

Thulium laser Clinical Architecture & Performance Reference Manual: Thulium laser

DEVICE IDENTIFICATION

The Thulium laser (Tm:YAG) platform represents a paradigm shift in dermatological laser surgery, operating at a wavelength of 1940nm or 2010nm. This system is designed as a versatile, high-precision instrument for a broad spectrum of aesthetic and surgical procedures, offering superior hemostasis, rapid ablation, and minimal collateral thermal damage. The device is configured as a turnkey system with integrated smart control architecture for predictable clinical outcomes.



INTERNAL HARDWARE TOPOLOGY

The core of the system is a solid-state Thulium-doped YAG crystal pumped by a high-efficiency laser diode array. This architecture ensures exceptional beam quality and long-term power stability. The optical delivery system utilizes a highly durable articulated arm or premium-grade optical fiber, terminated by a range of specialized handpieces. Internal temperature management is achieved via a closed-loop water-to-air heat exchanger, maintaining optimal operating temperatures for both the laser cavity and the power supply to guarantee energy consistency across extended treatment sessions.

EPIDERMAL PROTECTION MECHANISMS

Patient safety is paramount, addressed through a multi-faceted approach to epidermal protection. The system integrates a dynamic skin cooling mechanism, utilizing a sapphire contact cooling tip with a built-in thermoelectric cooler (TEC) and optional cryogen spray for real-time epidermal temperature reduction. This advanced cooling engine is synchronized with the laser pulse to provide a thermal buffer, effectively isolating the epidermis from the ablative energy. This facilitates higher fluence delivery to the target tissue while minimizing the risk of burns, pigmentary alteration, or scarring, thereby enhancing treatment tolerability and safety across Fitzpatrick skin types I-IV.

TREATMENT ADVANTAGES

The Thulium laser's 1940nm/2010nm wavelength is highly absorbed by water, making it an ideal tool for precise tissue vaporization and coagulation. Clinical advantages include:

- Superior hemostasis and bloodless surgical field due to efficient water absorption and collagen contraction.
- Exceptional precision for focal, fractional, or scanning modes.
- Reduced downtime compared to traditional ablative lasers.
- Enhanced patient comfort due to superior cooling integration.
- Versatility in treating both superficial and deeper dermal targets.

SPECIFICATION MATRIX

TECHNICAL SPECIFICATIONS

Parameter	Specification
Laser Type / Wavelength	Thulium (Tm:YAG) / 1940nm (± 10nm)
Operation Mode	Pulsed (Ablative, Fractional, Coagulation)
Maximum Output Power	≥ 30W (User selectable)

Pulse Energy	Up to 2.5 J per pulse
Spot Size (Handpiece)	0.5mm - 5.0mm (Continuous, adjustable)
Cooling System	Integrated Sapphire Contact Cooling + Forced Air + Active Water Chiller

REGULATORY COMPLIANCE

The Thulium laser system is manufactured in full compliance with ISO 13485:2016 standards for medical device quality management and is designed to meet the rigorous requirements of the Medical Device Regulation (MDR) (EU) 2017/745 and FDA 21 CFR Part 1040.10/1040.11. The device holds CE marking as a Class IIb medical device and is compliant with the latest IEC 60601 series standards for medical electrical equipment, ensuring maximum safety for both the operator and the patient.

