

EC Duro-Bond ETFE Lining

Description

Duro-Bond ETFE is a laminated sheet lining consisting of a layer of Ethylenetetrafluoroethylene (ETFE) resin laminated to a fabric backing that is readily bonded to steel, concrete, or FRP substrates. ETFE is a partially fluorinated thermoplastic resin that is melt flow processible. Duro-Bond ETFE sheet lining is available in thicknesses of 60 mils (1.5 mm) and 90 mils (2.3 mm).

Uses

Duro-Bond ETFE is used as a vessel lining material to provide chemical resistance to acids, bases, oxidizing agents, organic solvents and other corrosive media. **Duro-Bond ETFE** can be applied to tanks, scrubbing towers, reactors, valves, columns, agitators and other process equipment for handling corrosive materials.

When a combination of chemical, temperature, abrasion and permeation resistance is required **Duro-Bond ETFE** may be the optimum solution to the corrosion problem.

Advantages

Duro-Bond ETFE fluoropolymer sheet lining exhibits outstanding chemical resistance, being virtually unaffected by many of the corrosive chemicals commonly encountered in the chemical process industry.

Duro-Bond ETFE is resistant to strong mineral and oxidizing acids, alkalis, metal etchants, liquid oxygen and essentially all organic solvents. Typical of the fluoropolymers, **ETFE** is attacked by metallic sodium and potassium. Rate of attack is a function of exposure time and temperature.

Duro-Bond ETFE sheet lining provides substrate protection by virtue of its excellent permeation resistance. The **ETFE** fluoropolymer has low permeability to water vapor and various other gases. The **ETFE** fluoropolymer also exhibits low permeability to liquid chemicals.

Duro-Bond ETFE does not contain any fillers or plastizers to leach out and contaminate the service thereby making it an excellent choice for handling high purity chemicals.

Service Temperature

ETFE fluorocarbon resins withstand continuous service temperatures as high as 150 ° C (300 ° F). When adhesively bonded to a substrate, the maximum recommended service temperature for **Duro-Bond FEP** sheet lining is 110 ° C (230 ° F) on a continuous basis, 120 ° C (250 ° F) on an intermittent basis.

Chemical Resistance

The information listed may be considered as a basis for recommendation, but not as a guarantee, unless sold and installed by **ELECTRO CHEMICAL ENGINEERING & MFG. CO.** For resistance of **Duro-Bond ETFE** to chemicals not listed, contact our Engineering Department at:

inquiry@electrochemical.net or **1-800-235-1885**.

Electro Chemical Duro-Bond ETFE Lining

<u>Chemical</u>	<u>Maximum Use Temperature</u>		<u>Chemical</u>	<u>Maximum Use Temperature</u>	
	<u>°F</u>	<u>°C</u>		<u>°F</u>	<u>°C</u>
Acetaldehyde	200	95	Aqua Regia	212	100
Acetamide	230	110	Arsenic Acid	230	110
Acetic Acid (Glacial)	230	110	Barium Carbonate	230	110
Acetic Acid, Dilute (50% H ₂ O)	230	110	Barium Chloride	230	110
Acetic Anhydride	230	110	Barium Hydroxide	230	110
Acetone	150	65	Barium Sulfate	230	110
Acetone (50% H ₂ O)	150	65	Barium Sulfide	230	110
Acetonitrile	150	65	Battery Acid	230	110
Acetophenone	230	110	Benzaldehyde	212	100
Acetylchloride	150	65	Benzene	212	100
Acetylene	230	110	Benzene Sulfonic Acid	212	100
Acetylene Tebrabromide	230	110	Benzoic Acid	230	110
Acetylene Tetrachloride	230	110	Benzoyl Chloride	150	65
Acrylonitrile	150	65	Benzyl Alcohol	230	110
Adipic Acid	230	110	Benzyl Chloride	230	110
Air	230	110	Bismuth Carbonate	230	110
Alcohol, Allyl	212	100	Black Liquor	230	110
Allyl Chloride	212	100	Bleach (12.5% Cl ₂)	212	100
Aluminum Ammonium Sulfate	230	110	Borax	230	110
Aluminum Chloride	230	110	Boric Acid	230	110
Aluminum Fluoride	230	110	Brine	230	110
Aluminum Hydroxide	230	110	Bromic Acid	230	110
Aluminum Nitrate	230	110	Bromine (Dry)	150	65
Aluminum Oxychloride	230	110	Bromine Water (10%)	230	110
Aluminum Potassium Sulfate	230	110	mono-Bromobenzene	212	100
Amino Acids (H ₂ O)	212	100	Bromoform	212	100
Ammonia (Anhydrous)	230	110	m-Bromotoluene	212	100
Ammonia (Aqueous 30%)	230	110	Butadiene	230	110
Ammonium Bifluoride	230	110	Butane	230	110
Ammonium Bromide (50%)	230	110	Butanediol	230	110
Ammonium Carbonate	230	110	Butyl Acetate	230	110
Ammonium Chloride	230	110	Butyl Acrylate	230	110
Ammonium Dichromate	230	110	n-Butyl Alcohol	230	110
Ammonium Fluoride	230	110	sec-Butyl Alcohol	230	110
Ammonium Hydroxide	230	110	tert-Butyl Alcohol	230	110
Ammonium Nitrate (Conc.)	230	110	n-Butylamine	120	50
Ammonium Perchlorate	230	110	sec-Butylamine	120	50
Ammonium Persulfate	230	110	tert-Butylamine	120	50
Ammonium Phosphate	230	110	di-n-Butyl Amine	230	110
Ammonium Sulfate	230	110	tri-n-Butyl Amine	230	110
Ammonium Sulfide	230	110	Butylene	230	110
Ammonium Thiocyanate	230	110	Butyl Bromide	230	110
Amyl Acetate	230	110	Butyl Chloride	230	110
Amyl Alcohol	230	110	Butyl Phenol	230	110
Amyl Chloride	230	110	Butyl Phthalate	150	65
Aniline	230	110	Butyraldehyde	212	100
Aniline Hydrochloride (10%)	150	65	Butyric Acid	230	110
Anthraquinone	230	110	n-Butyl Mercaptan	230	110
Anthraquinone-Sulfonic Acid	230	110	Calcium Bisulfate	230	110
Antimony Trichloride	212	100	Calcium Bisulfide	230	110

Electro Chemical Duro-Bond ETFE Lining

<u>Chemical</u>	<u>Maximum Use Temperature</u>		<u>Chemical</u>	<u>Maximum Use Temperature</u>	
	<u>°F</u>	<u>°C</u>		<u>°F</u>	<u>°C</u>
Calcium Carbonate	230	110	Decalin	230	110
Calcium Chlorate	230	110	Decane	230	110
Calcium Chloride	230	110	Dextrin	230	110
Calcium Hydroxide	230	110	Diacetone Alcohol	212	100
Calcium Hypochlorite	230	110	1, 2, Dibromo Propane	200	95
Calcium Nitrate	230	110	Dibutyl Phthalate	150	65
Calcium Oxide	230	110	Dichloroacetic Acid	150	65
Calcium Sulfide	230	110	O-Dichlorobenzene	150	65
Calcium Sulfate	230	110	Dichloroethylene	150	65
Caprylic Acid	212	100	Dichloropropionic Acid	150	65
Carbon Tetrachloride	230	110	Diesel Fuels	230	110
Carbon Dioxide (Wet)	230	110	Diethylamine	230	110
Carbon Dioxide (Dry)	230	110	Diethyl Benzene	230	110
Carbon Disulfide	150	65	Diethyl Cellosolve	230	110
Carbonic Acid	230	110	Diethyl Ether	212	100
Carbon Monoxide	230	110	Diethylene Triamine	212	100
Castor Oil	230	110	Diglycolic Acid	212	100
Caustic Potash (10 and 50%)	212	100	Diisobutyl Ketone	212	100
Caustic Soda (10 and 50%)	212	100	Diisobutylene	230	110
Cellosolve®	230	110	Dimethylamine	120	50
Chloral Hydrate	212	100	Dimethylaniline	230	110
Chlorinated Brine	230	110	Dimethyl Phthalate	212	100
Chlorinated Phenol	212	100	Dimethyl Sulfoxide	212	100
Chlorine (Dry)	212	100	Dimethyl Formamide	230	110
Chlorine (Wet)	230	110	Dimethyl Sulfate	150	65
Chlorine Dioxide	230	110	Diocetyl Phthalate	150	65
Chloroacetic Acid (50% H ₂ O)	230	110	p-Dioxane	150	65
Chlorobenzene	212	100	Diphenyl Oxide	175	80
Chlorobenzyl Chloride	150	65	Divinyl Benzene	175	80
Chloroform	212	100	Epichlorhydrin	150	65
Chlorohydrin (Liquid)	150	65	Ether	212	100
Chlorosulphonic Acid	75	25	Ethyl Acetate	150	65
Chromic Chloride	212	100	Ethyl Alcohol	230	110
Chromic Acid (50%)	150	65	Ethylamine	100	40
Chromyl Chloride	212	100	Esters	150	65
Clorox Bleach (5-1/2% Cl ₂)	212	100	Ethylacetoacetate	150	65
Coal Gas	212	100	Ethyl Acrylate	212	100
Copper Chloride	230	110	Ethyl Chloride	230	110
Copper Cyanide	230	110	Ethyl Chloroacetate	212	100
Copper Fluoride	230	110	Ethyl Cyanoacetate	212	100
Copper Sulfate	230	110	Ethylene Bromide	230	110
Copper Nitrate	230	110	Ethylene Chloride	230	110
Cresol	230	110	Ethylene Chlorohydrin	150	65
Cresylic Acid	230	110	Ethylene Diamine	120	50
Crotonaldehyde	212	100	Ethylene Glycol	230	110
Crude Oil	230	110	Ethylene Oxide	230	110
Cyclohexane	230	110	Fatty Acids	230	110
Cyclohexanol	230	110	Ferric Chloride (50% in H ₂ O)	230	110
Cyclohexanone	230	110	Ferric Hydroxide	230	110
DDT	212	100	Ferric Nitrate	230	110

Electro Chemical Duro-Bond ETFE Lining

<u>Chemical</u>	<u>Maximum Use Temperature</u>	
	<u>°F</u>	<u>°C</u>
Ferric Sulfate	230	110
Ferrous Chloride	230	110
Ferrous Hydroxide	230	110
Ferrous Nitrate	230	110
Ferrous Sulfate	230	110
Fluoroboric Acid	230	110
Fluorine (Gaseous)	100	40
Fluosilicic Acid	230	110
Formaldehyde (37% in H ₂ O)	230	110
Formic Acid	230	110
FREON® 11	230	110
FREON® 12	230	110
FREON® 22	230	110
Fuel Oil	230	110
Furane	150	65
Fumaric Acid	200	95
Furfural	212	100
Gallic Acid	212	100
Gas-Manufactured	230	110
Gas-Natural	230	110
Gasoline-Leaded	230	110
Gasoline-Unleaded	230	110
Gasoline-Sour	230	110
Glycerol	230	110
Glycolic Acid	230	110
Glycol	230	110
Heptane	230	110
Hexane	230	110
Hydrazine	100	40
Hydrazine Dihydrochloride	125	50
Hydriodic Acid	230	110
Hydrobromic Acid (50%)	230	110
Hydrochloric Acid (20%)	230	110
Hydrochloric Acid (Conc.)	230	110
Hydrochloric Acid (Gas)	230	110
Hydrocyanic Acid	230	110
Hydrofluoric Acid (35%)	230	110
Hydrofluoric Acid (70%)	230	110
Hydrofluoric Acid (100%)	230	110
Hydrofluorosilicic Acid	230	110
Hydrogen	230	110
Hydrogen Cyanide	230	110
Hydrogen Peroxide (30%)	230	110
Hydrogen Peroxide (90%)	150	65
Hydrogen Phosphide	150	65
Hydrogen Sulfide (Dry)	230	110
Hydrogen Sulfide (Wet)	230	110
Hypochlorous Acid	230	110
Hydroquinone	230	110
Inert Gases	230	110

<u>Chemical</u>	<u>Maximum Use Temperature</u>	
	<u>°F</u>	<u>°C</u>
Iodine (Dry)	230	110
Iodine (Wet)	230	110
Iodoform	230	110
Isobutyl Alcohol	230	110
Isopropylamine	120	50
Jet Fuel-JP4	230	110
Jet Fuel-JP5	230	110
Lactic Acid	230	110
Lard Oil	230	110
Lauric Acid	230	110
Lauryl Chloride	230	110
Lauryl Sulfate	230	110
Lead Acetate	230	110
Linoleic Acid	230	110
Linseed Oil	230	110
Lithium Bromide (Saturated)	230	110
Lithium Hydroxide	230	110
Lubricating Oil	230	110
Magnesium Carbonate	230	110
Magnesium Chloride	230	110
Magnesium Hydroxide	230	110
Magnesium Nitrate	230	110
Magnesium Sulfate	230	110
Maleic Acid	230	110
Maleic Anhydride	200	95
Malic Acid	230	110
Mercuric Chloride	230	110
Mercuric Cyanide	230	110
Mercuric Nitrate	230	110
Mercury	230	110
Methacrylic Acid	200	95
Methane	230	110
Methane Sulfonic Acid (50%)	230	110
Methyl Alcohol	230	110
n-Methyl Aniline	230	110
Methyl Benzoate	230	110
Methyl Bromide	230	110
Methyl Cellosolve®	300	150
Methyl Chloride	230	110
Methyl Chloroform	150	65
Methyl Chloromethyl Ether	175	80
Methyl Cyanoacetate	175	80
Methyl Ethyl Ketone	230	110
Methyl Sulfuric Acid	212	100
Methylene Bromide	212	100
Methylene Chloride	212	100
Methylene Iodide	212	100
Methyl Isobutyl Ketone	230	110
Methyl Methacrylate	175	80
Methyl Salicylate	200	95

Electro Chemical Duro-Bond ETFE Lining

<u>Chemical</u>	<u>Maximum Use Temperature</u>		<u>Chemical</u>	<u>Maximum Use Temperature</u>	
	<u>°F</u>	<u>°C</u>		<u>°F</u>	<u>°C</u>
Methyl Trichlorosilane	200	95	Polyvinyl Acetate	230	110
Mineral Oil	300	150	Polyvinyl Alcohol	230	110
Monochlorobenzene	230	110	Potassium Aluminum Chloride	230	110
Monoethanolamine	150	65	Potassium Aluminum Sulfate (50%)	230	110
Morpholine	150	65	Potassium Bicarbonate	230	110
Naphtha	230	110	Potassium Borate	230	110
Naphthalene	230	110	Potassium Bromate	230	110
Nickel Chloride	230	110	Potassium Bromide	230	110
Nickel Nitrate	230	110	Potassium Carbonate	230	110
Nickel Sulfate	230	110	Potassium Chlorate	230	110
Nicotine	212	100	Potassium Chloride	230	110
Nicotonic Acid	230	110	Potassium Chromate	230	110
Nitric Acid (Conc. 70%)	75	25	Potassium Cyanide	230	110
Nitric Acid (50%)	150	65	Potassium Dichromate	230	110
Nitric Acid-Sulfuric Acid (50/50)	212	100	Potassium Ferrocyanide	230	110
Nitrobenzene	230	110	Potassium Fluoride	230	110
Nitrogen Gas	230	110	Potassium Hydroxide (50%)	212	100
Nitrogen Dioxide	212	100	Potassium Hypochlorite	230	110
Nitromethane	212	100	Potassium Nitrate	230	110
Nitrous Acid	212	100	Potassium Perborate	230	110
Octane	230	110	Potassium Perchlorate	212	100
Octene	230	110	Potassium Permanganate	230	110
Oleic Acid	230	110	Potassium Persulfate	150	65
Oleum	120	50	Potassium Sulfate	230	110
Oxalic Acid	230	110	Potassium Sulfide	230	110
Oxygen	230	110	Propionic Acid	212	100
Ozone (<1% in Air)	212	100	Propane	230	110
Palmitic Acid	230	110	Propyl Alcohol	212	100
Perchlorethylene	230	110	Propylene Dibromide	212	100
Perchloric Acid (72%)	150	65	Propylene Dichloride	212	100
Perchloric Acid (10%)	230	110	Propylene Glycol Methyl Ether	212	100
Petrolatum	230	110	Propylene Oxide	150	65
Petroleum	230	110	Pyridine	150	65
Petroleum Ether	212	100	Pyrogallol	150	65
Phenol (100%)	212	100	Salicylaldehyde	212	100
Phenol (10%)	230	110	Salicylic Acid	230	110
Phenolsulfonic Acid	212	100	Salt Brine	230	110
Phenylhydrazine	212	100	Sea Water	230	110
Pheny[hydrazine Hydrochloride	212	100	Silicon Tetrachloride	230	110
o-Phenylphenol	212	100	Silver Chloride	230	110
Phosgene	212	100	Silver Cyanide	230	110
Phosphoric Acid (30%)	230	110	Silver Nitrate	230	110
Phosphoric Acid (85%)	230	110	Sodium Acetate	230	110
Phosphorus Pentoxide	230	110	Sodium Benzene-Sulfonate	230	110
Phosphorus Oxychloride	212	100	Sodium Benzoate	230	110
Phosphorus Pentachloride	212	100	Sodium Bicarbonate	230	110
Phosphorus Trichloride	230	110	Sodium Bisulfate	230	110
Phthalic Acid	212	100	Sodium Bisulfite	230	110
Phthalic Anhydride	212	100	Sodium Borate	212	100
Picric Acid	125	50	Sodium Bromide	230	110

Electro Chemical Duro-Bond ETFE Lining

<u>Chemical</u>	<u>Maximum Use Temperature</u>	
	<u>°F</u>	<u>°C</u>
Sodium Carbonate	230	110
Sodium Chlorate	230	110
Sodium Chloride	230	110
Sodium Chromate	230	110
Sodium Cyanide	230	110
Sodium Dichromate (Alkaline)	212	100
Sodium Ferricyanide	230	110
Sodium Ferrocyanide	230	110
Sodium Fluoride	230	110
Sodium Glutamate	230	110
Sodium Hydroxide (50%)	230	110
Sodium Hydroxide (10%)	230	110
Sodium Hypochlorite	230	110
Sodium Hyposulfite	230	110
Sodium Iodide	230	110
Sodium Lignosulfonate	230	110
Sodium Metasilicate	230	110
Sodium Nitrate	230	110
Sodium Nitrite	230	110
Sodium Perborate	212	100
Sodium Perchlorate	150	65
Sodium Peroxide	230	110
Sodium Persulfate	175	80
Sodium Phosphate	230	110
Sodium Silicate	230	110
Sodium Silicofluoride	230	110
Sodium Sulfate	230	110
Sodium Sulfide	230	110
Sodium Sulfite	230	110
Sodium Thiosulfate	230	110
Sorbic Acid	230	110
Sour Crude Oil	230	110
Stannic Chloride	230	110
Stannous Chloride	230	110
Stannous Fluoride	230	110
Stearic Acid	230	110
Stoddard's Solvent	230	110
Styrene Monomer	212	100
Succinic Acid	230	110
Sulfamic Acid	212	100
Sulfur (Molten)	230	110
Sulfur Dioxide	230	110
Sulfur Trioxide (Liquid)	75	25
Sulfuric Acid (60%)	230	110
Sulfuric Acid (Conc.)	230	110
Sulfuric Acid (Fuming-Oleum)	120	50

<u>Chemical</u>	<u>Maximum Use Temperature</u>	
	<u>°F</u>	<u>°C</u>
Sulfurous Acid	230	110
Tall oil	230	110
Tannic Acid	230	110
Tartaric Acid	230	110
2,3,4,6-Tetrachlorophenol	212	100
Tetraethyl Lead	230	110
Tetrahydrofuran	212	100
Tetramethyl Ammonium Hydroxide (50%)	212	100
Tin Tetrachloride	230	110
Toluene	230	110
Tributyl Phosphate	150	65
Trichloroacetic Acid	212	100
Trichloroethylene	230	110
Trichloromethane	212	100
2,4,5-Trichlorophenol	212	100
Trichloroethylene	230	110
Triethylamine	230	110
Trisodium Phosphate	230	110
Thionyl Chloride	212	100
Titanium Dioxide	230	110
Titanium Tetrachloride	212	100
Turpentine	230	110
UDMH-Hydrazine (50/50)	120	50
Urea (50% H ₂ O)	230	110
Varsol	230	110
Vinyl Acetate	230	110
Vinyl Chloride (Monomer)	150	65
Water	230	110
Xylene	230	110
Water Sewage	230	110
Wax	230	110
Zinc Acetate	230	110
Zinc Chloride	230	110
Zinc Hydrosulfite (10%)	230	110
Zinc Nitrate	230	110
Zinc Sulfide	230	110
Zinc Sulfate	230	110

PLATING SOLUTIONS

Brass	230	110
Cadmium	230	110
Chrome	230	110
Copper	230	110
Gold	230	110

Physical Properties

The normal physical properties of the ETFE sheeting are shown in the following table.

Chemical characterization	Thermoplastic fluorocarbon polymer
Color	Clear to translucent, depending on thickness
Odor	None
Melting point	270°C
Upper Service Temperature	155°C
Density (23°C)	1.7 g/cm ³
Tensile Strength (N/mm ²)	44
Elongation at Break	200%
Solubility in water	Insoluble
Explosion limits	None
Hardness Durometer	D 75
Water absorption	< 0.03
Oxygen Index (%)	> 30
Flammability	V-0
Thermal Expansion Coefficient 23 -150°C (mm/mm/°C)	8-12 x 10 ⁻⁵

Application

The method of application is as follows:

1. The surface to be lined is properly cleaned and grit blasted to a white metal finish to provide a suitable surface for bonding. (See Electro Chemical Technical Bulletin #1, "Specification for Welded Steel Tanks, Stacks, Ducts or Other Fabricated Equipment for Protective Linings and/or Coatings".)
2. The Duro-Bond ETFE laminate is cut into panels to cover the entire area to be lined with a minimum amount of joints to be welded.
3. The panels are then cemented into position and the seams welded with Duro-Bond ETFE rod and ETFE cap strip using a thermoplastic welding gun with nitrogen gas as the inert atmosphere.
4. Suitable ventilation and respiration equipment must be used while working with this material.

Method of Testing

All lined surfaces are visually inspected for surface defects. Any special dimensional tolerances required after lining are also checked.

All lined areas are then spark tested for pinhole leaks using a dielectric spark tester adjusted to 10,000 volts. The tester is moved constantly and quickly over the lining surface to prevent a burn through.

Repair Procedures

Duro-Bond ETFE sheet lining can be shop or field repaired. The repairs to defective or damaged areas in the sheet lining are accomplished by cutting out the faulty area, grinding or grit blasting the substrate surface, preparing a piece of sheet of the same dimension, cementing it into position and

subsequently welding the joints as described under Application. The repaired area is then inspected and spark tested to insure lining integrity.

Safety Issues

ETFE resins are nonvolatile and safe at normal room temperatures. Good safety practice requires the use of adequate ventilation and respirators when processing ETFE. Heating ETFE may produce fumes and gases that are irritating or toxic. Care must be taken to avoid contamination of smoking tobacco or cigarettes.

Refer to the ETFE Material Safety Data Sheet for detailed recommended procedures for the safe handling and use of ETFE.

Additional Information

For additional technical or safety information, contact us at 1-800-235-1885, www.electrochemical.net, or inquiry@electrochemical.net.

Electro Chemical Engineering & Manufacturing Co.
750 Broad Street
Emmaus, Pa 18049
Phone: 610-965-9061
FAX: 610-965-2595

Electro Chemical Engineering & Manufacturing Co.
P.O. Box 1107
Port Allen, LA 70767
Phone: 225-336-0202
FAX: 225-336-0205

The data provided herein falls within the normal range of product properties, but they should not be used to establish specification limits nor used alone as the basis of design. Electro Chemical Engineering & Manufacturing Co. assumes no obligation or liability for any advice furnished by it or for results obtained with respect to these products. All such data and advice is provided gratis and Buyer assumes sole responsibility for results obtained in reliance thereon.