



Locomotive Manufacturing

- **Overview**

In recent years, with the transformation of China's railway line and increasing demands of transport capacity, domestic railway locomotives has entered a quick update period. The locomotive purchase reached 100 billion yuan in 2010, and 126 billion yuan in the next year. The market requirements of railway locomotives maintain upward momentum during the whole “Twelfth Five-year Plan” period.

In order to meet the needs of leaping development in locomotive industry, domestic passenger train and urban rail vehicle manufacturing are under overall technical equipment modification and product technology upgrade. Welding is one of the key technologies.

Different from traditional welding technology, laser welding can gather full energy in a small area because of the perfect propagation and focus features. Therefore, laser welding has highly-centralized energy, fast speed, high precision, good quality, small deformation, easy operation and many other advantages. As one of the potential welding methods in the 21st century, laser welding has been successfully used in locomotive manufacturing in recent years.

- **Our Solution**

Comparison of traditional welding methods and laser welding:

Resistance Spot Welding	Electric Arc Welding	Laser Welding
Dents on surface affect appearance; Poor sealing, not suitable for high-speed vehicles; Big deformation.	Big heat input, big deformation and low precision; Low intensity of welding joints (Al alloy), poor shaping; Slow speed, low efficiency.	No weld mark on skin, beautiful car body, small heat input and deformation, high precision, high efficiency; Easy to achieve automation and improve stability; Continuous welding, high intensity and sealing performance.

Laser Welding of Stainless Steel Car Body

Wide use of stainless steel car body:

- The stainless steel car body was first used in the United States and France in the 1930s;
- Kawasaki Heavy Industries of Japan introduced laser welding technology in stainless steel railway



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vehicles so as to improve the efficiency 20%~30%, and reduce costs 20% ~ 30%;

- In July 2003, Changchun railway vehicles Co., Ltd developed the first stainless steel urban rail passenger car;
- Changchun Passenger Car Works, Zhuzhou Electric Locomotive and other units have carried out the preliminary study of laser welding technology in stainless steel car body.



Stainless steel welding is conditioned by two physical properties::

- Big Thermal Expansion

The thermal expansion of stainless steel is 1.5 times of carbon steel, and the deformation is greater than normal steels when at same welding heat.

- Low Thermal Conductivity

The thermal conductivity stainless steel is one-third of carbon steel, which causes much heat accumulation in welding area.



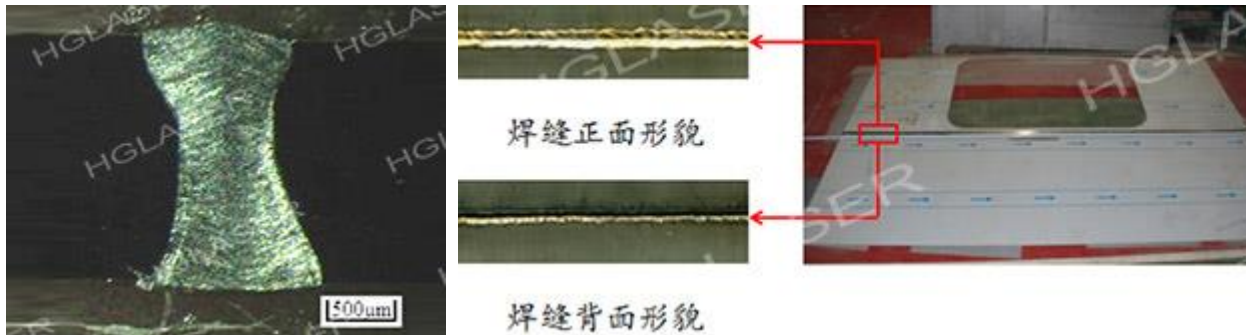
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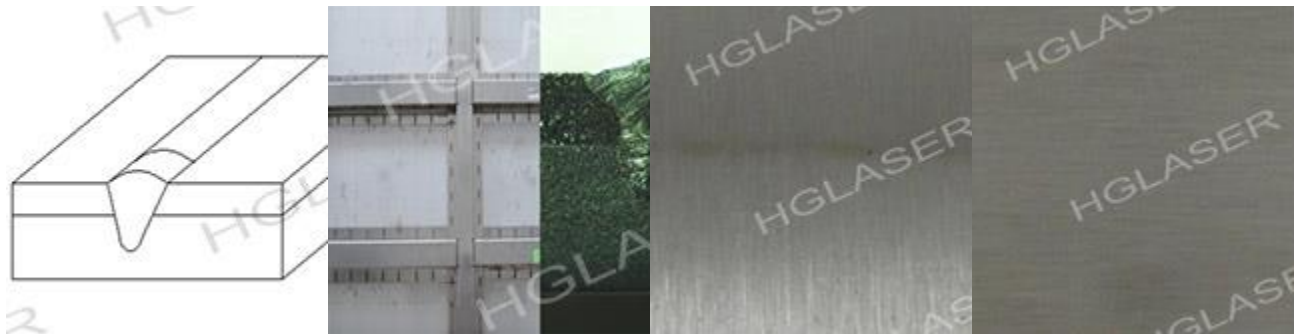
As the leader of laser industry, HGLASER aims to promote the application of different laser devices and provide the full range of solutions.

Butt Welding:

Butt Welding



Overlap Welding



Obvious imprint,
almost no oxidation

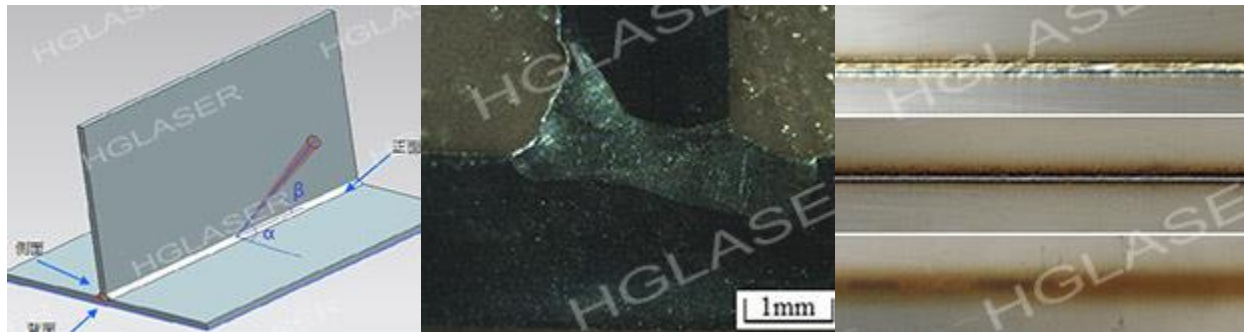
no imprint, no
oxidation

Fillet Welding



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Joint Welding



Skin joint

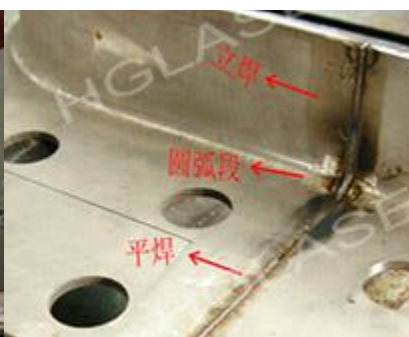


Skin joint

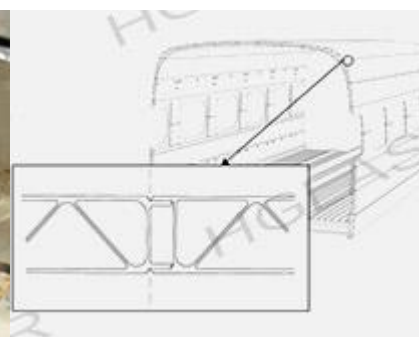
Doorframe 3D Splicing



Laser MIG Hybrid Welding of Aluminum Alloy Car



Laser MIG Hybrid Welding of Aluminum Alloy Car Body





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Body

Two welding methods comparison of high-speed train aluminum alloy body

Friction Stir Welding	Laser-MIG
Heavier structure because of the stirring head pressure	Faster welding speed and lighter structure

Laser-Arc Hybrid Welding

- High adaptability: Help to reduce the sensitivity, improve welding appearance, reduce air holes and the control of metallurgical crack;

- High efficiency: The auxiliary heating of electric arc can improve laser welding speed;

- Bigger penetration: Achieve bigger single pass welding penetration;

- **Customer Benefit**

With laser technology, customers will benefit much:

- Fast cutting speed improves production efficiency greatly;

- Smooth and beautiful welding joints, high intensity and toughness improve product quality;

- Some simple treatments or even no treatment after welding can reduce the labor intensity;

- No-contact processing, adjustable high-power laser beam energy and moving speed can realize various processing;

- Without tool wear, the operating and material costs are reduced;

- High reliability and strong stability can meet the demand of mass industrial production.



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- Related Application



Sheet Plate Online Welding



YAG—MIG Hybrid Welding Laser Welding



Metal

Tube

Welding