



PYROFLEX[®]

Acid-Proof Sheet Lining

A Koch Chemical Technology Group LLC Company

 **KOCH KNIGHT LLC**

PYROFLEX®

ACID-PROOF SHEET LINING

The unique ingredient in Koch Knight acid-proof construction – PYROFLEX® Membrane – is a flexible, uniform, thick sheet membrane used as an impervious barrier between acid-proof brick and the corrosion-prone steel or concrete shell. PYROFLEX Sheet Lining can also be applied to suitable concrete shells at a customer's plant. PYROFLEX Sheet Lining is manufactured by Koch Knight and applied by fusion directly to the shell to form a smooth, continuous, homogenous lining without lap joints. No vulcanization or adhesive cure is required. It can be factory or field installed in vessels of any size. Many installations remain in service for more than 20 years with no appreciable maintenance.

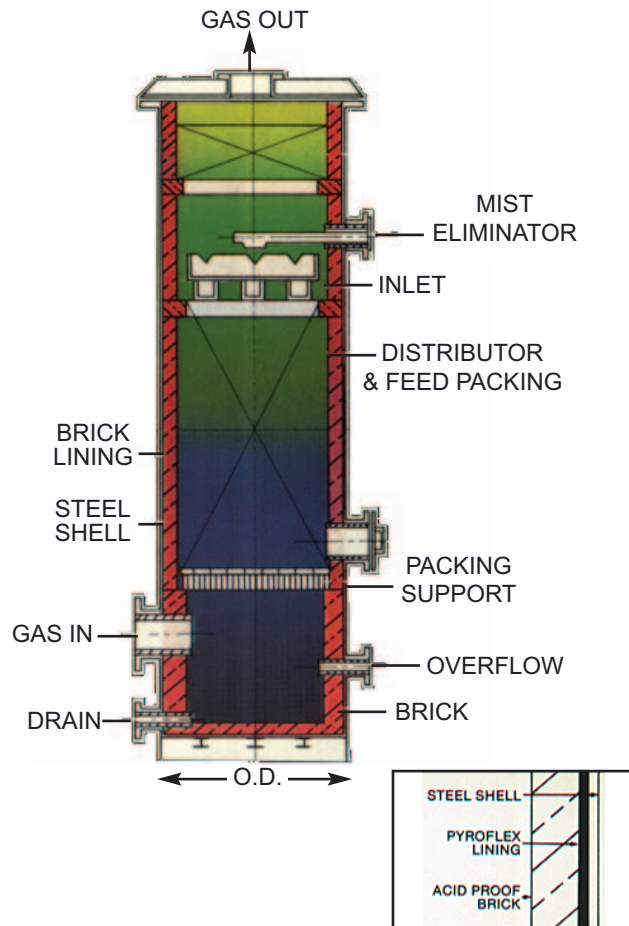
PYROFLEX Sheet Lining is corrosion-proof, thermoplastic, flexible, non-porous and non-aging. It can be electrostatically tested to insure a pin-hole free membrane. Its properties are listed on the back cover.



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A masonry sheathing covering the PYROFLEX Sheet Lining is in direct contact with the corrosive chemicals involved. This provides front-line protection against corrosive attack, temperature conditions, and mechanical abrasion. Any seepage of acid through the porous masonry and the mortar joints is stopped by the PYROFLEX Sheet Lining protecting the underlying shell. The masonry component most widely used is either KNIGHT-WARE® or a fire clay acid-proof brick. For special corrosive applications, other masonry materials are available, such as chemical porcelain brick, carbon brick, or PERMANITE® Book Tile.

To form a continuous masonry lining, the brick are laid in various types of acid-proof mortars available from Koch Knight.



An intermediate layer between the PYROFLEX® Sheet Lining and masonry may be used when the chemical solution contains organic solvents which may have a deleterious effect on the PYROFLEX Sheet Lining. PERMANITE® DUPLY, a furan-reinforced thermosetting resin manufactured by Koch Knight, is generally chosen because it offers the best chemical resistance to most acids, alkalies, and organic solvents. It may be applied directly to the PYROFLEX sheet surface. RESIBOND® DUPLY reinforced vinyl ester overlays and PTFE Sheet overlays are also available.

Proven Capability

With the many kinds of lining materials in the market place, a thorough knowledge of their properties as well as their application to the corrosion problem at hand is necessary. The physical design of the vessel also must be considered. Finally, adequately trained and experienced craftsmen for installation are required to complete the project. Koch Knight has extensive experience in meeting these requirements.

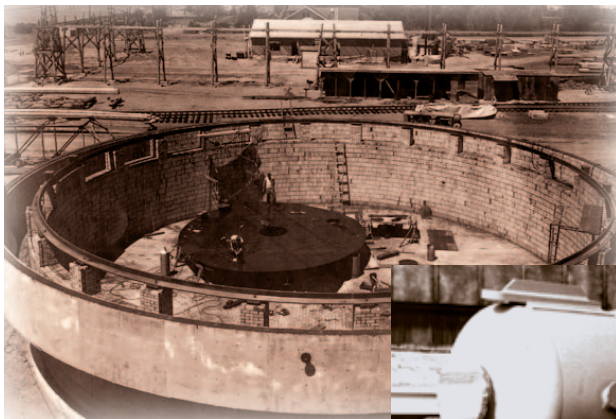
PYROFLEX Sheet Lining is a proven performer with capabilities in a wide range of service. Refer to the chart on this page for a list of typical installations.

Advantages of PYROFLEX Acid-Proof Lining

- Completely seals steel or concrete from chemical corrosion.
- Low installation cost.

- Easily applied - no curing or aging period required.
- Continuous, uniform lining - no lap joints.
- Remains permanently plastic - resists aging and weathering.
- Highly resistant to thermal decomposition.
- It is fused directly to steel or concrete with no adhesives required.
- Acts as an expansion joint between masonry and sheathing steel or concrete shell.
- Readily repaired if damaged.
- Can be electrostatically tested, even on concrete.
- Vessels in service over 40 years.

PYROFLEX® SHEET LINING CONSTRUCTION TYPICAL INSTALLATIONS					
EQUIPMENT	OPERATING CONDITIONS		CONSTRUCTION		
	SERVICE	TEMP.	SHEET LINING	BRICK	MORTAR
ABSORPTION TOWERS	SO ₂ gas and conc. H ₂ SO ₄	700° F (Gas)	3/8" PYROFLEX®	4 1/2" KW	ACIDSIL™ K
	HCl gas and water	180° F	3/8" PYROFLEX	2 1/2" KW	PERMANITE®
	ClO ₂ or Cl ₂ gas and water	60° F	3/8" PYROFLEX	2 1/2" KW	RESIBOND® D
STRIPPING COLUMNS	HCl, Benzene, Water	270° F	3/8" PYROFLEX DUPLY	9" Carbon	PERMANITE
QUENCH/ ABSORPTION TOWERS	Hot HCl laden gas and water	500-2800° F	3/8" PYROFLEX	4 1/2-9" KW	PERMANITE
	Hot HBr laden gas and water	500-2800° F	3/8" PYROFLEX	4 1/2-9" KW	ACIDSIL™
DRYING TOWERS	Conc. H ₂ SO ₄ and Cl ₂ gas	90° F	3/8" PYROFLEX	4 1/2" KW	ACIDSIL
	Conc. H ₂ SO ₄ and HCl gas	180° F	3/8" PYROFLEX	4 1/2" KW	ACIDSIL
	Conc. H ₂ SO ₄ and air	90° F	3/8" PYROFLEX	4 1/2" KW	ACIDSIL
PRESSURE OXIDATION	H ₂ SO ₄ and mineral slurry	180° F	1/4" PYROFLEX	3" KW AP302	RESIBOND D
		310° F	1/4" PYROFLEX	6" KW AP302	RESIBOND D
		420° F	3/8" PYROFLEX DUPLY	9" KW AP302	
PICKLING TANKS	30% H ₂ SO ₄ 10% HNO ₃ 15% HCl	230° F	3/8" PYROFLEX	4 1/2" KW	ACIDSIL
		160° F	1/4" PYROFLEX	3 3/4" KW	PERMANITE
		180° F	3/8" PYROFLEX	2 1/2" KW	PERMANITE
PROCESSING EQUIPMENT	32% HCl solution 35% H ₂ SO ₄ and scrap iron 30% H ₂ SO ₄ and oil 85% Phosphoric Acid	230° F	3/8" PYROFLEX	4 1/2" KW	PERMANITE
		270° F	3/8" PYROFLEX	4 1/2" KW	ACIDSIL
		240° F	3/8" PYROFLEX	4 1/2" KW	PERMANITE
		350° F	3/8" PYROFLEX	4 1/2" KW and 4 1/2" Carbon	KABO™
	HCl, MeOH, MeCl	284° F	1/2" PYROFLEX DUPLY	9" KW and 2 1/2" Carbon	PERMANITE
STORAGE TANKS	33% HCl & trace organic solvents 20% H ₂ SO ₄ 3% H ₂ SO ₄ , oil, traces HCl and HNO ₃ 70% Phosphoric Acid	85° F	3/8" PYROFLEX DUPLY	3 3/4" KW	PERMANITE
		80° F	3/8" PYROFLEX	4 1/2" KW	ACIDSIL
		90° F	3/8" PYROFLEX	3 3/4" KW	ACIDSIL
		140° F	3/8" PYROFLEX	4 1/2" KW	KABO
CHLORINE NEUTRALIZER/ SCRUBBER TOWERS	Cl ₂ gas and 10-20% NaOH	190° F	3/8" PYROFLEX	2 1/4" CORESITE™	CORESITE



PROPERTIES OF PYROFLEX® SHEET LINING

Chemical

Chemical Resistance:

PYROFLEX Sheet Lining is inert to all concentrations of alkali, most concentrations of mineral acids, and all salt solutions.

Oxidation Resistance:

In the presence of oxidizing agents, the surface of PYROFLEX Sheet Lining is oxidized at a uniform rate determined by the chemical environment. Because it remains stable, not cracking or becoming brittle, the lining has substantial service life under these conditions. Reducing agents do not affect PYROFLEX Sheet Lining.

Solvent Resistance:

Although some organic solvents cause softening of the surface, PYROFLEX Sheet Lining shows only a small percentage of volume swelling compared with rubber and other elastomers. With a properly installed acid-proof masonry sheathing, any combination of organic chemicals can be handled with PYROFLEX Sheet Lining.

Heat Resistance:

PYROFLEX Sheet Lining is a thermoplastic with a softening point of 320° F. Although PYROFLEX Lining will liquify at 450° F, it does not undergo thermal decomposition even at 500° F.

This remarkable thermal stability accounts for its outstanding performance records in masonry-lined towers operating at temperatures as high as 2800° F. The design temperature limitations for PYROFLEX Lining are determined by the allowable distortion. Although PYROFLEX Lining will not sag at 300° F, normal practice is to limit the temperature of the membrane itself to a maximum of 250° F.

Water Resistance:

PYROFLEX Sheet Lining will not distort in boiling water, and will absorb less than .001 of its own weight of boiling water.

Aging Resistance:

PYROFLEX Sheet Lining is extremely resistant to crazing, cracking and softening from aging. The problems of ultraviolet decomposition and brittleness due to plasticizer migration are eliminated. PYROFLEX Lining shows no significant change in physical properties after more than 20 years of weathering.

Abrasion Resistance:

Because PYROFLEX Sheet Lining is not resilient, it must be protected from impact cutting damage. PYROFLEX Lining is satisfactory in those applications where the abrasive will embed in the surface to form a resistant film.

Physical

Hardness, Shore A @ RT	70-80
Softening Point (ASTM D36-84)	320° F
Penetration at 77° F (ASTM D5-83)	8-12
Flash Point (ASTM D92-78)	615° F
Fire Point (ASTM D92-78)	625° F

General

Sheet Size	30" x 48" (10 sq. ft.)
Thickness (nominal)	3/8" and 1/4"
Weight	22 lbs./sheet 1/4" thick 27 lbs./sheet 3/8" thick
Density (ASTM D71)	85 lbs. Per cu. ft.
Color	Black
Storage Life	Unlimited

Grades

1071-General Purpose
1010-Fluoride Service
500-Extreme Service

Typical Design Practice

(for acid brick sheathing over PYROFLEX Lining)

Acid Brick Thickness	Max. Continuous Liquid Temp.
2-1/4"	275° F
3-3/4"	305° F
4-1/2"	320° F
6"	350° F
7-1/2"	380° F
9"	425° F
11-1/4"	450° F
12"	470° F

Creating value for customers through providing non-metallic solutions to the toughest corrosive process applications.

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Koch Knight LLC provides a wide range of corrosion resistant process equipment for the Chemical Process Industries. Our corrosive process applications engineers design this equipment. Our scope of supply can extend from the design and supply of tower packing and tower internals to project management of turnkey field erected and lined vessels or shop lined vessels.

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