

Application of Nitrogen in Laser Cutting



Control the water pressure of the focusing mirror (generally metal reflection focusing system). If the size of the beam before focusing becomes smaller and the focal spot diameter becomes larger, automatic control of water pressure to change the focus curvature so that the focal spot diameter becomes smaller. (4) flight light path cutting machine to increase the x, y direction of the compensation light path system. That is, when cutting the distal light range increases so that the compensation light path shorten; conversely, when cutting the proximal light range decreases, so that the compensation light path increases to maintain the same length of light range.

2. Cutting perforation technology.

Any kind of thermal cutting technology, in addition to a few cases can start from the edge of the board, generally must be perforated in a small hole in the board. Earlier in the laser stamping compound machine is used to punch a hole first, and then use the laser to cut

from a small hole. For laser cutting machines without punching equipment there are two basic methods of perforation.

(1) Blast drilling: (Blast drilling)

The material is irradiated by uninterrupted laser light to form a crater in the center, and then the oxygen flow coaxial to the laser beam quickly removes the molten material to form a hole. The general hole size is related to the thickness of the plate, the average diameter of the blast perforation is half of the plate thickness, so for thicker plates blast perforation hole diameter is larger, and not round, should not be used in the higher requirements of the parts (such as oil sieve tube), can only be used for scrap. In addition, because the oxygen pressure used for perforation is the same as when cutting, the spatter is larger.

(2) Pulse drilling

Using high peak power pulse laser to melt or vaporize a small amount of material, commonly used air or nitrogen as an auxiliary gas to reduce the expansion of the hole due to exothermic oxidation, the gas pressure is smaller than the oxygen pressure when cutting. Each pulse of the laser produces only small jets of particles that penetrate gradually, so the perforation time for thick plates takes a few seconds. Once the piercing is complete, the auxiliary gas is immediately switched to oxygen for cutting. This results in a smaller perforation diameter and better perforation quality than blast perforation. The laser used for this purpose should not only have a high output power; more importantly, the time and space characteristics of the beam, so a general cross-flow CO₂ laser cannot be adapted to the requirements of laser cutting. In addition, pulse perforation also requires a more reliable gas control system to realize the gas type, gas pressure switching and perforation time control.

In the case of pulsed perforation, the transition from pulsed perforation of the workpiece at rest to uninterrupted cutting at the same speed as the workpiece should be taken seriously in order to obtain a high quality kerf. Theoretically it is usually possible to change

the cutting conditions in the acceleration section: such as focal length, nozzle position, gas pressure, etc., but in practice it is not possible to change the above conditions because the time is too short. In industrial production is mainly used to change the average power of the laser approach is more realistic, the specific methods are the following three.

(1) change the pulse width; (2) change the pulse frequency; (3) change the pulse width and frequency at the same time. Practical results show that the first (3) the best results.

3. Nozzle design and airflow control technology.

When laser cutting steel, oxygen and focused laser beam is shot through the nozzle to the material being cut, thus forming an airflow beam. The basic requirement for airflow is to enter the incision of the gas flow rate to be large, high speed, so that enough oxidation to make the incision of the material to fully exothermic reaction; and at the same time there is enough momentum to molten material jet blown out. Therefore, in addition to the quality of the beam and its control directly affect the quality of the cut, the design of the nozzle and airflow control (such as nozzle pressure, the workpiece in the airflow position, etc.) is also a very important factor.

The current nozzle for laser cutting uses a simple structure, that is, a conical hole with a small round hole at the end (see figure). Usually designed using experimental and error methods. As the nozzle is generally made of purple copper, small size, is a wearable part, need to be replaced frequently, so no hydrodynamic calculations and analysis. In use from the side of the nozzle into a certain pressure P_n (gauge pressure of P_g) of gas, called nozzle pressure, from the nozzle outlet, after a certain distance to the surface of the workpiece, the pressure called cutting pressure P_c , and finally the gas expansion to atmospheric pressure P_a . Research work shows that as P_n increases, the airflow rate increases, P_c also increasing. It can be calculated by the following formula.

$$V=8.2d^2(P_g+1)$$

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