

Laser-Cutting Machine System Requirements Document

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Revision History

Rev	Date	Author	Description
1.0	2026-05-15	Auto	Initial consolidated SRD
1.1	2026-05-20	Auto	Expanded detail, interfaces, flows, diagrams placeholders

1. Purpose

Define detailed system-level requirements, interfaces, flows, and verification basis for an industrial laser cutting machine.

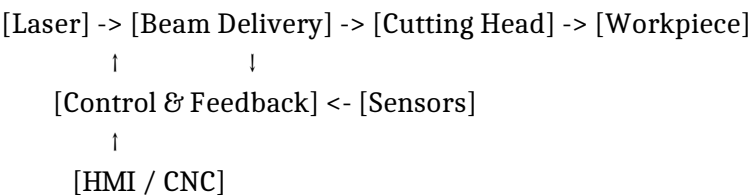
2. Scope

Covers laser/optics, motion, control, electronics, safety, cooling, plate handling, and software subsystems.

3. System Architecture

Top-level blocks: Laser & Optics | Motion System | Plate Handling | Control & Feedback | Electronics | Cooling | Safety | HMI/Software

Block Diagram (placeholder):



4. Performance Requirements

Req ID	Requirement	Value	Verification
PERF-1	Materials	Aluminum, Stainless Steel	Test
PERF-2	Max plate size	2500x1500x15 mm	Inspection
PERF-3	Throughput	≥125 m/hour	Test
PERF-4	Uptime	≥99.5%	Analysis

5. Precision Requirements

Req ID	Thickness Range	Feature Size	Verification
PREC-1	<0.5 mm	≤35 μm	Test
PREC-2	0.5–2 mm	≤80 μm	Test
PREC-3	2–6 mm	≤150 μm	Test
PREC-4	6–15 mm	≤350 μm	Test

6. Laser & Optics

Req ID	Requirement	Value
OPT-1	Laser type	Fiber
OPT-2	Wavelength	1070–1080 nm
OPT-3	Power	≤12 kW
OPT-4	Focus range	≥75 mm
OPT-5	DOF	15 mm

7. Motion System

Req ID	Requirement	Value
MOT-1	Architecture	Gantry
MOT-2	Accuracy	≤±10 μm

MOT-3	Repeatability	$\leq \pm 5 \mu\text{m}$
MOT-4	Speed	$\geq 80 \text{ m/min}$
MOT-5	Acceleration	$\geq 1\text{G}$

8. Plate Handling

Req ID	Requirement	Value
PLT-1	Batch size	$\leq 25 \text{ plates}$
PLT-2	Stack height	$\leq 495 \text{ mm}$
PLT-3	Auto loading	Required

9. Control & Feedback

Req ID	Requirement	Value
CTL-1	CNC	Real-time
CTL-2	Loop rate	$\geq 4 \text{ kHz}$
CTL-3	Adaptive control	Required

10. Interfaces

Interface	Type	Description
Electrical	480VAC	Main power
Cooling	Water	15 L/min
Comm	Ethernet	Control & monitoring
Mechanical	Loader	Plate input

11. System Flows

Material Flow: Load -> Position -> Cut -> Unload

Control Flow: Sensors -> Controller -> Actuators

Calibration Flow: Startup -> Homing -> Power calibration

12. Safety

Req ID	Requirement	Value
SAFE-1	Laser class	Class 1 enclosed
SAFE-2	Interlocks	Required
SAFE-3	Safety level	SIL-2

13. Cooling

Req ID	Requirement	Value
COOL-1	Type	Water
COOL-2	Flow	≥ 15 L/min
COOL-3	Temp	$\leq 74^{\circ}\text{C}$