BOC
A Member of The Linde Group

Shielding gas.

Gases for all types of stainless steel.


Argon

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 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, accounting for around 70% of all stainless steels fabricated. They are used in applications such as chemical processing, pharmaceutical manufacturing, food processing and 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 MAG welding of stainless steels

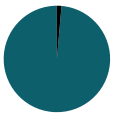
	Thickness range	Penetration	Spatter control	Welding speed	Fillet shape	Finish
STAINSHIELD®	1 to 8 mm	✶✶✶	✶✶✶	✶✶✶	✶✶✶	✶✶✶
STAINSHIELD® Light	1 to 8 mm	✶✶✶	✶✶✶	✶✶✶	✶✶✶	✶✶✶
STAINSHIELD® Heavy	1 to 13 mm	✶✶✶	✶✶✶	✶✶✶	✶✶✶	✶✶✶
STAINSHIELD® 66	1 to 6 mm	✶✶✶	✶✶✶	✶✶✶	✶✶✶	✶✶✶
STAINSHIELD® 69	1 to 13 mm	✶✶✶	✶✶✶	✶✶✶	✶✶✶	✶✶✶

The greater the number of stars, 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.

STAINSHIELD®

Gas code 075
Components: 1.5% oxygen, balance argon

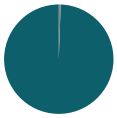


This 2 component gas mixture is used in applications for railway rolling stock, process equipment tanks and agriculture work.

Welding with STAINSHIELD® improves productivity due to faster welding speeds. Using this mixture also results in lower distortion levels and clean weld appearance with great corrosion resistance. These benefits result in STAINSHIELD® in having greater welder appeal.

STAINSHIELD® Light

Gas code 119
Components: 2.5% carbon dioxide, balance argon



This 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.

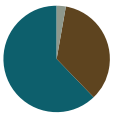
The gas performs in a similar way to gas mixtures used for welding steel, so for users unfamiliar with welding stainless steel this can be a good mixture to begin with.

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.

STAINSHIELD® Heavy

Gas code 092
Components: 2.8% carbon dioxide, 35% helium, balance argon



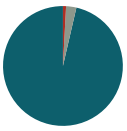
This three component shielding gas containing argon, helium and carbon dioxide is best suited for spray and pulse welding on thicker materials. The welds produced have good fusion, low reinforcement and porosity levels. This produces welds of the highest quality virtually eliminating the need for rework 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 minimising cleaning times keeps costs to a minimum.

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

STAINSHIELD® 66

Gas code 093
Components: 1% hydrogen, 2.8% carbon dioxide, balance argon

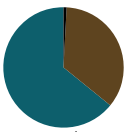


A three component gas mixture designed for short arc MAG welding austentic stainless steels only in all positions.

STAINSHIELD® 66 produces high integrity welds, good arc stability and excellent fusion characteristics. The added hydrogen produces a clean weld surface with higher production savings through less post weld cleaning.

STAINSHIELD® 69

Gas code 094
Components: 0.9% oxygen, 35% helium, balance argon



A three component gas mixture designed for welding all stainless steels in all positions. The added helium increases welding speeds, gives excellent fusion characteristics and produces a stable arc.

STAINSHIELD® 69 produces higher productivity due to the increased welding speeds, cleaner welds, lower distortion and reduced spatter levels.

Benefits for flux and metal cored welding.

Gases for flux and metal cored welding

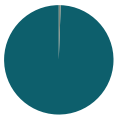
	Thickness range	Penetration	Spatter control	Welding speed	Fillet shape	Finish
STAINSHIELD® Light	1 to 8 mm	★★☆	★★½	★★½	★★½	★★½
ARGOSHIELD® Heavy	4 to 13 mm	★★½	★★½	★★½	★★½	★★½
ARGOSHIELD® 52	2 to 13 mm	★★★	★★★	★★★	★★★	★★★
Carbon Dioxide	2 to 13 mm	★★★	★★½	★★☆	★★½	★★½

The greater the number of stars, 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.

STAINSHIELD® Light

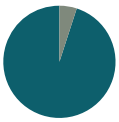
Gas code 119
Components: 2.5% carbon dioxide, balance argon



STAINSHIELD® Light 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. This lowers the cost and shortens the production process.

ARGOSHIELD® Heavy

Gas code 122
Components: 18% carbon dioxide, balance argon



ARGOSHIELD® Heavy is the mixture to use when high CO_2 mixed gases are recommended for welding stainless steel. This is because this mixture makes the weld easier to clean due to low spatter, fumes, and surface oxides. Welding with ARGOSHIELD® Heavy also produces less fumes than straight CO_2.

ARGOSHIELD® 52

Gas code 070
Components: 25% carbon dioxide, balance argon

Mixed gases are recommended for use with flux cored wires. ARGOSHIELD® 52 creates less spatter levels and particulate fume compared to carbon dioxide. This improved the workplace environment, as well as the wellbeing of the workforce.

Carbon dioxide

Gas code 081
Components: carbon dioxide

Stainless steel flux cored wires are often developed for use with carbon dioxide because it is 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.

The right gas mixtures for TIG and plasma welding.

Gases for TIG and plasma welding

	Thickness range	Penetration	Spatter control	Welding speed	Fillet shape	Finish
Argon	1 to 5 mm	★★☆	★★★	★★☆	★★★	★★★
ARGOPLAS® 5	2 to 10 mm	★★★	★★★	★★★	★★★	★★★
ARGOPLAS® 20	3 to 10 mm	★★★	★★★	★★★	★★★	★★★
STAINSHIELD® Duplex	1 to 10 mm	★★☆	★★☆	★★☆	★★½	★★½
ALUSHIELD® Light	1 to 8 mm	★★☆	★★★	★★½	★★★	★★★
ALUSHIELD® Universal	1 to 10 mm	★★½	★★★	★★½	★★★	★★★
ALUSHIELD® Heavy	1 to 13 mm	★★★	★★★	★★★	★★★	★★★

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

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. For example, mixtures containing. hydrogen and nitrogen are suitable for welding only austenitic types and for duplex types of stainless steel respectively.

Argon

Gas code 061
Components: argon

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 difficult to manipulate.

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

ARGOPLAS® 5

Gas code 143
Components: 5% hydrogen, balance argon

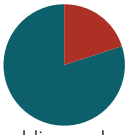
This gas mixture has 5% hydrogen in argon and is most commonly used for welding thicker sections. Although it can be used manually, it is best suited to automatic and orbital TIG welding of austenitic stainless steels.

ARGOPLAS® 5 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 gas increases maximum speed. 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.

ARGOPLAS® 20

Gas code 144
Components: 20% hydrogen, balance argon



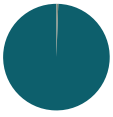
This argon and hydrogen mixture is used primarily for plasma welding and automatic TIG welding of austenitic stainless steels.

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.

ARGOPLAS® 20 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.

STAINSHIELD® Duplex

Gas code 114
Components: 2% nitrogen, balance argon

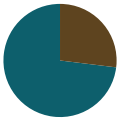


This mixture of argon and nitrogen is specifically designed for welding duplex stainless steels.

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.

ALUSHIELD® Light

Gas code 079
Components: 27% helium, balance argon



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 of 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 helping to reduce production costs and improve productivity.

ALUSHIELD® Universal

Gas code 113
Components: 50% helium, balance argon

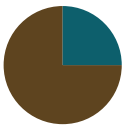
This higher helium mixture is best suited for use on thicker materials due to the addition energy it produces.

This helps improve energy transfer which gives great penetration, good sidewall fusion with the benefit of a very clean weld finish.

ALUSHIELD® Universal is a very welder friendly gas mixture due to its ability to reduce defect levels, thus decreasing clean up times.

ALUSHIELD® Heavy

Gas code 069
Components: 25% argon, balance helium



When welding on 10 mm stainless steel, welding with ALUSHIELD® Heavy can be 20% to 30% faster than Argon.

The 75% helium content in the mixture gives the extra benefit of the highest energy transfer. This gives deep wide weld beads, which reduce the chances of side wall fusion defects.

ALUSHIELD® Heavy also gives great results on copper and thick aluminium while reducing both production costs in preheating and distortion defects. Production costs can also be minimised by reducing weld prep joint angles.

Getting ahead through innovation.

With its innovative concepts, BOC 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.

BOC 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.

BOC – turning ideas into solutions.

Check out our YouTube video for tips on welding stainless steel.

For more information contact the **BOC Customer Engagement Centre** on:

131 262
www.boc.com.au
https://www.youtube.com/user/boclimited

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