

CO₂ Laser Processing System “ML3015NX-60CF-R”

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1. Introduction

Laser processing systems are now widely used for large lot productions, creating rapidly increasing demand for a “keep on running” capability while maintaining consistent processing performance. This demand is increasing the need for preventive maintenance technologies that prevent unexpected machine shutdowns as well as technologies that enhance machine reliability.

In response to these market requirements, we have developed the ML3015NX-60CF-R, which is equipped with a 6-kW output laser oscillator (Fig. 1). This machine was developed with the concepts of: (1) High performance (improved processing capability), (2) Keep on running (continuous operation), and (3) Think about less thing (improved operability). Details of each development concept will be described in the following sections.

2. High Performance

2.1 Improvement of cutting speed and processable thickness

Higher-speed cutting of a wide range of work materials has been achieved by the combination of: a new type of CO₂ laser oscillator, the ML60CF-R, which satisfies the requirements for high output for high-speed processing and high beam quality for high-quality proc-

essing; a beam stabilizer that generates uniform beam intensity over the entire processing area; a beam optimizer that controls the beam diameter and focus position to the best conditions for each material to be processed; and a two-dimensional laser processing system, the NX series, equipped with high-speed driving linear motors. About 1.5 times higher productivity is achieved for a wide range of work materials including mild steel (JIS SS400), stainless steel (JIS SUS304), and aluminum alloy (JIS A5052) (compared to Mitsubishi’s ML3015NX-40CF-R). For stainless steel (SUS 304, 1 mm thickness) in particular, the world’s highest speed of 30 m/min is possible.

In addition, laser processing allows a greater cutting thickness by increasing the output of the laser oscillator. The ML3015NX-60CF-R produces a maximum output of 6 kW, enabling a significant increase in cutting thickness compared to conventional laser processing systems. Its nominal processing capacity is 25 mm for mild steel, 15 mm for aluminum alloy, and 25 mm, which is a major increase from 14 mm for the widely marketable non-oxidized cutting of stainless steel.

Figure 2 shows examples of cutting various materials using a 6-kW oscillator.



Fig. 1 ML3015NX-60CF-R

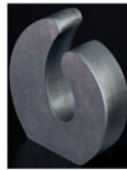
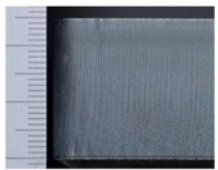

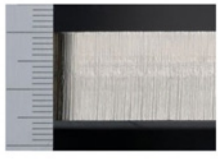

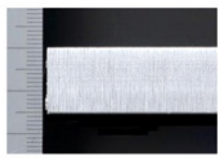
Material	Plate thickness	Cut sample	Cutting surface
Mild steel (SS400)	25mm		
Stainless steel (SUS304)	16mm		
Aluminum alloy (A5052)	15mm		

Fig. 2 Processing ability of the ML3015NX-60CF-R

2.2 Improved quality of cutting surface

The ML60CF-R CO₂ laser oscillator has a new power supply and new control method, which significantly improves the profile of the rectangular wave brilliant high peak pulse, which is a feature of 3-axis cross gas flow, by 50% from the conventional CF series (Fig. 3). In addition, the new system offers high-quality stainless-steel brilliant cut, thanks to an optimal beam path design that makes full use of the beam characteristics; an appropriately designed processing nozzle; and development of processing technology.

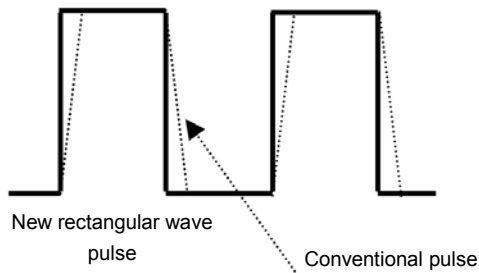


Fig. 3 Rectangular wave high peak pulse by new power supply

Figure 4 shows the roughness Rz of the cutting surface with the conventional method and the brilliant cut. The surface roughness Rz with brilliant cut is reduced to about 40 to 50% compared with the conventional method on both the upper and lower sides. The amount of taper is also reduced to about one-third of that by conventional cutting.

3. Improved “Keep on Running” Performance

The ML60CF-R CO₂ laser oscillator installed with the NX series system improves productivity by a high cooling mirror holder that can mitigate the thermal lens effect and hence generate a uniform beam for a long time, as well as newly developed clean technology that thoroughly eliminates the dust from the oscillator’s inner structural materials to improve the cleanliness by a factor of five in the vacuum zone between optical mir-

rors, thus extending the maintenance interval for optical components. Other technologies for achieving long-term stability include measures for high dust-proofness and high rigidity.

The processing system comes with a pallet changer as standard, and a sheet position detector to compensate the tilt and misalignment when changing the workpiece. These functions extended to the laser cell system in combination with an automatic material feeder enable long-time continuous processing. Even when consecutively processing different kinds of materials, the control unit automatically sets up process conditions based on the database, such as the focus point of the laser beam and the assist gas pressure, allowing continuous operation without manual setups.

In addition, a self-check function has been developed for monitoring the conditions of the mirrors in the oscillator and the sensitivity of the capacitance sensor to indicate the timing at which to replace parts. This function enables the user to develop a maintenance plan in advance and thus reduce machine down-time.

4. Think About Less Thing

The controller comes with a high-speed CPU and a 15-inch large-screen LCD display mounted with a touch-panel. The graphical user interface, tab representation, the use of icons, etc. is standardized among NC related products (Laser Processing Systems, Electrical Discharge Machines, and NC), and the drawing performance for on-screen diagnostic function, etc. is also improved, thus raising operability.

In addition, traditional guidance functions such as trial processing and help functions are enhanced, which makes it easier to change the operating parameters according to the processing conditions and to ensure optimal processing regardless of the operator’s skill level.

The processing strokes are 3,200 × 1,600 mm, which are about 5% greater than the standard dimensions of steel plate, 3,050 × 1,525 mm. These strokes ensure good workability when placing a material and

	Photograph of cutting surface	Surface roughness Rz (μm)	
		Upper surface	Lower surface
Conventional method		18	25
Brilliant cut		8	12

Fig. 4 Cutting surface by brilliant cut

allow the processing of special-size materials such as untrimmed materials, and so reduce the running cost by improving the material yield.

5. Conclusion

The key features and processing capability of the NX series, the latest two-dimensional laser processing system, were described.

As an comprehensive manufacturer of laser processing systems, we will continue to improve system performance and proactively respond to various needs from the production floors including the automotive and electric industries.