MacLean™
POWER SYSTEMS

GRIDCORE™
COMPOSITE UTILITY POLES

LIGHTWEIGHT. DURABLE. CORROSION RESISTANT.
BUILT FOR THE MODERN GRID.

UTILITY MARKET TRENDS

DRIVERS OF COMPOSITE POLE ADOPTION

ELECTRIFICATION

Increasing overall demand for power by transitioning away from traditional combustion sources and to electrical sources (like solar and wind power)

GRID EXPANSION

The capacity of the power grid must increase to meet this increased demand and provide reliable energy while integrating new energy sources

REPLACEMENT OF AGING INFRASTRUCTURE

Aging wood utility poles increase the risk of failure and impact reliability and safety; their limited service life, vulnerability to rot, and potential for fire hazards require proactive management strategies

GRID HARDENING

Improvement of the power grid's ability to withstand and recover from disruptions to reduce outages and improve reliability

FRP POLE MANUFACTURING

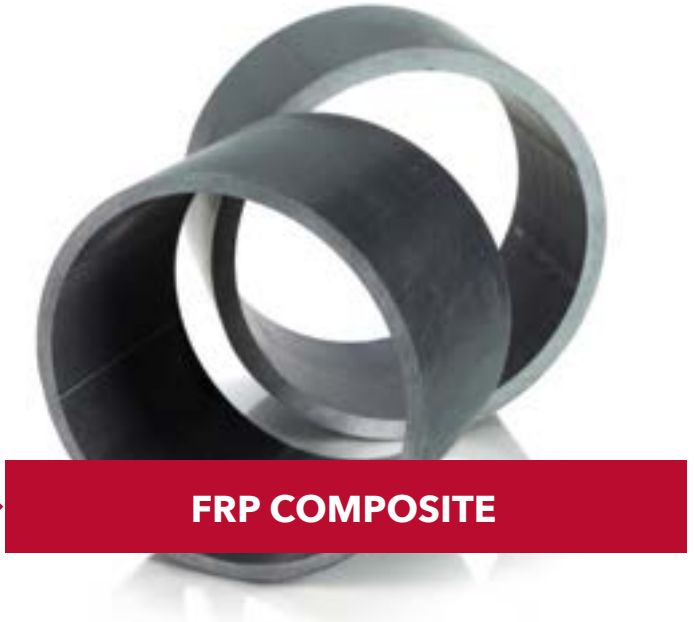
PULTRUSION PROCESS

FIBER REINFORCED POLYMER (FRP)

- **Fiber Reinforced Polymers** are strong, lightweight composite materials used in utility, construction, and industrial applications.
- FRP materials are made by combining two primary components:
  1. **Fibers:** Thin strands of a material such as glass, carbon, or aramid that provide strength and stiffness.
  2. **Polymer Matrix:** A type of plastic resin that binds the fibers together, transfers loads between fibers, and protects them from environmental damage.

GLASS FIBER

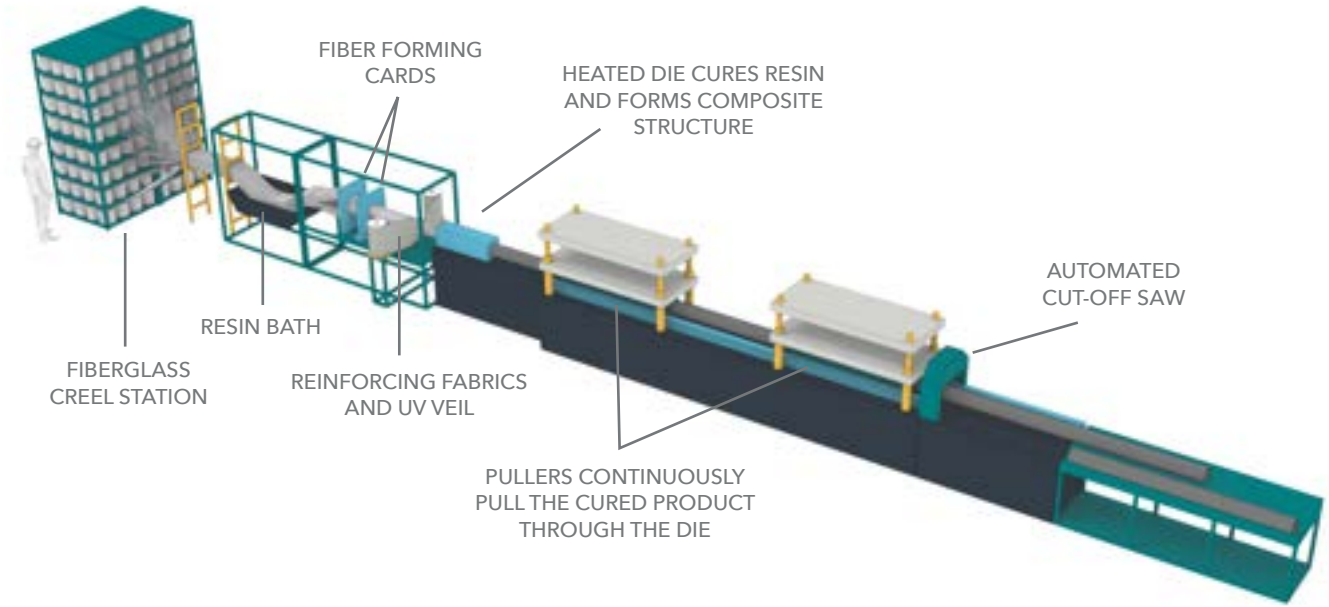
THERMOSET RESIN



FRP COMPOSITE

HOW COMPOSITE POLES ARE MADE

PULTRUSION PROCESS



GridCore™ poles are manufactured using a continuous pultrusion process:

1. Glass fiber strands are pulled from creels
2. Fibers pass through a resin bath
3. Materials is heated and formed in a die to the required diameter and wall thickness
4. The pole is continuously pulled and cured
5. The pole is cut to the specified length

This process produces a consistent high-strength, corrosion-resistant structure.

WHY COMPOSITE?

ADVANTAGES OF USING COMPOSITE POLES

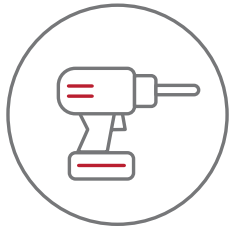
ADVANTAGES OF COMPOSITE POLES

LOWER TOTAL SYSTEM & LIFECYCLE COST

CUSTOMIZED & CONSISTENT MATERIAL

LIGHTWEIGHT & SAFER INSTALLATION

LOWER MAINTENANCE & RESISTANT TO PESTS



SIMPLE TO DRILL

NO CHEMICAL LEACHING

LOWER TOTAL SYSTEM & LIFECYCLE COST

- Composite utility poles have an expected service life of **up to 80 years**, compared to **30–40 years for traditional wood poles**
- While FRP poles may have a higher initial cost than wood, the **longer service life and reduced maintenance and replacement costs** result in **lower lifecycle costs**
- Utilities should also consider the **unplanned costs associated with replacing aged, damaged, or failed wood poles**
- Additional costs such as **outage-related revenue loss, emergency repairs, and customer reliability impacts** should be considered when evaluating total system cost

CUSTOMIZED & CONSISTENT MATERIAL

- Engineered for **consistent strength, uniform quality, and repeatable performance. Customizable diameters and wall thicknesses** to meet specific loading and design requirements
- Not subject to **warping, shrinkage, splitting, or splintering**
- Designed to **withstand severe weather and storm loading**
- Unlike wood poles, which are natural and variable, composite poles are **engineered materials with consistent mechanical properties**
- Wood poles typically have a Coefficient of Variation of 20%, while composite and other engineered poles consistently hold to a 5-6% CoV, providing **greater reliability and structural consistency over the life of the pole**

LIGHTWEIGHT & SAFER INSTALLATION

- Significantly lighter than equivalent-strength **wood, steel, ductile iron, and concrete poles**
- Lightweight design allows installation using **light-duty equipment,** often eliminating the need for large cranes
- Lower weight reduces **worker strain, lifting risks, and equipment stress**
- Lighter poles allow **standard bucket trucks to boom out farther** compared to heavier pole materials
- **Excellent dielectric strength** allows safer installation near energized lines. Non-conductive material can help **reduce flashover risk and improve lightning performance**

LOWER MAINTENANCE & RESISTANT TO PESTS

- Requires **only periodic visual inspection**
- Will not sustain damage from **woodpeckers, insects, or ground rot**
- Does not require **preservative treatments or routine maintenance programs**
- Hardware does not require **periodic tightening due to material shrinkage**
- Minor surface damage can often be **repaired on-site using repair kits**
- If structural laminate damage is suspected, **consult your MPS representative**

SIMPLE TO FIELD DRILL

- **GridCore™** poles can be **purchased pre-drilled** per customer specifications
- Poles can also be **easily field drilled using a handheld cordless drill and FRP-specific drill bits**
- MacLean Power Systems can **pre-drill holes per customer specifications**
- **Unused holes should be plugged** using hole plugs or similar plastic plugs to prevent pest entry

NO CHEMICAL LEACHING

- Wood poles are treated with preservatives to prevent rot and decay; over time, these preservatives can **leach chemicals into surrounding soil and groundwater**
- Steel and ductile iron poles are **coated to prevent corrosion** and may require recoating or maintenance during their service life
- **FRP composite poles are chemically inert** and do not leach chemicals into the environment
- Composite poles provide an **environmentally responsible alternative** to treated wood poles

* Source: EPA- Ingredients Used in Pesticide Products

POLE SIZING

GUIDE, STANDARDS, ACCESSORIES & HARDWARE

TESTING & STANDARDS

ASTM D1036 THIRD PARTY DESTRUCTIVE BREAK TESTING

Cantilever Bending Test

14" Diameter × ¾" Wall FRP Composite Pole

The pole base is fixed at the groundline, and the pole is loaded near the top using a winch and cable. Force is applied approximately **2 feet from the pole top** to simulate loading conditions.

Test Results:

- Average Breaking Load: **7,418 lb**
- Average Deflection at Failure: **198 in**

Sensors measure pole deflection under load throughout the test. This data is used to calculate **pole strength, stiffness, and overall structural performance.**

Testing results are factored using a **5% Lower Exclusion Limit (LEL),** meaning **95% of poles are expected to meet or exceed the published strength values.**

POLE SELECTION GUIDE

HOW FRP POLES ARE SIZED

LENGTH (FT)	CLASS	CATALOG NUMBER, UNDRILLED	DIAMETER (IN)	WEIGHT (LBS)	WEIGHT (CLASS B SYP)	DEFLECTION FOR RATING (IN)	DEFLECTION (CLASS B SYP)
40	C4	X34B-DG-40C4	14	707	1160	13	38
	C3	X34B-DG-40C3	14	707	1360	17	35
	C2	X34B-DG-40C2	14	707	1580	21	32
	C1	X34B-DG-40C1	14	707	1810	25	30
	H1	X34A-DG-40H1	14	1041	2050	19	28
	H2	X34A-DG-40H2	14	1041	2310	22	26
	H3	X34A-DG-40H3	14	1041	2580	26	24
45	C4	X34B-DG-45C4	14	795	1390	20	49
	C3	X34B-DG-45C3	14	795	1630	24	45
	C2	X34B-DG-45C2	14	795	1880	30	41
	C1	X34B-DG-45C1	14	795	2160	37	38
	H1	X34A-DG-45H1	14	1171	2450	27	36
	H2	X34A-DG-45H2	14	1171	2760	33	33
	H3	X34A-DG-45H3	14	1171	3090	38	31
50	C4	X34B-DG-50C4	14	884	1630	27	61
	C3	X34B-DG-50C3	14	884	1910	34	56
	C2	X34B-DG-50C2	14	884	2210	42	52
	C1	X34B-DG-50C1	14	1301	2530	32	48
	H1	X34A-DG-50H1	14	1301	2880	39	45
	H2	X34A-DG-50H2	14	1301	3240	46	42
	H3	X34A-DG-50H3	14	1301	3620	54	39
55	C4	X34B-DG-55C4	14	972	1890	37	75
	C3	X34B-DG-55C3	14	972	2210	47	68
	C2	X34B-DG-55C2	14	972	2550	58	63
	C1	X34B-DG-55C1	14	1431	2930	44	58
	H1	X34A-DG-55H1	14	1431	3320	52	54
	H2	X34A-DG-55H2	14	1431	3740	62	51
	H3	X34A-DG-55H3	14	1431	4180	73	48

GridCore™ FRP Pole vs. Equivalent Wood Pole

LENGTH (FT)	CLASS	CATALOG NUMBER, UNDRILLED	DIAMETER (IN)	WEIGHT (LBS)	WEIGHT (CLASS B SYP)	DEFLECTION FOR RATING (IN)	DEFLECTION (CLASS B SYP)
60	C4	X34B-DG-60C4	14	1060	2150	49	90
	C3	X34B-DG-60C3	14	1060	2520	62	82
	C2	X34B-DG-60C2	14	1060	2910	76	76
	C1	X34B-DG-60C1	14	1561	3340	58	70
	H1	X34B-DG-60H1	14	1561	3790	69	65
	H2	X34B-DG-60H2	14	1561	4270	82	61
	H3	X34B-DG-60H3	14	1561	4770	96	58
65	C4	X34B-DG-65C4	14	1149	2430	63	107
	C3	X34B-DG-65C3	14	1149	2840	79	97
	C2	X34B-DG-65C2	14	1691	3290	61	90
	C1	X34B-DG-65C1	14	1691	3770	74	83
	H1	X34B-DG-65H1	14	1691	4380	89	77
	H2	X34B-DG-65H2	14	1691	4820	106	72
70	C3	X34B-DG-70C3	14	1237	3810	100	114
	C2	X34B-DG-70C2	14	1821	3690	77	105
	C1	X34B-DG-70C1	14	1821	4220	94	97
	H1	X34B-DG-70H1	14	1821	4790	113	90
	H2	X34B-DG-70H2	14	1821	5390	134	85

*Grey highlight is wood equivalent data.

ACCESSORIES & HARDWARE

STANDARD ACCESSORIES PROVIDED

POLE CAP

BASE PLATE

HOLE PLUGS

NAMEPLATE

STORAGE & HANDLING

- Poles are designed to withstand outdoor conditions and **may be stored outdoors**
- **Do not stack poles directly on top of each other** to prevent surface damage
- Use **wood dunnage** between poles to prevent damage and allow lifting straps to be placed under the pole
- **Do not drag poles** to prevent damage to the pole surface or base
- Use **nylon or fabric lifting straps with grip coating;** do not use chains, cables, or other metal rigging
- **Plug any unused holes** to prevent moisture intrusion and pest entry

FRAMING
APPLICATIONS

- **GridCore™ poles** are compatible with most **standard non-cleated framing hardware**
- Structural connections (such as crossarm gain plates, guy brackets, etc.) are made using **through-bolts, curved brackets, and curved washer plates** (Verify washer curvature matches pole diameter)
- The recommended torque for GridCore™ structural connections is **50 ft-lb**
- **Do not exceed 70 ft-lb** when torquing through-bolts or threaded rods, as excessive torque may damage the pole surface

APPLICATIONS

EXTREME WEATHER
APPLICATIONS

ICE STORMS

HURRICANES

WILDFIRES

HIGH WINDS

COASTAL/CORROSIVE ENVIRONMENTS

GRID HARDENING
APPLICATIONS

- Utilities are increasingly installing **composite poles at strategic intervals within wood pole lines** to help prevent cascading failures during storm events, particularly on subtransmission lines
- Installing a composite pole approximately **every fifth pole** can help reduce the risk of multiple pole failures
- This approach has proven effective in **minimizing line damage, reducing outage duration, and improving system resiliency after major storms**

LIMITED ACCESS
APPLICATIONS

- Composite poles are ideal for **remote and hard-to-reach locations** due to their lightweight design and reduced need for heavy equipment
- **Lightweight construction** simplifies installation in areas with limited access
- Reduced maintenance requirements make composite poles well suited for **remote locations and difficult access areas**
- Lightweight poles can often be installed using **smaller trucks and equipment**

ENVIRONMENTAL
APPLICATIONS

- Fiberglass poles are perfectly suited for areas experiencing **high impact from woodpeckers, termites, and other wildlife related degradation.**
- FRP composite poles are well suited for **corrosive and harsh environmental conditions** where traditional materials may deteriorate over time.
- Composite poles **do not rust, rot, or corrode** when exposed to moisture, salt, chemicals, or harsh weather conditions
- Ideal for **coastal environments, wetlands, flood-prone areas, and industrial environments**
- Wood poles can experience **rot and deterioration** in areas with high water tables or frequent flooding
- Steel and concrete poles exposed to **salt, chemicals, or road salts** may corrode or experience surface deterioration (spalling)
- FRP composite poles provide **long-term durability in corrosive environments**

MacLean™
POWER SYSTEMS

THANK YOU

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