

Thulium Laser Machine - Official Clinical Overview & Datasheet

EXECUTIVE SUMMARY

The Thulium laser machine represents a paradigm shift in dermatological and aesthetic medicine, offering a uniquely precise, minimally ablative, and virtually painless solution for soft tissue resurfacing, rejuvenation, and selective photothermolysis. Clinically positioned between ablative CO₂ and non-ablative erbium lasers, the 1927nm or 1940nm wavelength delivers peak water absorption with a superficial zone of thermal injury (ZTI) of less than 100µm, enabling rapid epithelial healing with significantly reduced downtime and post-inflammatory hyperpigmentation (PIH) risk. This device is engineered exclusively for high-volume medical spas, dermatology clinics, and plastic surgery centers seeking to expand their revenue stream with a high patient-acceptance, low-pain profile procedure.

The primary value proposition revolves around "painless precision" and superior return on investment (ROI). By leveraging proprietary diffuse optical stacking technology and an advanced contact cooling sapphire tip, the Thulium laser achieves clinical efficacy for melasma, epidermal dyschromia, fine lines, and active acne without the need for topical anesthesia in most patients. Its low consumable cost and extended diode lifespan (over 10 million pulses) translate to a sub-12-month ROI cycle for a full-time clinical operator, making it the most

financially prudent capital equipment acquisition for practices prioritizing patient comfort and compliance.



CLINICAL ARCHITECTURE & DESIGN

The Thulium laser machine features a closed-loop, hermetically sealed laser cavity housing imported ceramic-core Thulium-doped fiber optic bars operating at a true continuous-wave (CW) or quasi-CW pulsed mode. Unlike traditional diode stacks, the Thulium medium exhibits negligible thermal lensing, ensuring consistent beam profile flatness (top-hat beam shape) across a 12.5mm x 12.5mm scanning area. The optical delivery system utilizes 200 μ m core silica fibers with anti-reflective (AR) coated SMA-905 connectors, transmitting up to 98% of generated energy to the handpiece with zero focal shift.

For epidermal integrity preservation, the system integrates a four-stage active cooling cascade: (1) Dual TEC (Thermoelectric Cooler) peltier elements chilling the sapphire window to 0°C to 4°C; (2) Sealed water-to-air heat exchanger with a variable-speed centrifugal pump (flow rate 1.2 L/min); (3) Three high-CFM radial fans for dissipating residual heat from the power supply; (4) Real-time skin impedance monitoring that modulates fluence if contact temperature deviates beyond $\pm 1^\circ\text{C}$. The user interface is a 15.6-inch capacitive medical-grade touchscreen with a proprietary AI-based treatment guidance system that dynamically adjusts pulse energy and stacking density based on scanned skin phototype (Fitzpatrick I-VI).

KEY INDICATIONS & CAPABILITIES

- Fractional Melasma & Pigmentation Clearance: Employs low-fluence (5-10 J/cm²), high-density (30-40% coverage) microbeam array to disrupt dermal melanin deposits without triggering reactive hyperpigmentation, clinically validated for Fitzpatrick IV-VI melasma subtypes.
- Acne & Sebaceous Gland Regulation: 1940nm wavelength targets water within sebaceous glands, inducing selective photothermolysis of hypertrophic sebocytes. A double-blind study showed a 67% reduction in inflammatory lesions after 3 bi-weekly sessions with zero purging.
- Smart Painless Resurfacing & Textural Refinement: Proprietary "CoolSync"

algorithm synchronizes laser pulse delivery with the skin's thermal relaxation time (TRT ~3ms), eliminating the sharp "prickling" sensation. Patients uniformly report a comparably warm massage-like experience (VAS score 1–2 out of 10).

- Low-Downtime Epidermal Remodeling: Micro-ablative channels (80-120µm depth) initiate wound healing cascade without full epidermis denudation. Erythema resolves within 2-4 hours, and visible skin flaking occurs between days 3-5, enabling "lunch-hour" procedures.

- Broad-Area & Spot-Specific Handpieces: Two clinically interchangeable handpieces – a 15mm x 15mm scanner for full-face rejuvenation (treatment time <8 minutes) and a 1.5mm diameter single-spot tip for periorbital fine lines or isolated actinic keratosis.

COMPLIANCE & STANDARDS

The Thulium laser machine is manufactured in an ISO 13485:2016 certified facility and complies with international medical device regulations. It has received Medical CE Certification (Class IIb, under Directive 93/42/EEC as amended by MDR 2017/745) and is 510(k) cleared by the U.S. Food and Drug Administration (FDA) for soft tissue incision, ablation, vaporization, and coagulation in dermatology. The laser safety system integrates Class 1M engineering controls per IEC 60825-1:2014, including a 5-second beam abort delay upon handpiece lift-off, a key-switch master interlock, and a passive

audible/visual emission indicator. All electrical components are certified to IEC 60601-1 (Medical Electrical Equipment Safety) and IEC 60601-2-22 (Laser Equipment Particular Requirements).

TECHNICAL SPECIFICATIONS

The following parameters define the operational envelope and performance benchmarks for the Thulium laser machine, validated under nominal room temperature ($22^{\circ}\text{C} \pm 2^{\circ}\text{C}$) and 40% relative humidity.

Parameter	Specification
Laser Type / Wavelength	Thulium-doped Fiber Laser / $1927\text{nm} \pm 5\text{nm}$ (or 1940nm selectable)
Operating Mode	Pulsed (Quasi-CW) / Continuous Wave (CW) / Fractional Scanning
Maximum Output Power	20 Watts (CW) / 40 Millijoules per microbeam (Fractional)
Spot Size	Fractional: $200\mu\text{m}$ microbeams; Full-beam: 3mm collimated
Scan Area	$12.5\text{mm} \times 12.5\text{mm}$ (max) with variable density 5% to 40% coverage
Cooling System	TEC + Sapphire Contact Cooling (0°C)

	to 4°C adjustable) + Sealed Water Circulation
Repetition Rate	1 Hz to 200 Hz (pulsed mode) / 500 Hz scanner stepping rate
Pulse Duration	100µs to 5ms (pulsed) / Continuous for CW mode
User Interface	15.6" Capacitive Touchscreen with AI Phototype Analyzer
Power Supply	110-230 VAC, 50/60 Hz, 15A (Standby <50W, Max 1200W)
Dimensions (WxDxH)	450mm x 600mm x 1100mm (console) / Handpiece: 180mm x 35mm
Weight	42 kg (console) / 380g (handpiece with fiber)

