Introduction

- The materials used for crossarms in distribution and transmission lines are steel, wood, and fiberglass.
- **Steel** is always a conductor in any condition, so it does not have an insulation resistance.
- **Wood** has low electrical strength at AC especially under wet condition, and also low mechanical strength per unit weight.
- **Fiberglass** has superior properties under dry condition compared to other materials.
- Its properties in non-conductivity and high mechanical strength-to-weight ratio make fiberglass crossarm supersede steel crossarm and wood crossarm.
Fiberglass Crossarms Installed on the Transmission Steel Tower

Electrical Strength of Three Different Types of Crossarms

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<th>Crossarm</th>
<th>Electrical Strength</th>
<th>AC Voltage</th>
<th>CFO Voltage</th>
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<td>Dry</td>
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<tr>
<td>Fiberglass</td>
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Design of Fiberglass Crossarm

- Fiberglass crossarms are manufactured from Fiberglass Reinforced Plastics with ductile iron galvanized fittings.
- The plastic material is composed of a polyester, epoxy, or cycloaliphatic. The choice of these materials has effects in mechanical and electrical properties as well as costs.
- The ultraviolet protective inhibitors are mixed in the plastic resin to prevent ultraviolet deterioration from sunlight. The fiberglass crossarm is also coated with polyurethane on the outer surface.
- All bonded joints are sealed to prevent moisture penetration. The end fittings are either aluminum alloy or iron hot dip galvanized and are free of burrs and sharp edges.

Distribution Fiberglass Crossarm System

Vertical single standoff bracket
Distribution Fiberglass Crossarm System

Transmission Fiberglass Crossarm System
Damaged Surface of Fiberglass Crossarm after 20 Years in Service

Expected Lightning Impulse CFO and AC Flashover Voltages versus Lengths for Fiberglass Crossarm
The CFO Voltage of Fiberglass Crossarm versus Length for Dry and Wet Condition

The CFO Voltage Per Unit Length of Fiberglass Crossarm versus Length
Flashover Arc on a Fiberglass Crossarm with Three Insulators
Lightning Impulse under Wet Condition
Flashover Arc on a Fiberglass Crossarm with Three Insulators Lightning Impulse under Wet Condition
Flashover Arc on a Fiberglass Crossarm with Three Insulators
AC Voltage under Wet Condition
The AC Flashover Test
Fiberglass Crossarm, Wet Condition

The AC Flashover Test
Fiberglass Crossarm, Wet Condition
The AC Flashover Test
Fiberglass Crossarm, Wet Condition

The AC Flashover Test
Fiberglass Crossarm, Wet Condition
Fiberglass Crossarm Ends Damaged after AC Wet Test

If the leakage current level is high and time duration of applied voltage is long, it could create extensive heat that would cause damage to the fiberglass crossarm surface.

Measured Lightning Impulse CFO AC Flashover Voltages versus Lengths of Fiberglass Crossarm
CFO Voltage of Fiberglass and Wood Crossarm versus Length

![Graph showing CFO Voltage of Fiberglass and Wood Crossarm versus Length. The graph compares the voltage in kilovolts (kV) against the length in feet (ft) for dry and wet conditions of fiberglass and wood crossarms.](image)

CFO Voltage Per Unit of Fiberglass and Wood Crossarm versus Length

![Graph showing CFO Voltage Per Unit of Fiberglass and Wood Crossarm versus Length. The graph compares the voltage per foot in kilovolts per foot (kV/ft) against the length in feet (ft) for dry and wet conditions of fiberglass and wood crossarms.](image)
Conclusions

• Taking all parameters into the account, especially the electrical performance, fiberglass crossarm can be used in place of other conventional crossarms.

• The fiberglass crossarm cannot be used as the only insulation component. It must be used as a secondary insulation component of the multiple-insulation with insulator as a primary insulation component.

Conclusions

• For fiberglass crossarm with porcelain insulators, CFO voltage is not much different under dry and wet condition.

• The AC flashover voltage under wet condition is approximately 50-60% lower than under dry condition.

• The CFO voltages of fiberglass crossarms are 30-40% higher than wood crossarms under dry condition and 40-50% higher under wet condition.

• As the length increases, the CFO voltage per unit length of the fiberglass crossarm and the wood crossarm tend to decrease.