

FRP Grating - Chemical Resistance and Resin Selection

What each resin system code means, which resin family it belongs to, and how it performs against 322 chemical media.

7 sections - 5 tables - 341 data points | GT-CHEM-RESIST | Rev 1.0

Important - read first

This document is provided for selection guidance only. Values are nominal and subject to manufacturing tolerance. Chemical resistance and load data depend on the exact medium, concentration, temperature and support conditions of your application. Confirm the final specification with us before ordering.

Selection guidance for choosing a resin system for a corrosive environment. Ratings are given for our vinyl ester and isophthalic polyester systems at room temperature and at elevated temperature.

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1 . Our resin system codes

Our resin systems are our own formulation. The base resin is one component of it: we choose the resin chemistry, then tune the remaining components to reach the required flame class and chemical performance. Supplier and grade details are not published, and the formulation is not tied to a single source, so the parameters below hold whichever source the raw material comes from.

Resin systems

Our code	Base resin	ASTM E84 flame spread	Oxygen index	Specified for
VEFR-25	Vinyl ester	25 max	28 min	Severe acids and alkalis; heavy-duty chemical service
VEFR-10	Vinyl epoxy resin	10 max	35 min	As VEFR-25 where flame resistance also matters
IFR-25	Isophthalic polyester	25 max	28 min	General industrial service, moderate chemical duty
IFGR-30	Isophthalic polyester, food grade formulation	30 max	26	Food processing areas
OFR-25	Orthophthalic polyester	25 max	28 min	Water, sea water and neutral salts
OFR	Orthophthalic polyester	not rated	-	Non flame-retardant applications

Our code	Base resin	ASTM E84 flame spread	Oxygen index	Specified for
MP-5	Phenolic	5	Typically 80	Maximum flame resistance and low smoke

ASTM E84 flame spread is the number in the code; a lower figure means the material spreads flame less. A rating of 25 or less is the threshold normally specified as Class 1, and VEFR-25, IFR-25 and OFR-25 all meet it. Oxygen index is a separate measure of ignitability; oxygen index figures are typical values unless a test report is supplied.

2 . How our codes work

The code carries three pieces of information: the base resin chemistry, the flame class, and - where it applies - the food grade formulation.

- A lower ASTM E84 flame spread figure is better. MP-5 at 5 is our highest flame performance; VEFR-10 at 10 is next; the -25 systems meet the Class 1 threshold of 25.
- VEFR-25 and VEFR-10 have the same chemical resistance. They differ in flame class only, so choose between them on the fire requirement, not on the chemistry.
- The code is ours and does not change when the raw material source changes. That is the point of it: you specify a performance, not a supplier.

Reading a code

Part of the code	Meaning
OFR / IFR / VEFR	Base resin chemistry: orthophthalic polyester, isophthalic polyester, or vinyl ester. OFR-25 and OFR differ only in flame class.
IFGR	Isophthalic polyester, food grade formulation.
MP	Phenolic.
The number	ASTM E84 flame spread index. Lower is better. 25 or less is the threshold normally specified as Class 1.
No number	No flame rating claimed for that system.

3 . What each code means

The code identifies the base resin chemistry and the flame class. It is our own reference: it stays the same whichever supplier the raw material comes from, so a code on a quotation or a panel marking tells you what the product will do without depending on a particular source.

- The base resin chemistry, not the brand, is what determines chemical resistance. That is why the ratings in this document are given against the chemistry named above.
- The same code can be produced from more than one source. We hold the parameters, not the source.
- Our formulation is not only resin. Flame class, surface finish and mechanical performance come from the full mix, which we control.
- IFGR-30 states a food grade formulation. Where a market requires food contact certification, tell us before ordering so we can confirm what documentation is available.

Vinyl ester systems - the corrosion workhorse

Our code	Base resin	Specified for
VEFR-25	Vinyl ester	Standard heavy-duty chemical service. Given for acid, alkali, salt, organic solvent and bleaching media. Start here for severe chemical duty. ASTM E84 flame spread 25 max.
VEFR-10	Vinyl epoxy resin	Same chemical resistance as VEFR-25, with a higher flame class: ASTM

Our code	Base resin	Specified for
		E84 flame spread 10 max against 25, and oxygen index 35 min against 26.

Polyester and phenolic systems

Our code	Base resin	Specified for
IFR-25	Isophthalic polyester	Moderate chemical duty: dilute hydrochloric and sulphuric acid, phosphoric acid, general industrial service. ASTM E84 flame spread 25 max. This is the family rated as Isophthalic in the data table below.
IFGR-30	Isophthalic polyester, food grade formulation	Food processing areas. ASTM E84 flame spread 30 max, oxygen index 26.
OFR-25	Orthophthalic polyester	Water, sea water and neutral salts. ASTM E84 flame spread 25 max. Not rated in the data table below: it is not recommended for the acids, alkalis and oxidisers where isophthalic is already limited.
OFR	Orthophthalic polyester, no flame rating	Non flame-retardant applications where no flame class is specified.
MP-5	Phenolic	Maximum flame resistance with very low smoke: ASTM E84 flame spread 5 max. Chosen for fire-critical areas such as tunnels, offshore and enclosed spaces. Chemical resistance is moderate and limited by alkali, so check the chemistry separately.

4 . How to read the ratings

- R - recommended for the stated medium.
- NR - not recommended. Shown in the warning colour in the table.
- A number instead of R or NR is the temperature in Fahrenheit at which the resin was tested or evaluated. It is not necessarily the maximum service temperature.
- R.T. means room temperature, below 38°C (100°F). The elevated columns are 65°C (150°F) and 71°C (160°F).

5 . Chemical resistance data - 322 media

Ratings for molded FRP grating. Compare the room temperature and elevated temperature columns before specifying: many media rated R at room temperature are NR when hot.

Chemical resistance by medium

Chemical medium	Vinyl Ester R.T.	Vinyl Ester 71°C	Isophthalic R.T.	Isophthalic 65°C
0.025% Epsom Salts	R	R	R	R
0.8% Fluoboric Acid	R	120	NR	NR
10% Ferric Sulfate	R	R	NR	NR
10.5% Copper	R	R	NR	NR
15% CaCl ₂	R	R	NR	NR
30% Ferric Chloride	R	R	NR	NR
5% Benzene in Kerosene	R	NR	NR	NR
6% Sodium Cyanide	R	R	NR	NR
7% Potassium Cyanide	R	R	NR	NR
7% Tin	R	120	NR	NR
8-8-8 Fertilizer	R	R	R	R
9% Hydrochloric	R	R	NR	NR
Acetic Acid 0-25%	R	R	R	125

Chemical medium	Vinyl Ester R.T.	Vinyl Ester 71°C	Isophthalic R.T.	Isophthalic 65°C
Acetic Anhydride	NR	NR	NR	NR
Acetone	NR	NR	NR	NR
Acrylonitrile	NR	NR	NR	NR
Alcohol, Butyl	R	NR	NR	NR
Alcohol, Ethyl 10%	R	120	NR	NR
Alcohol, Ethyl 100%	NR	NR	NR	NR
Alcohol, Isopropyl 10%	R	150	NR	NR
Alcohol, Isopropyl 100%	R	NR	NR	NR
Alcohol, Methyl 10%	R	NR	NR	NR
Alcohol, Methyl 100%	NR	NR	NR	NR
Alcohol, Methyl Isobutyl	R	120	NR	NR
Alcohol, Secondary Butyl	R	150	NR	NR
Alum	R	120	NR	NR
Aluminum Chloride	R	120	R	NR
Aluminum Hydroxide 5%	R	120	NR	NR
Aluminum Nitrate	R	120	NR	NR
Aluminum Potassium Sulfate	R	120	NR	NR
Ammonia, Aqueous 0-10%	R	NR	NR	NR
Ammonia, Gas	R	NR	NR	NR
Ammonium Bicarbonate	R	120	R	NR
Ammonium Bisulfite	R	120	R	NR
Ammonium Carbonate 10%	R	120	NR	NR
Ammonium Citrate	R	120	R	NR
Ammonium Hydroxide 10%	R	120	NR	NR
Ammonium Hydroxide 20%	R	NR	NR	NR
Ammonium Hydroxide 5%	R	120	NR	NR
Ammonium Nitrate	R	R	R	R
Ammonium Persulfate	R	120	NR	NR
Ammonium Phosphate	R	120	NR	NR
Ammonium Sulfate	R	R	R	R
Arsenious Acid	R	R	R	NR
Barium Acetate	R	R	NR	NR
Barium Carbonate	R	R	R	NR
Barium Chloride	R	R	R	120
Barium Hydroxide	R	120	NR	NR
Barium Sulfate	R	R	R	R
Barium Sulfide	R	R	NR	NR
Beer	R	120	R	NR
Benzene	NR	NR	NR	NR
Benzene Sulfonic Acid 30%	R	R	NR	NR
Benzoic Acid	R	R	R	NR
Benzyl Alcohol	R	NR	NR	NR
Benzyl Chloride	NR	NR	NR	NR

Chemical medium	Vinyl Ester R.T.	Vinyl Ester 71°C	Isophthalic R.T.	Isophthalic 65°C
Butyric Acid 0-50%	R	R	R	NR
Cadmium Chloride	R	R	R	NR
Calcium Bisulfite	R	R	R	R
Calcium Chlorate	R	R	R	R
Calcium Chloride	R	R	R	R
Calcium Hydroxide	NR	NR	NR	NR
Calcium Hypochlorite	R	120	NR	NR
Calcium Nitrate	R	R	R	R
Calcium Sulfate	R	R	R	R
Calcium Sulfite	R	R	R	R
Caprylic Acid	R	R	R	NR
Carbon Dioxide	R	R	R	R
Carbon Disulfide	NR	NR	NR	NR
Carbon Methyl Cellulose	R	120	NR	NR
Carbon Monoxide	R	R	R	R
Carbon Tetrachloride	NR	NR	NR	NR
Carbonic Acid	R	R	R	120
Castor Oil	R	R	R	R
Chlorinated Wax	R	R	NR	NR
Chlorine Dioxide, Wet Gas	R	R	NR	NR
Chlorine Dioxide/Air	R	R	NR	NR
Chlorine, Dry Gas	R	R	NR	NR
Chlorine, Liquid	NR	NR	NR	NR
Chlorine, Water	R	NR	NR	NR
Chlorine, Wet Gas	R	R	NR	NR
Chloro-Phenyl Types	NR	NR	NR	NR
Chloroacetic Acid 0-50%	R	NR	NR	NR
Chlorobenzene	NR	NR	NR	NR
Chloroform	NR	NR	NR	NR
Chlorosulfonic Acid	NR	NR	NR	NR
Chromic Acid	NR	NR	NR	NR
Chromium Sulfate	R	R	R	R
Citric Acid	R	R	R	R
Coconut Oil	R	R	R	NR
Concrete	R	R	NR	NR
Copper Chloride	R	R	R	R
Copper Cyanide	R	R	R	NR
Copper Fluoride	R	R	NR	NR
Copper Nitrate	R	R	R	R
Copper Sulfate	R	R	R	R
Corn Oil	R	R	R	R
Corn Starch-Slurry	R	R	R	R

Chemical medium	Vinyl Ester R.T.	Vinyl Ester 71°C	Isophthalic R.T.	Isophthalic 65°C
Crude Oil, Sour	R	R	R	NR
Crude Oil, Sweet	R	R	R	NR
Cyclohexane	R	120	NR	NR
Deionized	R	R	R	R
Demineralized	R	R	R	R
Detergents, Sulfonated	R	R	R	NR
Di-Ammonium Phosphate	R	R	NR	NR
Dibromophenol	NR	NR	NR	NR
Dibutyl Ether	R	NR	NR	NR
Dichloro Benzene	NR	NR	NR	NR
Dichloroethylene	NR	NR	NR	NR
Diesel Fuel	R	R	R	120
Diethylene Glycol	R	R	R	R
Dimethyl Phthalate	R	R	NR	NR
Dioctyl Phthalate	R	R	NR	NR
Dipropylene Glycol	R	R	R	R
Distilled	R	R	R	R
Dodecyl Alcohol	R	R	NR	NR
Esters, Fatty Acids	R	R	R	R
Ethyl Acetate	NR	NR	NR	NR
Ethyl Benzene	NR	NR	NR	NR
Ethyl Ether	NR	NR	NR	NR
Ethylene Dichloride	NR	NR	NR	NR
Ethylene Glycol	R	R	R	R
Fatty Acids	R	R	R	R
Ferric Chloride	R	R	R	R
Ferric Nitrate	R	R	R	R
Ferric Sulfate	R	R	R	R
Ferrous Chloride	R	R	R	R
Ferrous Nitrate	R	R	R	R
Ferrous Sulfate	R	R	R	R
Flue Gas	R	R	NR	NR
Formaldehyde	R	R	R	NR
Formic Acid 10%	R	R	R	NR
Fresh	R	R	R	R
Fuel Oil	R	R	R	NR
Gas, Natural	R	R	R	NR
Gasoline, Auto	R	120	R	NR
Gasoline, Aviation	R	120	R	NR
Gasoline, Ethyl	R	120	R	NR
Gasoline, Sour	R	120	R	NR
Glucose	R	R	R	R
Glycerine	R	R	R	R

Chemical medium	Vinyl Ester R.T.	Vinyl Ester 71°C	Isophthalic R.T.	Isophthalic 65°C
Glycolic Acid 70%	R	R	R	NR
Glyconic Acid	R	R	R	NR
Heptane	R	R	R	NR
Hexalene Glycol	R	R	R	R
Hexane	R	R	R	NR
Hydraulic Fluid	R	R	R	NR
Hydrobromic Acid 0-25%	R	R	R	NR
Hydrochloric Acid 0-37%	R	R	NR	NR
Hydrocyanic Acid	R	R	R	NR
Hydrofluoric Acid	NR	NR	NR	NR
Hydrogen Bromide, Wet Gas	R	R	NR	NR
Hydrogen Chloride, Dry Gas	R	R	NR	NR
Hydrogen Chloride, Wet Gas	R	120	NR	NR
Hydrogen Fluoride, Vapor	NR	NR	NR	NR
Hydrogen Peroxide 35%	R	120	R	120
Hydrogen Sulfide Dry	R	R	R	120
Hydrogen Sulfide, Aqueous	R	R	NR	NR
Hydrosulfite Bleach	R	120	NR	NR
Hypochlorous Acid 0-10%	R	120	NR	NR
Isopropyl Amine	R	NR	NR	NR
Isopropyl Palmitate	R	R	R	R
Jet Fuel	R	R	NR	NR
Kerosene	R	R	R	120
Lactic Acid	R	R	R	R
Lauric Acid	R	R	NR	NR
Lauroyl Chloride	R	R	NR	NR
Lead Acetate	R	R	R	R
Lead Chloride	R	R	R	R
Lead Nitrate	R	R	R	R
Levulinic Acid	R	R	NR	NR
Linseed Oil	R	R	NR	NR
Lithium Bromide	R	R	R	R
Lithium Sulfate	R	R	R	R
Magnesium Bisulfite	R	R	NR	NR
Magnesium Chloride	R	R	R	R
Magnesium Hydroxide	R	140	NR	NR
Magnesium Nitrate	R	R	R	R
Magnesium Sulfate	R	R	R	R
Maleic Acid	R	R	NR	NR
Mercuric Chloride	R	R	R	R
Mercurous Chloride	R	R	R	R
Methyl Ethyl Ketone	NR	NR	NR	NR
Methyl Isobutyl Carbitol	NR	NR	NR	NR

Chemical medium	VR Vinyl Ester R.T.	VR Vinyl Ester 71°C	NR Isophthalic R.T.	NR Isophthalic 65°C
Methyl Isobutyl Ketone	NR	NR	NR	NR
Methyl Styrene	NR	NR	NR	NR
Methylene Chloride	NR	NR	NR	NR
Mineral Oil Types	R	R	R	R
Mineral Oils	R	R	R	R
Molybdenum Disulfide	R	R	NR	NR
Monochloric Acetic Acid	NR	NR	NR	NR
Monoethanolamine	NR	NR	NR	NR
Motor Oil	R	R	R	R
Myristic Acid	R	R	NR	NR
Naphtha	R	R	R	R
Naphthalene	R	R	R	NR
Nickel Chloride	R	R	R	R
Nickel Nitrate	R	R	R	R
Nickel Sulfate	R	R	R	R
Nitric Acid 0-5%	R	R	R	NR
Nitric Acid 15%	R	120	NR	NR
Nitric Acid Fumes	NR	NR	NR	NR
Nitrobenzene	NR	NR	NR	NR
O-Benzoyl Benzoic Acid	R	R	NR	NR
Octanoic Acid	R	R	R	NR
Oil, Sour Crude	R	R	R	R
Oil, Sweet Crude	R	R	R	R
Oleic Acid	R	R	R	R
Oleum (Fuming Sulfuric)	NR	NR	NR	NR
Olive Oil	R	R	R	R
Oxalic Acid	R	R	R	R
Ozone	NR	NR	NR	NR
Phenol	NR	NR	NR	NR
Phenol Sulfonic Acid	NR	NR	NR	NR
Phosphoric Acid 85%	R	R	R	R
Phosphoric Acid Fumes	R	R	R	R
Phosphorous Pentoxide	R	R	R	NR
Phosphorous Trichloride	NR	NR	NR	NR
Phthalic Acid	R	R	R	R
Picric Acid, Alcoholic	R	R	R	NR
Polyvinyl Acetate Latex	R	R	R	NR
Polyvinyl Alcohol	R	NR	R	NR
Potassium Aluminum Sulfate	R	R	R	R
Potassium Bicarbonate	R	R	R	NR
Potassium Bromide	R	R	NR	NR
Potassium Chloride	R	R	R	R
Potassium Dichromate	R	140	NR	NR
Potassium Ferricyanide	R	R	R	R

Chemical medium	Vinyl Ester R.T.	Vinyl Ester 71°C	Isophthalic R.T.	Isophthalic 65°C
Potassium Permanganate	R	140	NR	NR
Potassium Persulfate	R	R	R	NR
Potassium Sulfate	R	R	R	R
Propionic Acid 1-50%	R	120	NR	NR
Propylene Glycol	R	R	R	R
Pulp Paper Mill Effluent	R	R	NR	NR
Pyridine	NR	NR	NR	NR
Salicylic Acid	R	140	NR	NR
Salt	R	R	R	R
Sea	R	R	R	R
Sebacic Acid	R	R	NR	NR
Selenious Acid	R	R	NR	NR
Silver Nitrate	R	R	R	R
Sodium Acetate	R	R	R	NR
Sodium Benzoate	R	R	R	NR
Sodium Bicarbonate	R	R	NR	NR
Sodium Bifluoride	R	120	R	NR
Sodium Bisulfate	R	R	R	R
Sodium Bisulfite	R	R	R	R
Sodium Bromate	R	140	R	NR
Sodium Bromide	R	R	R	R
Sodium Chlorate	R	R	R	NR
Sodium Chloride	R	R	R	R
Sodium Chlorite 25%	R	R	R	NR
Sodium Chromate	R	R	NR	NR
Sodium Cyanide	R	R	R	NR
Sodium Di-Phosphate	R	R	R	R
Sodium Dichromate	R	R	NR	NR
Sodium Ferricyanide	R	R	R	R
Sodium Fluoride	R	120	NR	NR
Sodium Fluoro Silicate	R	120	NR	NR
Sodium Hexametaphosphates	R	NR	NR	NR
Sodium Hydrosulfide	R	R	R	NR
Sodium Hydroxide 0-5%	R	150	NR	NR
Sodium Hydroxide 5-50%	R	120	NR	NR
Sodium Hypochlorite (5% bleach)	R	120	NR	NR
Sodium Lauryl Sulfate	R	R	R	R
Sodium Mono-Phosphate	R	R	R	R
Sodium Nitrate	R	R	R	R
Sodium Silicate	R	R	R	R
Sodium Sulfate	R	R	R	R
Sodium Sulfide	R	R	R	R
Sodium Sulfite	R	R	R	NR

Chemical medium ^e	Vinyl Ester R.T.	Vinyl Ester 71°C	Isophthalic R.T.	Isophthalic 65°C
Sodium Thiocyanate	R	R	NR	NR
Sodium Thiosulfate	R	R	R	NR
Sodium Tripolyphosphate	R	R	R	NR
Sodium Xylene Sulfonate	R	R	R	NR
Soya Oil	R	R	R	R
Stannic Chloride	R	R	R	R
Stannous Chloride	R	R	R	R
Stearic Acid	R	R	R	R
Styrene	NR	NR	NR	NR
Sugar, Beet and Cane Liquor	R	R	R	NR
Sugar, Sucrose	R	R	R	R
Sulfamic Acid	R	R	R	NR
Sulfanilic Acid 50%	R	R	NR	NR
Sulfated Detergents	R	R	R	NR
Sulfur Dioxide, Dry or Wet	R	R	NR	NR
Sulfur, Trioxide/Air	R	R	NR	NR
Sulfuric Acid 0-30%	R	R	R	R
Sulfuric Acid 30-50%	R	R	NR	NR
Sulfuric Acid 50-70%	R	NR	NR	NR
Sulfurous Acid 10%	R	NR	NR	NR
Tall Oil	R	150	R	NR
Tannic Acid	R	120	R	NR
Tartaric Acid	R	R	R	R
Thionyl Chloride	NR	NR	NR	NR
Toluene	NR	NR	NR	NR
Toluene Sulfonic Acid	R	R	NR	NR
Trichlorethylene	NR	NR	NR	NR
Trichloro Acetic Acid	NR	NR	NR	NR
Trichloropenol	NR	NR	NR	NR
Tricresyl Phosphate	R	120	NR	NR
Tridecylbenzene Sulfonate	R	R	R	NR
Trisodium Phosphate	R	R	R	NR
Turpentine	R	NR	NR	NR
Urea	R	140	R	NR
Vegetable Oils	R	R	R	R
Vinegar	R	R	R	R
Vinyl Acetate	NR	NR	NR	NR
White Liquor (Pulp Mill)	R	R	NR	NR
Xylene	NR	NR	NR	NR
Zinc Chlorate	R	R	R	R
Zinc Nitrate	R	R	R	R
Zinc Sulfate	R	R	R	R

6 . What the data shows

- Vinyl ester is recommended for 273 of the 322 media listed; isophthalic for 173.
- There are 100 media where vinyl ester is recommended and isophthalic is not - strong alkalis, hypochlorites and other oxidisers, and concentrated acids. These cases decide the resin.
- 173 media are handled by both, mostly neutral salts, water and dilute solutions.
- 49 media are not recommended in either system: solvents and concentrated sulphuric acid fall here.
- Temperature matters as much as chemistry. Compare the two columns before specifying.

7 . How to specify

Send us the following and we will confirm a resin system and grade against the supplier data.

- Chemical name, or full mixture composition
- Concentration in per cent
- Normal and maximum service temperature
- Continuous immersion, or occasional splash
- Any abrasive solids present
- The standard or market approval you must satisfy