

# EXEL HOLLOW AND FOAM-FILLED TUBES FOR ELECTRICAL APPLICATIONS

Exel Composites produces high quality glassfibre pullwound tubes and hollow profiles with **very good surface finish**. Exel tubes have a high glass content and do not incorporate fillers, which ensures excellent **insulation** and **low water absorption** characteristics for **electrical applications**.

## Non-live working and live working applications

Exel Composites' Fiberglass Reinforced Plastic (FRP) tubes and profiles are naturally isolative and widely used in **non-live working** and **live working** electric tool products, like voltage detector poles, earthing poles and insulation poles (e.g. manoeuvring sticks, rescue poles, telescopic poles, fuse disconnecting poles).

In **live working** electric applications, material safety is mandatory, and it is strictly regulated by local authorities. Exel's pullwinding process ensures manufacturing of constant quality tubes, complying with several electrical standards, e.g. **EN61230**, **EN61235**, **EN62193** and **IEC60855**. Same high quality requirements apply to other **insulation** applications in electric industry, e.g. **contact line suspension**.



Hollow tube platforms for electrical applications



Foam-filled tubes

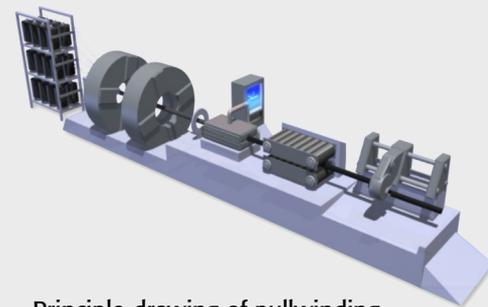


## Key advantages of Exel pullwound tubes:

- Superior electrical insulation properties
- Low water absorption
- High quality surface finish
- Cost-effective continuous manufacturing method
- Excellent corrosion and chemical resistance
- Compliant with live working requirements
  - EN61235
  - IEC60855-1
- Good temperature resistance also in low temperatures (-50°C)
- Exceptional strength and toughness compared to weight

| HOLLOW AND FOAM-FILLED TUBES FOR ELECTRICAL APPLICATIONS |                                      |
|--|--------------------------------------|
| Diameter   | from 10mm (0.39") to 65mm (2.56") OD |
| Wall thickness   | from 2mm (0.08") up to 3mm (0.12")   |
| Length   | according to customer need           |
| Colours  | any RAL or Pantone colour            |

| Electrical work      | NON-LIVE WORKING  | LIVE WORKING          | LIVE WORKING          |
|----------------------|---|-----------------------|-----------------------|
| Tube profile         | Hollow  | Hollow                | Foam-filled           |
| Manufacturing method | Pullwinding   | Pullwinding           | Pultrusion            |
| Structure            | UCUMV   | UCUCUV                | FUV                   |
|                      | U = unidirectional fibers<br>C = crosswinded fibers<br>V = surface finish: Nonwoven veil<br>F = foam<br>M = mat |                       |                       |
| Materials            | Glass fibres, polyester   | Glass fibres, epoxy   | Glass fibres, epoxy   |
| Fiber weight content | 75 w-%  | 75–80 w-%             | 70 w-%                |
| E-modulus            | > 35 GPa  | > 40 GPa              | > 45 GPa              |
| Density              | 1.9 g/cm <sup>3</sup>   | 2.0 g/cm <sup>3</sup> | 2.1 g/cm <sup>3</sup> |
| Surface finish       | Exelens™ nonwoven   | Exelens™ nonwoven     | Exelens™ nonwoven     |
| Water absorption     | < 2.0 w-%   | < 0.2 w-%             | < 0.2 w-% lacquered   |
| Electrical standards | -   | EN61235 compliant     | IEC 60855-1 compliant |



### Principle drawing of pullwinding process

Pullwinding is based on fibers that are impregnated with a thermosetting resin and pulled through a heated die where curing takes place.

In pullwinding process winders wind fiber in the crosswise direction during the pultrusion process. This gives better performance than other crosswise reinforcement as mats and fabrics.

The finished profiles are cut to length by a saw at the end of the line.



Pullwound tube structure is accurately controlled with lengthwise and crosswise fibers, finalized with high quality nonwoven surface.

