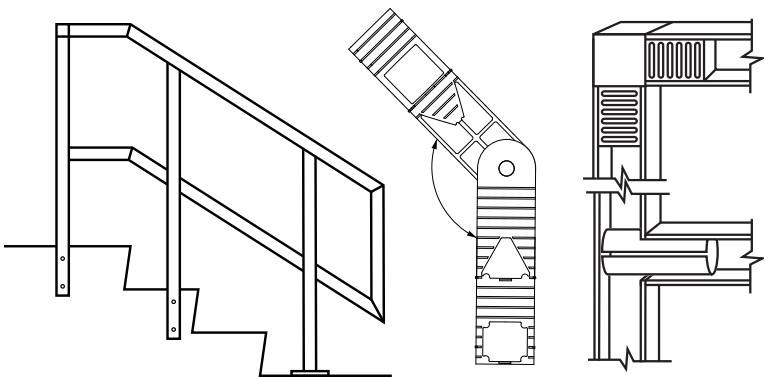




**SAF RAIL**™

**INDUSTRIAL FIBERGLASS RAILING SYSTEM**



# SAFRAIL™ Industrial Fiberglass Railing Systems



SAFRAIL™ system in a road department storage facility.



## NSF International

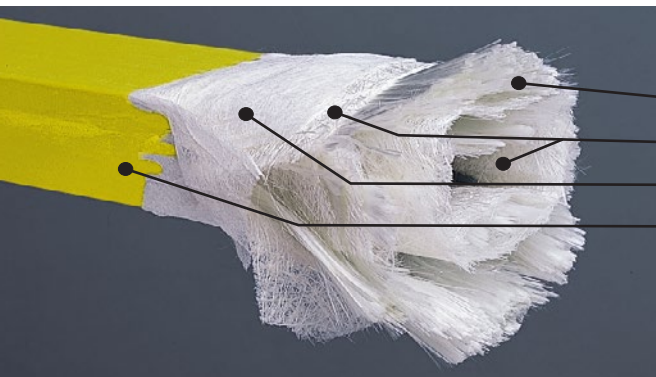
Strongwell railing systems can be manufactured using NSF-61 certified materials. See Custom Railing Systems (pg. 3) for details.

## American Bureau of Shipping

Approved for use on a variety of ABS Class ships.



SAFRAIL™ and DURAGRID® pultruded grating were fabricated to make access platforms over wastewater recycling tanks. The previous steel structure corroded, and was unsafe.



## What is SAFRAIL™?

SAFRAIL™ industrial fiberglass railing systems are made exclusively in the U.S.A. for use as stair rails, platform/walkway handrails and guardrails. SAFRAIL™ systems are fabricated from pultruded fiberglass components produced by Strongwell and compression molded FRP connectors. The railing systems are particularly well-suited to corrosive environments like those found in industrial, chemical and wastewater treatment plants, as well as commercial structures with urban and salt air corrosion.

## Why Use SAFRAIL™?

SAFRAIL™ systems can be used like traditional metal railing systems but offer the inherent benefits of pultruded fiberglass. In addition, SAFRAIL™ systems have been optimized to offer the following advantages:

- **Ease of Assembly** — lightweight standard sections can be prefabricated in large sections and shipped to the jobsite or fabricated and installed on site with simple carpenter tools.
- **Internal Connection System** — construction of continuous handrail systems is simplified, even around circular tanks, without special fittings.
- **Safety Features** — SAFRAIL™ systems come standard in a “safety yellow color”, feature low electrical conductivity and exhibit high strength. Systems meet federal OSHA standards with a 2:1 factor of safety with a 6-foot (1830mm) maximum post spacing. SAFRAIL™ systems also comply with international standard AFNOR NF E 85-101. In addition, the long-term durability of SAFRAIL™ components virtually eliminates maintenance requirements.\*
- **Cost Effective** — Corrosion resistant, pigmented fiberglass will outlast aluminum or steel systems with virtually no maintenance. The systems’ easy-to-assemble designs provide savings on installation time and labor. The light weight of the systems saves on freight costs and minimizes the need for special installation equipment.

SAFRAIL™ can be used in guardrail applications where railing is needed to protect the open side of an elevated walkway. SAFRAIL™ systems meet OSHA 1910.29 standards for a height of 42" (1067mm) from the top of walkway to the top of the guardrail with a 2:1 factor of safety.

## Features

SAFRAIL™ fiberglass handrail systems are:

- Corrosion Resistant
- Structurally Strong
- Impact Resistant
- Lightweight
- Easy to Field Fabricate
- Low Thermal and Electrical Conductivity

## Materials of Construction

SAFRAIL™ is an engineered composite consisting of:

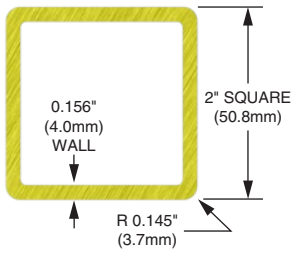
- Continuous glass fibers
- Two continuous strand glass mats
- A synthetic surfacing veil
- Fire-retardant polyester resin (vinyl ester, phenolic, and other resin systems are available upon request)

This unique combination provides the ultimate in strength, stiffness and long-term corrosion and UV protection.\*

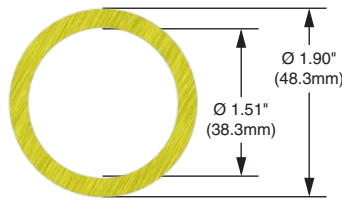
**\*Strongwell recommends a coating to reduce color fade for outdoor applications. If a coating is not applied, components may fade rapidly.**

# SAFRAIL™ Mechanical Properties

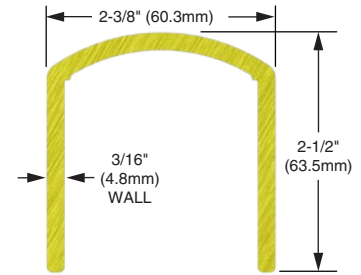
## Square Post or Rail



## Round Post or Rail



## Channel Top Rail



## Section Properties

SHAPE	WEIGHT LB/LIN. FT (KG/M)	A IN <sup>2</sup> (MM <sup>2</sup> )	S IN <sup>3</sup> (MM <sup>3</sup> )	I IN <sup>4</sup> (MM <sup>4</sup> )	E* PSI (N/MM <sup>2</sup> )
Square	0.95 (1.41)	1.15 (742.5)	0.657 (1.077 x 10 <sup>4</sup> )	0.657 (2.735 x 10 <sup>5</sup> )	3.7 x 10 <sup>6</sup> (25,500)
Round	0.86 (1.28)	1.05 (677.4)	0.405 (6.637 x 10 <sup>3</sup> )	0.385 (1.602 x 10 <sup>5</sup> )	4.5 x 10 <sup>6</sup> (31,000)
Channel Top	0.99 (1.47)	1.21 (780.6)	S <sub>x</sub> = 0.962 (1.576 x 10 <sup>4</sup> ) S <sub>y</sub> = 0.935 (1.532 x 10 <sup>4</sup> )	I <sub>x</sub> = 0.717 (2.984 x 10 <sup>5</sup> ) I <sub>y</sub> = 1.110 (4.620 x 10 <sup>5</sup> )	3.0 x 10 <sup>6</sup> (20,700)

\* Where E = Full Section Modulus

## Material Properties (Typical)

PROPERTY	TEST METHOD	UNITS	SQUARE RAIL	ROUND RAIL	CHANNEL TOP RAIL
Ultimate Flexural Stress (Full Section)	N/A	psi N/mm <sup>2</sup>	36,000 248	60,000 414	30,000 207
Full Section Modulus (non-phenolic)	N/A	psi N/mm <sup>2</sup>	3.7 x 10 <sup>6</sup> 25,500	4.5 x 10 <sup>6</sup> 31,000	3.0 x 10 <sup>6</sup> 20,700
Full Section Modulus (phenolic)	N/A	psi N/mm <sup>2</sup>	6.0 x 10 <sup>6</sup> 41,400	6.0 x 10 <sup>6</sup> 41,400	N/A
Density	ASTM D792	lbs/in <sup>3</sup> g/cc	0.065 - 0.075 1.80 - 2.08	0.065 - 0.075 1.80 - 2.08	0.065 - 0.075 1.80 - 2.08
24 hr. Water Absorption (non-phenolic)	ASTM D570	% max by wt.	0.6	0.6	0.6
24 hr. Water Absorption (phenolic)	ASTM D570	% max by wt.	2.0	2.0	N/A
Coefficient of Thermal Expansion, lengthwise	ASTM D696	in/in/°F mm/mm/°C	7 x 10 <sup>-6</sup> 1.2 x 10 <sup>-5</sup>	7 x 10 <sup>-6</sup> 1.2 x 10 <sup>-5</sup>	7 x 10 <sup>-6</sup> 1.2 x 10 <sup>-5</sup>

## HOW TO SPECIFY SAFRAIL™

Fiberglass railing shall be SAFRAIL™ as manufactured by Strongwell. Railing shall be pultruded and assembled in the U.S.A. Resin shall be fire retardant (polyester) (vinyl ester) (phenolic where available) meeting the requirements of a Class 1 rating of 25 or less per ASTM E-84 and the self-extinguishing requirements of ASTM D-635. Color shall be (gray) (yellow). Resin shall be UV inhibited and the composite shall include a veil on all exposed surfaces (unless phenolic). The visual quality of the pultruded shapes shall conform to ASTM D-4385.

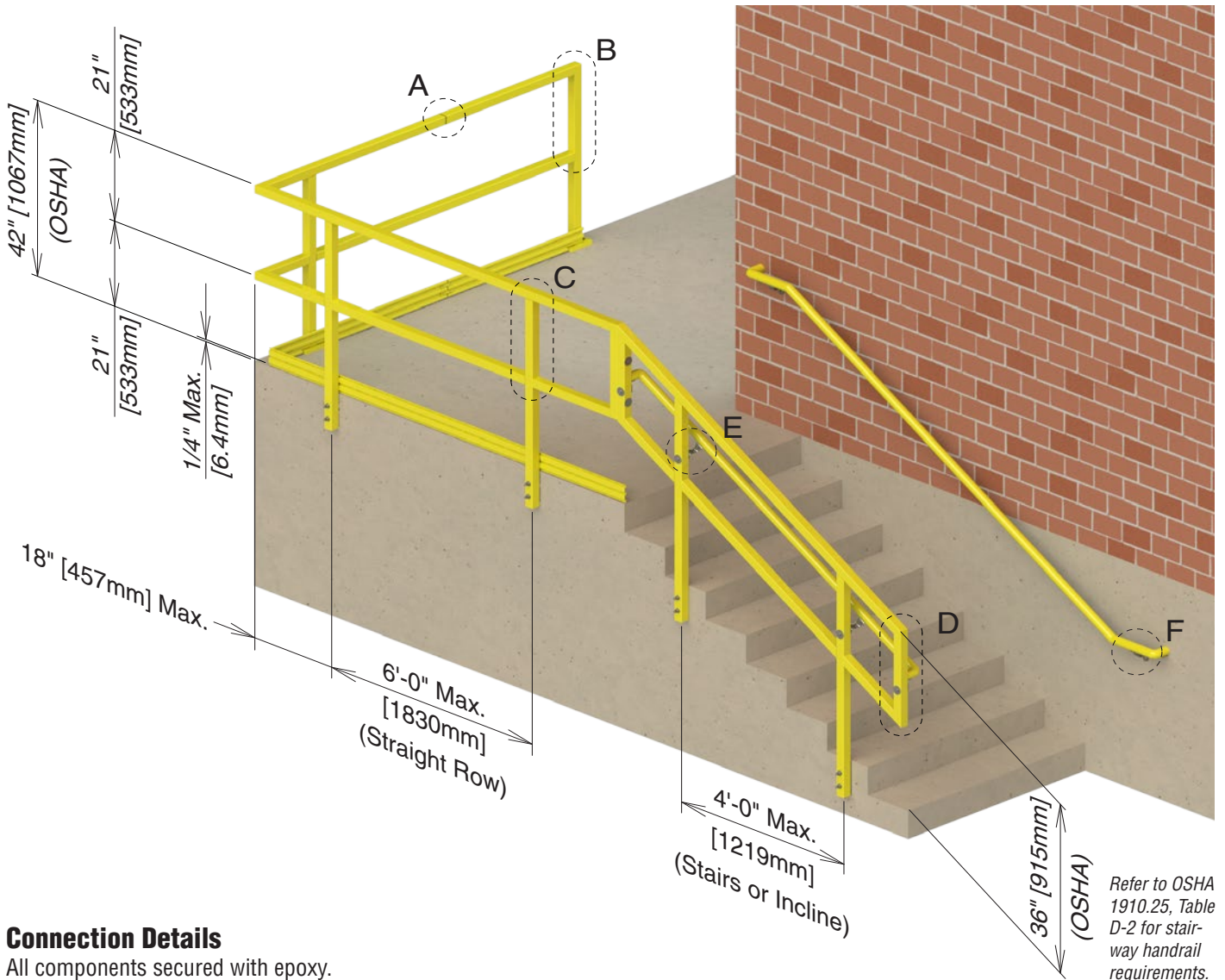
Note: If special options are required that are not stated in the above specification, fill in your special requirement in the appropriate section.

## CUSTOM RAILING SYSTEMS

SAFRAIL™ systems are cost effective standard systems designed to fit a wide variety of applications. Custom guard and fence systems are also available from Strongwell to suit specific needs. Examples include vertical pickets, multi-color, architectural features, heavy duty systems as well as NSF-61 certified materials.

For more custom handrail options, see Strongwell's STRONGRAIL® Architectural Handrail and Fencing Systems.

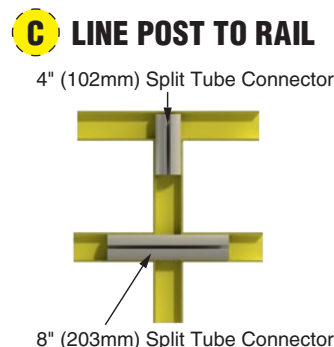
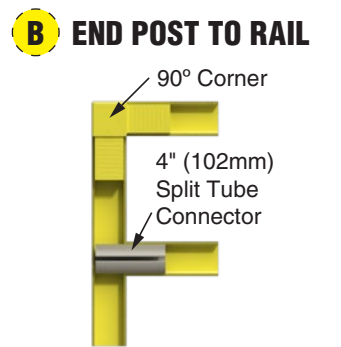
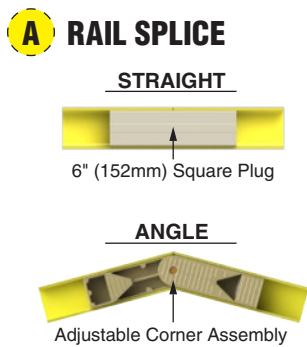
# STANDARD SQUARE HANDRAIL CONSTRUCTION



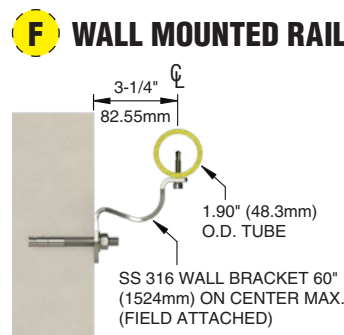
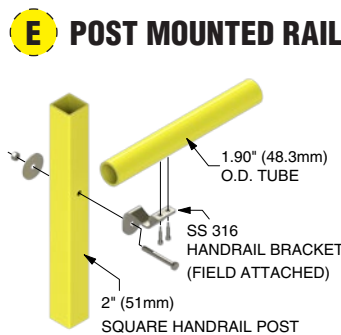
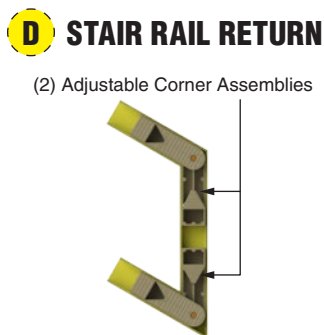
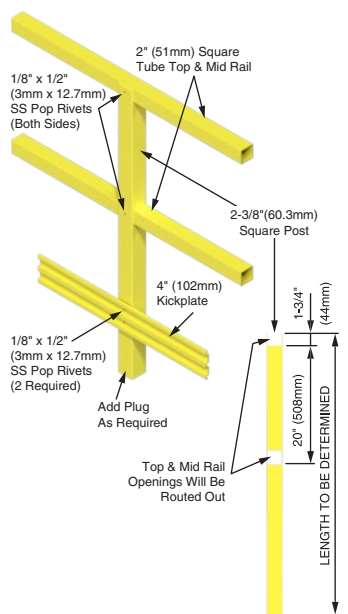
Refer to OSHA 1910.25, Table D-2 for stairway handrail requirements.

## Connection Details

All components secured with epoxy.



## ALTERNATIVE POST DESIGN

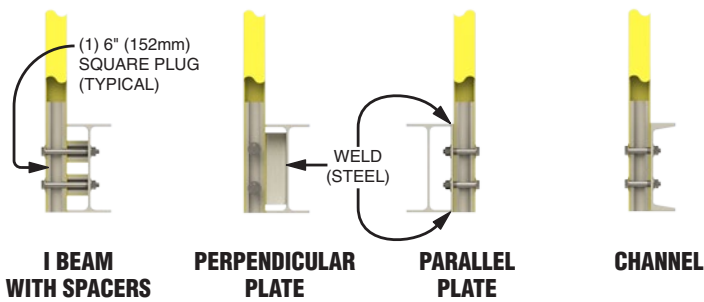


# RECOMMENDED SQUARE POST AND KICK PLATE INSTALLATION

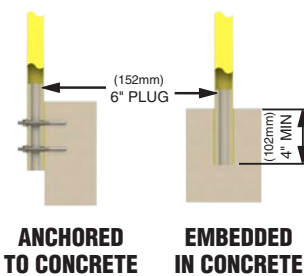
## Posts with FRP Base Plate



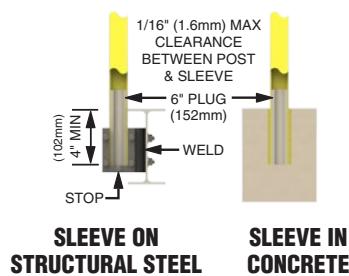
## Fastening to Structural Steel or Fiberglass



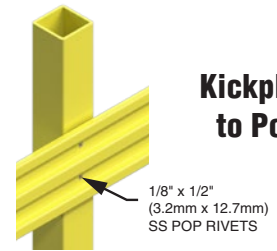
## Fastening to Concrete



## Removable Posts

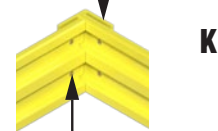


## Kickplate to Post

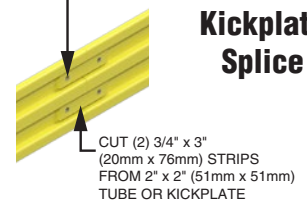


CUT 1-1/2" x 1-1/2" x 4" (38mm x 38mm x 102mm) ANGLE FROM 2" x 2" (51mm x 51mm) TUBE

## Kickplate Corner

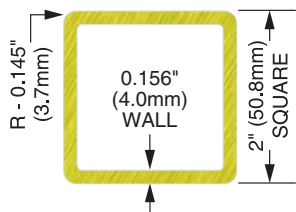
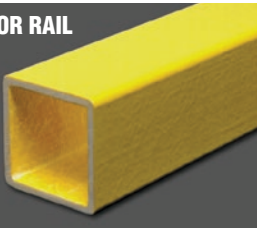


## Kickplate Splice

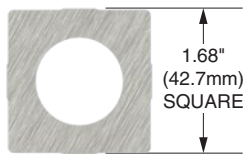
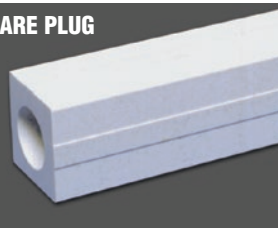


# SQUARE HANDRAIL COMPONENTS

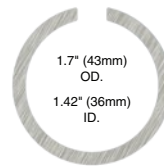
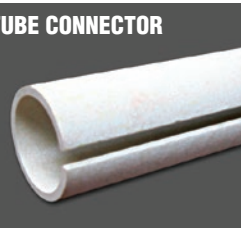
## POST OR RAIL



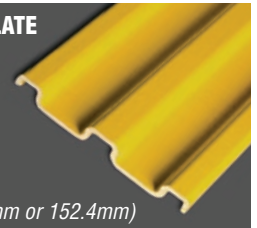
## SQUARE PLUG



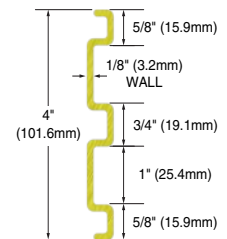
## SPLIT TUBE CONNECTOR



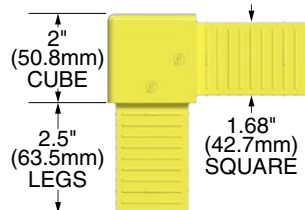
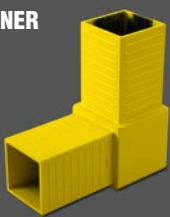
## KICKPLATE



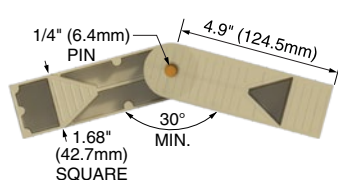
4" or 6" (101.6mm or 152.4mm)



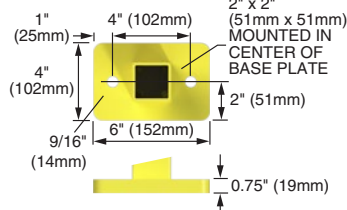
## 90° CORNER



## ADJUSTABLE CORNER ASSEMBLY



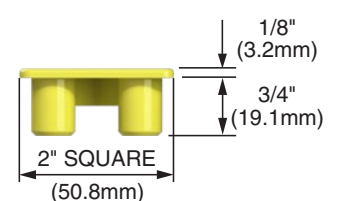
## POST BASE (Mounted To Post)



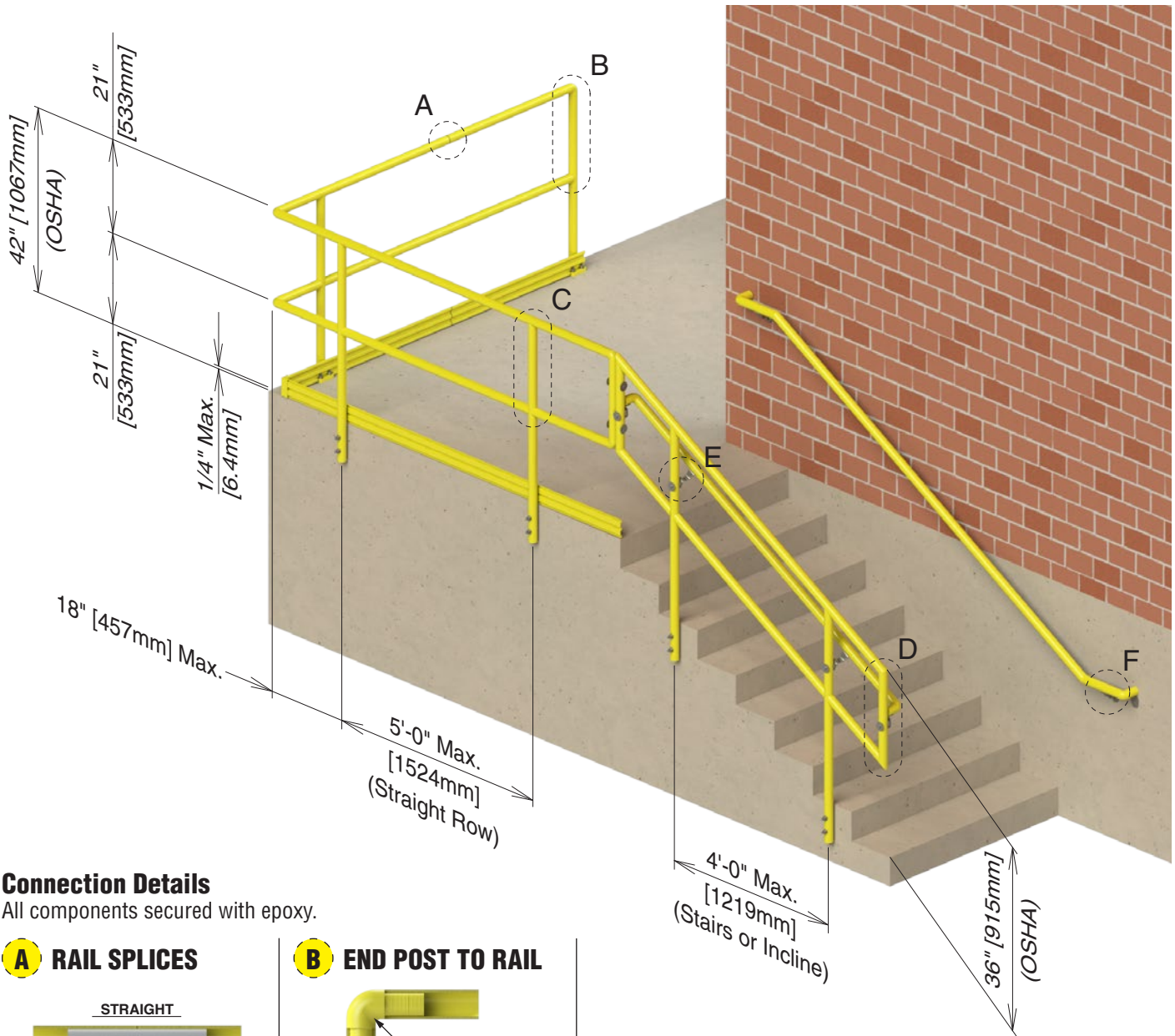
## END CAP



Note: For Capping Tubes (Special Construction)



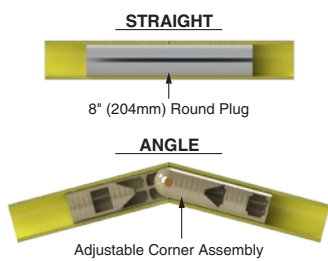
# STANDARD ROUND HANDRAIL CONSTRUCTION



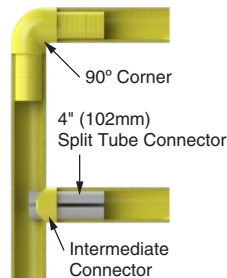
## Connection Details

All components secured with epoxy.

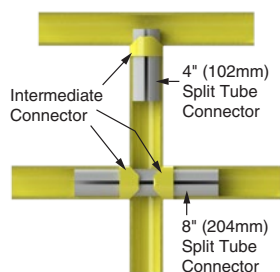
### A RAIL SPLICES



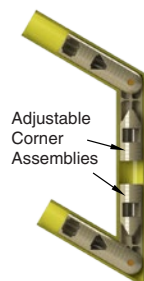
### B END POST TO RAIL



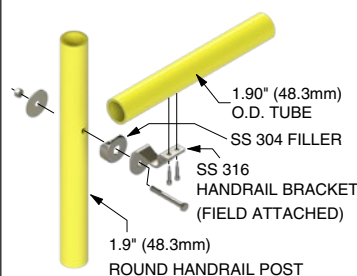
### C LINE POST TO RAIL



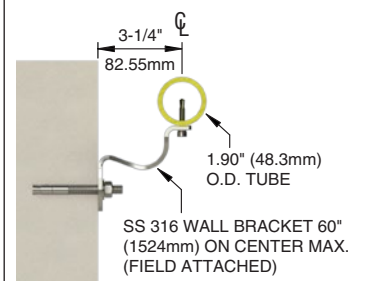
### D STAIR RAIL RETURN



### E POST MOUNTED RAIL



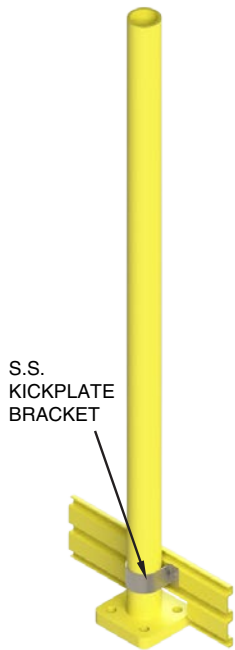
### F WALL MOUNTED RAIL



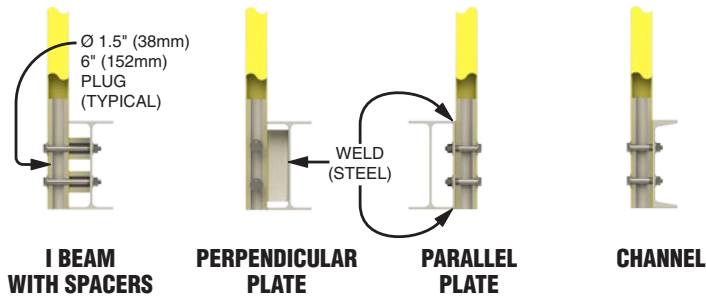
Refer to OSHA 1910.25, Table D-2 for stairway handrail requirements.

# RECOMMENDED ROUND POST AND KICK PLATE INSTALLATION

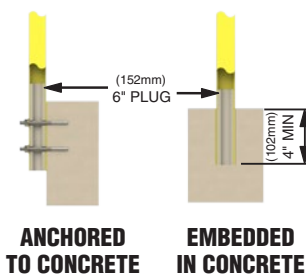
## Posts with FRP Base Plate



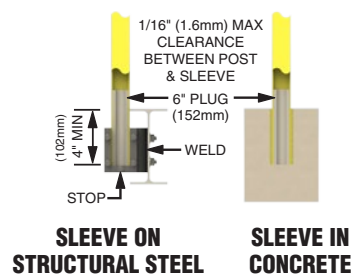
## Fastening to Structural Steel or Fiberglass



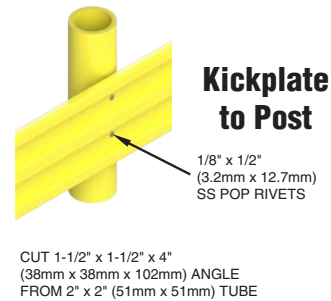
## Fastening to Concrete



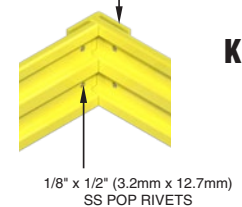
## Removable Posts



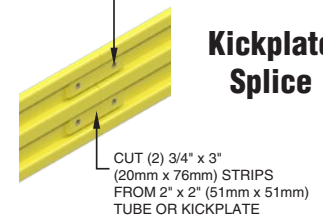
## Kickplate to Post



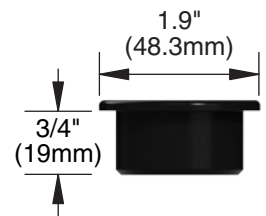
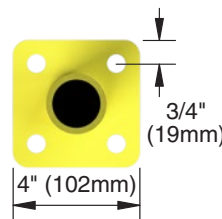
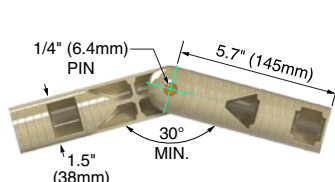
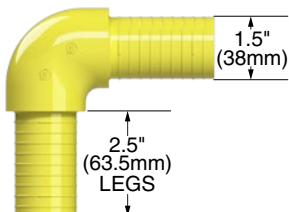
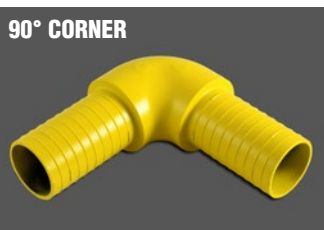
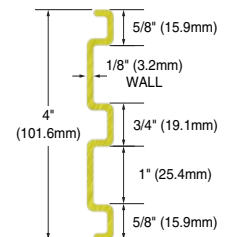
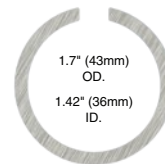
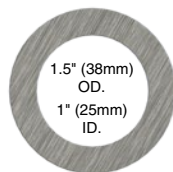
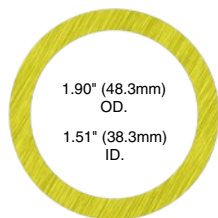
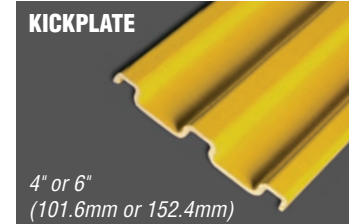
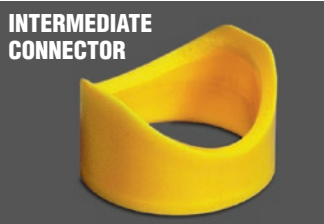
## Kickplate Corner



## Kickplate Splice



# ROUND HANDRAIL COMPONENTS



# ECONOMY CHANNEL TOP HANDRAIL CONSTRUCTION

SAFRAIL™ channel top industrial fiberglass handrail is an economical commercial railing system designed for long runs on platforms and walkways. The railing system is designed for fabrication

efficiency. SAFRAIL™ channel top can be used in combination with round and square SAFRAIL™. 2" square SAFRAIL™ sections are installed along stairs and inclines.

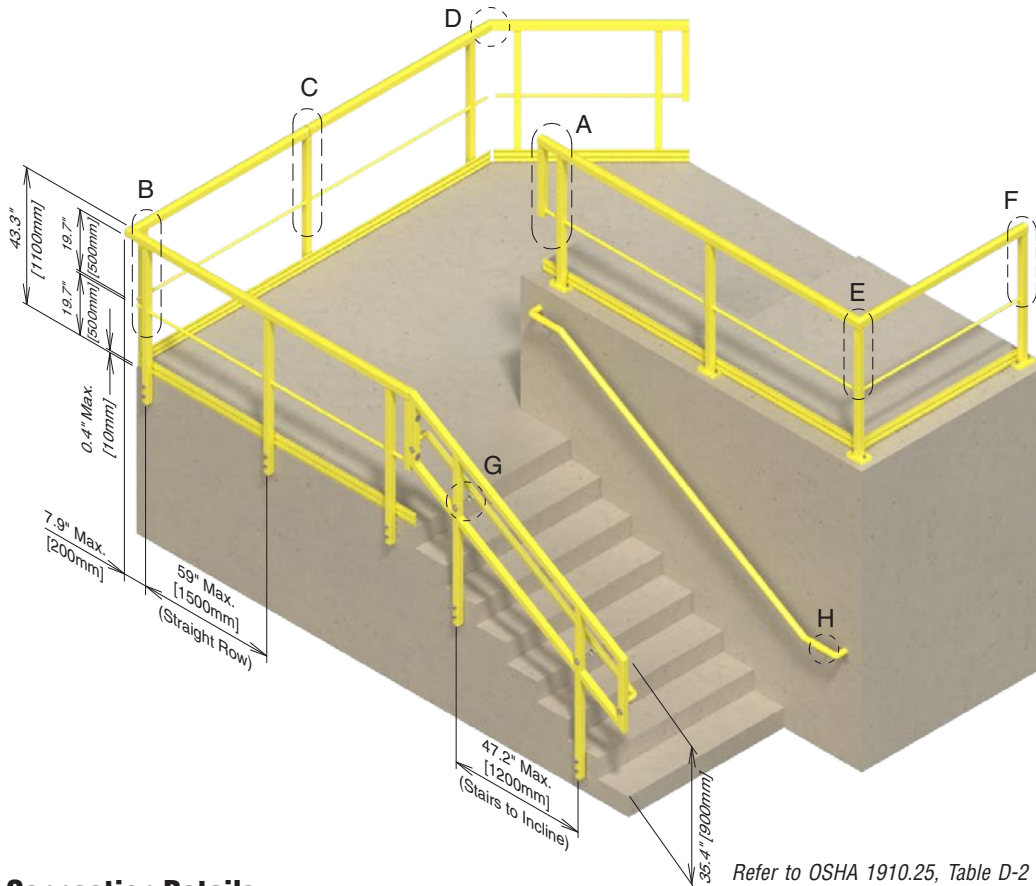
## Advantages

The benefits of designing a SAFRAIL™ channel top fiberglass handrail system are:

- Economical installation of long, straight runs
- Fewer components, reduced freight cost
- No epoxy required
- All riveted connections

## Safety

The channel top handrail system meets OSHA strength requirements. It has been independently tested and meets British Standard EN ISO 14122-3:2001 requirements. The handrail system sustained a falling weighted bag impact force of 216.5 ft-lb (293.6 N-m).

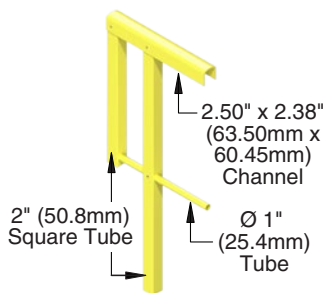


Refer to OSHA 1910.25, Table D-2 for stairway handrail requirements.

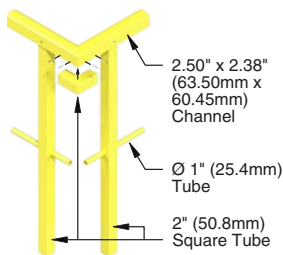
## Connection Details

All components secured with rivets.

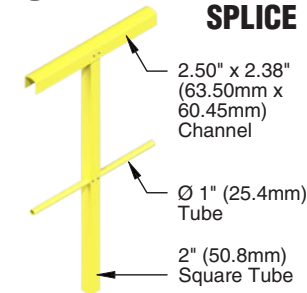
### A END RETURN



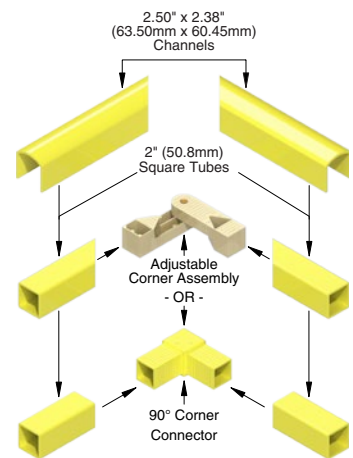
### B CORNER SPLICE



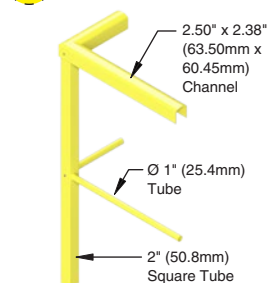
### C TOP & MID RAIL SPLICE



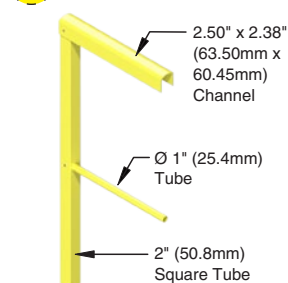
### D ALTERNATIVE RAIL SPLICES



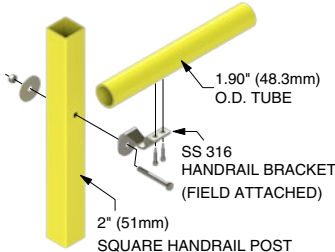
### E CORNER POST



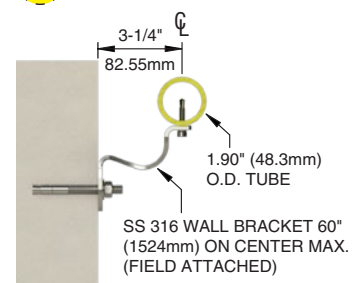
### F END POST



### G POST MOUNTED RAIL

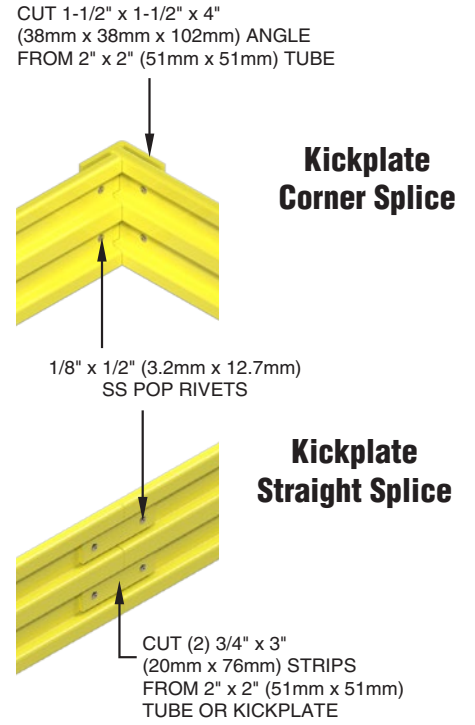
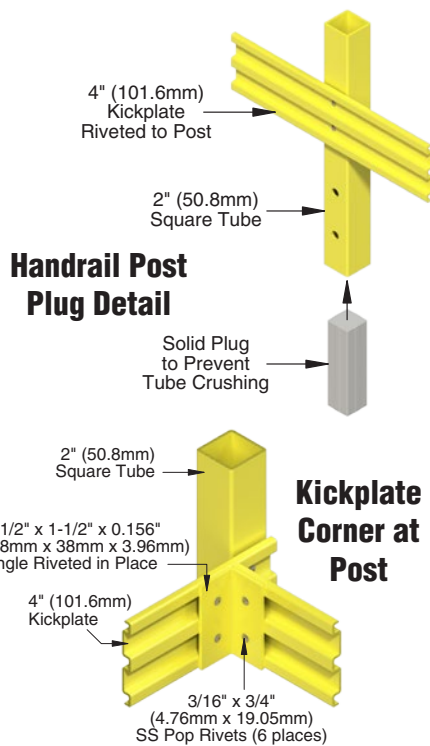
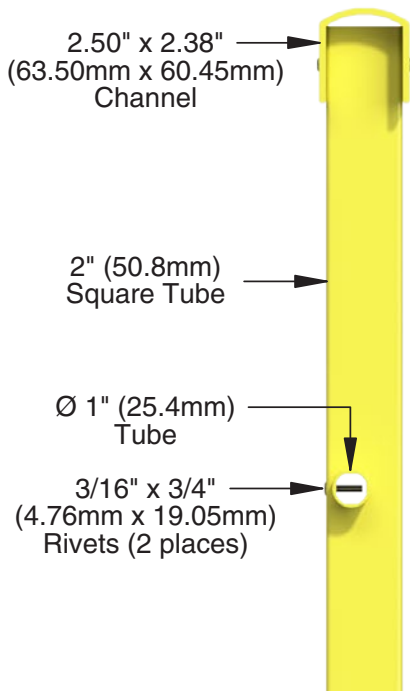


### H WALL MOUNTED RAIL



# RECOMMENDED CHANNEL TOP POST AND KICK PLATE INSTALLATION

## Handrail Post, Top Rail & Mid Rail



## CHANNEL TOP HANDRAIL COMPONENTS

<p><b>TOP RAIL</b></p> <p>2-3/8" (60.3mm)</p> <p>3/16" (4.8mm) WALL</p> <p>2-1/2" (63.5mm)</p>	<p><b>MID RAIL</b></p> <p>Ø 1" (25.4mm)</p> <p>0.11" (2.79mm)</p>	<p><b>SQUARE PLUG</b></p> <p>1.68" (42.7mm) SQUARE</p>	<p><b>KICKPLATE</b></p> <p>4" or 6" (101.6mm or 152.4mm)</p> <p>5/8" (15.9mm)</p> <p>1/8" (3.2mm) WALL</p> <p>3/4" (19.1mm)</p> <p>1" (25.4mm)</p> <p>5/8" (15.9mm)</p>
<p><b>90° CORNER</b></p>	<p><b>ADJUSTABLE CORNER ASSEMBLY</b></p> <p>1/4" (6.4mm) PIN</p> <p>4.9" (124.5mm)</p> <p>1.68" (42.7mm) SQUARE</p> <p>30° MIN.</p>	<p><b>POST BASE (Mounted To Post)</b></p> <p>1" (25mm)</p> <p>4" (102mm)</p> <p>2" x 2" (51mm x 51mm) MOUNTED IN CENTER OF BASE PLATE</p> <p>2" (51mm)</p> <p>9/16" (14mm)</p> <p>6" (152mm)</p> <p>0.75" (19mm)</p>	<p><b>END CAP</b></p> <p>Note: For Capping Tubes (Special Construction)</p>
<p>2" (50.8mm) CUBE</p> <p>2.5" (63.5mm) LEGS</p> <p>1.68" (42.7mm) SQUARE</p>			<p>1/8" (3.2mm)</p> <p>3/4" (19.1mm)</p> <p>2" SQUARE (50.8mm)</p>

# APPLICATIONS



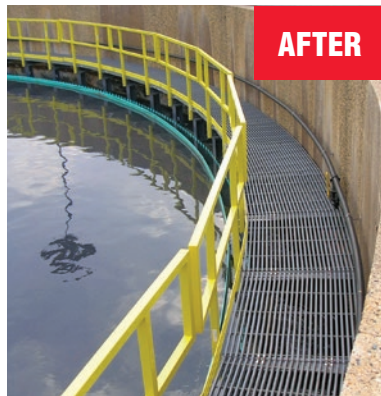
In 1994, an industrial equipment supplier teamed with a coal company's engineering group to address corrosion problems at the Galatia, Illinois coal preparation plant. The coal preparation environment results in significant deterioration of carbon steel within two years and stainless steel in less than six. The coal company's goal was to use non-metallic structural products in the design of a new section of the plant.

Strongwell's SAFRAIL™ FRP square tube industrial handrail combined with DURAGRID® I-6000 FRP grating and stair treads were specified in all areas of the new section.

After sixteen years of service, Strongwell revisited the plant in 2012. The results were a testament to the superior performance of the pultruded FRP solution. There had not been a single corrosion related problem, while the metal structures and components around the fiberglass railing and platforms were failing.



(Also featured on Cover) A chemical processing plant in Charleston, West Virginia was outfitted with square SAFRAIL™ FRP handrail along with DURAGRID® I-6000 FRP grating, EXTREN® FRP channels and angles and COMPOSOLITE® fiberglass building panels by a Strongwell fabricator. The fabricator designed, built, and installed the two new process vessels to replace old deteriorating wooden tanks, and provided new access walkways, railings, and covers for the two existing vessels.



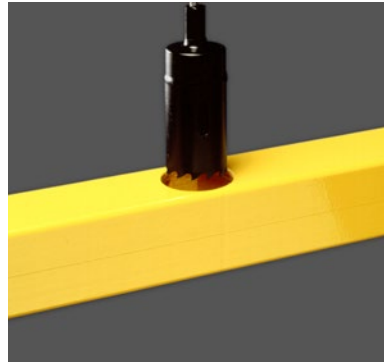
Primary Clarifiers at Albert Lea Wastewater Treatment Plant. One of the most corrosive areas in the water treatment process due to Hydrogen Sulfide and/or Sulfuric Acid. Aluminum clarifier covers trap the corrosive gases, which severely corroded the original steel handrail and grating.

# FABRICATION METHODS

1. Cut components to length and miter where necessary.



2. Locate and drill holes for split tube connector. Must use 1.68" dia. core drill (available from Strongwell).



3. Apply recommended epoxy adhesive to connectors and inside tube (available from Strongwell).



4. Press together. Wipe off excess adhesive. 1/8" tension pins may be used at connections for field fabrication.



*NOTE: Joints must be immobilized until cured. The recommended temperature for epoxy cure is 60°F (15°C) or above. Failure to use these installation and fabrication methods, including recommended epoxy adhesive and 1.68" dia. core drill, may cause failure.*

## List of Components & Accessory Items

- 2" x 2" x .156" (51 x 51 x 4mm) Square Tube, Yellow, Polyester Fire Retardant, UV Inhibited @ 240" (6100mm)
- 2-3/8" x 2-3/8" x 3/16" (60 x 60 x 5mm) Square Tube, Yellow, Polyester Fire Retardant, UV Inhibited @ 240" (6100mm)
- 4" Kickplate, Yellow, Polyester Fire Retardant, UV Inhibited @ 240" (6100mm)
- 6" Kickplate, Yellow, Polyester Fire Retardant, UV Inhibited @ 240" (6100mm)
- FRP Base Plate with Post — Total Height 40" (1016mm) (Polyester)
- 2-3/8" x 2-3/8" x 3/16" (60 x 60 x 5mm) Alternate Handrail Post, Routed Out, No Bottom Plugs
- Black End Caps
- Adjustable Corner Assembly (Total Assembly)
- 90° Corner Plug
- Kickplate Splice
- Kickplate 90° Splice
- Split Round Tube 8" (200mm) Length
- Split Round Tube 4" (100mm) Length
- Split Round Tube 144" (3660mm) Length
- 6" (150mm) Square Plug
- 144" (3660mm) Square Plug
- 1/8" x 1-1/2" Tension Pins
- Epoxy Kits — 1 Pint Yellow
- Core Drill (1.68" Dia.)
- 1/8" x 1/2" SS Pop Rivets
- 90° Corner Sample
- Tee Sample
- Mounting Bolts

## Tools

- Electric Drill
- Core Drill
- Circular Saw
- 1/8" Drill Bits
- Hammer
- Circular Saw Blades
- Sandpaper

*NOTE: Tungsten carbide-tipped core drill bit and 7" grit-edged tungsten carbide circular saw blades are recommended (available from Strongwell).*

# SAFRAIL™ LADDER AND CAGE SYSTEMS

SAFRAIL™ fiberglass ladders and ladder cages mounted on the sides of tanks and buildings are a common application in a wide range of industries. Fiberglass ladder and ladder cage systems have been in use since the 1950's in chemical plants and other corrosive environments. Even in complete immersion applications, fiberglass has outlasted and outperformed aluminum and steel and required little or no maintenance.

## Sizes & Availability

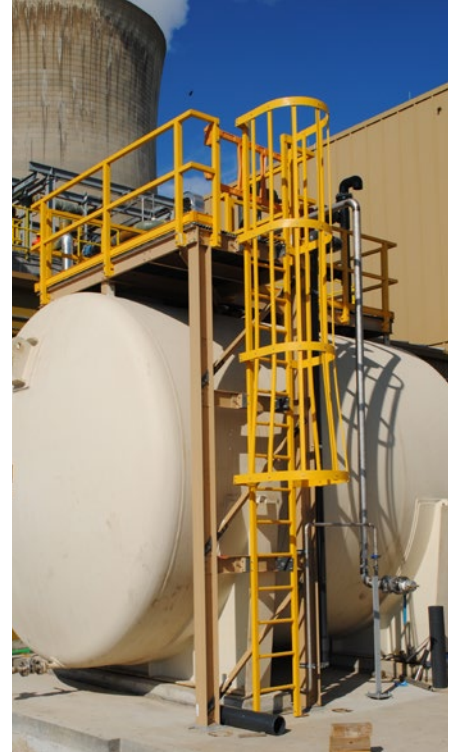
SAFRAIL™ ladders are fabricated in a standard 18" (457mm) rung width configuration with 12" (305mm) rung spacings. Various ladder lengths can be produced as practical. Standard SAFRIL™ ladder and ladder cage systems are designed and fabricated to meet the requirements of OSHA 1910.23 and 1926.1053. Custom colors and 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

SAFRIL™ ladders and ladder cage systems are produced using a premium grade polyester resin system with flame retardant and ultraviolet (UV) inhibitor additives. A vinyl ester resin system is available upon request for additional corrosion resistance. Standard side rails and cages are pigmented OSHA safety yellow. The rungs are a pultruded fiberglass polyester tube with a fluted, non-skid surface.

**See the SAFRIL™ Ladder and Cage Systems brochure for more information.**

**Standard Cage Walk Through Ladder with Base Mount**



*ISO 9001 Quality Certified Manufacturing Plants*



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400 Commonwealth Ave., Bristol, VA 24201 USA  
(276) 645-8000

### CHATFIELD LOCATION

1610 Highway 52 South, Chatfield, MN 55923-9799 USA  
(507) 867-3479

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