

X-ray Cable Structure & Material Analysis

This guide aims to help technicians, engineers, and customers understand the structure of high tension cable in x ray tube. These cables are widely used in medical X-ray systems such as DR, CT, fluoroscopy, and C-arm devices. We analyze each layer's function and material from both technical and X-ray system perspectives to explain why these materials are ideal for high-voltage imaging environments.

1 Conductor

Function: Conduct high-voltage anode voltage and filament current.

Material: Stranded tinned copper + ETFE insulation.

ETFE provides excellent dielectric strength and heat resistance ($>150^{\circ}\text{C}$), crucial for high-temperature X-ray tube environments.

Challenge: Hard insulation; thickness control is critical to avoid partial discharge.

2 Bare Ground Conductor (Drainwire)

Function: Provide ground connection for shielding.

Material: Stranded tinned copper.

Advantage: Safe discharge path in case of insulation failure; protects X-ray control circuits.

3 Filler Material

Function: Maintain cable roundness and flexibility.

Note: Essential for dynamic applications like C-arm systems where repeated motion occurs.

4 Semi-conductive Layers (Inner & Outer)

Function: Smooth electrical field and prevent corona discharge.

Material: Carbon-loaded rubber or semiconductive polymers.

Advantage: Stabilizes high-voltage field in X-ray pulses; reduces risk of localized electrical stress.

5 Main Insulation Layer

Function: Withstand 75kVDC operating voltage.

Material: EPDM rubber.

Advantage: Ozone-resistant, heat-resistant, long lifespan.

Ideal for X-ray tubes that generate ozone during prolonged discharge.

6 Outer Shielding Layer (Braided)

Function: Shield EMI, discharge static, and block RF leakage.

Material: Braided tinned copper (95% coverage).

Protects sensitive image detectors and prevents noise/artefacts in X-ray images.

7 Outer Jacket

Function: Provide mechanical, oil, and chemical protection.

Material: PVC or PUR.

PVC for fixed systems; PUR for mobile X-ray systems needing frequent bending.