

Shielding gas.

# Gases for welding non-ferrous materials.





There is a wide range of aluminium, copper and titanium alloys used in a variety of industries such as in the aerospace, automotive, power generation and petro-chemical sector.

These non-ferrous alloys can exhibit a wide range of mechanical, electrical and corrosion resistant properties, depending on the alloy system. However, they all have one property in common – they oxidise very easily during welding and are sensitive to moisture and impurity pick up by the weld. They are therefore not as easy to weld as the steel alloys and good welding technique/procedures, together with good housekeeping and cleanliness in and around the welding area, are essential in order to weld these materials successfully.

# Improved performance for MIG and TIG welding.

Both MIG and TIG welding are widely used for welding non-ferrous alloys. The choice of process is similar to that for other alloys – MIG for high productivity and TIG for high precision welding.

The choice of shielding gas for welding these materials is simple – only the inert gases are suitable. Consequently, the most common gas mixtures for both MIG and TIG welding of aluminium, copper and titanium alloys are pure argon, pure helium and mixtures of the two. Titanium is also very sensitive to oxygen and nitrogen and may even require special low impurity products, especially for high quality applications.

Small additions, usually less than 0.05%, of oxidising gases have been shown to be beneficial additions to argon or argon and helium mixtures for welding aluminium. However, these are specialised applications and require welding engineering assessments to be carried out to ensure their suitability.



VARIGON  
He30

# The right gases for aluminium, copper and titanium alloys.

## Gases for non-ferrous materials

	Welding speed	Spatter control	Porosity control	Fusion	Penetration	Ease of use	Thickness range for MIG (mm)	Thickness range for TIG (mm)
Argon 4.6	•	•	•	•	•	••	1 to 4	0 to 3
VARIGON He30	••	••	••	••	•••	•••	1 to 6	1 to 6
VARIGON He50	•••	•••	•••	•••	•••	••	3 to 10	3 to 9
VARIGON He70	•••	•••	•••	•••	•••	•	6 to 12+	6 to 12+

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

### Argon 4.6

Argon is only suited for welding thin sections as it does not produce a very fluid weld pool. When used for MIG welding, it can give welds with high levels of reinforcement, as well as poor fusion and porosity when welding thicker sections. If reinforcement levels are high, this can increase stresses within the weld area, so it may be necessary to reduce these by machining. This adds another manufacturing process increasing component costs.

Poor fusion and penetration can also increase defect levels, especially as the material thickness increases. Porosity can also be a problem when using argon caused by the fast freezing weld pool. All these problems increase costs through additional processes such as weld repair or through the component having to be scrapped.

When MIG or TIG welding copper, some level of preheating is normally required and as the thickness of the material increases, so does the preheat temperature required. Again this additional process and the length of time required to preheat adds cost into the component being manufactured.

### VARIGON He30

The addition of 30% helium to argon improves the fluidity of the weld pool, whether the mixture is used for MIG and TIG welding. This mixture is best suited for welding thin to medium section thicknesses either manually or automatically.

Fusion and penetration profiles are improved over pure argon, as are its gap bridging capabilities, reducing the chances of burn through. The addition of helium also helps to lower the levels of porosity, reducing defect rates. Which in turn helps to reduce the defect rates, lowering production costs and scrapping rates.

Preheating will still be required for welding most thicknesses of copper, but temperatures will be lower than for argon. This will save both the cost of the preheating medium and the time taken to reach the required temperature.



## VARIGON He50

### VARIGON He50

An addition of 50% helium to this mixture produces a more fluid weld pool than with VARIGON He30 and so tends to be used on thicker components. It can be used for both MIG and TIG welding, either manually or on automatic welding equipment.

The fusion and penetration characteristics are significantly improved over argon and much lower defect rates are achieved. Reinforcement levels are also much lower as the weld flows much easier giving flatter weld profiles. Welding speeds can also be improved while maintaining the weld quality. All the features improve productivity while reducing production costs.

The high energy available means that little or no preheating is required when welding thicker aluminium sections or thinner copper sections. In some cases the weld preparation can be reduced in size. This enables a considerable cost saving as the cost to manufacture the weld preparation, the cost in wire and time to re-weld the joint are all reduced or eliminated.

### VARIGON He70

This 70% helium and argon mixture is most commonly used for automatic MIG and TIG welding. It produces a very fluid weld pool with excellent fusion and penetration and is ideal for welding very thick aluminium sections and copper.

The fluid weld pool allows a significant increase in welding speed to be achieved over argon. The fusion characteristics and penetration profile are improved and this reduces the defect level minimising the number of rejected components, increasing productivity and efficiency while reducing overall production costs.

Even smaller weld preparations can often be used than with VARIGON He50, giving a further economic advantage when using this shielding gas.

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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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