

## Q019 Please explain plasma cutting and gas cutting.

**Q.** Why is it possible to cut mild steel by oxygen and propane (acetylene, hereinafter gas cutting) but not stainless steel?

**A.** Gas cutting, which is widely used in industry today, is the best cutting method. Why, then, can such hard iron be cut so easily?

Think of iron exposed to wind and rain for a long time. Red rusted iron should come to the mind of many people. As you can see, this phenomenon is caused by the oxidation of iron reacting with oxygen in the atmosphere.

When this oxidation reaction is intensified, iron oxidizes and starts to burn. Gas cutting utilizes this phenomenon.

Plasma cutting, on the other hand, utilizes the thermal energy of the plasma arc. Its thermal energy is said to be about 20,000 degrees Celsius, and it can melt any metal in an instant.

As described above, gas cutting is an oxidation reaction cutting method using oxygen gas, and plasma cutting is a fusion cutting method using high energy. The cutting principle is different for each method.

When gas cutting is applied to rust-resistant (oxidation-resistant) stainless steel, it cannot be cut because the oxidation reaction cannot be used (Fig. 1), but it can be cut by plasma cutting.

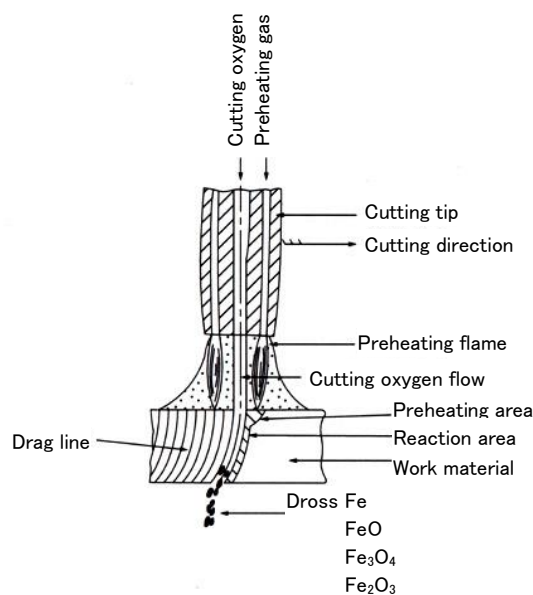


Fig. 1

**Q.** What are the types and coverage of plasma cutting machines?

**A.**

● **Oxygen plasma cutting machine**

Cutting method using oxygen gas as plasma gas. It is used for high-speed automatic cutting of carbon steel because plasma arc energy and combustion energy generated by oxidation reaction are combined. NC controlled automatic cutting is used in shipyards and steel bridge manufacturers throughout Japan.

● **Argon and hydrogen plasma cutting machine**

This is the most excellent plasma cutting machine for cutting stainless steel and non-ferrous metals, using a mixture of plasma gas, argon gas, and hydrogen gas (nitrogen gas if necessary). It demonstrates excellent performance especially for cutting stainless steel. Hydrogen gas used as plasma gas is known as reducing gas, and this reducing effect gives the cutting surface a beautiful metallic luster.

● **Nitrogen plasma cutting machine**

This is the oldest plasma cutting machine that uses nitrogen gas as plasma gas. Before the introduction of oxygen plasma cutting machines, they were widely used in shipyards. However, nitrogen gas used as plasma gas is a source of NO<sub>x</sub>, and these cutting machines are disappearing due to severe restrictions on the working environment in recent years.

It can be applied to a wide range of steel grades, regardless of ferrous or non-ferrous materials.

However, the nitriding of the cut surface tends to cause defects in the welding process, which is also a reason of disuse.

● **Air plasma cutting machine**

A plasma cutting machine that uses inexhaustible atmosphere as plasma gas. Although it is the newest technology, it is becoming synonymous with plasma cutting machines. Small machines with a current of 150 A or less are the mainstream, and most of them employ manual cutting. (Fig. 2)

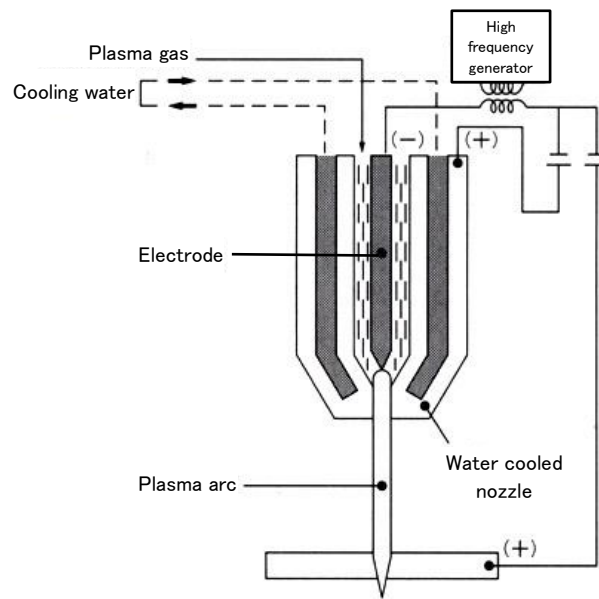


Fig. 2

**Q.** What is the cutting thickness of the plasma cutting machine?

**A.** At present, even with the best plasma cutting technology, cutting a plate thickness of 150 mm is the limit. This is made possible by arranging the argon/hydrogen plasma cutting machine NW-300ACG in parallel at 600 A.