

STRONGWELL

SAF RAIL™

FIBERGLASS HANDRAIL & LADDER SYSTEMS



Fiberglass Handrail Systems



SAFRAIL™ system in a chemical plant.



Internal connections make circular handrail systems such as these possible around tanks.



158 lineal feet of SAFRAIL™ handrail is used on this floating dock over corrosive effluent in a landfill seepage containment pit.

SAFRAIL™ fiberglass handrail is an industrial/commercial railing system for stair rails, platform/walkway handrails and guardrails. Manufactured of pultruded fiberglass reinforced vinyl ester resin and molded thermoplastic, the SAFRAIL™ system is particularly well-suited to corrosive environments. These include applications in industrial, chemical and wastewater treatment plants as well as commercial structures with urban and salt air corrosion.

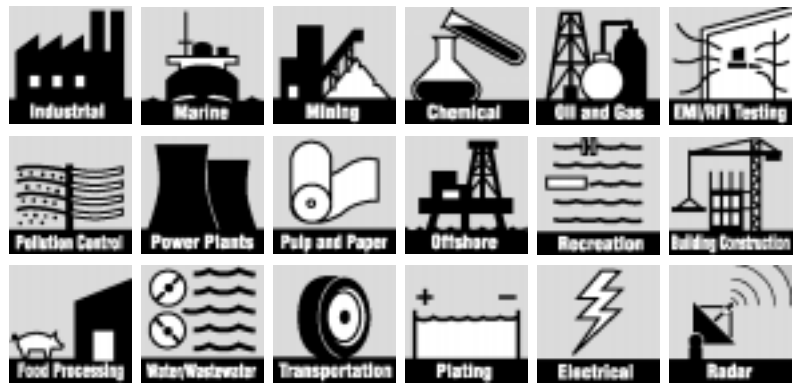
The SAFRAIL™ fiberglass handrail system has these features:

- Corrosion Resistance
- Structurally Strong
- High Impact Resistance
- Light Weight
- Electrically non-conductive
- Easy to Field Fabricate
- Low Thermal Conductivity
- Low Maintenance
- UV Resistant

SAFRAIL™ is the result of over 20 years experience in the manufacture, design and fabrication of fiberglass handrail systems. Advantages of the SAFRAIL™ system are:

- **Ease of Assembly** — SAFRAIL™ is produced in lightweight standard sections that include both post and rail. The system can be prefabricated in large sections and shipped to the site or fabricated and installed on site with simple carpenter tools.
- **Internal Connection System** — All connections fit flush, resulting in a pleasing, streamlined appearance. The internal connections allow the construction of continuous handrail systems around circular tanks without special fittings.
- **Safety Features** — SAFRAIL™ comes in a “safety yellow color”, is electrically non-conductive for worker safety, and exhibits high strength. It meets federal OSHA standards with a safety factor of 2.
- **Low Maintenance** — Corrosion resistant fiberglass with molded-in color will outlast aluminum or steel systems with virtually no maintenance.
- **Cost Effectiveness** — Fiberglass components and easy to assemble design provide savings on labor and maintenance, resulting in long term savings and eliminating the cost and inconvenience of “downtime for repairs” in plant operations.

Fiberglass Ladders & Cages



SAFRAIL™ fiberglass ladders and ladder cages mounted on the sides of tanks are a common sight in a wide range of industries all across the country. Fiberglass ladder and ladder cage systems have been in continuous use for more than 20 years in chemical plants and other corrosive environments. Even in complete immersion applications, fiberglass has outlasted aluminum and steel and required little or no maintenance.

Sizes & Availability

SAFRAIL™ ladders are fabricated in a standard 18" rung width configuration with 12" rung spacings. Various ladder lengths can be produced as practical. Standard SAFRAIL™ ladder and ladder cage systems are designed and fabricated to meet the requirements of OSHA 1910.27. Custom designed ladders and access cages can be fabricated upon request. Ladders can be shipped pre-assembled for installation in the field.

Materials of Construction

The SAFRAIL™ ladder and ladder cage system is produced in a premium grade vinyl ester resin system with flame retardant and ultraviolet (UV) inhibitor additives. Standard side rails and cages are pigmented safety yellow. The rungs are a pultruded fiberglass vinyl ester tube with a fluted non-skid surface.

An optional industrial grade polyurethane coating may be applied to rails and cage for extra UV protection in outdoor applications.



High strength, maintenance free SAFRAIL™ fiberglass ladders and ladder cages are ideal for highly corrosive environments.



Fiberglass access ladders are used throughout the service areas of Sea World, Orlando, FL to resist saltwater corrosion and reduce maintenance costs.



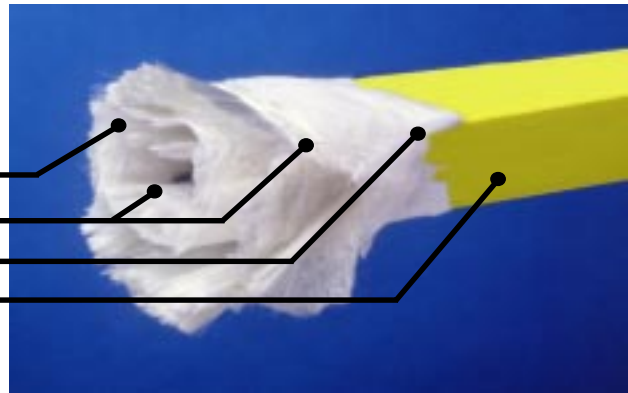
This fiberglass ladder and ladder cage provide worker access to a maintenance platform at a Ciba Geigy plant in the northeastern United States.

Materials of Construction

SAFRAIL™ is an engineered composite consisting of:

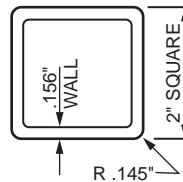
- Continuous glass fibers
- Two continuous strand glass mats
- A synthetic surfacing veil
- Fire-retardant vinyl ester resin

This unique combination provides the ultimate in strength, stiffness and long-term corrosion and U.V. protection.



Minimum Mechanical Properties for Pultruded Parts:

Properties	Test Method	Values
Tensile Stress	ASTM D638	30,000 psi
Tensile Modulus	ASTM D638	2.5×10^6 psi
Compressive Stress	ASTM D695	30,000 psi
Compressive Modulus	ASTM D695	2.5×10^6 psi
Flexural Stress	ASTM D790	30,000 psi
Flexural Modulus	ASTM D790	1.6×10^6 psi
Shear Stress	ASTM D2344	4500 psi
Density	ASTM D792	.060-.070 lbs./in ³
24 Hr. Water Absorption	ASTM D570	0.6% max
Coef. Thermal Expansion	ASTM D696	4.4×10^{-6} in/in/°F (min.)
Flexural Stress	Full Section	36,000 psi (typical)
Flexural Modulus	Full Section	3.7×10^6 psi (typical)



Post or Rail Section Properties

$$A = 1.151 \text{ in.}^2$$

$$S = .657 \text{ in.}^3$$

$$I = .657 \text{ in.}^4$$

$$E = 3.7 \times 10^6 \text{ psi}$$

$$WT = .95 \text{ lbs./lin.ft.}$$

where E = Flexural modulus full strength

Options

UV Coating

An industrial grade polyurethane coating may be applied to the finished handrail and/or ladder and cage for additional protection in outdoor applications. Standard SAFRAIL™ handrail systems are unpainted; the polyurethane UV coating must be requested when ordered.

Resin Systems

Vinyl ester is standard for the SAFRAIL™ handrail system but other resin systems are available upon request.

Colors

SAFRAIL™ handrail and ladder systems are produced in a standard safety yellow color. Other colors are available upon request.

Custom Handrail Systems

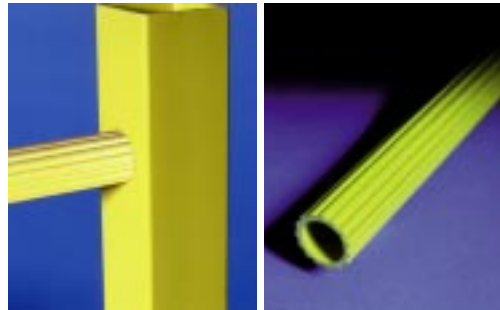
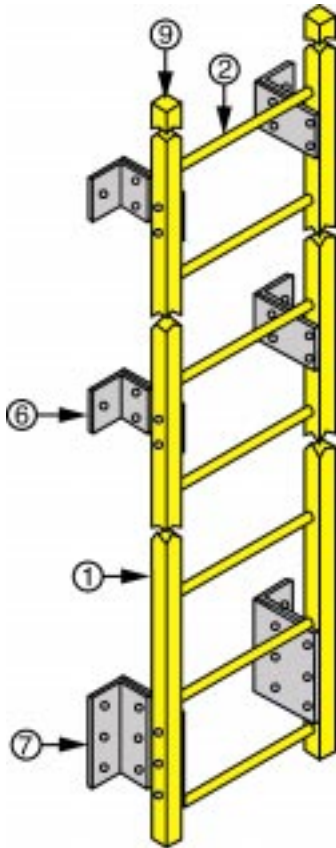
SAFRAIL™ is designed to fit a wide variety of applications and because it is a standard system, to be cost effective. However, custom handrail systems are available from Strongwell to suit special needs. Some examples of custom handrail from Strongwell includes vertical pickets, 2-color handrail, architectural handrail and heavy duty handrail systems.



This custom half round top rail is used by Fairfield Inn hotels to reduce maintenance and provide long lasting good looks.

Ladder Systems

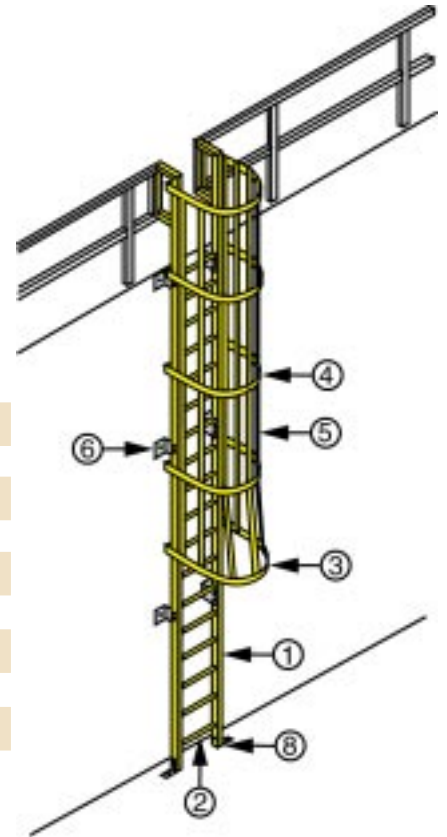
Part Identification



Rung Detail

End View of Rung

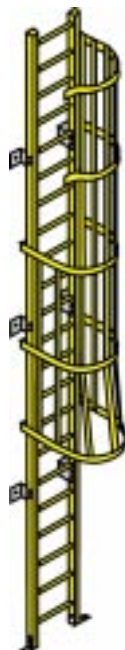
NAME	DESCRIPTION
1 Side Rail	2" x .156" sq.tube
2 Rung	1-1/8" dia. fluted tube
3 Top or Bottom Hoop	3" x 1/4" strip
4 Intermediate Hoop	2" x 1/4" strip
5 Cage Straps	2" x 3/16" strip
6 Standoff Bracket	5" bracket plate
7 Standoff Bracket	10-1/2" bracket plate
8 Base Angle	3" angle
9 End Plug	Molded end cap



Ladder Options



Walk-Through Cage w/Return



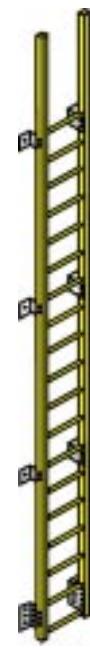
Side Mount Cage



Walk-Through w/Return



Floor Mount

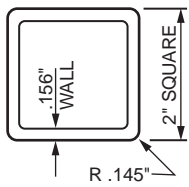


Wall Mount

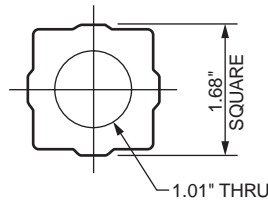
SAFRAIL™ Components



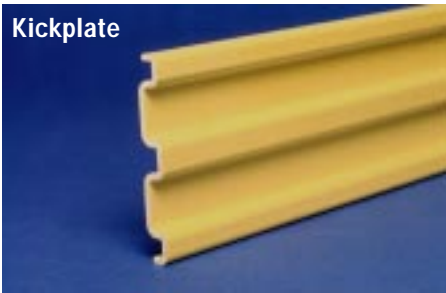
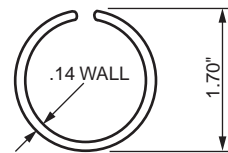
Post or Rail



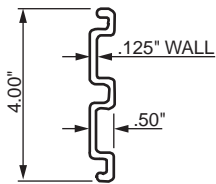
Square Plug



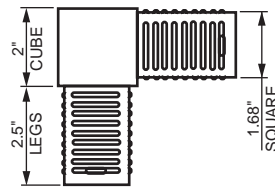
Split Tube Connector



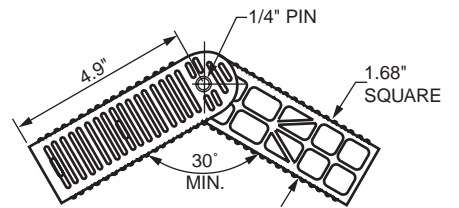
Kickplate



90° Corner

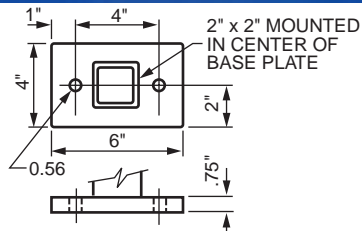


Adjustable Corner Assembly



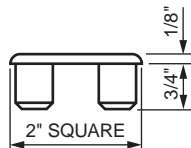
Post Base

(Mounted To Post)



End Cap

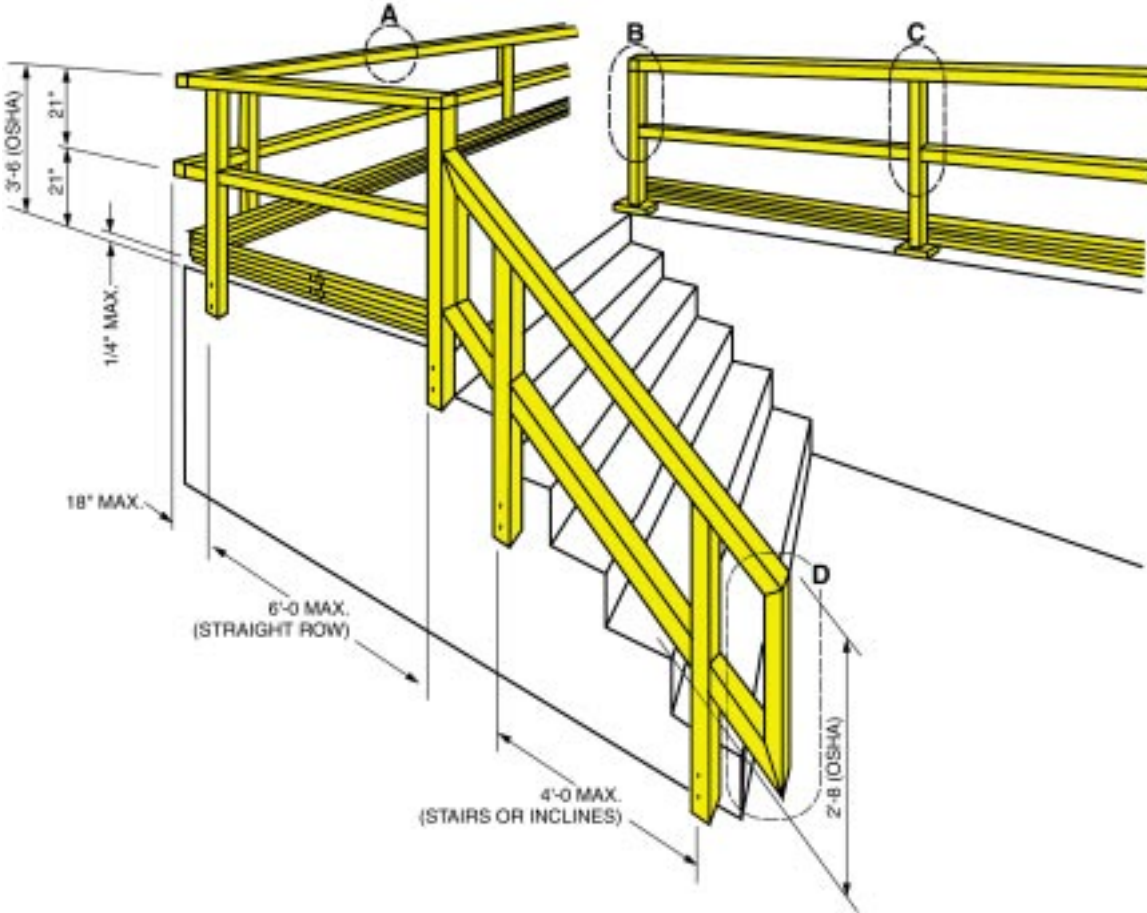
Note: For Capping Tubes (Special Construction)



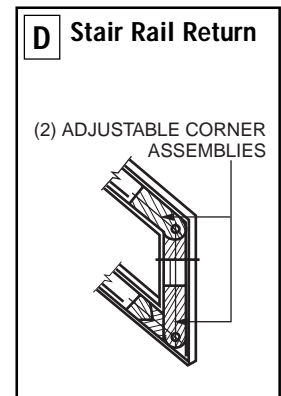
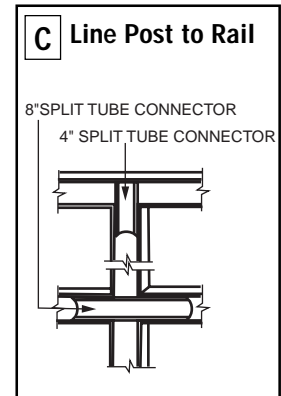
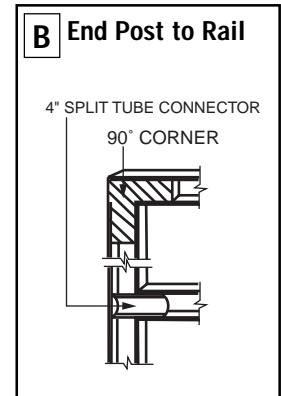
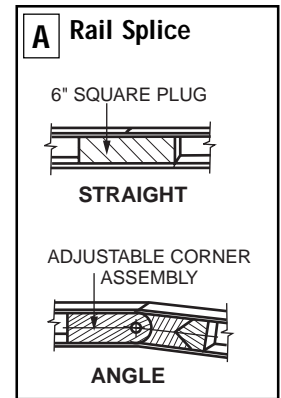
Supplementary Components

- Nylon Rivets
- 1/8" x 1-1/2" Tension Pins
- Two Part Epoxy Kits
- Mounting Bolts
- Kickplate Splice and Corner Connectors

Typical SAFRAIL™ Construction



Connection Details
All components secured with epoxy.



Specifications

SAFRAIL™ fiberglass handrail and ladder systems shall be fabricated from pultruded fiberglass components as produced by Strongwell. Cage hoops shall be produced by the open molded hand lay-up method.

The pultruded parts shall be made with a fire retardant vinyl ester resin which meets the ASTM E-84 test for flame spread of 25 or less and contains a U.V. inhibitor. The color shall be OSHA safety yellow.

SAFRAIL™ Handrail

The handrail system shall be designed to meet the configuration and loading requirements of OSHA 1910.23, with a minimum factor of safety on loading of 2.0.

Materials

The rails and posts shall be 2" x 2" x .156" square tube manufactured by the pultrusion process. The kickplate shall be 4" x 1/2" (corrugated) x .125" thick pultruded fiberglass shape.

Installation and Mounting

Post shall be constructed with a square pultruded bottom plug. Length shall be sufficient to extend a minimum of one inch beyond the uppermost bolt hole to prevent crushing of post tubing. Bolt holes shall provide clearance of 1/16" for 1/2" diameter bolts/studs. Holes shall be on longitudinal center line of post, 1" from bottom of post (minimum) and not less than 3" apart on center. Posts shall be fastened with stainless steel anchor bolts or studs, 1/2" diameter, extending no less than 2-1/4" into the concrete, or into a minimum thickness of 1/4" structural steel or pultruded fiberglass.

Post locations shall be no greater than 18", nor less than 9" from horizontal or vertical change in handrail direction. Post

centers shall be no greater than 72" apart on any straight run of rail, or 48" apart on any inclined rail section.

Base mount, embedded, and removable are also types of mounting procedures for handrail. Contact approved fabricator for detailed information on these connection types.

The fabricated handrail systems shall be supplied complete with fittings by the FRP manufacturer. The components used to join fabricated sections together may be shaped loose, to be epoxied and riveted together in the field by the contractor, per the manufacturer's recommendations.

SAFRAIL™ Ladders and Ladder Cages

SAFRAIL™ fiberglass reinforced plastic (FRP) ladder and cage systems shall meet the requirements set forth in OSHA 1910.27.

Ladders shall be shop assembled and may be pre-drilled and prepared for field attachments of standoff clips.

Materials

The side rails, rungs and cage straps shall be pultruded fiberglass reinforced components. The side rails shall be 2" square tube with a wall thickness of .156" or greater. The rungs shall be pultruded 1.25" diameter FRP fluted tube.

Cage hoops shall be manufactured by the open mold hand lay-up process with a width of 3" and thickness of 1/4" minimum at the top and bottom and 2" x 1/4" at the intermediate hoops. The cage shall be interconnected with 2" x 3/16" pultruded straps spaced 9" on center around the hoop.



STRONGWELL

ISO-9001 Certified Manufacturing Plants

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