→ Product Brochure

THE LINDE GROUP

Shielding gas.

Gases for all types of stainless steel.

Stainless steel is usually defined as an iron-chromium alloy, containing at least 11 % chromium. Often containing other elements such as silicon, manganese, nickel, molybdenum, titanium and niobium, it is most widely used as corrosion resistant engineering material and it is used in applications where aggressive environments or elevated temperatures are prevalent.

Stainless steel is traditionally categorised into four main groups and each group is further sub-divided into specific alloys. The main groups are: austenitic, ferritic, martensitic and duplex.

- Austenitic stainless steels are the most widely used group, accounting for around 70 % of all stainless steels fabricated. They are used in applications such as chemical processing, pharmaceutical manufacturing, food processing & brewing and liquid gas storage. The weldability of these grades is usually very good.

- Ferritic stainless steels are not as corrosion resistant or as weldable as austenitic stainless steels. They have high strength and good high temperature properties and are used for products such as exhausts, catalytic converters, air ducting systems, and storage hoppers.

- Martensitic stainless steels are high strength but are more difficult to weld than other types of stainless steels. They are used for products such as vehicle chassis, railway wagons, mineral handling equipment and paper and pulping equipment.

- Duplex stainless steels combine the high strength of ferritic steels and the resistance of austenitic steels. They are used in corrosive environments such as offshore and petrochemical plants, where the integrity of the welded material is critical.

Perfect complements for MAG welding.

Gases for all types of stainless steels

	Welding speed	Spatter control	Reduced surface oxide	Porosity control	Fusion	Penetration	Ease of use	Thickness range (mm)
CRONIGON 2	●	●●	●●	●●	●●	●	●●	1 to 6
CRONIGON 2He38	●●	●●●	●●●	●●●	●●●	●●●	●●●	3 to 15+
CRONIGON 2He55	●●●	●●●	●●●	●●●	●●●	●●●	●●	1 to 12

The greater the number of dots, the better the gas performs.

MAG welding using solid wire with argon or argon/helium mixtures is an important process for joining stainless steels. These gases also contain small amounts of an oxidising gas such as carbon dioxide to stabilise the arc. Carbon pick up can be a problem, and this limits the amount of carbon dioxide that can be used. For low carbon ("L")-grade stainless steels this is limited to about 3 % but for other grades up to 5 % can be used.

CRONIGON 2

A mixture of argon and 2.5 % carbon dioxide is a general purpose gas mixture for MAG welding stainless steels. The mixture produces a smooth weld with little or no spatter and with low surface oxidation, it reduces the need to use aggressive chemical cleaning agents after welding, avoiding a costly and time consuming process.

The gas performs in a similar way to gas mixtures used for welding steel, so for users unfamiliar with welding stainless steel this can be a good mixture to begin with.

This mixture is best suited to welding stainless steels below 6 mm in thickness as it can begin to exhibit fusion and penetration problems in thicker materials.

Some carbon pick up in the weld may occur, but levels in the weld metal should not exceed those required for low carbon grades.

CRONIGON 2He38

This three component shielding gas containing argon, helium and carbon dioxide it is best suited for spray and pulse welding on thicker materials. The welds produced have good fusion, low reinforcement and porosity levels. This produces welds of the highest quality virtually eliminating the need for rework or repair.

The welds also have good surface appearance with low surface oxidation and excellent corrosion resistance. Reducing the need for aggressive chemical cleaning agents, and minimizing cleaning times keeping costs to a minimum.

CRONIGON 2He38 is ideal for manual, mechanised and robotic welding. The addition of helium into the gas means that welding speeds are much higher than with CRONIGON 2, leading to significant improvements in productivity. High welding speeds also have the advantage of keeping distortion low, avoiding the need for costly rectification procedures.

CRONIGON 2He55

This argon, helium and carbon dioxide mixture produces welds with very good low temperature toughness values, excellent corrosion resistance combined with good penetration as well as low levels of porosity. This makes this mixture ideal for applications where weld quality is paramount and the cost of weld failure is high.

This mixture is suitable for welding a wide range of material thicknesses with excellent penetration and fusion properties, even on the thickest materials or in multi-pass welds.

The welding speeds achievable with this mixture are much higher than with CRONIGON 2 and this can improve productivity and lower the production cost per component.

CRONIGON 2He55 operates well in all transfer modes: dip, pulse and spray, producing welds with very low surface oxidation and a very regular bead shape, reducing the need for post weld dressing and aggressive cleaning, again reducing the cost of manufacture.

Benefits for flux and metal cored welding.

Gases for all types of stainless steels

	Welding speed	Spatter control	Porosity control	Fusion	Penetration	Ease of use	Thickness range (mm)
Carbon dioxide	●●	●	●●	●●●	●●●	●●	0 to > 25
CORGON 25	●●	●●	●●●	●●	●●●	●●●	0 to > 25
CRONIGON 2	●●	●●	●●	●●	●●	●●●	0 to > 25

The greater the number of dots, the better the gas performs.

Flux cored arc welding of stainless steels is becoming increasingly popular as high quality tubular wires become available. As with steel cored wires, check the wire manufacturer recommendations when deciding which shielding gases are suitable.

Carbon dioxide

Stainless steel flux cored wires are often developed for use with carbon dioxide because it is often seen as a low cost product. Carbon dioxide gives good fusion and penetration characteristics, even in positional work.

However, it produces a less stable welding arc, which increases the amount of spatter and particulate fume generated. This can lead to an increase in the cost of post weld cleaning.

CORGON 25

When mixed gases are recommended for use with flux cored wires, CORGON 25 gives lower particulate fume and spatter levels than pure carbon dioxide. These lower fume levels can improve the workplace environment, as well as improve the well being of the workforce.

CRONIGON 2

CRONIGON 2 is recommended by some wire manufacturers for use with metal cored products, as its lower oxidation potential gives welds with lower surface oxide making them easier to clean, lowering the cost and shortening the production process.

The right gas mixtures for TIG and plasma welding.

TIG welding is one of the most popular processes for welding stainless steels where high quality welds with good surface finish are very important. Plasma welding is less commonly used although it produces high quality welds especially if a key hole technique is used.

There is a greater number of shielding gas mixtures that can be used for TIG welding stainless steel than for steel, but not all gas mixtures are suitable for all material types, i.e. hydrogen containing mixtures are suitable for welding only austenitic types and nitrogen containing mixtures for duplex types of stainless steel.

Argon 4.6

Argon is the simplest gas for TIG welding stainless steels and nickel alloys. It produces a stable welding arc and is suitable for all grades of stainless steel. However, as the thickness of the material increases, fusion and porosity problems can arise, due to the arc being more viscous and more difficult to manipulate.

Argon can also be used as a purging gas should this be required.

VARIGON H2

This two component argon and hydrogen mixture is the preferred gas mixture for manual TIG welding of austenitic grades of stainless steels.

The addition of hydrogen to the shielding gas helps to scavenge oxygen close to the weld pool giving a very clean weld surface, minimising the need for any post weld cleaning. This can be a significant cost saving especially if chemical cleaning agents were previously required. It also helps to speed up the manufacturing process by removing one task.

VARIGON H2 produces a more fluid weld pool which not only increases the welding speed but also makes it easier for the welder to manipulate the weld pool, giving a neater, more consistent weld appearance. Increasing the welding speed reduces the time to manufacture a component, making it cheaper to produce.

By making it easier for the welder to use, it reduces the risk of welding defects such as porosity and fusion problems. With high value raw materials such as stainless steel, the scrapping or repairing of welding defects can be a significant cost and must be avoided.

The addition of hydrogen to argon has the benefit of reducing the amount of ozone generated when welding. This is achieved by the chemical reaction between ozone and hydrogen. The lower the ozone levels when welding, the less the hygienic burden on the welder.

VARIGON H5

This gas mixture has a higher hydrogen content than VARIGON H2 and is most commonly used for welding thicker sections. Although it can be used manually, it is best suited to automatic and orbital TIG welding of austenitic stainless steels.

VARIGON H5 has a much more fluid weld pool, which can be used to increase the welding speed. This is particularly useful in automatic welding applications where the maximum speed the gas is capable of delivering can be achieved. Higher welding speeds will reduce the weld cost for any component produced.

In addition to increasing the welding speed, the more fluid weld pool also gives good weld penetration and fusion. These characteristics ensure that low defect levels occur, reducing weld repair and scrapping costs.

VARIGON H10

This argon and hydrogen mixture is used primarily for plasma welding and automatic TIG welding of austenitic stainless steels.

The fluid weld pool makes this mixture ideal for key hole plasma welding. It can weld thicker materials with high welding speeds and high production rates, but careful control of the welding process is required to reduce the chance of losing the weld pool.

VARIGON H10 can also be used for automatic TIG welding where speed is a priority, as it helps to control distortion. Fusion and penetration levels are increased, which is useful when welding thicker materials but can be a problem for thinner sections. These features will help reduce defect levels and scrapping costs.

VARIGON N2.5

This mixture of argon and nitrogen is specifically designed for welding duplex stainless steels.

The nitrogen in the gas mixture helps to balance the weld metal microstructure improving the in-service corrosion performance, particularly pitting corrosion resistance. As duplex stainless steels are used for their good corrosion resistance, a shielding gas which can improve this property will help maintain the design life of a component, reducing scrapping rates and additional costs.

Gases for all types of stainless steels

	Types of stainless steel suitable	Welding speed	Porosity control	Fusion	Penetration	Ease of use	Thickness range (mm)
Argon 4.6	all	●	●	●●	●	●●	0 to 3
VARIGON H2	austenitic	●●	●●●	●●●	●●	●●●	0 to 10
VARIGON H5	austenitic	●●●	●●●	●●●	●●●	●●	1 to 10+
VARIGON H10	austenitic	●●●	●●●	●●●	●●●	●	6 to 10+
VARIGON N2.5	duplex	●●	●●	●●	●●	●●	0 to 10
VARIGON He30	all	●●●	●●●	●●●	●●●	●●	0 to 10

The greater the number of dots, the better the gas performs.

VARIGON He30

This argon and helium gas mixture is suitable for TIG welding all grades of stainless steel.

The addition of helium to argon increases the available energy to the weld pool making it more fluid. This in turn increases the penetration profile and weld fusion characteristics. Both these features will help reduce defect levels, reducing scrapping rates and rework, both of which are expensive and must be carefully controlled.

Welding speeds are also higher than with pure argon and this helps reduce production costs and improve productivity.

Getting ahead through innovation.

With its innovative concepts, Linde is playing a pioneering role in the global market. As a technology leader, it is our task to constantly raise the bar. Traditionally driven by entrepreneurship, we are working steadily on new high-quality products and innovative processes.

Linde offers more. We create added value, clearly discernible competitive advantages, and greater profitability. Each concept is tailored specifically to meet our customers' requirements – offering standardised as well as customised solutions. This applies to all industries and all companies regardless of their size.

If you want to keep pace with tomorrow's competition, you need a partner by your side for whom top quality, process optimisation, and enhanced productivity are part of daily business. However, we define partnership not merely as being there for you but being with you. After all, joint activities form the core of commercial success.

Linde – ideas become solutions.

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