CREATIVE COMPOSITES GROUP

TECHNICAL SPECIFICATIONS

TRIDENTSTRONG™ COMPOSITE UTILITY POLES

POLES FROM 35 – 110 FEET MEETING ALL ANSI O5.1 CLASSES

TridentStrong Composite Poles

TRIDENTSTRONG MULTI-LAYER DESIGN

When it comes to utility pole products, TridentStrong Fiberglass Reinforced Polymer (FRP) poles redefine unguyed pole performance. Engineered for strength, lightweight handling and long-lasting durability, our self-supporting poles are the future of grid infrastructure.

TridentStrong poles have a smaller footprint than comparable filament-wound poles and have been used in self-supporting situations. CCG offers TridentStrong poles in four sizes: 12 inch, 14 inch, 15 inch and 17 inch diameters. These pultruded FRP poles are lightweight and prefabricated, cutting installation time and making them ideal for hard-to-reach installations.

Our multi-layer poles are the result of combining single-layer poles. With each layer running the entire length of the structure, our unique design has unmatched strength and resilience. These stronger poles have a smaller footprint than comparable filament-wound poles and have been used in self-supporting and partially guyed situations or even in place of steel lattice structures for transmission projects. These nested poles come fully assembled and prefabricated, ready for installation. Unlike modular designs, these are **the strongest FRP poles on the market**.

Why TridentStrong FRP Self-Supporting Utility Poles?

CCG is a global supplier of TridentStrong Fiberglass Reinforced Polymer (FRP) transmission and distribution utility poles, designed for lightweight ease of installation in the harshest of conditions. Our wide range of pole offerings allows us to construct a pole of your specific strength and stiffness requirements up to 110 feet in length, which meet all wood equivalent ANSI O5.1 class sizes.

The advantages of FRP poles are plentiful, and we've helped our customers solve problems that simply cannot be solved with traditional wood, steel or concrete options.

EXCEPTIONAL STRENGTH

Fiberglass composite materials are often utilized in applications in which high strength, fatigue resistance and resilience are critical to end-use performance. Meaning that poles can undergo significant stress in severe events and return to their original position with no property loss.

CORROSION-RESISTANT

TridentStrong composite poles have a resin-rich surface with high UV stabilization. Each pole must pass the 10,000-hour UV test standards, making every TridentStrong pole very resistant to sun and weather damage. Impervious to rot, rust, woodpeckers and UV degradation, ensuring decades of dependable service in even the harshest environments. Our poles have a service life expectancy of **80+ years**.

SAFETY

The poles have high dielectric-strength and are safer for workers, birds and other wildlife. FRP utility poles are significantly lighter than steel and are cheaper to transport and safer to install in the field.

LIGHTWEIGHT & EASY TO INSTALL

At 1/3 the weight of traditional materials, TridentStrong poles reduce transportation costs and enable safer, faster installation. Poles can be delivered prefabricated, including ground wire run internally, top cap and base plate installed and all attachment holes pre-drilled.

ENVIRONMENTALLY SAFE

Composite poles are inert. You don't have to worry about special handling or chemical preservatives leaching into the soil or groundwater.

LOW-PROFILE

Contrary to typical self-supporting poles with wide tapered bases, TridentStrong FRP poles will never have a groundline diameter larger than 17 inches.

FIRE RESISTANT

Our poles have been tested to the standard **ASTM E-84 Class A** for flame spread and smoke density.

STORM HARDENING

Composite utility poles are flexible. They bend in high winds without breaking. When the storm ends, composite poles return to their original shape. Because of this, Trident poles have been used extensively to prevent cascading outages.

CASCADE FAILURE MITIGATION

TridentStrong poles are often intermittently installed between standard wood poles to strengthen the circuit and mitigate cascading pole failure from accidents, wind or storm-induced damage.

READY TO INSTALL

We can deliver your poles prefabricated for faster installation, or they can be drilled in the field.

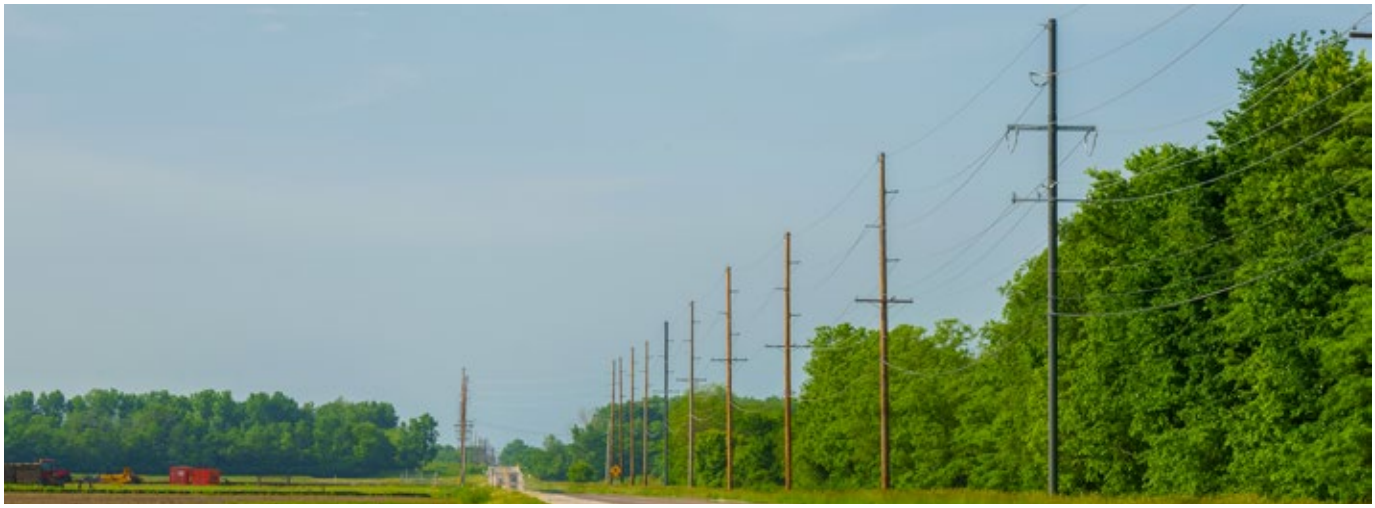
OVER 500 POLES IN STOCK

CCG maintains lead times of 6-8 weeks after approved pole-fabrication drawings.

TridentStrong FRP Pole Applications

STORM HARDENING

With storm intensity and frequency increasing, improving the resilience of the electrical grid has never been more critical. Trident composite poles routinely find application in areas susceptible to hurricanes, tornadoes, ice storms and seismic events. Composites can absorb significant elastic strain, allowing them to take on much higher loads during these severe events and return to their original position after the storm. Whether replacing every pole or every fifth pole to prevent a cascading event, Trident poles are up to the challenge and will keep your grid operating.



LIMITED ACCESS INSTALLATION

The superior strength-to-weight ratio of composite utility poles makes them an excellent candidate for applications in which traditional installation may be difficult. The use of lighter-duty equipment for installation saves time and cost in these environments.

UNGUYED APPLICATIONS

Whether it is space constraints, easement issues or simply cost, our multi-layer pole systems are strong enough for any self-sustaining, unguyed application. Our team will work with yours to understand the loading requirements on the pole and suggest which of our multi-layer pole systems is right for the job. Download and complete our Structural Design Guide and send it to info@tridentstrong.com to get started.

ENVIRONMENTAL CHALLENGES

The inert nature of composites makes them ideal for challenging environmental conditions. Composites do not rust and will long outlast steel in coastal applications. They do not leach chemicals, can be safely deployed without environmental concern and they are impervious to woodpecker or insect damage. Trident poles are engineered to perform in the harshest of conditions.

TRANSFORMER AND SWITCH APPLICATIONS

Trident poles are built to bear the weight of transformers and can be used in multi-function methods, for example, a storm-hardened, unguyed switch pole.

H-FRAMES

Since composites are engineered materials, there is a high degree of consistency from one pole to the next. H-frames are an excellent application for Trident poles in that they will age at the same rate and not need to be replaced until both poles have exceeded their expected lifespan, unlike wood. Their strength and stiffness also make them great candidates for long-span designs.

Hardware

POLE GROUNDING

Ground wires can be fastened to the pole with metal ground clips and self-tapping screws. Plastic wire molding strips can also be used to secure the ground wire to the pole. These strips contain the ground wire and are easily secured to the pole with a self-drilling screw. Ground wires can also be positioned inside of the pole to discourage theft. Some utilities elect to run the ground wire in the pole two feet below the ground line up to a distance of approximately 10' above the ground line to mitigate theft while still having the option of visually inspecting the ground wire.

Ground Wire Clip

Self-Drilling Screw

HARDWARE OPTIONS

Permanent steps can be ordered in single-sided or working step configurations. Steps are secured through the pole and will support up to 750 lbs. of load without fracture or disassembly from the poles.

Composite sleeves slide inside pre-drilled or field-drilled holes to prevent over-torquing and maintain steel isolation. Trident composite sleeves are 1-inch round and can be preinstalled and capped for field hardware installation.

Trident poles come complete with impact-resistant **pole caps** and **baseplates**. Caps are fitted to poles using removable self-tapping screws for easy access. HDPE baseplates include drainage holes that can be drilled to customer specifications.

Physical & Mechanical Properties

Single-Layer Profiles

Physical Properties (Imperial Units)	12″	14″	15″	17″
Outer Diameter (in)	12.18	13.76	15.42	17.14
Inner Diameter (in)	11.18	12.26	13.86	15.46
Wall Thickness (in)	0.5	0.75	0.78	0.84
Cross Sectional Area (in^2)	18.35	30.65	35.87	43.01
Moment of Inertia (in^4)	313.19	649.76	964.64	1,429.46
Section Modulus (in^3)	51.43	94.44	125.12	166.80
Weight (lb/ft)	15.3	26.3	30.5	36.8
Density (lb/ft^3)	120.1	123.5	122.4	123.2
Poisson's Ratio	0.31	0.31	0.31	0.31
Fiber Weight Fraction	≥68%	≥68%	≥68%	≥68%
Coefficient of Thermal Expansion (in/in/°F)	2.70E+06	2.70E+06	2.70E+06	2.70E+06
UV Testing (>10,000 hrs)[1]	Passed	Passed	Passed	Passed
Water Absorption (%)[2]	0.13	0.13	0.13	0.13
Mechanical Properties (Imperial Units)				
Average Ultimate Moment Capacity (ft*lbs)[3]	213,842	407,121	477,595	645,629
5% LEL Ultimate Moment Capacity (ft*lbs)	194,693	356,678	398,870	574,312
Average Maximum Allowable Bending Stress (psi)[3]	49,898	51,730	45,807	46,449
5% LEL Maximum Allowable Bending Stress (psi)	45,430	45,320	38,256	41,318
Average Modulus of Elasticity (psi)[3]	4,533,211	4,503,858	4,431,731	4,424,767
Bending Stiffness (E*I)	1.42E+09	2.93E+09	4.28E+09	6.33E+09
Shear Modulus, Gxy (psi)	879,000	879,000	879,000	879,000
Pin-Bearing Strength (Lengthwise) (lbs)[4,7]	15,940	25,828	25,000	25,000
Washer Pull-Through Strength (lbs)[4]	10,488	16,746	18,884	19,132

Multi-Layer Profiles

Physical Properties (Imperial Units)	12″/14″	14″/15″	15″/17″	12″/14″/15″	14″/15″/17″	12″/14″/15″/17″
Outer Diameter (in)	13.76	15.42	17.14	15.42	17.14	17.14
Inner Diameter (in)	11.18	12.26	13.86	11.18	12.26	11.18
Wall Thickness (in)[5]	1.25	1.53	1.62	2.03	2.37	2.87
Cross Sectional Area (in^2)[5]	49.00	66.53	78.89	84.88	109.54	127.89
Moment of Inertia (in^4)[5]	962.95	1,614.40	2,394.10	1927.59	3043.86	3,357
Section Modulus (in^3)[5]	139.96	209.39	279.36	250.01	355.18	392
Weight (lb/ft)[5]	41.6	56.8	67.3	72.1	93.6	108.9
Density (lb/ft^3)[5]	122.3	122.9	122.8	122.3	123.0	122.6
Poisson's Ratio	0.31	0.31	0.31	0.31	0.31	0.31
Fiber Weight Fraction	≥68%	≥68%	≥68%	≥68%	≥68%	≥68%
Coefficient of Thermal Expansion (in/in/°F)	2.70E+06	2.70E+06	2.70E+06	2.70E+06	2.70E+06	2.70E+06
UV Testing (>10,000 hrs)[1]	Passed	Passed	Passed	Passed	Passed	Passed
Water Absorption (%)[2]	0.13	0.13	0.13	0.13	0.13	0.13
Mechanical Properties (Imperial Units)						
Average Ultimate Moment Capacity (ft*lbs)[5]	620,963	884,715	1,123,223	1,098,557	1,530,344	1,744,186
5% LEL Ultimate Moment Capacity (ft*lbs)[5]	551,372	755,549	973,182	950,242	1,329,860	1,524,554
Average Maximum Allowable Bending Stress (psi)[5]	53,239	50,702	48,249	52,728	51,704	53,431
5% LEL Maximum Allowable Bending Stress (psi)[5]	47,273	43,300	41,804	45,609	44,931	46,703
Average Modulus of Elasticity (psi)[6]	4,518,534	4,467,794	4,428,249	4,489,600	4,453,452	4,473,392
Bending Stiffness (E*I)[5]	4.35E+09	7.20E+09	1.06E+10	8.62E+09	1.35E+10	1.49E+10
Shear Modulus, Gxy (psi)	879,000	879,000	879,000	879,000	879,000	879,000

NOTE: Pin Bearing and washer pull-through data currently not available for multi-layer poles
1. Based on both Xenon Arc and QUV Testing
2. Determined per ASTM D570 (24 hours)
3. Determined per ASTM D1036
4. Testing conducted with utility grade 13/16″ bolts and 3″x3″ curved washer
5. Value is a SUM of the single layer properties
6. Value is an average of the single layer properties
7. Pin bearing Strengths for 15″ and 17″ pole listed are theoretical numbers. Experimental testing to be performed with updated values in future revision of brochure

Self-Supported Pole Reference Tables

The tables below provide a quick reference for the capabilities of TridentStrong single, dual, triple and quad-layer poles in self-supporting applications. The "Max Load" columns in the tables represent the resultant load applied 2 ft from the tip of the self-supporting pole that will produce a maximum allowable horizontal tip deflection of 48 in (4 ft).

All self-supporting poles will need to be verified via the TridentStrong design calculator or by using software such as PLS Pole, since constant tensions, field rake calculations and wind loads for unique scenarios cannot be easily represented in a table format.

Single-Layer Self-Supporting Poles

Pole Height	12			14			15			17		
	Max Load (lbf)	ANSI Class	Deflection per 1000 lbf (in)	Max Load (lbf)	ANSI Class	Deflection per 1000 lbf (in)	Max Load (lbf)	ANSI Class	Deflection per 1000 lbf (in)	Max Load (lbf)	ANSI Class	Deflection per 1000 lbf (in)
35 FT	5,129	1	9.4	10,404	H5	4.6	14,500	H6	3.1	20,880	H6	2.1
40 FT	3,301	3	14.5	6,695	H2	7.2	9,940	H4	4.8	14,707	H6	3.3
45 FT	2,248	5	21.3	4,560	1	10.5	6,770	H2	7.1	10,016	H5	4.8
50 FT	1,600	6	30.0	3,244	3	14.8	4,817	1	10.0	7,126	H2	6.7
55 FT	1,178	< 6	40.7	2,390	5	20.1	3,548	3	13.5	5,249	1	9.1
60 FT	-			1,811	6	26.5	2,689	4	17.9	3,978	2	12.1
65 FT	-			1,405	< 6	34.2	2,086	5	23.0	3,086	3	15.6
70 FT	-						1,651	6	29.1	2,442	4	19.7
75 FT	-						1,329	< 6	36.1	1,966	5	24.4
80 FT	-									1,605	6	29.9
85 FT										1,328	< 6	36.1

Dual-Layer Self-Supporting Poles

Pole Height	12/14			14/15			15/17		
	Max Load (lbf)	ANSI Class	Deflection per 1000 lbf (in)	Max Load (lbf)	ANSI Class	Deflection per 1000 lbf (in)	Max Load (lbf)	ANSI Class	Deflection per 1000 lbf (in)
40 FT	10,117	H5	4.7	16,771	H6	2.9	24,650	H6	1.9
45 FT	6,890	H2	7.0	11,422	H6	4.2	16,788	H6	2.9
50 FT	4,902	1	9.8	8,126	H3	5.9	11,945	H6	4.0
55 FT	3,611	3	13.3	5,986	H1	8.0	8,799	H4	5.5
60 FT	2,737	4	17.5	4,536	1	10.6	6,668	H2	7.2
65 FT	2,123	5	22.6	3,519	3	13.6	5,173	1	9.3
70 FT	1,680	6	28.6	2,785	4	17.2	4,094	2	11.7
75 FT	1,352	< 6	35.5	2,242	5	21.4	3,295	3	14.6
80 FT				1,831	6	26.2	2,691	4	17.8
85 FT				1,515	6	31.7	2,226	5	21.6
90 FT	-			1,267	< 6	37.9	1,863	6	25.8
95 FT	-						1,574	6	30.5
100 FT	-						1,342	< 6	35.8

Triple & Quad-Layer Self-Supporting Poles

Pole Height	12/14/15			14/15/17			12/14/15/17		
	Max Load (lbf)	ANSI Class	Deflection per 1000 lbf (in)	Max Load (lbf)	ANSI Class	Deflection per 1000 lbf (in)	Max Load (lbf)	ANSI Class	Deflection per 1000 lbf (in)
45 FT	13,704	H6	3.5	21,466	H6	2.2	23,781	H6	2.0
50 FT	9,750	H4	4.9	15,273	H6	3.1	16,919	H6	2.8
55 FT	7,183	H2	6.7	11,251	H5	4.3	12,464	H6	3.9
60 FT	5,443	H1	8.8	8,526	H3	5.6	9,445	H4	5.1
65 FT	4,223	2	11.4	6,614	H2	7.3	7,327	H2	6.6
70 FT	3,342	3	14.4	5,234	1	9.2	5,798	H1	8.3
75 FT	2,690	4	17.8	4,213	2	11.4	4,667	1	10.3
80 FT	2,197	5	21.9	3,441	3	14.0	3,812	2	12.6
85 FT	1,817	6	26.4	2,847	4	16.9	3,153	3	15.2
90 FT	1,520	6	31.6	2,382	5	20.2	2,638	4	18.2
95 FT	1,285	< 6	37.4	2,013	5	23.8	2,230	5	21.5
100 FT				1,716	6	28.0	1,901	5	25.2

1. Tables provided assume a 10% + 2 ft burial depth. Most self-supporting applications will require an additional 1-5 additional ft of depth.
2. Strengths and Deflections based on values produced via third-party experimental testing.

TridentStrong Wood Pole Equivalency (Tangent Structures)

The tables below utilize ANSI Grade B wood equivalent loads and limit the horizontal tip deflection of a TridentStrong pole to ~20% of the pole's above-ground height (AGH). 10% + 2 ft standard burial depths are used, but soil conditions should be referenced for real installations to determine burial depth. The tables are for reference only - contact CCG engineering if you have different tip deflection requirements, class loads or special cases not shown in these tables.

Pole Height	ANSI Class	Grade B Load (lbs)	Trident Profile	Pole Weight (lbs)	Tip Deflection at Grade B Load (in)	Tip Deflection % of AGH	Pole 5% LEL Moment Capacity (ft-lb)
40	2	2405	Trident 12	612	35.0	9%	194,693
	1	2925	Trident 12	612	42.5	10%	194,693
	H1	3510	Trident 12	612	51.0	13%	194,693
	H2	4160	Trident 12	612	60.5	15%	194,693
	H3	4875	Trident 12	612	70.9	17%	194,693
	H4	5655	Trident 14	1052	39.9	10%	356,678
	H5	6500	Trident 14	1052	45.9	11%	356,678
	H6	7410	Trident 14	1052	52.3	13%	356,678
45	2	2405	Trident 12	689	51.3	11%	194,693
	1	2925	Trident 12	689	62.4	14%	194,693
	H1	3510	Trident 12	689	74.9	16%	194,693
	H2	4160	Trident 12	689	88.8	19%	194,693
	H3	4875	Trident 14	1184	50.5	11%	356,678
	H4	5655	Trident 14	1184	58.6	13%	356,678
	H5	6500	Trident 14	1184	67.3	15%	356,678
	H6	7410	Trident 14	1184	76.8	17%	356,678
50	2	2405	Trident 12	765	72.2	14%	194,693
	1	2925	Trident 12	765	87.8	17%	194,693
	H1	3510	Trident 14	1315	51.1	10%	356,678
	H2	4160	Trident 14	1315	60.6	12%	356,678
	H3	4875	Trident 14	1315	71.0	14%	356,678
	H4	5655	Trident 14	1315	82.3	16%	356,678
	H5	6500	Trident 14	1315	94.6	18%	356,678
	H6	7410	Trident 15	1525	107.9	21%	398,870
55	2	2405	Trident 12	842	98.0	17%	194,693
	1	2925	Trident 14	1447	57.8	10%	356,678
	H1	3510	Trident 14	1447	69.4	12%	356,678
	H2	4160	Trident 14	1447	82.2	14%	356,678
	H3	4875	Trident 14	1447	96.3	17%	356,678
	H4	5655	Trident 14	1447	111.8	20%	356,678
	H5	6500	Trident 15	1678	87.9	15%	398,870
	H6	7410	Trident 15	1678	100.2	18%	398,870
60	2	2405	Trident 14	1578	62.7	10%	356,678
	1	2925	Trident 14	1578	76.3	12%	356,678
	H1	3510	Trident 14	1578	91.5	15%	356,678
	H2	4160	Trident 14	1578	108.5	17%	356,678
	H3	4875	Trident 15	1830	87.0	14%	398,870
	H4	5655	Trident 15	1830	101.0	16%	398,870
	H5	6500	Trident 15	1830	116.0	19%	398,870
	H6	7410	Trident 17	2208	89.4	14%	574,312
65	2	2405	Trident 14	1710	80.8	12%	356,678
	1	2925	Trident 14	1710	98.3	15%	356,678
	H1	3510	Trident 14	1710	118.0	17%	356,678
	H2	4160	Trident 15	1983	95.7	14%	398,870
	H3	4875	Trident 15	1983	112.2	17%	398,870
	H4	5655	Trident 15	1983	130.1	19%	398,870
	H5	6500	Trident 17	2392	101.1	15%	574,312
	H6	7410	Trident 17	2392	115.2	17%	574,312

Pole Height	ANSI Class	Grade B Load (lbs)	Trident Profile	Pole Weight (lbs)	Tip Deflection at Grade B Load (in)	Tip Deflection % of AGH	Pole 5% LEL Moment Capacity (ft-lb)
70	2	2405	Trident 14	1841	102.2	14%	356,678
	1	2925	Trident 14	1841	124.3	17%	356,678
	H1	3510	Trident 15	2135	102.1	14%	398,870
	H2	4160	Trident 15	2135	121.0	17%	398,870
	H3	4875	Trident 15	2135	141.8	19%	398,870
	H4	5655	Trident 17	2576	111.1	15%	574,312
	H5	6500	Trident 17	2576	127.8	17%	574,312
	H6	7410	Trident 17	2576	145.6	20%	574,312
75	2	2405	Trident 14	1973	126.9	16%	356,678
	1	2925	Trident 14	1973	154.4	20%	356,678
	H1	3510	Trident 15	2288	126.8	16%	398,870
	H2	4160	Trident 15	2288	150.3	19%	398,870
	H3	4875	Trident 17	2760	119.0	15%	574,312
	H4	5655	Trident 17	2760	138.1	18%	574,312
	H5	6500	Trident 14/15 (2-Layer)	4260	139.2	18%	755,549
	H6	7410	Trident 15/17 (2-Layer)	5048	108.0	14%	973,182
80	2	2405	Trident 14	2104	155.4	19%	356,678
	1	2925	Trident 15	2440	129.4	15%	398,870
	H1	3510	Trident 15	2440	155.3	18%	398,870
	H2	4160	Trident 17	2944	124.4	15%	574,312
	H3	4875	Trident 17	2944	145.8	17%	574,312
	H4	5655	Trident 14/15 (2-Layer)	4544	148.3	18%	755,549
	H5	6500	Trident 15/17 (2-Layer)	5384	115.9	14%	973,182
	H6	7410	Trident 15/17 (2-Layer)	5384	132.2	16%	973,182
85	2	2405	Trident 15	2593	128.6	14%	398,870
	1	2925	Trident 15	2593	156.4	17%	398,870
	H1	3510	Trident 17	3128	126.8	14%	574,312
	H2	4160	Trident 17	3128	150.3	17%	574,312
	H3	4875	Trident 17	3128	176.2	20%	574,312
	H4	5655	Trident 15/17 (2-Layer)	5721	121.9	14%	973,182
	H5	6500	Trident 15/17 (2-Layer)	5721	140.1	16%	973,182
	H6	7410	Trident 15/17 (2-Layer)	5721	159.8	18%	973,182
90	2	2405	Trident 15	2745	153.7	16%	398,870
	1	2925	Trident 15	2745	186.9	20%	398,870
	H1	3510	Trident 17	3312	151.6	16%	574,312
	H2	4160	Trident 17	3312	179.7	19%	574,312
	H3	4875	Trident 14/15 (2-Layer)	5112	184.7	19%	755,549
	H4	5655	Trident 15/17 (2-Layer)	6057	145.7	15%	973,182
	H5	6500	Trident 15/17 (2-Layer)	6057	167.5	18%	973,182
	H6	7410	Trident 14/15/17 (3-Layer)	8424	149.3	16%	1,329,860
95	2	2405	Trident 15	2898	181.9	18%	398,870
	1	2925	Trident 17	3496	149.5	15%	574,312
	H1	3510	Trident 17	3496	179.4	18%	574,312
	H2	4160	Trident 14/15 (2-Layer)	5396	186.5	19%	755,549
	H3	4875	Trident 15/17 (2-Layer)	6394	148.7	15%	973,182
	H4	5655	Trident 15/17 (2-Layer)	6394	172.4	17%	973,182
	H5	6500	Trident 15/17 (2-Layer)	6394	198.2	20%	973,182
	H6	7410	Trident 14/15/17 (3-Layer)	8892	176.7	18%	1,329,860
100	2	2405	Trident 17	3680	144.2	14%	574,312
	1	2925	Trident 17	3680	175.3	17%	574,312
	H1	3510	Trident 17	3680	210.4	20%	574,312
	H2	4160	Trident 15/17 (2-Layer)	6730	148.8	14%	973,182
	H3	4875	Trident 15/17 (2-Layer)	6730	174.3	17%	973,182
	H4	5655	Trident 15/17 (2-Layer)	6730	202.2	19%	973,182
	H5	6500	Trident 14/15/17 (3-Layer)	9360	181.8	17%	1,329,860
	H6	7410	Trident 14/15/17 (3-Layer)	9360	207.3	20%	1,329,860

Testing Guidelines for FRP Poles

Our poles have been subjected to the most rigorous test standards for utility poles and adhere to the 5% lower exclusion limit (LEL) rule.

FULL SECTION POLE TESTING – ASTM D1036

This test is conducted on a routine basis to determine the ultimate bending moment of the poles. Poles are tested in a horizontal cantilever arrangement with the base placed in a rigid test frame held in place with 12-inch nylon straps. A nylon sling is placed two feet from the tip of the pole, a load is applied at a constant rate of deformation and load vs. deflection is plotted.

MODULUS OF ELASTICITY – ASTM D1036

The modulus of elasticity (MOE) can be computed from the ASTM D1036 results and shall be based on approximately 30% of the ultimate pole strength.

ULTIMATE MOMENT CAPACITY

The ultimate moment capacity is calculated based on the maximum recorded load prior to failure. The moment is calculated by multiplying the ultimate load by the moment arm (distance between the load application and first constraint at the base of the pole).

TORSIONAL STRENGTH – ASTM D5379

Torsional strength is computed based on in-plane shear strength as determined by ASTM D5379. The torsional strength is calculated in the following manner:

$$T = \tau_{xy} 2\pi r^2 t$$

Where:
T = Torque (lb-ft) [N-m]
τ_{xy} = In-plane shear strength (psi) [Pa]
r^2 = mean radius (in) [mm]
t = wall thickness (in) [mm]

ELECTRICAL – ASTM F711

This is a dielectric-strength test, and while FRP poles exhibit inherent non-conductivity, they are not intended to be used as insulators.

UV AND ATMOSPHERIC MOISTURE – ASTM G154 CYCLE 1

Trident poles have been tested for UV stability via both xenon arc and QUV methods at 100% relative humidity. Our construction with a 10 mil surface veil provides for a resin-rich surface, which meets the criteria for passing this standard test. After 10,000 hours of exposure, no indication of fiber blooming was observed.

WATER ABSORPTION – ASTM D570

Excessive water absorption in a composite structure can ultimately lead to degradation, especially in climates with freeze-thaw cycles. Trident poles have been tested to ASTM D570 and pass easily with water absorption measurements well below the 2% (by weight) allowable limit, stipulated by the ANSI-approved **Standard Specification for FRP Composite Utility Poles**, making our poles ideal for application in wetlands or areas with seasonally high water tables.

FIRE EXPOSURE – UL94, ASTM D635, ASTM E84

FRP poles are often subjected to multiple fire tests:

(a) UL 94 is a vertical burn test in which a flame is applied to a coupon of the pole and must pass a "self-extinguishing" rating in which the flame extinguishes when the fuel source is removed from the sample, denoting a V-0 passing criteria.

(b) ASTM D635 is a horizontal burn test in which HB classifications are based on the following criteria:

A. There are no visible signs of combustion after the source is removed; or

B. The flame front does not pass the 1 in. [25 mm] reference mark; or

C. The flame front passes the 1 in. [25 mm] reference mark, but does not reach the 4 in. [100 mm] reference mark; or

D. The flame front reaches the 4 in. [100 mm] reference mark, and the linear burning rate does not exceed 1.5 in. min [40 mm/min] for specimens having a thickness between 0.1 in and 0.5 in. [3 and 13 mm] or 3 in/min [75 mm/min] for specimens having a thickness less than 0.1 in [3 mm].

Trident poles have a Class B designation.

(c) ASTM E84 is a test measuring flame spread and smoke density in which Trident poles meet Class A performance of flame spread index <25 and smoke development index <450.

Note: Standard Trident poles are not FR rated. However, they can be specified and ordered to meet the fire properties described above. Consult with your sales professional for guidance.

Installation Guide

In general, FRP utility poles can be installed similarly to wood, steel or concrete poles.

POLE MARKINGS

The information tag is placed 6' above ground level. The tag is at 0 degrees, which is located directly under the middle phase of the source line. The pole ground is always mounted at 45 degrees internally. Ground line is marked with red tape. The balance point is marked with yellow tape.

STORAGE

Composite poles are intended to be in the elements and can be stored virtually anywhere with little concern.

Do not stack poles directly on top of one another to prevent pole surface damage. We recommend using wood dunnage to separate poles and allowing lifting straps to be slid under the poles for picking.

HANDLING

Do not drag the pole across abrasive surfaces, such as asphalt. If a pole is dragged a short distance on the butt end of the pole, any minor surface damage that will be buried is not a major concern. Butt plate shall be protected during installation.

Use nylon or fabric straps for lifting poles. Do not use chains, cable or other metal rigging to lift poles. Take care to prevent damage to the UV protective surface. Plug any unused holes with rubber or plastic hole plugs.

PPE

When cutting and drilling composite poles, composite utility pole manufacturers recommend the following personal protective equipment (PPE): a particle mask, safety glasses, gloves, long-sleeve shirt and long pants, safety footwear and a hard hat. Wear long sleeves and gloves when drilling or cutting to minimize minor skin irritation associated with fiberglass dust.

Inhalation of dust from cutting or drilling a composite pole can irritate the respiratory system. OSHA considers these dusts to be "Inert/Nuisance Dusts" or "Particulates Not Otherwise Regulated (PNOR)" and has established a workplace Permissible Exposure Limit (PEL) of 5 mg/m^3 for the PNOR respirable fraction and 15 mg/m^3 for PNOR as total dust.[1]

[1] *OSHA Occupational Chemical Database: Fibrous Glass Dust; https://www.osha.gov/chemicaldata/805; see note in Exposure Limits table: "For General Industry, please see 29 CFR 1910.1000 Table Z-3, Mineral Dusts for Inert or Nuisance Dust". Also see OSHA Occupational Chemical Database: Particulates Not Otherwise Regulated, Total and Respirable Dust; https://www.osha.gov/chemicaldata/801.*

FOUNDATION AND BACKFILL

FRP utility poles are designed to be embedded in the ground, similar to wood, steel and concrete poles. Typical burial depth is 10% of the pole is 10% of the pole length plus 2 ft. For standard tangent distribution applications, a utility can use its wood pole burial depths and backfill instructions.

For self-supported Trident applications, the following is a standard recommendation for foundation and backfill. L-pile foundation design of a self-supported pole is available by request for a more in-depth foundation analysis.

Tamp backfill at each lift to assure good compaction. Care should be taken to avoid impacting the pole wall with steel tools during backfill and tamping.

Backfill options include crushed limestone, road crush, pole-setting foam or concrete.

Install 1′ of backfill in the hole prior to installing the pole.

When a pole is set in concrete, use 1″ to 2″ of expansion material between the pole and the concrete.

Hole Diameters and Backfill Type:

Pole Size	Hole diameter (in)	Backfill Type
17″ pole	34″ diameter hole	¾″ stone with fines
15″ pole	30″ diameter hole	¾″ stone with fines
14″ pole	28″ diameter hole	¾″ stone with fines
12″ pole	24″ diameter hole	¾″ stone with fines

The standard burial depth for composite poles is as follows:

10% + 2′ is used for tangent applications and storm structure for storm hardening
10% + 3.5′ is used for angles up to 20°, switch applications and super storm structures
10% + 5′ is used for angles from 20° to 60°
10% + 6.5′ is used for angles from 60° to 90°

Note: Burial depth is also dependent on the dead load at the tip of the pole, so recommended depths may vary from this standard.

REPAIRS

Minor Scrapes and Scratches

Minor scratches can also be addressed with cleaning the area and then applying one to two coats of a Sherwin-Williams Polyurethane paint.

Large Surface Area Repairs

Deeper or larger scrapes and gouges can be filled with 3M Short Strand Fiberglass Reinforced Filler. After the patched area has dried, sand it with 220 Grit sandpaper, then apply a coat of the paint referenced above.

FRP Do's and Don'ts

DRILLING

Do	Don't
Use **Carbide or diamond tipped bits.**	Use wood pole bits or spade bits as they will burn up instantly.
Use self-tapping screws with U-clips for exterior grounding installation.	Install standard wood decking screws, any screws not intended for self-tapping or staples.
Use **low speed** electric or cordless drills (≤ 1000 rpm).	Use high speed drills (Hydraulic or Pneumatic) as it will break the drill bit.
6" hole spacing is recommended; however, a minimum of a 4" hole spacing may be used if necessary, no more than 3 holes per 12" height.	

FRAMING

Do	Don't
Back field-drilled bolted connections with a curved washer. *Recommended bolt torque should not exceed* ***50 ft.-lbs***. or hand tightened plus ½ to one full turn.	Over torque bolts with high-speed drills.
Use **through bolts** for all load bearing hardware attachments.	Use lag bolts for loading bearing hardware attachments.
Use **non-cleated hardware** or tools.	Use cleated hardware or other hardware designed to be drawn into the pole.

CUTTING

Do	Don't
Use **segmented diamond blades** for partner or handheld circular saws. Standard concrete cutting blades may also be used.	Use any type of wood blade, they will burn up or can break up and throw metal fragments.

Technical Support

CCG's Support Team is available to assist utilities with all composite utility pole needs. We can help with all facets from line design to installation. We provide the following services to utilities:

STANDARDS SUPPORT

Trident's Support Team can assist in writing or reviewing industry standards for composite utility poles.

LINE DESIGN & POLE SELECTION

Our team is happy to work with yours on line design and selecting the right pole for the right application.

INSTALLATION

We offer full on-site installation support and will work with your crew to assist with burial depth, rake and type of backfill.

Choose Creative Composites Group for Comprehensive Project Support

Your Single Source for Innovative Engineered T&D Solutions Using TridentStrong FRP Composites

Advance your products and projects beyond the limitations of traditional concrete, steel and wood by leveraging the combined strength of Creative Composites Group. We are a leader in technical innovation that is backed by the industry's most comprehensive FRP manufacturing group for infrastructure.

Creative Composites Group can help you engineer and manufacture T&D infrastructure projects to ensure durability and protection against extreme weather with our TridentStrong products.

Other companies commoditize FRP in off-the-shelf shapes and forms; CCG does not. We offer comprehensive engineering, design and consultation for shoreline and asset protection. Our manufacturing capabilities include the broadest range of TridentStrong FRP solutions to build your ideal projects. That's possible only with our proven engineering processes, end-to-end collaboration, service and support resources. Since TridentStrong FRP composites last longer than conventional materials, they often have a lower lifetime cost when you consider longer service life and low to no maintenance costs.

Discover Your Custom Engineered FRP T&D Infrastructure Provider

Creative Composites Group is committed to becoming a trusted business partner who is keenly interested in your project's success. Creative Composites Group works alongside your team, from facility owners to design engineers and contractors, to help you develop a customized FRP solution that meets the most demanding structural requirements and environmental conditions.

Contact us for your next engineered T&D infrastructure project. We'd be thrilled to discuss it with you.

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