گـــروه فـــن آوری هـــای نـــویـــن

ارائه خدمات و تکنولوژیهای نوین صنعت ساختمان

MTgroup

CONSTRUCTIONS & DEVELOPMENT

SPECIFICATIONS OF PULTRUDED LADDER-TYPE CABLE TRAYS

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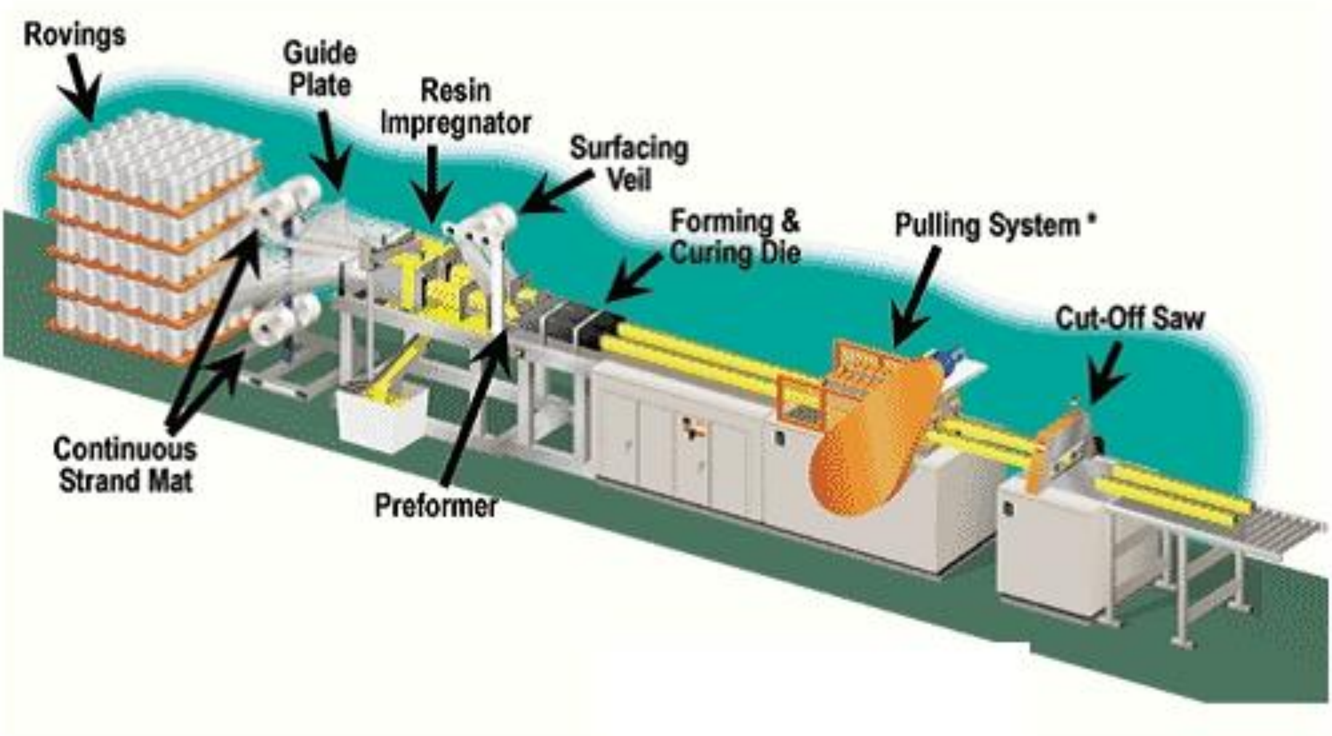
THE PULTRUSION PROCESS

Pultrusion is a manufacturing process for producing continuous lengths of reinforced polymer structural shapes with constant cross-sections. Raw materials are a liquid resin mixture (containing resin, fillers and specialized additives) and flexible textile reinforcing fibers. The process involves pulling these raw materials (rather than pushing, as is the case in extrusion) through a heated steel forming die using a continuous pulling device. The reinforcement materials are in continuous forms such as rolls of mat and doffs of roving. As the reinforcements are saturated with the resin mixture ("wet-out") in the resin bath and pulled through the die, the gelatin or hardening, of the resin is initiated by the heat from the die and a rigid, cured profile is formed that corresponds to the shape of the die. While pultrusion machine design varies with part geometry, the basic pultrusion process concept is described in the following schematic.



The creels position the reinforcements for subsequent feeding into the guides. The reinforcement must be located properly within the composite and this is the function of the reinforcement guides.

The resin bath saturates (wets out) the reinforcement with a solution containing the resin, fillers, pigment, and catalyst plus any other additives required. The interior of the resin bath is carefully designed to optimize the wet-out of the reinforcement.

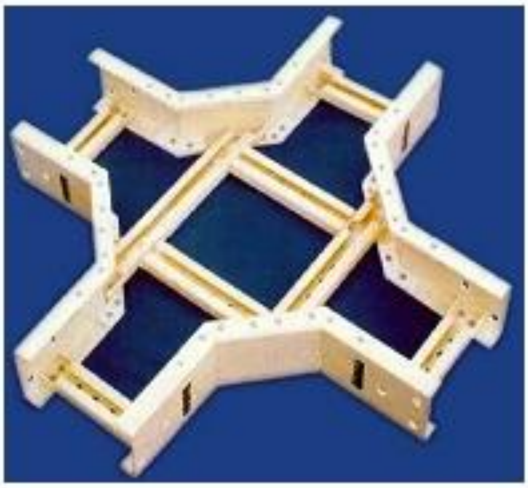
On exiting the resin bath, the composite is in a flat sheet form. The performer is an array of tooling which squeezes away excess resin as the product is moving forward and gently shapes the materials prior to entering the forming and curing die. In the forming and curing die, the thermosetting reaction is heat activated (energy is primarily supplied electrically) and the composite is cured (hardened). On exiting the die, it is necessary to cool the hot part before it is gripped by the pull blocks (made of durable urethane foam) to prevent cracking and/or deformation by the pull blocks. Strong well uses two distinct pulling systems, one that is a caterpillar counter-rotating type and the other a hand-over-hand reciprocating type to pull the cured profile to the saw for cutting to length.

CABLE TRAY

Per the National Electrical Code, a cable tray system is "a unit or assembly of units or sections and associated fittings forming a rigid structural system used to securely fasten or support cables and race ways". Composite cable trays are fabricated from components derived from a process called PULTRUSION. This process enables a high percentage of reinforcement to be incorporated into the components giving it very superior strength. The strength of it in relation to its weight therefore exceeds the performance of those of steel or aluminum. Composite cable trays are made from a selection of premium resin reinforced with reinforcements to form a strong composite which is resistance to must chemicals and ultra violet. Composite cable tray resists acids, salts, alkalis and a wide range of aggressive chemicals and solvents. They are also available in fire retardant grade.

DIFFERENT TYPES OF CABLE TRAYS ARE:

1) Ladder type FRP cable trays:



2) Box type FRP cable trays:

APPLICATIONS OF CABLE TRAYS

Applications:

- ***Chemical and purification plants***
- ***Refineries***
- ***Tunnels***
- ***Effluent treatment plants***
- ***Marine industry***
- ***Metallurgical plants***
- ***Fertilizer plants***
- ***Oil & Gas sector***
- ***Food & Drag industry etc.***

Users:

- ***Railway cable laying***
- ***Telephone cable laying***
- ***Electrical cable laying***
- ***Protection of medium and low tension cable on walls or poles***

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Benefits and Characteristics of FRP Cable Trays

- Corrosion Resistance
- Fire Resistance
- Non-Magnetic
- Impact Resistance
- Non-sparking
- Maintenance Free
- Light Weight
- Cost Saving
- Non-Conductive
- Low Installation Costs
- Superior Strength
- Mechanical Strength
- High Performance
- Easily Worked
- Cut and drilled on site
- Easy to install
- Long Life
- Non rust
- Nor do they ever require painting
- Resistance to most chemicals
- Gives added fire protection to the cables in case of external fire

DESCRIBTION

CORROSION RESISTANCE

The ability of Composite Cable tray is to guard against deterioration from industrial chemicals and environmental factors makes it a logical and cost-effective alternative to carbon steel, aluminium or other conventional materials also it is resistance to weather and UV. Whether Cable tray is exposed to continuous submersion, splash, spills, fumes or gases, you can be assured that Composite Cable tray will outperform other mediums.

FIRE RESISTANCE

Composite Cable tray is available in various resin systems, two of which meet the Class 1 flame spread rating of 25 or less, in accordance with ASTM E-84 Tunnel Test Method. If a flame spread of 10 or less is required, it will be available in request.

NON-MAGNETIC

The non-magnetic properties allow the Composite Cable tray to be used in sensitive installations where the inherent magnetic properties of metallic Cable tray would prove unsuitable.

IMPACT RESISTANCE

The impact resistance of Composite Cable tray allows repeated deflection without permanent deformation. A certain amount of deflection can occur with loading. However, once the load is removed, the grating will return to its original shape, unlike metallic Cable tray, which will remain deformed and require costly repairs or replacement.

NON-SPARKING

The non sparking qualities of Composite Cable tray systems are ideally suited for those installations where hydrogen or other combustible gases may be found and which may explode or cause a fire from sparks produced.

MAINTENANCE FREE

The use of Composite Cable tray virtually eliminates maintenance costs since painting is not required and UV inhibitors protect against degradation from the sun.

LIGHTWEIGHT

Composite Cable tray weighs about one-quarter as much as steel Cable tray. So it needs few men for handling. The lightweight design of the Cable tray reduces installation and fabrication costs.

COST SAVINGS

In a review of costs, Composite Cable tray showed significant savings over the use of stainless steel Cable tray, and when consideration is given to 'life cycle costs', the saving over the use of metal Cable tray alternatives is quite considerable.

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NON-CONDUCTIVE

Composite Cable trays don't conduct heat or electricity and also protects the cables.

LOW INSTALLATION COSTS

Composite Cable tray weighs considerably less than conventional metal Cable trays and is easier and less expensive to transport, install and remove.

SUPERIOR STRENGTH

The high glass-to-resin ratio of Composite Cable tray provides superior strength and load-bearing characteristics. With structural integrity protected by its unique corrosion resistance capabilities, Composite Cable tray lasts longer than traditional materials.

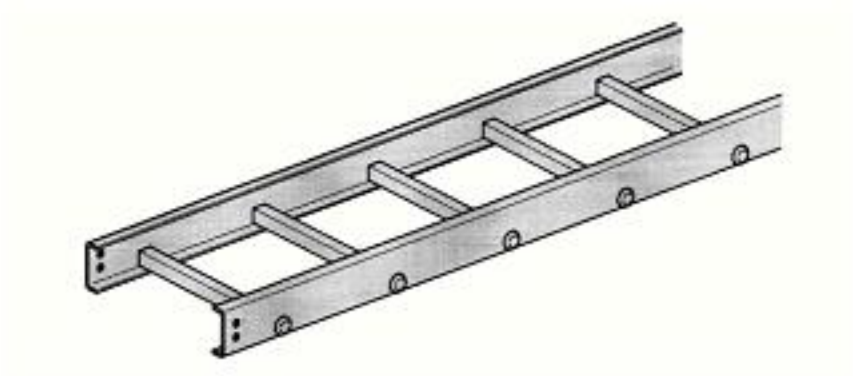
MECHANICAL STRENGTH

Breaking strength under a lateral force is exceptional. The uni-directional continuous Composite reinforcement offers numerous advantages, including rigidity, shock-resistance and no permanent deformation after overloading. These factors provide excellent mechanical strength and a generous factor of safety. Composite Cable tray is designed for maximum safety in intensive industrial use.

HIGH PERFORMANCE

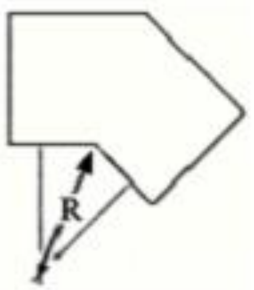
Composite structural Composite Cable tray materials have demonstrated a proven ability to withstand the harsh side effects of corrosive conditions better than galvanized steel. For many years, composites have been reliably used in traditionally corrosive industries while the cost of material is an important criteria in the design of a project, it does not reflect the total cost of the project. Beyond material purchase price, the engineer also should consider the related costs of installation, maintenance over time and replacement of debilitated materials.

FIBERGLASS CABLE TRAY SELECTION

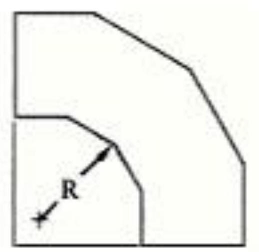


Straight Section

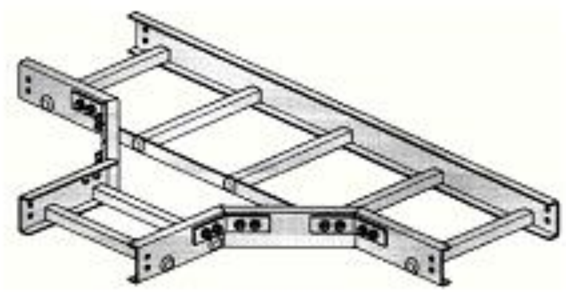
Horizontal Bend 90º, 45º (HB)



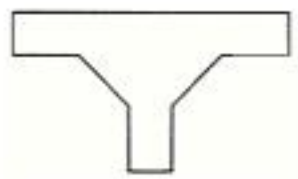
Horizontal Bend 90º



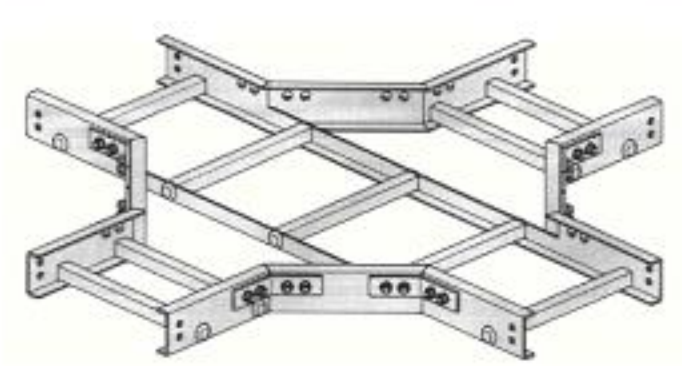
Horizontal Bend 45º



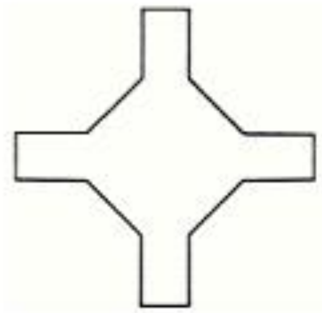
Horizontal Tee (HT)



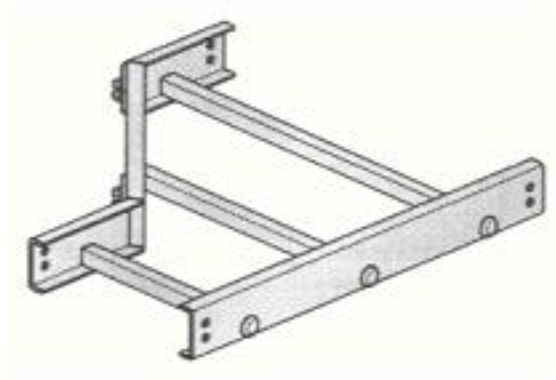
Horizontal Tee



Horizontal Cross (HX)

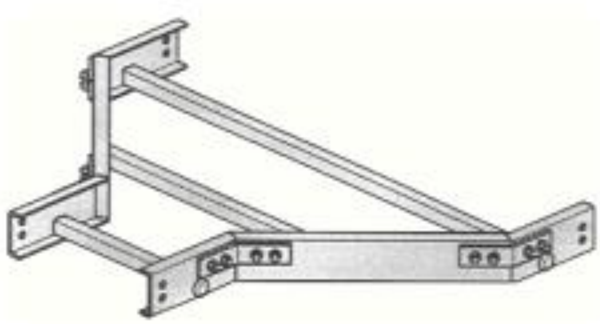


Horizontal Cross

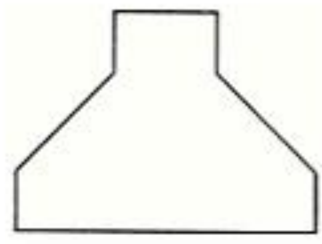


Reducer (LR)

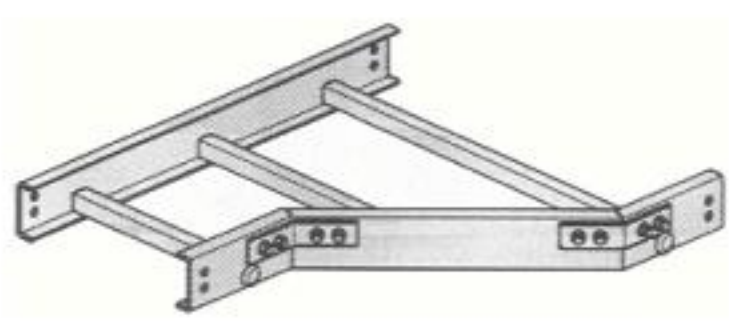
Left Reducer



Reducer (SR)

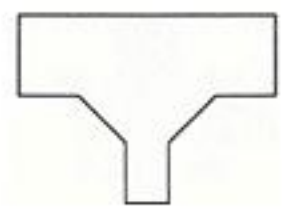


Straight Reducer



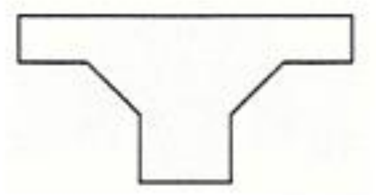
Reducer (RR)

Right Reducer



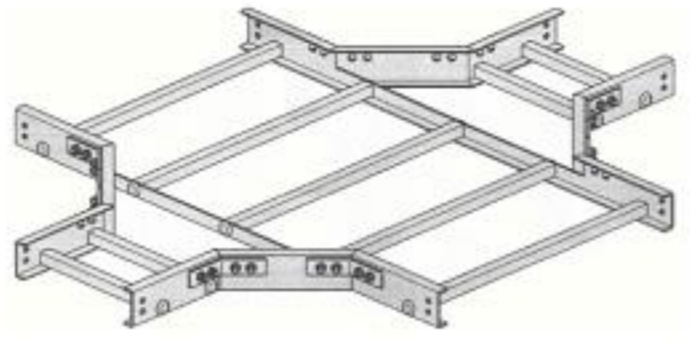
Horizontal Reducing Tee (HT)

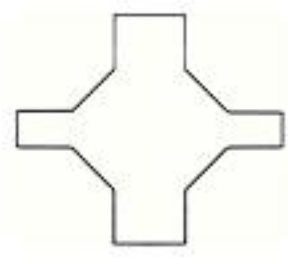
Horizontal Reducing Tee



Horizontal Expanding Tee (HT)

Horizontal Expanding Tee





Horizontal Expanding / Reducing Cross (HX)

Horizontal Expanding / Reducing Cross

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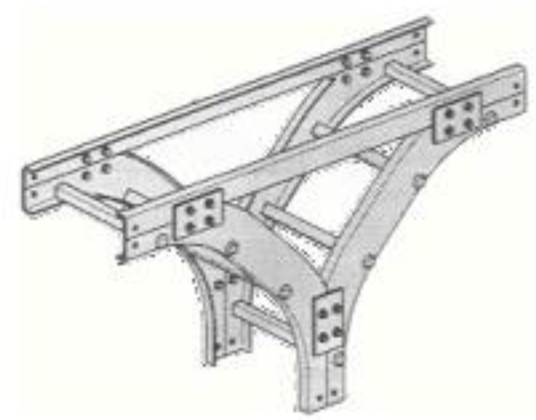
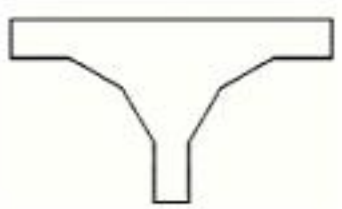
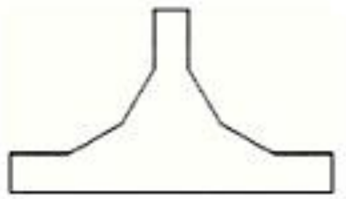


Vertical Tee Down (VTD)

Vertical Tee Up (VTU)



Vertical Tee Down



Vertical Tee Up

Outside Vertical Bend 90º

Outside Vertical Bend 45º

Outside Vertical Bend (VO)

Inside Vertical Bend 45º

Intside Vertical Bend 90º

Inside Vertical Bend (VI)

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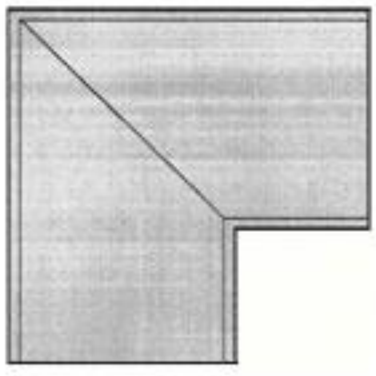
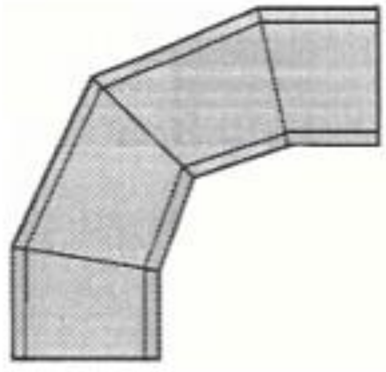
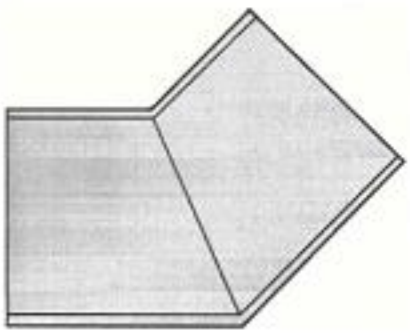


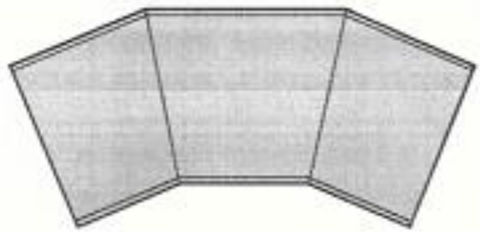
90º Direct Horizontal Bend



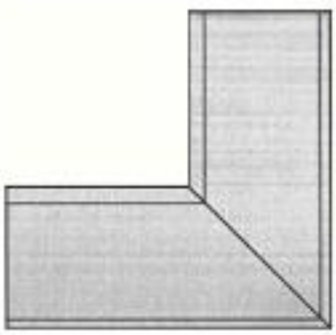
90º Horizontal Bend 12" Radius



45º Direct Horizontal Bend

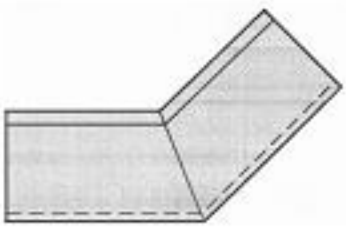


45º Horizontal Bend 12" Radius

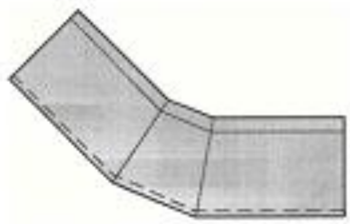


90º Direct Vertical Inside Bend

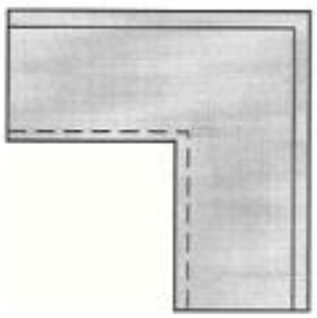
90º Vertical Inside Bend 12" Radius



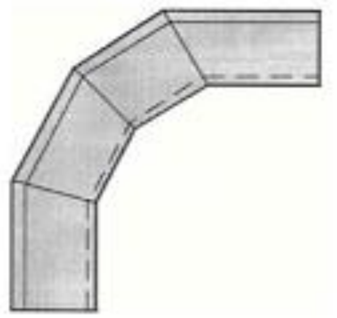
45º Direct Vertical Inside Bend



45º Vertical Inside Bend 12" Radius

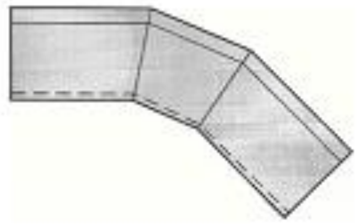


90º Direct Vertical Outside Bend

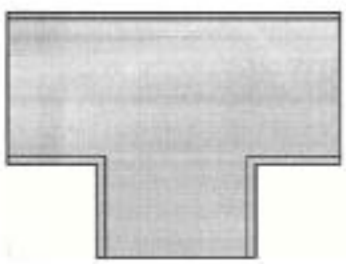


90º Vertical Outside Bend 12" Radius

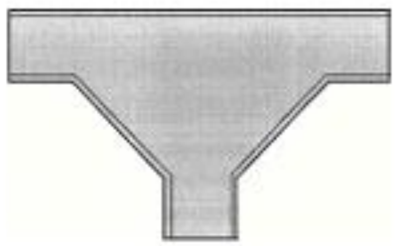
45º Direct Vertical Outside Bend



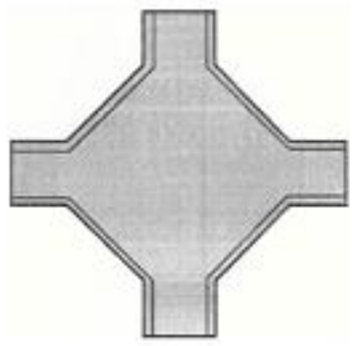
45º Vertical Outside Bend 12" Radius



Horizontal Tee Direct



Horizontal Tee 12" Radius



Horizontal Cross 12" Radius

CABLE TRAY CHEMICAL RESISTANCE GUIDE

CHEMICAL ENVIROMENT	POLYESTER		VINYL ESTER	
	Max Wt. %	Max Oper. Temp °F	Max Wt. %	Max Oper. Temp °F
Acetic Acid	10	190	10	210
Acetic Acid	50	125	50	180
Acetone	N/R	N/R	100	75
Aluminum Chloride	SAT	170	SAT	200
Aluminum Hydroxide	SAT	160	SAT	170
Aluminum Nitrate	SAT	150	SAT	170
Aluminum Sulfate	SAT	180	SAT	200
Ammonium Chloride	SAT	170	SAT	190
Ammonium Hydroxide	1	100	10	150
Ammonium Hydroxide	28	N/R	28	100
Ammonium Carbonate	N/R	N/R	SAT	150
Ammonium Bicarbonate	15	125	SAT	130
Ammonium Nitrate	SAT	160	SAT	190
Ammonium Persulfate	SAT	N/R	SAT	150
Ammonium Sulfate	SAT	170	SAT	200
Amyl Alcohol	ALL	N/R	ALL	90
Amyl Alcohol Vapor	-	140	-	120
Benzene	N/R	N/R	100	140
Benzene Sulfonic Acid	25	110	SAT	200
Benzoic Acid	SAT	150	SAT	200
Benzoyl Alcohol	100	N/R	100	N/R
Borax	SAT	170	SAT	200
Calcium Carbonate	SAT	170	SAT	200
Calcium Chloride	SAT	170	SAT	200
Calcium Hydroxide	25	70	25	165
Calcium Nitrate	SAT	180	SAT	200
Calcium Sulfate	SAT	180	SAT	200
Carbon Disulfide	N/R	N/R	N/R	N/R
Carbonic Acid	SAT	130	SAT	180
Carbon Dioxide Gas	-	200	-	200
Carbon Monoxide Gas	-	200	-	200
Carbon Tetrachloride	N/R	N/R	100	75
Chlorine, Dry Gas	-	140	-	170
Chlorine, Wet Gas	-	N/R	-	180
Chlorine Water	SAT	80	SAT	180
Hydrogen Bromide, Wet	100	75	100	130
Hydrogen Chloride	-	120	-	200

CHEMICAL ENVIROMENT	POLYESTER		VINYL ESTER	
	Max Wt. %	Max Oper. Temp °F	Max Wt. %	Max Oper. Temp °F
Chromic Acid	5	70	10	120
Citric Acid	SAT	170	SAT	200
Copper Chloride	SAT	170	SAT	200
Copper Cyanide	SAT	170	SAT	200
Copper Nitrate	SAT	170	SAT	200
Crude Oil, Sour	100	170	100	200
Cyclohexane	N/R	N/R	N/R	N/R
Cyclohexane, Vapor	ALL	100	ALL	130
Diesel Fuel	100	160	100	180
Diethy Ether	N/R	N/R	N/R	N/R
Dimethyl Phthalate	N/R	N/R	N/R	N/R
Ethanol	50	75	50	90
Ethyl Acetate	N/R	N/R	N/R	N/R
Ethylene Chloride	N/R	N/R	N/R	N/R
Ethylene Glycol	100	90	100	200
Fatty Acids	SAT	180	SAT	200
Ferric Chloride	SAT	170	SAT	200
Ferric Nitrate	SAT	170	SAT	200
Ferric Sulfate	SAT	170	SAT	200
Ferrous Chloride	SAT	170	SAT	200
Fluoboric Acid	N/R	N/R	SAT	165
Fluosilicic Acid	SAT	N/R	SAT	70
Formaldehyde	50	75	50	100
Formic Acid	SAT	N/R	50	100
Gasoline	100	80	100	150
Glucose	100	170	100	200
Glycerine	100	150	100	200
Heptane	100	110	100	120
Hexane	100	90	100	130
Hydrobromic Acid	50	120	50	120
Hydrochloric Acid	10	150	10	200
Hydrochloric Acid	20	140	20	190
Hydrochloric Acid	37	75	37	95
Hydrofluoric Acid	N/R	N/R	15	80
Hydrogen Bromide, Dry	100	190	100	200
Potassium Hydroxide	N/R	N/R	25	150
Potassium Nitrate	SAT	170	SAT	200

CHEMICAL ENVIROMENT	POLYESTER		VINYL ESTER	
	Max Wt. %	Max Oper. Temp °F	Max Wt. %	Max Oper. Temp °F
Hydrogen Peroxide	5	100	30	100
Hydrogen Sulfide, Dry	100	170	100	210
Hydrogen Sulfide, Wet	100	170	100	210
Hypocholorous Acid	20	80	20	150
Isopropyl Alcohol	N/R	N/R	15	80
Kerosene	100	140	100	180
Lactic Acid	SAT	170	SAT	200
Lead Acetate	SAT	170	SAT	200
Lead Chloride	SAT	140	SAT	200
Lead Nitrate	SAT	-	SAT	200
Linseed Oil	100	150	100	190
Lithium Chloride	SAT	150	SAT	190
Magnesium Carbonate	SAT	140	SAT	170
Magnesium Chloride	SAT	170	SAT	200
Magnesium Hydroxide	SAT	150	SAT	190
Magnesium Nitrate	SAT	140	SAT	180
Magnesium Sulfate	SAT	170	SAT	190
Mercuric Chloride	SAT	150	SAT	190
Mercurous Chloride	SAT	140	SAT	180
Methyl Ethyl Ketone	N/R	N/R	N/R	N/R
Mineral Oils	100	170	100	200
Monochlobenzene	N/R	N/R	N/R	N/R
Naphtha	100	140	100	170
Nickel Chloride	SAT	170	SAT	200
Nickel Nitrate	SAT	170	SAT	200
Nickel Sulfate	SAT	170	SAT	200
Nitric Acid	5	140	5	150
Nitric Acid	20	70	20	100
Oleic Acid	100	170	100	190
Oxalic Acid	ALL	75	ALL	120
Paper Mill Liquors	-	100	-	120
Perchlorethylene	100	N/R	100	N/R
Perchloric Acid	N/R	N/R	10	150
Perchloric Acid	N/R	N/R	30	80
Phosphoric Acid	10	160	10	200
Phosphoric Acid	100	120	100	200
Potassium Aluminum Sulfate	SAT	170	SAT	200
Potassium Bicarbonate	50	80	50	140
Potassium Carbonate	10	N/R	10	120
Potassium Chloride	SAT	170	SAT	200
Potassium Dichromate	SAT	170	SAT	200

CHEMICAL ENVIROMENT	POLYESTER		VINYL ESTER	
	Max Wt. %	Max Oper. Temp °F	Max Wt. %	Max Oper. Temp °F
Potassium Permanganate	100	80	100	210
Potassium Sulfate	SAT	170	SAT	200
Propylene Glycol	ALL	170	ALL	200
Phthalic Acid	-	-	SAT	200
Sodium Acetate	SAT	160	SAT	200
Sodium Benzoate	SAT	170	SAT	200
Sodium Bicarbonate	SAT	160	SAT	175
Sodium Bisulfate	ALL	170	ALL	200
Sodium Bromide	ALL	170	ALL	200
Sodium Carbonate	10	80	35	160
Sodium Chloride	SAT	170	SAT	200
Sodium Cyanide	SAT	170	SAT	200
Sodium Hydroxide	N/R	N/R	50	150
Sodium Hydroxide	N/R	N/R	250	80
Sodium Hypochloride	N/R	N/R	10	150
Sodium Monophosphate	SAT	170	SAT	200
Sodium Nitrate	SAT	170	SAT	200
Sodium Sulfate	SAT	170	SAT	200
Sodium Thiosulfat	ALL	100	ALL	120
Stannic Chloridee	SAT	160	ALL	190
Styrene	N/R	N/R	N/R	N/R
Sulfated Detergent	0/50	170	0/50	200
Sulfur Dioxide	100	80	100	200
Sulfur Trioxide	100	80	100	200
Sulfuric Acid	93	N/R	93	N/R
Sulfuric Acid	50	N/R	50	180
Sulfuric Acid	25	75	25	190
Sulfurous Acid	SAT	80	N/R	N/R
Tartaric Acid	SAT	170	SAT	200
Tetrachloroethylene	N/R	N/R	FUM	75
Toluene	N/R	N/R	N/R	N/R
Trisodium Phosphate	N/R	N/R	SAT	175
Urea	SAT	130	SAT	140
Vinegar	100	170	100	200
Water, Distilled	100	170	100	190
Water, Tap	100	170	100	190
Water, Sea	SAT	170	SAT	190
Xylene	N/R	N/R	N/R	N/R
Zinc Chloride	SAT	170	SAT	200
Zinc Nitrate	SAT	170	SAT	200
Zinc Sulfate	SAT	170	SAT	200

PHYSICAL PROPERTIES OF LADDER - TYPE CABLE TRAY

Properties	Test Method	Unit	Value
Ultimate Tensile Strength	ASTM D638	PSI	30,000
Ultimate Compressive Strength	ASTM D695	PSI	30,000
Ultimate Flexural Strength	ASTM D790	PSI	30,000
Tensile Modulus		$PSI \times 10^{6}$	2.5
Compressive Modulus		$PSI \times 10^{6}$	2.5
Flexural Modulus		$PSI \times 10^{6}$	1.6
Ultimate Shear Strength		PSI	5,500
Ultimate Bearing Stress		PSI	30,000
Izod Impact Strength (sample thickness 1/8")	ASTM D256	Ft.-LBS. Per Inch of notch	25
Barcol Hardness	ASTM D2583-75		50
Electric Strength, Short Term in Oil 1/8"	ASTM D149	VPM	200
Electric Strength, Short Term in Oil		KV Per Inch	35
Dielectric Constant	ASTM D150	60HZ	5.6
Dissipation Factor	ASTM D150	60HZ	0.03
Arc Resistance	ASTM D495	Second	120
Surface Burning characteristics	ASTM E84	Max	15
Thermal Coefficient of Expansion	ASTM D696	Inches / Inch / °F	5×10^{-6}
Thermal Conductivity	ASTM C-177-76	BTU Per Sq. Ft./Hr./°F/In	4
Specific Heat		BTU / Lb. / °F	0.28
Density	ASTM D792	$Lbs. / In^{3}$	0.065
Specific Gravity	ASTM D792		1.8
Water Absorption (24 hour Immersion)	ASTM D570	Max % by weight	0.5

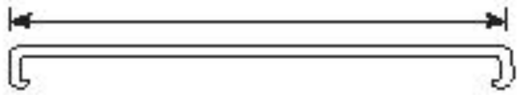
PHYSICAL PROPERTIES OF BOX - TYPE CABLE TRAY

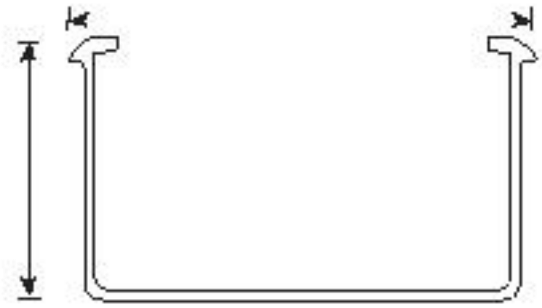
Properties	Test Method	Unit	Value
Ultimate Tensile Strength	ASTM D638	PSI	30,000
Ultimate Compressive Strength	ASTM D695	PSI	30,000
Ultimate Flexural Strength	ASTM D790	PSI	30,000
Electric Strength, Short Term in Oil 1/8"	ASTM D149	VPM	200
Electric Strength, Short Term in Oil		KV Per Inch	35
Thermal Coefficient of Expansion	ASTM D696	Inches / Inch / °F	5×10^{-6}
Density - Solid Shape	ASTM D792	$Lbs. / In^{3}$	0.065
Water Absorption (24 hour Immersion)	ASTM D570	Max % by weight	0.5
Surface Burning Characteristic	ASTM E84	Max	25

LOAD DESCRIPTION

Fiberglass Box-Type Cable Tray System		
Catalog Number	**Maximum Span (Ft)**	**Maximum Loading (Lb / Ft)**
CCT1	10	10
CCT2	10	12
CCT3	10	20
CCT4	10	25

Catalog No.	**Dimension mm**		
	A	**B**	**C**
CCT1	102	121	129.75
CCT2	102	324	333.75
CCT3	152	171	180.75
CCT4	152	324	333.75



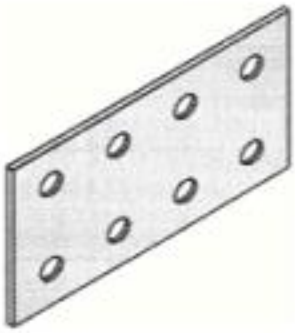


Fiberglass Ladder-Type Cable Tray Systems - Working (Allowable) Load Lbs./Ft. (Kg/m)								
Support Span Ft. (m)	**Kind of Resins**							
	ELL3 Class A	**ELL4 Class A**	**EHL4 Class A**	**ELL6 EMZ6 Class A**	**EIL6 Class B**	**D-EHL6 EHL6 Class C**	**D-EHL8 EHL8 Class C**	**D-EHL10 Class C**
30 (9.1)	-	-	-	-	-	-	-	100 (148)
20 (6.0)	-	-	50 (74)	50 (74)	75 (111)	100 (148)	100 (148)	225 (335)
18 (5.5)	-	-	76 (113)	61 (90)	92 (137)	123 (183)	123 (183)	277 (412)
16 (4.8)	-	-	103 (153)	78 (116)	117 (174)	156 (232)	156 (232)	-
14 (4.3)	-	-	134 (199)	100 (149)	150 (232)	200 (298)	-	-
12 (3.6)	-	50 (74)	176 (262)	139 (207)	208 (310)	-	-	-
10 (3)	-	72 (107)	224 (333)	200 (298)	-	-	-	-
8 (2.4)	50 (74)	112 (167)	-	-	-	-	-	-

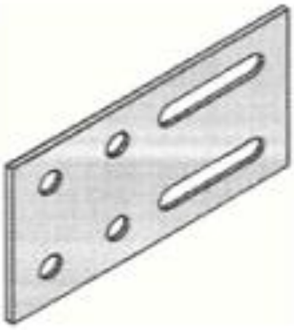
SPLICE PLATES, CONNECTORS & ACCESSORIES

FIBERGLASS CABLE TRAY SYSTEMS

Standard Splice Plate



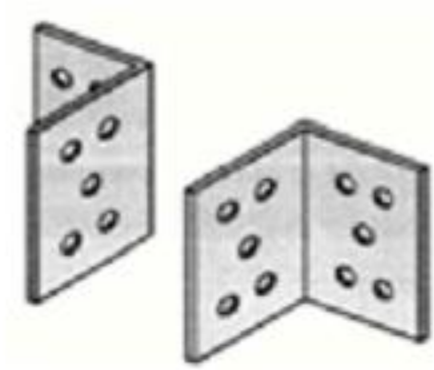
Expansion Splice Plate



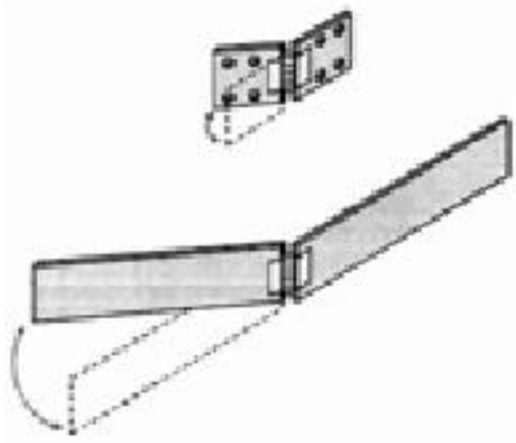
Horizontal Splice Plate (30º, 45º, 90º)

Vertical Splice Plate (30º, 45º, 90º)

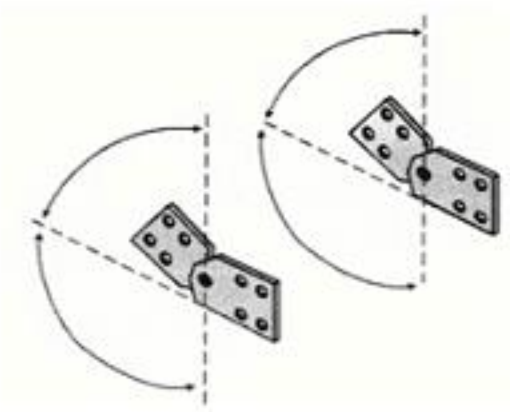
90 Degree Angle Connector



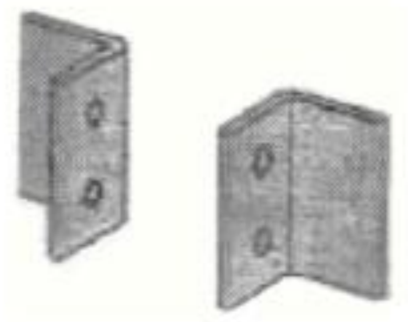
Horizontal Adjustable Connector



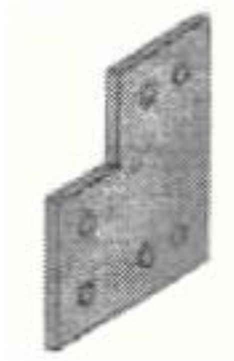
Vertical Adjustable Connector



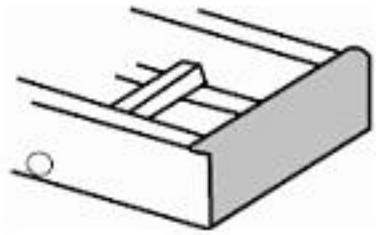
Tray To Box Splice Plates



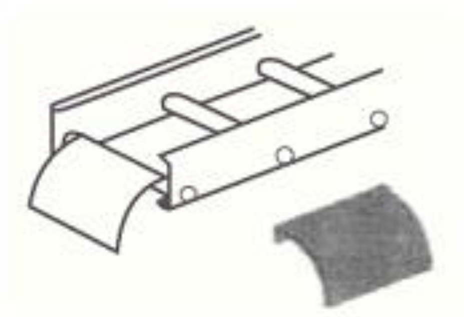
Step Down Plates



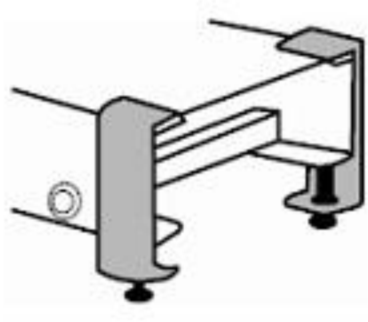
Blind End Plate



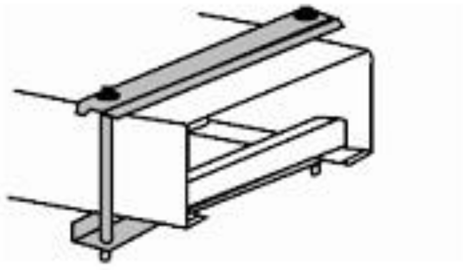
Ladder Drop-out



Standard Cover Clamp



Heavy Duty Cover Clamp



STANDARDS OF FRP COMPOSITES

The Following Standards are used in composite productions:

ASTM C-177-85	**Heat Flux**
ASTM D-149-87	**Dielectric Strength**
ASTM D-229-86	**Testing Rigid Sheet for Electrical Insulation (Ladder)**
ASTM D-256-87	**Impact Resistance**
ASTM D-495-84	**Electrical Resistance**
ASTM D-570-81	**Water Absorption**
ASTM D-635-81	**Flammability**
ASTM D-638-87b	**Tensile Strength**
ASTM D-695-85	**Compressive Strength**
ASTM D-696-79	**Thermal Expansion**
ASTM D-709-87	**Specifications for Laminated Thermosetting Materials**
ASTM D-732-85	**Shear Strength by Punch**
ASTM D-790-86	**Flexural Strength**
ASTM D-792-86	**Specific Gravity**
ASTM D-953-87	**Bearing Strength**
ASTM D-1499-84	**Weathering**
ASTM D-1505-85	**Density**
ASTM D-2344-89	**Interlaminar Short Beam Shear Strength**
ASTM D-2583-87	**Hardness**
ASTM D-2584-85	**Ignition Loss**
ASTM D-3647-84	**Classifying Pultruded Shapes**
ASTM D-3846-85	**In-plane Shear Strength**
ASTM D-3914-84	**In Plane Shear**
ASTM D-3916-84	**Tensile**
ASTM D-3917-88	**Dimensional Tolerances**
ASTM D-3918-80	**Pultrusion Terms**
ASTM D-4385-88	**Visual Defects**
ASTM D-4475-85	**Short Beam Shear Strength**
ASTM D-4476-90	**Flexural Properties**
ASTM E-84-87	**Tunnel Beam Test**
ASTM E-662-83	**Smoke Chamber**
ASTM E-831-86	**Linear Thermal Expansion (CTE)**
ASTM F-1092-94	**Handrails**
ASTM G-23-81	**Weathering**
ASTM G-53-84	**Weathering**