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FIBREGLASS IN CORROSIVE ENVIRONMENTS

Fibre–reinforced plastic (FRP) or Glass–reinforced polyester (GRP) has been used for various types of equipment in the chemical process industries since the early 1950's. Its use has continued to grow in areas such as process vessels, scrubbers, hoods, ducts, pumps, pipes, floor toppings and tank linings, among others. The chief reason for the popularity of these materials is their excellent resistance to corrosion. The properties and factors for this are discussed below.

What is FRP?

FRP as mentioned above, stands for Fibre Reinforced Plastic. FRP is a composite material consisting of a thermosetting polymer, generally polyester, reinforced with glass or other fibres. The polymers which are resins, are dissolved in styrene monomer. A fabricator cures these resins to a solid state by reacting them with the styrene in the presence of the glass reinforcements to produce a fibre reinforced rigid structure, hence fibreglass. There are six types of FRP resins, Ampelite predominantly uses only three.

- **Orthophthalic**

Orthophthalic resins are often called general purpose or ortho resins. This type of resin is used in the manufacture fibreglass skylight sheeting. They provide minimum corrosion resistance, although they do provide alternatives to metal based products in mild environments such as fertilizer storage facilities.

- **Isophthalic**

Isophthalic resins differ from the Orthophthalic resins through thier molecular composition. Isophthalic resins in general will exhibit good resistance to water, acids and alkalis, solvents and petroleum-based products. Temperature can play a major role in chemical resistance, and Isophthalic resins display good resistance in applications up to 80°C.

- **Vinyl Ester**

Vinyl Ester resins are methacrylated epoxy dysfunctional polyesters. They are classified separately from polyesters due to their enhanced mechanical properties. Vinyl Ester resins offer excellent physical strength, better impact strength and thermal shock resistance than polyester resins. These resins exhibit excellent resistance to acids, alkalies, hypochlorites and many solvents. Their applications are suitable in temperatures up to 120°C.

Evaluating Corrosion Resistance

The table below provides a general guide to the properties of the above-mentioned resins. FRP's do not resist all environments, nor do they respond equally to specific corrosives.

Corrosion Resistance	Orthophthalic	Isophthalic	Vinyl Ester
Acids	C	B	A
Alkalis	C	B	A
Peroxides	C	C	A
Hypochlorites	C	C	A
Solvents	C	B	A
Structural Strength	B	A	A
Thermal Insulation	A	A	A

A = High B = Moderate C = Low

Chemical Attack

As a result of exposure to an environment, fibreglass sheeting manufactured from the various resins can respond in a number of different ways. The sheet may not be affected at all, or it may become brittle, softened, discoloured, charred, crazed, weakened, delaminated, dissolved or blistered. Or it may exhibit any combination of these effects. In assessing the Environment Vs Product and possible failure due to chemical attack the following types of attack are to be considered.

- **Resin Attack:**

This includes (1) degradation and disintegration of a physical nature due to absorption, permeation or solvent action, which under mild conditions, may manifest itself as reversible or irreversible swelling; (2) oxidation; (3) hydrolysis; (4) radiation; (5) thermal attack; (6) combinations of the above.

- **Glass Attack:**

Certain environments might not attack the resin itself, but upon absorption will attack the glass reinforcement. Fluorides, alkalis, hot water and its vapour and hydrochloric acid under certain conditions, are typical examples of glass attacking agents.

- **Glass Resin Interface Attack:**

Many substances can attack the glass resin interface, even though the resin itself might be reasonably resistant to attack. Wicking (degradation of the reinforcement due to an inadequate resin cover) and delaminating are typical effects of this type of attack.

Choosing the correct Material

To compare Ampelite's range of GRP cladding with other materials, i.e. steel or aluminium, a detailed analysis of the specific application must be conducted. While economics may well be the controlling influence, it must be considered in its entirety for the life of the various products. Other factors that may also be considered are:

- All chemicals to which the cladding will be exposed.
- Normal operating concentrations of chemicals and maximum and minimum concentrations.
- The pH range of the system.

Other cladding systems require protective coatings to both internal and external exposed surfaces. They are not fully corrosion resistant as chemical attack occurs on the raw edges of the sheeting, or where a break occurs (i.e. scratch etc.) within the coating system. This does not apply with the FRP sheeting, as the product itself is corrosion resistant. GRP is inherently nonconductive – an excellent electrical insulator, as well as a very good thermal insulator and noise barrier.

To allow Ampelite NZ Ltd to recommend and warranty the correct FRP sheeting for your application the follow information is required.

- Is the proposed project a new or replacement job?
- If it is replacement, what is the existing product and how long has this product lasted. It is also helpful to know where the existing sheet is failing i.e. around the fastenings or in the laps or from the cut edge. This will help us to build a picture.
- Is the current product being used for the roof, walls or internal linings.
- Will the product be walked on. Will there need to be access to air conditioning or ventilation equipment.
- What is the current or proposed building being used for i.e. Fertiliser works, Galvanising plant, Skins processing etc.
- Is it foreseen that the building use may change at some time .i.e. if the building is currently used fertiliser storage, will it become fertiliser production with a change of plant configuration. We need to plan for future applications.
- What is the prevailing chemical environment. We must have the details of all the chemicals involved as brand names can be confusing. Most importantly we must have the concentrations of these in either parts per million or millilitres per cubic metre.
- Where will our product be in relation to the caustic environment i.e. will it be immersed, splashed, touching or exposed to gas. An example of this was sheeting being used above a bath of pelt curing brine. we needed to know what the stud height was. The chemicals in the brine gave off a gas of a particular concentration at an ambient room temperature, but from time to time the roofing also got splashed with these chemicals.
- What is the general environment internally , how hot is it, in particular at the hottest point. This could be under the apex of the roof. Is the temperature constant. Is there any moisture present in the building. It is important to remember most aggressive corrosive environments are exacerbated by both temperature and moisture.
- What is the general environment externally. Is there any chemical discharge from chimney stacks. If so what are the details of these chemicals. What is considered the maximum time it may go unwashed by rain. Is the site coastal. often very harsh environments are put as far away from towns as possible. Operations like fertiliser works will be beside the sea because of their reliance on shipping.
- What is the fastening detail. Remember in most applications S/S screws and seals will be needed.
- Lastly is there any criteria imposed by and architect or fire engineer.

An Ampelite representative is available to visit your and help you to ensure the above details are complete and correct.