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.

ARGOSHIELD®, ALUSHIELD® STAINSHIELD® and SPECSHIELD® are registered trademarks of BOC a Member of The Linde Group.
Perfect complements for MAG welding.

Gases for MAG welding of stainless steels

<table>
<thead>
<tr>
<th>Gas Code</th>
<th>Components</th>
<th>Thickness range</th>
<th>Penetration</th>
<th>Spatter control</th>
<th>Welding speed</th>
<th>Fillet shape</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECSHIELD® Multi</td>
<td>2% oxygen, balance argon</td>
<td>1 to 8 mm</td>
<td>***</td>
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<td>***</td>
</tr>
<tr>
<td>STAINSHIELD® MIG</td>
<td>2% carbon dioxide, balance argon</td>
<td>1 to 8 mm</td>
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<td>***</td>
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<tr>
<td>STAINSHIELD® Light</td>
<td></td>
<td>1 to 6 mm</td>
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</tr>
<tr>
<td>STAINSHIELD® Universal</td>
<td></td>
<td>1 to 13 mm</td>
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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.

SPECSHIELD® Multi
Gas code 511
Components: 2% oxygen, balance argon

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

Welding with SPECSHIELD® Multi 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 SPECSHIELD® Multi in having greater welder appeal.

STAINSHIELD® MIG
Gas code 509
Components: 2% carbon dioxide, balance argon

This mixture of argon and 2% 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® Light
Gas code 503
Components: 1.5 carbon dioxide, 85% helium, balance argon

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

STAINSHIELD® Light produces good fusion, clean weld appearance and finish. The addition of helium, not only results in less surface oxidation than traditional oxygen-argon mixtures but also increases welding speed.

STAINSHIELD® Universal
Gas code 504
Components: 2% carbon dioxide, 55% 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® Universal produces higher productivity due to the increased welding speeds, cleaner welds, lower distortion and reduced spatter levels.

STAINSHIELD® Heavy
Gas code 505
Components: 2% carbon dioxide, 38% 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.
Benefits for flux and metal cored welding.

Gases for flux and metal cored welding

<table>
<thead>
<tr>
<th>STAINSHIELD® MIG</th>
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<tr>
<td></td>
<td>1 to 8 mm</td>
<td>★ ★ ★</td>
<td>★ ★ ★</td>
<td>★ ★ ★</td>
<td>★ ★</td>
<td>★ ★ ★</td>
</tr>
<tr>
<td>SPECSHIELD® FCW</td>
<td>2 to 13 mm</td>
<td>★ ★ ★</td>
<td>★ ★ ★</td>
<td>★ ★ ★</td>
<td>★ ★</td>
<td>★ ★ ★</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>2 to 13 mm</td>
<td>★ ★ ★</td>
<td>★ ★ ★</td>
<td>★ ★ ★</td>
<td>★ ★</td>
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</tr>
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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® MIG
Gas code 509
Components: 2% carbon dioxide, balance argon

STAINSHIELD® MIG 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.
Carbon dioxide
Gas code 169
Components: carbon dioxide

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

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.

SPECSHIELD® FCW
Gas code 512
Components: 23% carbon dioxide, balance argon

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.

Argon
Argoshield Light
Argoshield Universal
Argoshield Heavy
Argoshield MCW
Specshield FCW
Carbon Dioxide
Stainshield MIG
Stainshield TIG
Specshield Multi
Stainshield Light
Stainshield Universal
Stainshield Heavy
Alushield Light
Alushield Heavy
Alushield Universal
Stainshield TIG Plus
Argon
The right gas mixtures for TIG and plasma welding.

Argon
Gas code 130
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.

STAINSHIELD® TIG
Gas code 510
Components: 2% hydrogen, balance argon
The inclusion of hydrogen in this 2 component shielding gas helps reduce oxide formation when welding expensive and sensitive metals. However, it should be noted that this mixture can only be used to weld austenitic stainless steels and should not be used with aluminium and ferric steels.

Furthermore, this mixture results in a higher heat in the arc, which in turn results in a more constricted arc and improved penetration. There is also a smoother transition between weld base and base metal.
Forming Gas A20  
Gas code 233  
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.  
Forming Gas A20 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® TIG Plus  
Gas code 230  
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.  
STAINSHIELD® TIG Plus 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.
**ALUSHIELD® Light**  
Gas code 506  
Components: 30% 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® Heavy**  
Gas code 505  
Components: 30% argon, balance helium  

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

The 70% 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.

**ALUSHIELD® Universal**  
Gas code 507  
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.
The right gas mixtures for TIG and plasma welding
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:

0800 111 333
www.boc.co.nz
https://www.youtube.com/user/boclimited