



CASE STUDY: ELECTRICAL ISOLATION FOR A PRECISION SURGICAL ABLATION DEVICE

Challenge

A medical device manufacturer was developing an advanced ablation device designed to access small, complex joints such as the ankle and wrist. These anatomical areas present significant design challenges due to their tight geometry and proximity to sensitive nerves and surrounding tissue. The device required:

- Reliable electrical isolation to protect adjacent nerves
- A thin, flexible profile capable of navigating tight joint spaces
- The ability to move around obstructions without compromising structural integrity
- Precise dimensional control to ensure consistent performance at the distal tip

Achieving high dielectric strength while maintaining flexibility and ultra-thin wall construction was critical to the success of the device.

Solution

TE Medical partnered with the customer to engineer a thin-wall polymer solution that balanced electrical performance, flexibility, and manufacturability. Key elements of the solution included:

- Ultra-thin wall extrusion with tight tolerances on both wall thickness and inner diameter (ID)
- Material selection optimized for flexibility, enabling smooth navigation within confined joint spaces
- Superior dielectric properties to support a smaller device tip while maintaining safe electrical isolation
- Low coefficient of friction, improving maneuverability and minimizing tissue interaction

Two material platforms were selected based on performance requirements:

- MT-PBX (Pebax-based solution)
- MT-2000 (HDPE-based solution)

Both materials provided the necessary mechanical recovery and electrical performance to withstand installation stresses while maintaining dimensional stability.

Results

The final solution delivered strong electrical isolation performance without sacrificing flexibility or recoverability.

MT-PBX (Pebax-based):

- Dielectric strength: 800 volts/mil
- Installed thickness: 3/1000 in., recovering to 4/1000 in.

MT-2000 (HDPE-based):

- Dielectric strength: 1000 volts/mil
- Installed thickness: 6/1000 in., recovering to 10/1000 in.

These results enabled the customer to develop a device capable of safely accessing and treating small joints while minimizing the risk of nerve damage and tissue disruption.

Capabilities

TE Medical's polymer extrusion expertise supports demanding surgical applications requiring precision, performance, and speed to market. Core capabilities demonstrated in this project include:

- Thin-wall extrusion for both Pebax (MT-PBX) and HDPE (MT-2000)
- Tight tolerance control on wall thickness and ID
- Materials engineered for flexibility with superior dielectric strength
- Low-friction surfaces to enhance device navigation
- Rapid sample turnaround to accelerate device development

By combining advanced materials science with precision manufacturing, TE Medical helps customers solve complex electrical isolation challenges in next-generation surgical devices.

Conclusion

Designing surgical devices for small joint applications demands a careful balance of flexibility, electrical performance, and dimensional precision. Through advanced thin-wall extrusion and material expertise, TE Medical delivered a polymer solution that enabled safe electrical isolation in highly constrained anatomical environments.

The collaboration resulted in a high-performance ablation device capable of navigating complex joint structures while protecting surrounding nerves and tissue. By combining innovative materials with precise manufacturing capabilities, TE Medical continues to support medical device manufacturers in bringing safer, more effective technologies to market.

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