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FRP Composite Utility Pole Field Drilling Manual

Wagners Composite Fiber Technologies (CFT)

WAGNERS



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Introduction

This guide covers safe field drilling procedure of fiber reinforced polymer (FRP) composite utility poles. It emphasises practical steps and personal protective equipment. Key points include proper PPE, using the correct drill bits, supporting the pole, controlling dust, and recognizing hazards (i.e. fire, electrical, fall, kickback).



Figure 1 – Predrilled Wagners Pole

Drilling Workflow

Wagners FRP poles can be pre-drilled to accommodate framing patterns, pole steps and other hardware as requested. However, if on-site field drilling is required, the proposed and simplified flowchart of the drilling process includes the following steps:

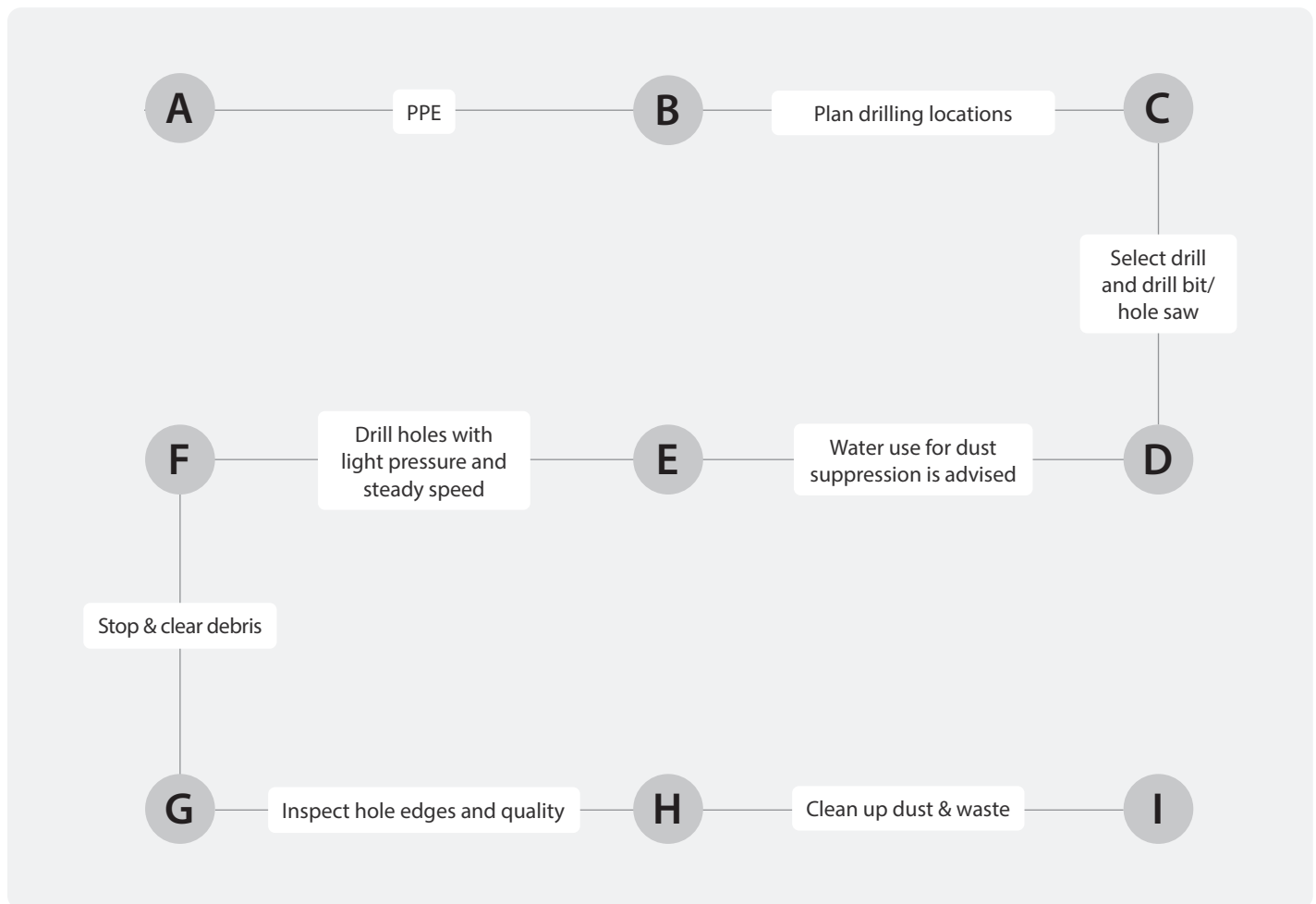


Figure 2 – Field drilling flowchart

Personal Protective Equipment (PPE)

Before drilling, crews require appropriate PPE. Recommended PPE is described in the following sections.

3.1 Respiratory

Although OSHA considers fibreglass dust non-toxic, it is a nuisance and can still irritate the lungs. Always wear a fitted NIOSH dust mask (N95/P2) or better (P100) when drilling. In heavy dust or enclosed spaces, use a half-mask or powered respirator with P100 filters.

3.2 Eye and face

Wear approved safety glasses or goggles. A face shield can be used to guard against flying debris.

3.3 Hands and skin

Wear gloves to prevent fiber splinters. Long sleeves and pants protect your arms and legs from fibers. Avoid touching your face. After work, wash exposed skin to remove any stray fibers.

3.4 Hearing protection

Drilling can be loud (>85 dB). Use earplugs or earmuffs as required by site safety rules.

3.5 Other

Always wear a hard hat and safety boots. When climbing poles, use a full-body harness and fall-arrest gear including fall restrict and fall arrest elements. Secure tools and materials so they cannot fall on others.



Figure 3 – Drilling a composite pole

Recommended Tools and Drill Bits

4.1 Drill bits

High-speed steel (HSS) drill bit can be used however the composite material will dull the bit quickly due to the glass content.

Milwaukee Shockwave™ Impact Duty Lineman's Fiberglass brand carbide tipped drill bits are recommended. See Figure 4 below.



Figure 4 – Milwaukee carbide-tipped drill bit

4.2 Hole saws/ core drills

Use carbide tipped or diamond-coated hole saws with a pilot bit. See Figure 5 below.



Figure 5 – Carbide-tipped hole saw with a pilot bit.

4.3 Drill bits versus hole saws

Although either drill bits or hole saws can be used to drill Wagners FRP composite poles, there are some important distinctions to understand between the two.

- A drill bit will create more dust than the same-sized hole saw. This is because a drill bit turns the entire hole volume to dust whereas a hole saw turns the hole perimeter and arbor pilot hole to dust but leaves the plug from the hole as the original laminate intact.
- To avoid challenges when removing the plug created by the hole saw, hole saws are only recommended for hole diameters 1 1/16" and larger.
- When using hole saws, a counter rotational movement is recommended with the drill to ensure easy plug removal from the hole saw.

4.4 Speed

Use moderate speeds (e.g. 300–1000 RPM, slower for larger bits) and a light pressure.

4.5 Pressure

Let the drill do the work. Avoid using excess pressure to force the bit into the FRP material.

Hole Size and Spacing Requirements

Hole size and spacing is important to maintain the integrity of the FRP composite pole wall. The following hole size and spacing requirements will ensure your Wagners FRP poles continue to perform.

5.1 Hole size

It is recommended that hole size be 1/16" larger than the through bolt being used. Table 1, below, details the hole sizes recommended for through bolt diameters ranging from 1/2" to 1".

Bolt Diameter	Hole Diameter
1/2"	9/16"
5/8"	11/16"
3/4"	13/16"
7/8"	15/16"
1"	1-1/16"

Table 1 – Recommended hole size for through bolts ranging from 1/2" to 1" in diameter

5.2 Hole spacing

It is recommended that any two holes be located a minimum of four diameters (4D) apart from one another. In the event of two different hole sizes, the larger hole size is used.

Figure 6, below, details visual 4D center-to-center hole spacing on both vertical and horizontal axes of the pole.

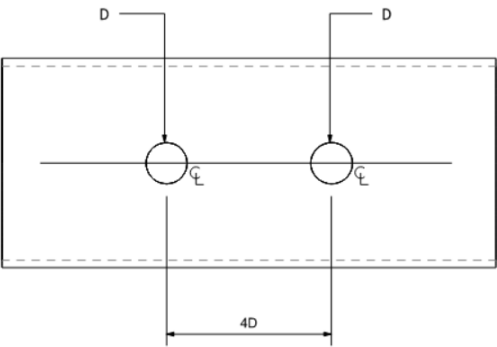


Figure 6– 4D center-to-center hole spacing on both vertical and horizontal axes of the pole.

5.2 Hole spacing

Table 2, below, details the center-to-center hole spacing for through bolt diameters ranging from 1/2" to 1".

Bolt Diameter	4D Center-to-Center Hole Spacing
1/2"	2-1/4"
5/8"	2-3/4"
3/4"	3-1/4"
7/8"	3-3/4"
1"	4-1/4"

Table 2 – Recommended 4D center-to-center hole spacing for through bolts ranging from 1/2" to 1" in diameter

The minimum hole center to pole tip dimension is 4". Figure 7, below, details the visual 4" hole center to tip requirement.

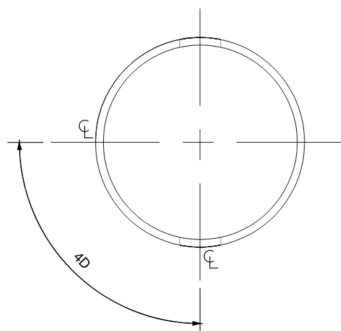


Figure 7 – 4" hole center to tip requirement

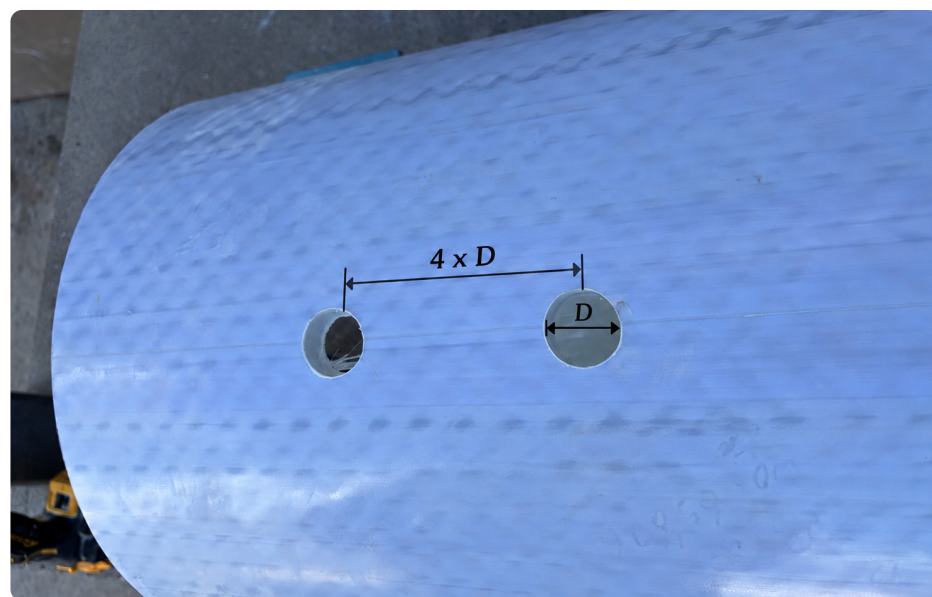


Figure 8 – Pole specimen with bolt holes spaced at 4D hole placement

Drilling Technique and Bite Control

6.1 Setup

Secure the pole so that it is locked in position and cannot rotate or fall.

6.2 Mark hole locations

Use a permanent marker to mark hole locations.

6.3 Multiple Holes

A chalk line can be used along the pole's vertical axis and hole locations measured from the pole tip to ensure consistent hole placement. Once the holes are drilled along a single axis, it is recommended to spin the pole 180 degrees and repeat the process. This method is recommended for precise hole placement rather than drilling both through holes in a single movement.

6.4 Drill orientation

Once the holes are marked and you are preparing to drill, keep the drill perpendicular to the pole surface, both in the vertical and horizontal planes, for clean holes.

6.5 Starting the hole

Engage the drill at low speed to start, then ramp up while applying steady pressure and avoid sudden thrust that could catch fibers. Ensure drill is positioned squarely on both the longitudinal and transverse axes.

6.6 Feed rate

Use moderate feeding pressure. Too rapid a feed causes excessive thrust force; too slow or high-speed causes heat.

6.7 Exit/Break-through

As you approach the hole exit, slow down and lighten the feed to minimize internal chipping.

6.8 Rotational Angle

To drill into an intact pole, locate the pole's seam line. This line marks where the dyes meet during pole manufacturing. Drill the first hole while the pole is fixed. To drill a second hole at a 90-degree angle to the first, use the measuring tape to mark a distance equal to the pole's circumference divided by four (4). For instance, for 12"CHS, the circumference is 37.2", so the mark should be 9.3" from the center of the reference hole. For 14"CHS, the 90-degree orientation hole length is 11".

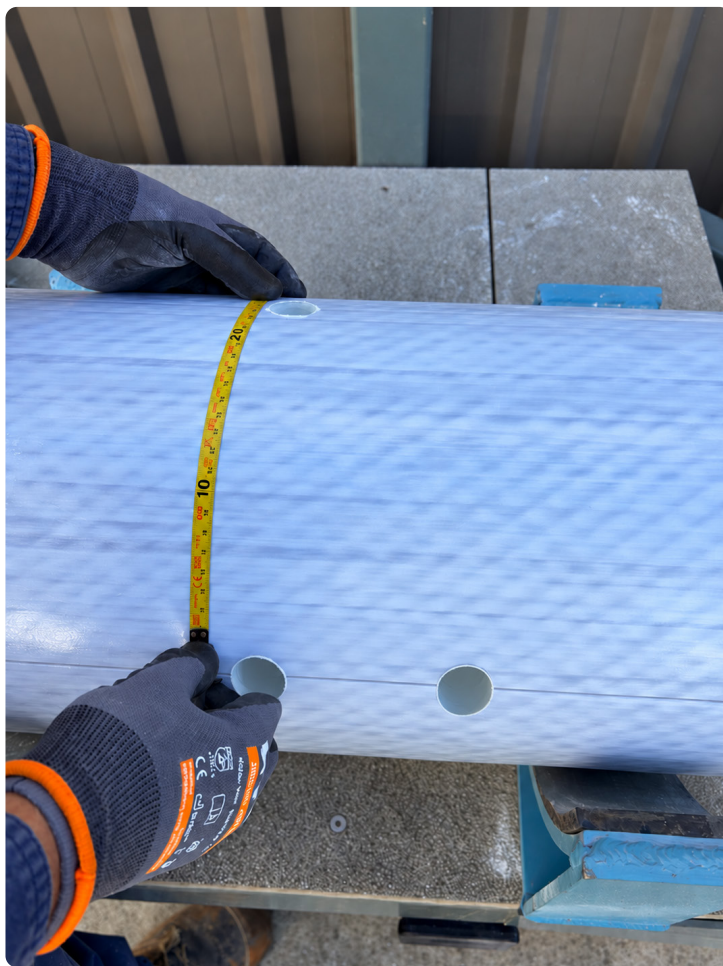


Figure 9 – Drilling for rotational angle and hole distance

Dust Exposure and Control

Drilling an FRP composite pole generates dust comprised of resin and glass fibers. This dust created is considered nuisance dust. Studies show that when drilled or cut, FRP fibers break perpendicularly and remain >0.0002 Mil (6 microns), so they are not deeply respirable. OSHA classifies it under PNOR. OSHA PEL is 0.0066 gr/ft^3 (15 mg/m^3) (total) and 0.0022 gr/ft^3 (5 mg/m^3) (respirable) for PNOR. The ACGIH TLV for continuous filament glass is 0.06 fiber/in^3 (1 fiber/cm^3) respirable or 0.0022 gr/ft^3 (5 mg/m^3) inhalable. However, any airborne dust can irritate eyes, skin and lungs. Some recommended practices include:

- **Monitor exposure:** If drilling in confined spaces or many holes, consider air monitoring (NIOSH 0500).
- **Local control:** Use wet drilling (coated bits that carry water, or mist spray or shaving foam) to trap dust at the source.
- **Personal protection:** At minimum, wear a fitted N95/P100 respirator. The ACMA advisory even suggests a “particle mask” with NIOSH marking for composite pole work. Ensure respirator seal test for each wearer. A full facepiece respirator may be used if the dust is heavy.
- **Ventilation:** Whenever possible, drill outdoors or in well-ventilated areas. Position so that wind or fans blow dust away from personnel.
- **HEPA vacuum:** After drilling, vacuum all dust with a HEPA-filtered shop vacuum. Wet wipes for surfaces and tools can be useful. Proper housekeeping prevents exposure.

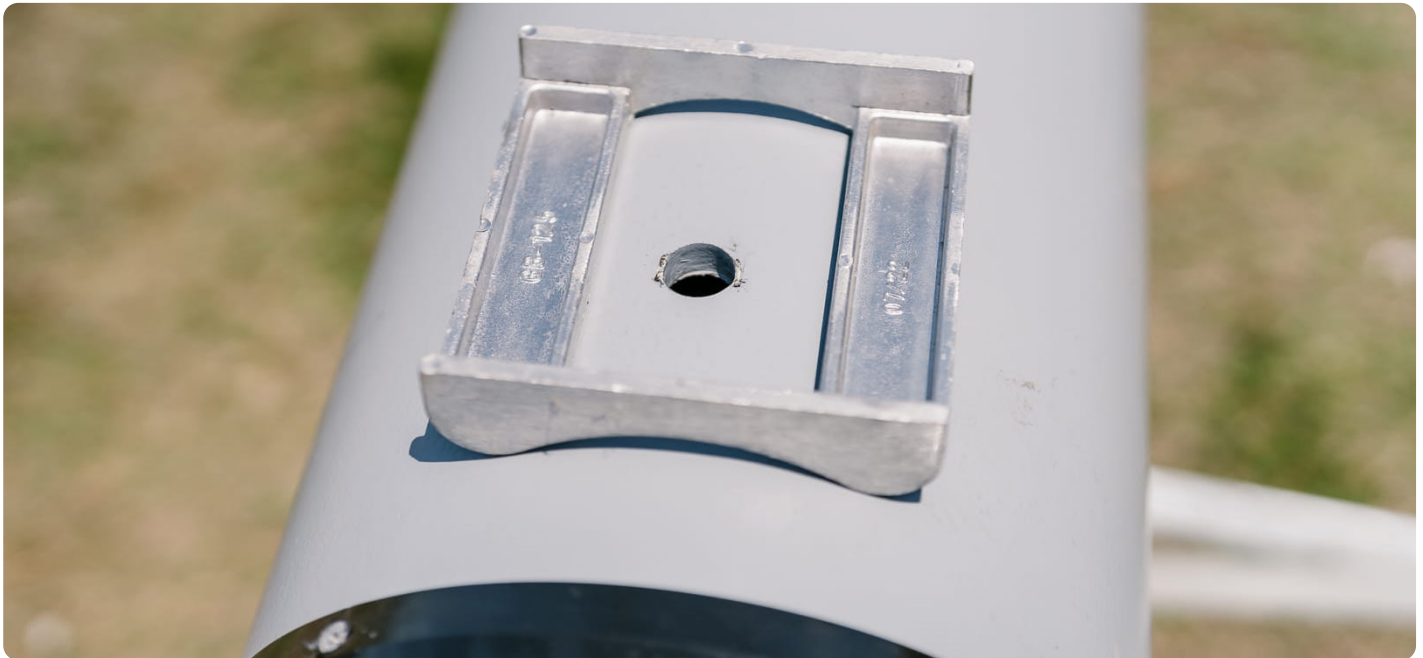


Figure 10 – Photo of the predrilled pole

Hazards and Controls

8.1 Chemical	Vinyl ester resin can contain styrene and other irritants, although cured resin emits gases minimally.
8.2 Skin contact	Wear gloves and long sleeves to keep fibers off skin. Wash any exposed skin after work.
8.3 Eye contact	Flush immediately with water if dust gets in the eyes.
8.4 Sharp Fibers	Keep skin covered and wash thoroughly after work.
8.5 Electrical	Before climbing or drilling near energised lines, follow electrical safety protocols. FRP is an insulator, but tools and hardware are not. De-energise lines or maintain proper clearance per electric utility requirements.
8.6 Fall Hazard	Drilling holes in a pole may require climbing. Use approved ladders or pole-climbing gear and fall arrest equipment at all times.
8.7 Kickback	Stand to one side and use a two-hand grip on the drill. If the bit catches, power off immediately to prevent wrist/arm injury.

Emergency Procedure

9.1 First Aid

In case of eye/skin irritation, flush immediately with water.

9.2 Injury

For any cuts or lacerations (fiberglass shards can cause small wounds), clean the area; seek medical care if needed.



Figure 11 – Installed Wagners pole

Training and Competency

It is advisable that crews are trained in FRP drilling procedures. The engineering and field service teams at Wagners CFT are available to provide training and answer questions.



Figure 12 – Wagners CFT's team is available for training and inquiries



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Top 10 Myths
Debunked