PHE) Gasket Type

- EPDM (secondary consumable rubber type)
- Crude Rubber Polymer Molecule Sketch:





1. Removable Plate Heat Exchanger (PHE) Gasket Type

- Characteristic of EPDM: It is a Non-Polar Polymer with polar compound resistant.
- The content proportion of Ethylene, propylene and ENB determines the performance quality of EPDM.
- The higher the ethylene content the higher the strength and chemical and temperature resistance is better; but poor elasticity(high compression set) and poor processability.
- The higher content of propylene the higher resilience (compression set becomes low) , but poor intensity.



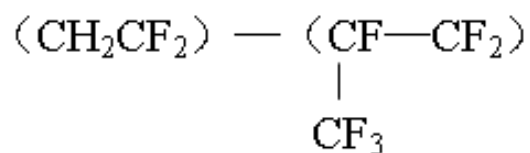
LIANY PHE GASKET COMPOUNDS (EPDM)

TYPE	CURING SYSTEM	APPLICABLE TEMPERATURE		APPLICABLE MEDIUM	GL No.	corresponding to AL grade and color code
		Minimum	Maximum			
EPDM	General EG	peroxide	-25°C	150°C	water, saturated steam and polar medium and so on (saturated steam pressure reaches 0.5MPa) ; can supersede butylrubber.	70806 EPDM 1灰
	FOOD EF	peroxide	-20°C	150°C	Suitable for various carbonated beverage, juice, dairy; non-fat or low fat liquid food comply with FDA.	70817 EPDM F 2灰
	Chemical EC	peroxide	-20°C	130°C	Low concentration inorganic acid; caustic soda, soda ash; variety of concentration hydrochloric acid and chloride; phosphoric acid, carbonic acid; oxidant; Whiten fluid; butyric acid and its salt; plating liquid and so on. Various polar solvent such as alcohol, ketone, esters.	

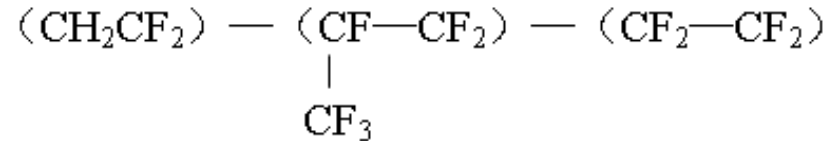
*AL—Alfa Laval CO.,GL—Gislaved CO.

1. Removable Plate Heat Exchanger (PHE) Gasket Type

- Characteristic of FKM: Fluorocarbon Polymer
- Performance quality is determined by content of fluorine and curing system.



Bisphenol System (Viton A)

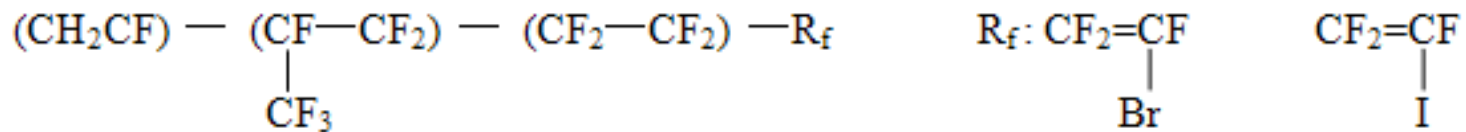


Bisphenol System (Viton B)



1. Removable Plate Heat Exchanger (PHE) Gasket Type

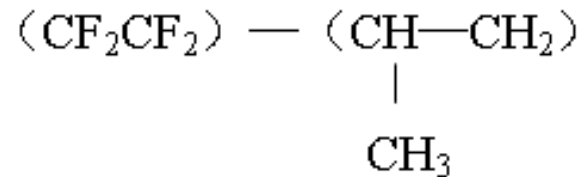
- Characteristic of FKM: Fluorocarbon Polymer
- Performance quality is determined by content of fluorine and curing system.



Peroxide Curing System (Viton G)

1. Removable Plate Heat Exchanger (PHE) Gasket Type

- Characteristic of FKM: Fluorocarbon Polymer
- Performance quality is determined by content of fluorine and curing system.



Peroxide Curing System (Aflas F-TP四丙氟,)



1. Removable Plate Heat Exchanger (PHE) Gasket Type

- Characteristic of FKM: Fluorocarbon Polymer has an excellent stability in temperature and medium resistance.
- Due to the chemical bond energy of Fluorocarbon is high and the volume of a fluorine atom is big, it shields the Chemical Bond of Hydrocarbon; therefore it has an excellent stability of molecular chain.



LIANYI PHE Gasket Polymer (FKM)

Type	Curin g System	Applicable Temperature		Applicable Medium	GL No.	Correspondin g to AL Grade and Color Code
		MIN	MAX			
FKM	Binary F A	Bisphenol	-15°C	180°C	Light and heavy fuel and various mineral oil under high temperature condition; non-polar medium such as animal fat and plant oil; comply with FDA. 高温条件下的轻重燃油等各类矿物油品; 动植物脂肪油等非极性介质。符合FDA要求。	FKM A 1purple
	Tertiary F B	Bisphenol	-10°C	150°C	benzene and light aromatic hydrocarbon	FKM B 2purples
	F TP	Peroxide	0°C	150°C	High concentration caustic soda , soda ash; incombustibility phosphate ester oils; organic amine compounds (preservative); liquid chlorine, chloric acid and perchloric acid; and other polar chemical mediator.	--
	Quaternary	Peroxide	-20°C	180°C	The mediums mentioned as FA; alkyl aromatic hydrocarbons compounds(such as conduction oil), acidic fuel, alcohol blended gasoline; T-butyl mercaptan; T-butyl titanate; tetrahalogenated	FKM G



2. Gasket Selection Principle for Movable Plate Heat Exchanger (PHE)

- Selection Sequence : First consideration is temperature then is medium and consider cost for polymers with similar performance quality.
- Such as EPDM and FKM TP; NBR and FKM A.
- To make it clearly on weakness of a polymer.



2. Removable Plate Heat Exchanger (PHE) Gasket selection principle

- Weakness of a polymer
- NBR: useful temperature is limited, poor for atmosphere aging resistance (storage requirement)
- EPDM: can not come into contact with mineral oil, but can be stored for long time.
- FKM: Viton A,B poor resistance to acid, alkali and steam.
- Viton G poor resistance to good solvent



2. Gasket Election Principle For Removable Plate Heat Exchanger (PHE)

Type	Matters Need Attention
NBR	<ol style="list-style-type: none">1. Unsuitable: benzene and aromatic compounds, 苯及芳香类化合物 Alkylate Aromatic Hydrocarbon based heat conduction oil, 以烷基化芳基碳氢化合物为基础的导热油, Hydrochloric Ether 氯代烃, Organic Acid 有机酸, Ketone 酮, Aldehyde 醛, Ester Polar Solvent 酯极性溶剂; Strong Acid and Strong Oxidizing Property Substances 强酸及强氧化性物质。2. The specified applicable temperature is not allowed to surpass, especially for NG (NBR General) 不能超过规定的使用温度, 特别是NG (通用丁腈)



2.Gasket Selection Principle For Removable Plate Heat Exchanger (PHE)

Type	Matters Need attention
EPDM	Unsuitable: mineral oil, Hydrocarbonize Conduction Oil 碳氢类导热油, Paraffin石蜡, animal fat, vegetable oil and so on.



2. Gasket Selection Principle for Removable Plate Heat Exchanger (PHE)

Type	Matters Need Attention
FKM Bisphenols	Unsuitable: BTX aromatics Conduction Oil and so on 混合芳烃类导热油等。



2. Gasket Selection for Removable Plate Heat Exchanger (PHE)

Type	Matters Need Attention
FKM G	Unsuitable: Hydrochloric Ether, Organic Acid, Ketone, Aldehyde, Ester Polar Solvent; Organic Amine Compound and so on. 不适合: 氯代烃, 有机酸, 酮, 醛, 酯类极性溶剂; 有机胺类化合物等。



2. Gasket Selection for Removable Plate Heat Exchanger (PHE)

Type	Matters Need Attention
FKM TP	Unsuitable: Mineral Oil, Hydrocarbon Heat Conduction Oil, Paraffin, Animal Fatty Oil, Plant Oil and son on. It's unsuitable for low temperature the applicable temperature must be above 0C.不适合：矿物油，碳氢类导热油，石蜡，动物脂肪油，植物油等。不适合低温，必须在0℃上使用。



Thank You !

谢谢大家！