

# Product Catalog

Custom Electrical Insulation Tubes, Laminates, Rods & Fuse Components — Built to Your Drawing

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- ♦ LV / MV / HV Fuse Tubes
- ♦ Flexible & Heat-Shrink Tubing
- ♦ Laminated Sheets
- ♦ Epoxy Fiberglass Tubes
- ♦ Insulation Rods
- ♦ Washers & Spacers

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**50**

PRODUCTS

**500+**

ACTIVE SKUS

**ISO 9001**

SINCE 2017

**±0.05 mm**

TOLERANCE

**24h**

RFQ RESPONSE

## ABOUT WELLELE

# Precision Insulation, Engineered to Your Drawing

WELLELE manufactures precision insulation parts for OEM equipment makers, fuse assemblers and industrial distributors across Europe, the Middle East and Asia. Located in Suzhou, China since 2017, five production lines — rolling, filament winding, pultrusion, punching and CNC machining — run under one roof.

Every part is reviewed against your dimensioned drawing and qualification plan. Send the drawing — our engineering team reviews manufacturability before quotation, and responds within 24 hours.

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## QUALITY & COMPLIANCE

- ISO 9001:2015 Certified
- RoHS & REACH Compliant
- UL 94 V-0 (material dependent)
- IEC 60269 Fuse Dimensions
- ASTM D2491 / D709 / D4909 Standards
- Dielectric & IR Testing on Request

## MATERIAL FAMILIES

- Vulcanized fiber (fish paper)
- Ceramic-filled epoxy glass
- G10 / FR-4 epoxy glass
- G11 high-temp epoxy glass
- GPO-3 polyester glass
- G5 / G9 melamine glass
- Phenolic cotton / kraft paper
- PTFE / FEP / PFA
- Polyimide (Kapton)
- Mylar (PET)
- Silicone fiberglass
- Polyolefin / PVC

## FACTORY CAPABILITY

- Lead time 30–45 days standard · 7–10 days express prototype
- Cpk  $\geq 1.67$  on critical dimensions
- COA, FAI & batch traceability per your plan
- Weekly consolidations to EU / ME / Asia

# 01 LV / MV / HV Fuse Tubes

Fuse bodies, arc-quenching liners and end caps in vulcanized fiber, ceramic-filled epoxy glass, melamine and phenolic kraft. **11 parts**



## Custom Vulcanized Fiber Tubes for Fuse Links and Switchgear

Rolled and machined vulcanized fiber (fish paper) fuse bodies, thin-wall and small-diameter, to your drawing. Vulcanized fiber is the long-standing choice for LV cylindrical fuse bodies.

|                            |                                       |
|----------------------------|---------------------------------------|
| <b>Material</b>            | Vulcanized fibre (fish paper)         |
| <b>Density</b>             | 1.20 - 1.40 g/cm <sup>3</sup>         |
| <b>Service temperature</b> | Class B, up to ~130 degC              |
| <b>Dielectric strength</b> | 10 - 15 kV/mm (through thickness)     |
| <b>Wall tolerance</b>      | +/-0.05 mm typical on thin wall       |
| <b>Moisture</b>            | Seal or wax-impregnate for humid duty |

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## Ceramic-Filled Epoxy Fiberglass Tubes for HV Fuse Links

Arc-resistant, high-track-resistance tubes for current-limiting and HV fuse links. Ceramic-filled epoxy glass combines the arc containment of ceramic with the machinability of epoxy glass.

|                            |                                 |
|----------------------------|---------------------------------|
| <b>Material</b>            | Epoxy glass + ceramic filler    |
| <b>Service temperature</b> | Up to ~180 degC class           |
| <b>Track resistance</b>    | High (CTI rated, arc-quenching) |
| <b>Voltage class</b>       | MV / HV per drawing             |
| <b>Form</b>                | Filament-wound or molded tube   |

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## Medium and High Voltage Fuse Link Bodies to Drawing

Cylindrical fuse bodies for MV/HV links, with end-cap interfaces machined to spec. We build the non-ceramic portion of MV/HV fuse links: the cylindrical body and machined interface.

|                      |                                                                  |
|----------------------|------------------------------------------------------------------|
| <b>Voltage class</b> | MV / HV per drawing                                              |
| <b>Body form</b>     | Cylindrical, drawn to spec                                       |
| <b>Materials</b>     | Ceramic epoxy glass / vulcanized fiber / arc-quenching composite |
| <b>Interface</b>     | Machined to end-cap drawing                                      |
| <b>Docs</b>          | Incoming, in-process and final inspection records                |

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## Small-Diameter, Thin-Wall Fuse Tubes with Tight Tolerances

Thin-wall vulcanized fiber and epoxy tubes for compact cylindrical links. Compact links need thin walls and small diameters held to tight ID/OD.

|                 |                                     |
|-----------------|-------------------------------------|
| <b>ID range</b> | Small-diameter, per drawing         |
| <b>Wall</b>     | Thin-wall, +/-0.05 mm typical       |
| <b>Material</b> | Vulcanized fiber / thin epoxy glass |
| <b>Check</b>    | Wall concentricity and straightness |

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## Phenolic Kraft Paper Tubes for Fuse Liners and Forms

Resin-impregnated kraft paper tubes for liners, forms and low-cost fuse bodies. Phenolic kraft tubes are the economical body for many LV links and liners.

|                 |                                 |
|-----------------|---------------------------------|
| <b>Material</b> | Resin-impregnated kraft paper   |
| <b>Form</b>     | Helically or convolutedly wound |
| <b>Service</b>  | LV fuse liners and bodies       |
| <b>Cost</b>     | Lower than epoxy glass systems  |

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## G5 / G9 Melamine Tubes for Arc-Resistant Fuse Bodies

Glass-melamine tubes with high mechanical strength and arc resistance. Melamine glass (G5/G9) tubes bring high mechanical strength and arc resistance to fuse bodies and insulating sleeves.

|                   |                                 |
|-------------------|---------------------------------|
| <b>Material</b>   | Glass-melamine laminate (G5/G9) |
| <b>Temp class</b> | Class B/E per grade             |
| <b>Properties</b> | High mechanical, arc resistant  |
| <b>Form</b>       | Machined tube / sleeve          |

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## Fiber-Epoxy Combination Tubes for Hybrid Fuse Bodies

Layered vulcanized fiber and epoxy glass for combined arc and strength. Some links need the arc behavior of fiber on the inside and the strength of epoxy glass on the outside.

|                              |                                                                                                           |
|------------------------------|-----------------------------------------------------------------------------------------------------------|
| <b>Material</b>              | Vulcanized fiber + epoxy glass layers                                                                     |
| <b>Purpose</b>               | Combined arc + mechanical duty                                                                            |
| <b>Form</b>                  | Laminated / combination tube                                                                              |
| <b>Standard</b>              | ASTM D2491 (vulcanized fiber), IEC 60269 (fuse dimensions), UL 94 V-0 (flammability, material dependent). |
| <b>Operating temperature</b> | -40 °C to +105 °C                                                                                         |
| <b>Dielectric strength</b>   | ≥ 20 kV/mm (per ASTM test method)                                                                         |

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## Vulcanized Fiber and Fiberglass Combination Tubes

Fiber inner with fiberglass reinforcement for stronger thin-wall bodies. Reinforcing vulcanized fiber with a fiberglass layer raises the thin-wall strength without losing machinability.

|                              |                                                                                                           |
|------------------------------|-----------------------------------------------------------------------------------------------------------|
| <b>Material</b>              | Vulcanized fiber + fiberglass layer                                                                       |
| <b>Purpose</b>               | Thin-wall strength + arc resistance                                                                       |
| <b>Form</b>                  | Combination tube                                                                                          |
| <b>Standard</b>              | ASTM D2491 (vulcanized fiber), IEC 60269 (fuse dimensions), UL 94 V-0 (flammability, material dependent). |
| <b>Operating temperature</b> | -40 °C to +105 °C                                                                                         |
| <b>Dielectric strength</b>   | ≥ 20 kV/mm (per ASTM test method)                                                                         |

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## Canvas Epoxy (Phenolic Cotton) Fuse Tubes

Phenolic cotton canvas tubes for cost-effective mechanical fuse bodies. Canvas epoxy (phenolic cotton) tubes are the mechanical, lower-cost option for fuse bodies that are not arc-facing.

|                              |                                                                                                           |
|------------------------------|-----------------------------------------------------------------------------------------------------------|
| <b>Material</b>              | Phenolic cotton canvas laminate                                                                           |
| <b>Properties</b>            | Good mechanical, machinable                                                                               |
| <b>Use</b>                   | Non-arc-facing bodies and forms                                                                           |
| <b>Standard</b>              | ASTM D2491 (vulcanized fiber), IEC 60269 (fuse dimensions), UL 94 V-0 (flammability, material dependent). |
| <b>Operating temperature</b> | -40 °C to +105 °C                                                                                         |
| <b>Dielectric strength</b>   | ≥ 20 kV/mm (per ASTM test method)                                                                         |

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## Knurled and Screwed Vulcanized Fiber Tubes

Vulcanized fiber tubes with knurl, thread or shoulder for end termination. End terminals need grip and thread. We machine knurl, external thread or shouldered features into vulcanized fiber tubes.

|                              |                                                                                                           |
|------------------------------|-----------------------------------------------------------------------------------------------------------|
| <b>Material</b>              | Vulcanized fiber                                                                                          |
| <b>Features</b>              | Knurl / thread / shoulder                                                                                 |
| <b>Use</b>                   | Fuse end terminals and indicators                                                                         |
| <b>Standard</b>              | ASTM D2491 (vulcanized fiber), IEC 60269 (fuse dimensions), UL 94 V-0 (flammability, material dependent). |
| <b>Operating temperature</b> | -40 °C to +105 °C                                                                                         |
| <b>Dielectric strength</b>   | ≥ 20 kV/mm (per ASTM test method)                                                                         |

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## Synthetic Arc-Quenching Fuse Tubes for MV/HV Links

Engineered arc-quenching liner materials for high clearing energy. Synthetic arc-quenching tubes are formulated to absorb and extinguish arc energy in MV/HV links.

|                              |                                                                |
|------------------------------|----------------------------------------------------------------|
| <b>Material</b>              | Synthetic arc-quenching composite                              |
| <b>Use</b>                   | MV/HV high-energy links                                        |
| <b>Qualification</b>         | Per your test plan                                             |
| <b>Standard</b>              | ASTM D7049 (melamine), IEC 60269 (fuse dimensions), UL 94 V-0. |
| <b>Operating temperature</b> | -40 °C to +130 °C (arc-facing up to 155 °C)                    |
| <b>Dielectric strength</b>   | ≥ 20 kV/mm (per ASTM test method)                              |

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## 02 Epoxy Fiberglass Tubes

Wound and pultruded epoxy glass tubes for insulation, structural and high-voltage casing parts. **7 parts**



### Engineered Filament-Wound Epoxy Glass Tubing

Wound to a fiber angle set by your load path, then machined to shape. Filament winding lets us place glass where the load is.

|                   |                                 |
|-------------------|---------------------------------|
| <b>Material</b>   | Epoxy-impregnated E-glass / ECR |
| <b>Temp class</b> | F/H, up to ~155-180 degC        |
| <b>Dielectric</b> | >14 kV/mm through thickness     |
| <b>Wind angle</b> | Set from load path              |
| <b>Flame</b>      | UL 94 V-0 on FR-4 grade         |

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### Filament Fiberglass Wound Tubing, Custom ID/OD and Wall

Standard and custom-wound fiberglass tubing for insulation and structure. Wound fiberglass tubing is our baseline epoxy glass product: consistent wall, low voids and good dielectric.

|                              |                                                         |
|------------------------------|---------------------------------------------------------|
| <b>Material</b>              | Epoxy glass filament wound                              |
| <b>Wall</b>                  | Custom, low void                                        |
| <b>Finish</b>                | Bondable, squared ends                                  |
| <b>Standard</b>              | ASTM D2583 (G10), IPC-4101 (FR-4), IEC 60672 (thermal). |
| <b>Operating temperature</b> | -40 °C to +130 °C                                       |
| <b>Dielectric strength</b>   | ≥ 20 kV/mm (per ASTM test method)                       |

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### Shaped High-Voltage Casing Parts in FR-4 / G10

Machined casing, bushing and insulator shapes from wound epoxy glass. Casing and bushing parts are wound tube taken to a finished shape: tapers, steps, grooves and bores machined to the assembly drawing.

|                 |                           |
|-----------------|---------------------------|
| <b>Material</b> | FR-4 / G10 epoxy glass    |
| <b>Form</b>     | Machined casing / bushing |
| <b>Control</b>  | Bore-to-OD concentricity  |
| <b>Creepage</b> | Cut or molded to drawing  |

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### PV Insert Epoxy Fiberglass Tubes for Terminal Insulators

Insulator inserts for PV and busbar terminal assemblies. PV insert tubes are the insulating core in terminal and busbar connectors.

|                              |                                                         |
|------------------------------|---------------------------------------------------------|
| <b>Material</b>              | Epoxy glass (G10/FR-4)                                  |
| <b>Use</b>                   | PV / busbar terminal inserts                            |
| <b>Form</b>                  | Machined insert tube                                    |
| <b>Standard</b>              | ASTM D2583 (G10), IPC-4101 (FR-4), IEC 60672 (thermal). |
| <b>Operating temperature</b> | -40 °C to +130 °C                                       |
| <b>Dielectric strength</b>   | ≥ 20 kV/mm (per ASTM test method)                       |

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## Current-Limiting Fuse Tubes in Epoxy Glass

Bodies for current-limiting links, built to the clearing spec. Current-limiting links clear fault current fast and generate high internal energy.

|                              |                                                         |
|------------------------------|---------------------------------------------------------|
| <b>Material</b>              | Epoxy glass / ceramic epoxy glass                       |
| <b>Use</b>                   | Current-limiting links                                  |
| <b>Control</b>               | Wall per clearing energy                                |
| <b>Standard</b>              | ASTM D2583 (G10), IPC-4101 (FR-4), IEC 60672 (thermal). |
| <b>Operating temperature</b> | -40 °C to +130 °C                                       |
| <b>Dielectric strength</b>   | ≥ 20 kV/mm (per ASTM test method)                       |

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## Filament-Wound Fiber Glass Rocket and Motor Tubes

Composite motor-case tubing wound to pressure and thrust load. Rocket and motor tubes are pressure vessels.

|                              |                                                         |
|------------------------------|---------------------------------------------------------|
| <b>Material</b>              | Epoxy E-glass / ECR filament wound                      |
| <b>Load</b>                  | Hoop + axial from thrust                                |
| <b>Docs</b>                  | Winding, cure, inspection records                       |
| <b>Standard</b>              | ASTM D2583 (G10), IPC-4101 (FR-4), IEC 60672 (thermal). |
| <b>Operating temperature</b> | -40 °C to +130 °C                                       |
| <b>Dielectric strength</b>   | ≥ 20 kV/mm (per ASTM test method)                       |

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## Fiber Sanding Discs on Vulcanized Fiber Backing

Vulcanized-fiber backing discs for bonded abrasive wheels. Abrasive discs are mounted on a vulcanized fiber backing for rigidity and heat resistance.

|                              |                                                                                                           |
|------------------------------|-----------------------------------------------------------------------------------------------------------|
| <b>Material</b>              | Vulcanized fiber backing                                                                                  |
| <b>Form</b>                  | Punched disc with arbor hole                                                                              |
| <b>Check</b>                 | Flatness and balance                                                                                      |
| <b>Standard</b>              | ASTM D2491 (vulcanized fiber), IEC 60269 (fuse dimensions), UL 94 V-0 (flammability, material dependent). |
| <b>Operating temperature</b> | -40 °C to +105 °C                                                                                         |
| <b>Dielectric strength</b>   | ≥ 20 kV/mm (per ASTM test method)                                                                         |

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## 03 Flexible & Heat-Shrink Tubing

Polyimide, Mylar, PTFE, silicone-coated fiberglass and polyolefin shrink sleeving for 800V EV, ESS and power cable. **19 parts**



### Heat-Shrink Busbar Sleeve for EV, ESS and Switchgear

Recovers to a tight fit on busbars with V-0 flame and rated voltage wall. Busbar sleeve shrinks to hug the bar so the insulation follows the cross-section and any corner buildup.

|              |                              |
|--------------|------------------------------|
| Type         | Polyolefin heat-shrink       |
| Voltage      | Rated to busbar voltage      |
| Flame        | UL 94 V-0                    |
| Shrink ratio | 2:1 / 3:1 / 4:1              |
| Use          | EV / ESS / switchgear busbar |

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### 800V Busbar Heat-Shrink Tubing for High-Voltage Platforms

Rated wall and recovery for 800V EV and energy-storage busbars. 800V platforms need insulation that holds wall after recovery and resists tracking under humidity.

|              |                                      |
|--------------|--------------------------------------|
| Voltage      | 800V platform rated                  |
| Wall         | Voltage-rated, stable after recovery |
| Flame        | UL 94 V-0                            |
| Shrink ratio | 2:1 / 3:1 / 4:1                      |

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### Battery Energy Storage (ESS) Busbar Insulation Sleeve

Insulation for battery racks and ESS busbar links. ESS busbars carry high current in dense packs, so the sleeve must insulate, resist flame and survive the pack environment.

|         |                      |
|---------|----------------------|
| Use     | Battery ESS busbars  |
| Voltage | Rated to busbar      |
| Flame   | UL 94 V-0            |
| Options | Cut length, pre-slit |

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### Power Cable Heat-Shrink Tubing (1 kV / 10 kV / 35 kV)

Joint and termination sleeve rated across LV and MV cable voltages. Power-cable shrink tubing covers joints and terminations from 1 kV through 35 kV.

|              |                         |
|--------------|-------------------------|
| Voltage      | 1 / 10 / 35 kV          |
| Shrink ratio | 2:1 / 3:1               |
| Use          | Joints and terminations |
| Flame        | V-0 options             |

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## Heat-Shrink Power Cable Accessories and Kits

Molded accessories and kits for cable joints and terminations. Beyond straight sleeve we supply molded accessories and kits for cable joints and terminations: stress cones, breakouts and end caps in the rated material.

|                              |                                                                            |
|------------------------------|----------------------------------------------------------------------------|
| <b>Items</b>                 | Cones, breakouts, end caps, kits                                           |
| <b>Voltage</b>               | Per cable system                                                           |
| <b>Use</b>                   | Joints and terminations                                                    |
| <b>Material</b>              | Heat-shrink tubing (polyolefin)                                            |
| <b>Standard</b>              | ASTM D2048, IEC 60228, UL 224 (flame retardant), RoHS and REACH compliant. |
| <b>Operating temperature</b> | -55 °C to +105 °C (standard polyolefin)                                    |
| <b>Dielectric strength</b>   | ≥ 20 kV/mm (per ASTM test method)                                          |

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## Double-Wall (Adhesive-Lined) Heat-Shrink Tube

Inner adhesive layer seals out moisture on cable and harness joints. Double-wall tube carries an inner melt adhesive that flows on shrink to seal the joint against moisture and debris.

|                     |                               |
|---------------------|-------------------------------|
| <b>Structure</b>    | Outer shrink + inner adhesive |
| <b>Seal</b>         | Moisture-proof on shrink      |
| <b>Shrink ratio</b> | 3:1 / 4:1                     |
| <b>Use</b>          | Harness and cable joints      |

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## PVC Heat-Shrink Sleeving for Identification and Light Duty

Low-cost shrink sleeving for color coding and light insulation. PVC shrink sleeving is the economical choice for color coding, marking and light insulation on wire and small components.

|                 |                            |
|-----------------|----------------------------|
| <b>Material</b> | PVC                        |
| <b>Shrink</b>   | 2:1                        |
| <b>Use</b>      | Identification, light duty |
| <b>Colors</b>   | Standard range             |

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## Teflon (PTFE) Heat-Shrink Tubing for High Temperature and Chemical Duty

Shrink PTFE for chemically aggressive and high-temperature service. PTFE shrink tubing serves where nothing else survives: continuous heat to ~260 degC and almost total chemical resistance.

|                    |                               |
|--------------------|-------------------------------|
| <b>Material</b>    | PTFE / FEP                    |
| <b>Temperature</b> | -200 to +260 degC             |
| <b>Chemical</b>    | Near-universal resistance     |
| <b>Use</b>         | Harsh process and sensor duty |

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## PTFE Tubes and Tubing for Chemical and High-Temperature Service

Pure and filled PTFE tube for fluid, electrical and semiconductor duty. PTFE tube is inert, non-stick and stable from cryogenic to 260 degC.

|                    |                                  |
|--------------------|----------------------------------|
| <b>Material</b>    | PTFE (pure / filled)             |
| <b>Temperature</b> | -200 to +260 degC                |
| <b>Chemical</b>    | Near-universal resistance        |
| <b>Use</b>         | Fluid, electrical, semiconductor |

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## PTFE Tubing for Medical Devices and Catheters

Medical-grade PTFE liners and shafts with tight ID control. Medical PTFE tubing needs tight ID, low friction and clean processing.

|                 |                           |
|-----------------|---------------------------|
| <b>Material</b> | Medical-grade PTFE        |
| <b>Control</b>  | Tight ID, low friction    |
| <b>Records</b>  | Lot traceability          |
| <b>Use</b>      | Catheters, liners, shafts |

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## Teflon Tube for Automotive and High-Temperature Cable

PTFE sleeving for engine-bay and powertrain wiring. Engine-bay and powertrain wiring runs hot and against fluids. PTFE sleeving protects it across the temperature range without hardening.

|                    |                        |
|--------------------|------------------------|
| <b>Material</b>    | PTFE                   |
| <b>Temperature</b> | Up to +260 degC        |
| <b>Use</b>         | Engine bay, powertrain |
| <b>Form</b>        | Sleeving, cut or spool |

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## Polyimide (Kapton) Capillary Tubes for Temperature Sensors

Thin-wall polyimide capillary for thermocouple and RTD protection. Polyimide capillary protects sensor elements while staying thin and flexible across a wide temperature span.

|                    |                           |
|--------------------|---------------------------|
| <b>Material</b>    | Polyimide (Kapton)        |
| <b>Temperature</b> | -269 to +400 degC         |
| <b>Wall</b>        | Thin, tight tolerance     |
| <b>Use</b>         | Thermocouple / RTD sheath |

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## Mylar (PET) Shrink Tubing for Insulation and Wrap

Polyester shrink tubing for phase insulation and wrap. Mylar shrink tubing gives a thin, tough polyester insulation layer used for phase isolation and wrap in coils and buses.

|                              |                                                                  |
|------------------------------|------------------------------------------------------------------|
| <b>Material</b>              | Polyester (PET / Mylar)                                          |
| <b>Use</b>                   | Phase insulation, wrap                                           |
| <b>Property</b>              | Thin, tough dielectric                                           |
| <b>Standard</b>              | ASTM D5487 (polyimide film), IEC 60672 (thermal classification). |
| <b>Operating temperature</b> | -269 °C to +400 °C                                               |
| <b>Dielectric strength</b>   | ≥ 20 kV/mm (per ASTM test method)                                |

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## Mylar Sleeve for Flange Bolt Insulation

Bolt sleeves that break the galvanic path at flanged joints. Flange bolt sleeves insulate the bolt from the flange to stop galvanic corrosion and stray current.

|                              |                                               |
|------------------------------|-----------------------------------------------|
| <b>Material</b>              | Polyester film                                |
| <b>Use</b>                   | Flange bolt insulation                        |
| <b>Purpose</b>               | Break galvanic path                           |
| <b>Standard</b>              | ASTM D880 (PET film), IEC 60250 (dielectric). |
| <b>Operating temperature</b> | -55 °C to +105 °C                             |
| <b>Dielectric strength</b>   | ≥ 20 kV/mm (per ASTM test method)             |

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## Acrylic-Coated Fiberglass Sleeving

Braid-and-coat sleeving for flexible electrical insulation. Acrylic-coated fiberglass sleeving is the standard flexible electrical sleeve: braided glass with an acrylic binder that stays flexible and dielectric.

|                 |                      |
|-----------------|----------------------|
| <b>Material</b> | Fiberglass + acrylic |
| <b>Flex</b>     | Flexible braid       |
| <b>Use</b>      | Electrical sleeving  |
| <b>Temp</b>     | Moderate class       |

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## Silicone-Coated Fiberglass Sleeving

Higher-temperature flexible sleeving for harness and components. Silicone-coated fiberglass sleeving runs hotter than acrylic and stays flexible, making it the choice for engine-bay and industrial harness.

|                    |                           |
|--------------------|---------------------------|
| <b>Material</b>    | Fiberglass + silicone     |
| <b>Temperature</b> | Higher class than acrylic |
| <b>Flex</b>        | Flexible braid            |
| <b>Use</b>         | Hot harness, industrial   |

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## Silicone Resin Impregnated Fiberglass Sleeve

Resin-impregnated glass sleeve with a sealed, smooth wall. Silicone resin impregnation seals the braid into a smooth, dielectric wall that resists moisture and fraying at the cut.

|                              |                                                                             |
|------------------------------|-----------------------------------------------------------------------------|
| <b>Material</b>              | Fiberglass + silicone resin                                                 |
| <b>Wall</b>                  | Sealed, smooth                                                              |
| <b>Use</b>                   | Sealed electrical sleeve                                                    |
| <b>Standard</b>              | ASTM D5611 (silicone sleeving), IEC 60228 (wire identification), UL 94 V-0. |
| <b>Operating temperature</b> | -50 °C to +200 °C                                                           |
| <b>Dielectric strength</b>   | ≥ 20 kV/mm (per ASTM test method)                                           |

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## Silicone-Coated Fire Sleeve for Hose and Cable

High-temperature fire sleeve for hydraulic lines and harnesses. Fire sleeve protects hydraulic hose and wiring from flame, heat and abrasion.

|                              |                                                                       |
|------------------------------|-----------------------------------------------------------------------|
| <b>Material</b>              | Silicone-coated fiberglass                                            |
| <b>Use</b>                   | Fire / heat protection                                                |
| <b>Options</b>               | Hook-and-loop, cut length                                             |
| <b>Standard</b>              | ASTM D4896 (PTFE), IEC 60245 (dielectric), UL 94 V-0 (unfilled PTFE). |
| <b>Operating temperature</b> | -200 °C to +260 °C                                                    |
| <b>Dielectric strength</b>   | ≥ 20 kV/mm (per ASTM test method)                                     |

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## Busbar Conjunction (Joint) Box Series

Insulated boxes and covers for busbar joints and taps. Busbar joint boxes enclose and insulate the tap or joint so crews and adjacent metal are protected.

|                              |                                                                           |
|------------------------------|---------------------------------------------------------------------------|
| <b>Material</b>              | Insulating laminate                                                       |
| <b>Use</b>                   | Busbar joint / tap enclosure                                              |
| <b>Supply</b>                | Box + cover + fixings                                                     |
| <b>Standard</b>              | ASTM or IEC standards referenced in your drawing; COA supplied per batch. |
| <b>Operating temperature</b> | Per drawing specification                                                 |
| <b>Dielectric strength</b>   | ≥ 20 kV/mm (per ASTM test method)                                         |

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## 04 Insulation Rods

Machined and pultruded rods for switchgear operating rods, spacers and structural insulators. [4 parts](#)



### ECR Epoxy Fiberglass Rods for Outdoor Duty

Moisture-resistant pultruded rods for outdoor and switchgear duty. ECR glass resists corrosion from moisture better than standard E-glass, so these rods suit outdoor and humid switchgear.

|                 |                                |
|-----------------|--------------------------------|
| <b>Material</b> | ECR epoxy glass, pultruded     |
| <b>Property</b> | Moisture resistant             |
| <b>Use</b>      | Outdoor / switchgear           |
| <b>Control</b>  | Diameter, straightness, runout |

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### Phenolic Cotton Cloth Laminated Rods

Machinable phenolic rods for mechanical insulating parts. Phenolic cotton rod machines cleanly and carries good mechanical load, making it the default for non-arc-facing insulating parts.

|                              |                                                        |
|------------------------------|--------------------------------------------------------|
| <b>Material</b>              | Phenolic cotton cloth laminate                         |
| <b>Property</b>              | Good mechanical, machinable                            |
| <b>Use</b>                   | Mechanical insulating parts                            |
| <b>Standard</b>              | ASTM D4909 (phenolic), UL 94 V-0 (material dependent). |
| <b>Operating temperature</b> | -40 °C to +120 °C                                      |
| <b>Dielectric strength</b>   | ≥ 20 kV/mm (per ASTM test method)                      |

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### Vulcanized Fiber (Fish Paper) Rods

Fish-paper rods for arc-facing and formed insulator parts. Vulcanized fiber rod is used where arc faces the part or where the rod must be formed and punched.

|                              |                                                                                                           |
|------------------------------|-----------------------------------------------------------------------------------------------------------|
| <b>Material</b>              | Vulcanized fiber (fish paper)                                                                             |
| <b>Property</b>              | Arc-resistant, machinable                                                                                 |
| <b>Use</b>                   | Arc-facing insulator parts                                                                                |
| <b>Standard</b>              | ASTM D2491 (vulcanized fiber), IEC 60269 (fuse dimensions), UL 94 V-0 (flammability, material dependent). |
| <b>Operating temperature</b> | -40 °C to +105 °C                                                                                         |
| <b>Dielectric strength</b>   | ≥ 20 kV/mm (per ASTM test method)                                                                         |

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### Beech Dowel and Coffin Stick Rods

Hardwood dowels and coffin sticks for fixtures and forming. Beech dowels and coffin sticks are the low-cost, stable wood rod for fixtures, mandrels and forming tools.

|                              |                                   |
|------------------------------|-----------------------------------|
| <b>Material</b>              | Beech hardwood                    |
| <b>Use</b>                   | Fixtures, mandrels, forming       |
| <b>Supply</b>                | Cut to length                     |
| <b>Standard</b>              | ASTM D4909 (phenolic), UL 94 V-0. |
| <b>Operating temperature</b> | -40 °C to +120 °C                 |
| <b>Dielectric strength</b>   | ≥ 20 kV/mm (per ASTM test method) |

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## 05 Laminated Sheets

Cut, punched and machined insulating plates for panels, barriers and structural parts. **7 parts**



### GPO-3 Polyester Glass Laminate Sheet

Track-resistant, V-0 sheet for busbar supports and barriers. GPO-3 is the standard sheet for busbar supports and switchgear barriers because of its track resistance and V-0 flame class.

|                   |                           |
|-------------------|---------------------------|
| <b>Material</b>   | Polyester glass (GPO-3)   |
| <b>Temp class</b> | F, ~155 degC              |
| <b>Flame</b>      | UL 94 V-0                 |
| <b>Property</b>   | High track resistance     |
| <b>Use</b>        | Busbar supports, barriers |

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### G5 / G9 Glass Melamine Laminate Sheet

High-strength, arc-resistant sheet for switchgear parts. Glass melamine (G5/G9) sheet brings high mechanical strength and arc resistance to switchgear parts that see load and clearing energy.

|                              |                                                                |
|------------------------------|----------------------------------------------------------------|
| <b>Material</b>              | Glass-melamine (G5/G9)                                         |
| <b>Property</b>              | High mechanical, arc resistant                                 |
| <b>Use</b>                   | Switchgear parts                                               |
| <b>Standard</b>              | ASTM D7049 (melamine), IEC 60269 (fuse dimensions), UL 94 V-0. |
| <b>Operating temperature</b> | -40 °C to +130 °C (arc-facing up to 155 °C)                    |
| <b>Dielectric strength</b>   | ≥ 20 kV/mm (per ASTM test method)                              |

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### Phenolic Cotton Cloth Laminated Sheets

Machinable phenolic plate for mechanical insulating parts. Phenolic cotton sheet is the economical, machinable choice for mechanical insulating parts that are not arc-facing.

|                              |                                                            |
|------------------------------|------------------------------------------------------------|
| <b>Material</b>              | Phenolic cotton cloth laminate                             |
| <b>Property</b>              | Good mechanical, machinable                                |
| <b>Use</b>                   | Mechanical insulating parts                                |
| <b>Standard</b>              | ASTM D7049 (GPO-3), UL 94 V-0 (standard grade), IEC 60672. |
| <b>Operating temperature</b> | -40 °C to +150 °C                                          |
| <b>Dielectric strength</b>   | ≥ 20 kV/mm (per ASTM test method)                          |

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### Phenolic Cotton Cloth Laminated Sheet (3230)

General industrial phenolic plate for mechanical and electrical parts. The 3230-grade phenolic cotton sheet is a general industrial laminate for mechanical and light electrical parts.

|                              |                                                        |
|------------------------------|--------------------------------------------------------|
| <b>Grade</b>                 | 3230 phenolic cotton                                   |
| <b>Use</b>                   | Mechanical / light electrical                          |
| <b>Property</b>              | Machinable                                             |
| <b>Material</b>              | Phenolic cotton cloth laminate                         |
| <b>Standard</b>              | ASTM D4909 (phenolic), UL 94 V-0 (material dependent). |
| <b>Operating temperature</b> | -40 °C to +120 °C                                      |
| <b>Dielectric strength</b>   | ≥ 20 kV/mm (per ASTM test method)                      |

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## Bakelite Plate (Orange / Black) Phenolic Laminate

Paper-phenolic plate for panels, tags and mechanical parts. Bakelite (paper-phenolic) plate is the classic insulating panel material, supplied orange or black.

|                              |                                   |
|------------------------------|-----------------------------------|
| <b>Material</b>              | Paper-phenolic (bakelite)         |
| <b>Colors</b>                | Orange / Black                    |
| <b>Use</b>                   | Panels, tags, parts               |
| <b>Standard</b>              | ASTM D4909 (phenolic), UL 94 V-0. |
| <b>Operating temperature</b> | -40 °C to +120 °C                 |
| <b>Dielectric strength</b>   | ≥ 20 kV/mm (per ASTM test method) |

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## SMC Sheet Molding Compound

Moldable sheet compound for large insulated enclosures and parts. SMC is a moldable glass-polyester sheet used for large insulated enclosures and structural parts where molding beats machining.

|                              |                                          |
|------------------------------|------------------------------------------|
| <b>Material</b>              | Sheet molding compound (glass-polyester) |
| <b>Use</b>                   | Molded enclosures, parts                 |
| <b>Property</b>              | Moldable, insulating                     |
| <b>Standard</b>              | ASTM D4909 (phenolic), UL 94 V-0.        |
| <b>Operating temperature</b> | -40 °C to +120 °C                        |
| <b>Dielectric strength</b>   | ≥ 20 kV/mm (per ASTM test method)        |

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## Vulcanized Fiber (Fish Paper) Sheet

Fish-paper sheet for arc-facing and formed insulation parts. Vulcanized fiber sheet is formed, punched and machined for arc-facing insulation: barriers, arc chutes and gaskets.

|                              |                                                                                                           |
|------------------------------|-----------------------------------------------------------------------------------------------------------|
| <b>Material</b>              | Vulcanized fiber (fish paper)                                                                             |
| <b>Property</b>              | Arc-resistant, formable                                                                                   |
| <b>Use</b>                   | Arc-facing parts                                                                                          |
| <b>Standard</b>              | ASTM D2491 (vulcanized fiber), IEC 60269 (fuse dimensions), UL 94 V-0 (flammability, material dependent). |
| <b>Operating temperature</b> | -40 °C to +105 °C                                                                                         |
| <b>Dielectric strength</b>   | ≥ 20 kV/mm (per ASTM test method)                                                                         |

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# 06 Washers & Spacers

Stamped and machined insulating washers and spacers for terminal and busbar assemblies. **2 parts**



## G10 / FR-4 Epoxy Glass Insulating Washers and Spacers

Precision epoxy glass washers for terminal and busbar insulation. G10/FR-4 washers give moisture-stable insulation at terminal and busbar joints.

|           |                              |
|-----------|------------------------------|
| Material  | G10 / FR-4 epoxy glass       |
| Property  | Moisture stable, V-0 (FR-4)  |
| Tolerance | Thickness +/-0.05 to 0.10 mm |
| Use       | Terminal / busbar washers    |

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## Vulcanized Fiber (Fish Paper) Washers and Spacers

Arc-resistant washers and spacers punched or machined to drawing. Vulcanized fiber washers are the arc-resistant choice for fuse and switchgear joints.

|          |                               |
|----------|-------------------------------|
| Material | Vulcanized fiber (fish paper) |
| Property | Arc-resistant                 |
| Form     | Punched or machined           |
| Use      | Fuse / switchgear washers     |

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