Safety First: Professional TIW Triple Insulated Litz Wires Solutions from RVYUAN with UL Certification



Tianjin, China Nov 4, 2026 (Issuewire.com**)** - What actually holds a switching transformer safe once the barrier between the primary and secondary side shrinks to a fraction of a millimetre? For designers of adapters, LED drivers, medical power supplies and on-board chargers, that question has moved from a footnote to a starting condition — and it explains why professional TIW triple insulated litz wires

solutions have become a standard building block rather than a niche option. A triple insulated litz wire is a twisted bundle of fine enamelled copper strands carrying three separately extruded insulating layers, each layer recognized as one level of insulation, so that reinforced insulation lives inside the wire instead of being assembled around it. RVYUAN (Tianjin Ruiyuan Electric Material Co., Ltd.) has worked in the high-end magnet wire field for more than twenty years as a specialised enterprise combining research and development, production and trade, and its TIW triple insulated litz wires are built specifically for that safety-critical position in the winding.

Why Reinforced Insulation Starts at the Wire

The isolation logic written into IEC 60950 — and carried forward in IEC 62368-1 and the transformer-specific IEC 61558 — asks for a defined, verifiable separation between hazardous voltage circuits and user-accessible ones. Traditionally that separation was assembled: margin tape at both ends of the bobbin, two or three layers of polyester film between primary and secondary, and a construction that consumed winding window before a single turn of copper was placed. Each tape interface also introduced a potential source of moisture ingress, wrinkles and inconsistent thickness.

Triple insulated wire changes where the safety function sits. Because the three extruded layers together satisfy the reinforced insulation requirement, interlayer tape and creepage margins can be reduced or removed, allowing primary and secondary windings to sit closer together. The practical consequences are measurable rather than abstract: better coupling, lower leakage inductance, smaller cores for the same throughput, and a more repeatable build because insulation thickness no longer depends on how tightly an operator wrapped a film. In flyback and LLC designs running above 100 kHz, that closer coupling also reduces the ringing and switching loss that come from a loose primary-secondary interface.

Triple Co-Extrusion and the Interface Between Enamel and Fluoropolymer

The engineering difficulty is not the existence of three layers but their behaviour as one body. RVYUAN forms the litz bundle first, twisting fine enamelled strands to a defined pitch, and then applies the insulation by triple co-extrusion over the completed bundle. Extruding over a stranded, non-circular surface is harder than extruding over a solid round wire, so concentricity is monitored on the line: eccentric wall thickness would leave the thinnest point defining the dielectric strength of the whole construction, regardless of how generous the average wall appears.

The layer sequence — a polyester base coat, a polyesterimide intermediate layer, and an outer jacket of PTFE or ETFE — is chosen for interface compatibility as much as for individual properties. The fluoropolymer jacket supplies chemical resistance, moisture protection and abrasion resistance during handling; the intermediate enamel-type layer supplies adhesion and dielectric depth.

Where the two meet, thermal fusion during extrusion matters more than any single layer thickness, because a poorly bonded interface tends to reveal itself only later, as delamination or layer creep when the wire is pulled at speed through a tensioner and around a bobbin flange. Controlling that fusion is why the TIW triple insulated litz wires solutions offered by Tianjin Ruiyuan Electric Material Co., Ltd. hold their toughness and flexibility at thermal Class 155, rather than becoming brittle at the point where mechanical stress is highest.

UL Insulation System Certification: Evidence Instead of Assumption

A single component certificate confirms that a wire type was tested. An insulation system certification

confirms that a wire, together with the varnishes, insulting films, and bobbin materials used alongside it, behaves as a system over time. RVYUAN pursues the second route: its triple insulated litz wires are covered by UL insulation system recognition supported by continuous ageing, including 5,000-hour thermal ageing and periodic retesting, so that the thermal endurance claim rests on documented degradation data rather than on a one-off dielectric snapshot.

That documentation is reinforced by RoHS compliance and by conformity with the transformer safety requirements of IEC 61558, which matters for customers exporting finished power supplies into markets where the certification file, not the sample, is what an inspector reads. Batch-level traceability follows the same reasoning: production records, insulation thickness data and breakdown voltage results are retained per lot, so a question raised in a customer's own safety audit can be traced back to a specific run instead of a general specification sheet.

Multi-Strand Litz TIW and Winding Safety Margin

High-frequency loss and safety separation are usually treated as separate problems. A multi-strand TIW construction addresses both in one conductor. Subdividing the cross-section into fine strands limits skin and proximity effect losses, keeping AC resistance and winding temperature down at frequencies where a solid conductor of equal area would waste power in its own interior. At the same time, the triple extrusion means no additional inter-turn insulation is required, which removes a whole category of assembly-related failure — displaced tape, cut film edges, and the micro-shorts that appear between adjacent turns after thermal cycling.

Automatic winding equipment adds another requirement. Surface behaviour has to be consistent, or tension control drifts and the outer jacket scuffs. RVYUAN specifies a static friction coefficient of no more than 0.155 for these constructions, which supports stable payoff on high-speed machines and reduces jacket damage at guide nozzles and flange corners. For designs limited by window area, profiled and rectangular litz variants from the same production base raise the copper fill factor further, and Tianjin Ruiyuan Electric Material Co., Ltd. supplies these alongside enamelled, self-bonding and servo motor wire families, so a transformer, inductor and motor programme can be sourced against one set of process controls.

A Practical Position: Safety First

Component-level compliance has quietly become part of electrical design rather than a step that follows it. Insulation that is extruded, tested as a system and traceable by lot removes assumptions from a transformer's safety case, and it does so without forcing designers to give up window space or high-frequency performance. That is the position RVYUAN occupies with its TIW triple insulated litz wires: a safety-approved conductor engineered for the winding process it will actually meet.

Engineers evaluating professional TIW triple insulated litz wires solutions for a specific isolation, thermal class or fill-factor target can request technical data, samples and certification documents from Tianjin Ruiyuan Electric Material Co., Ltd. at https://www.rvyuan.com/



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