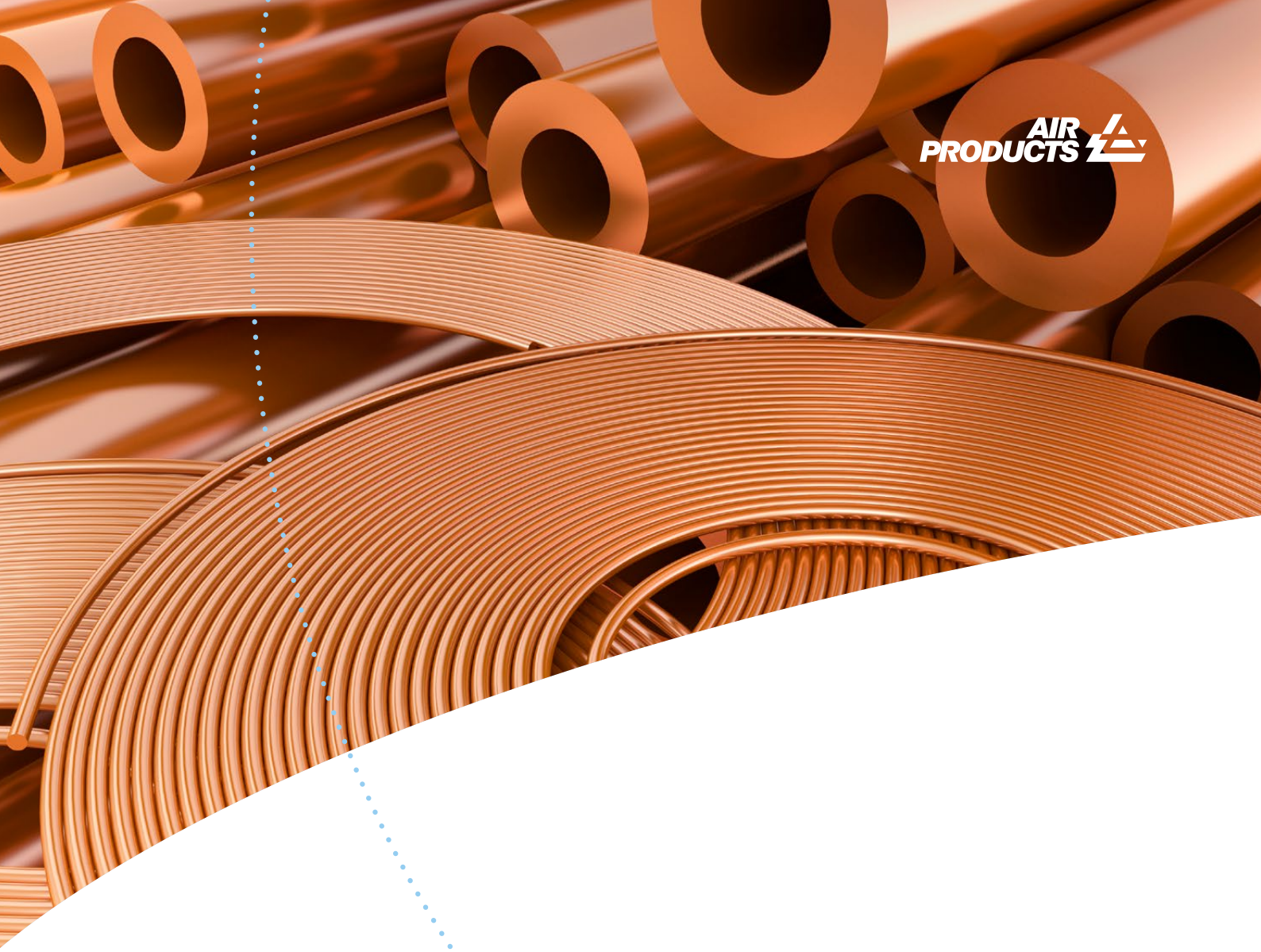


Improve your copper production with our gas technologies.

Contributing to Generating a Cleaner Future.

Copper's unique properties and high conductivity make it a highly valuable and key element in the distribution of electricity and the production of electrical components for multiple industries.

Ensuring your copper production is as efficient and sustainable as possible and results in the highest quality product is vital to remaining competitive.

With extensive experience in optimising copper production, our wide range of industrial gas technologies can help improve product quality, reduce costs, increase yields, reduce emissions and contribute to a cleaner future.

Cu

Towards a Greener Copper

H_2

Oxy-fuel technologies for melting

Oxy-fuel and oxygen enhanced combustion systems that use oxy-fuel, air-oxy-fuel or oxygen enrichment can increase efficiency, productivity and yield, while oxy-hydrogen or air-oxy-hydrogen systems can lower your carbon footprint in reverb, rotary or shaft furnaces.

Transient Heating Oxy-fuel Burner

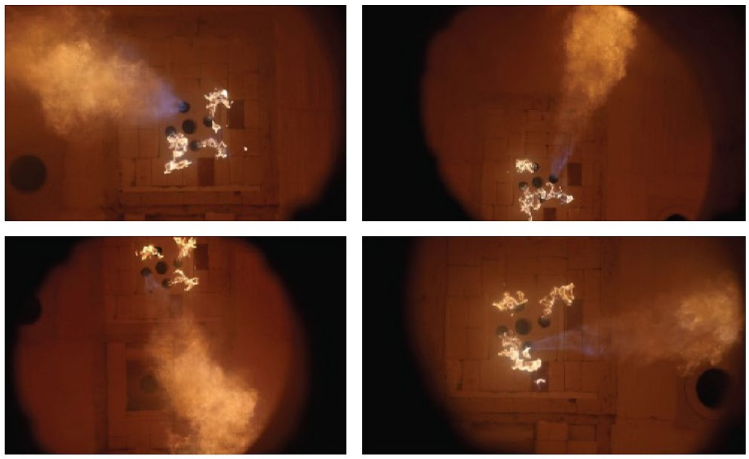
Our NEW oxy-fuel burner is designed for reverb furnaces. It features air-oxy-fuel capabilities for use in holding furnaces, as well as the use of hydrogen as a fuel to reduce emissions.

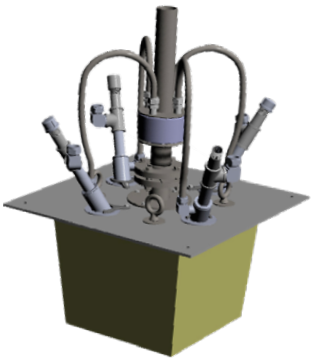
It incorporates Air Products Smart Technology, supporting the convergence of Information Technology (IT) and Operational Technology (OT) systems via Industry 4.0.

Our burners are significantly more efficient than traditional air-fuelled burners.

Benefits include:

- Up to 40% increased productivity
- Up to 40% improved fuel efficiency
- Higher yield
- Minimises NO_X generation by lowering the flame temperature via staged combustion





The Transient Heating burner with combination of the four flames to heat more evenly, eliminate cold zones, and maximize melt rates.

Atmosphere solutions for copper annealing

Non-ferrous annealing

Our atmosphere solutions for nonferrous annealing can maintain the consistency needed to achieve oxide-free surfaces. They can also generate consistent metallurgical properties for materials, such as copper and alloyed copper tube, wire, and strip products. A 1%-10% hydrogen addition to nitrogen base provides the necessary reducing potential for maximum surface quality and minimum cleaning.

Non-ferrous (ie: CU) annealing atmosphere composition

Atmosphere Component	Exothermic	Dissociated Ammonia	Air Products' Atmospheres
N_2%	70-98	25	90-100
H_2%	2-15	75	0-10
O_2 ppm	10-75	10-35	5
Dew point °F (°C)	-30 to +50 (-34.4 to 10°C)	-20 to +60 (-28.8 to 51°C)	-90 (-67.7°C)
CO%	2-12	–	–
CO_2%	1-10	–	–
CH_4%	0.02-0.10	–	–
NH_3 ppm	–	50-100	–

Air Products' atmospheres are more environmentally friendly, there is no CO and CO_2 present in the off-gas, resulting in lower carbon footprint, as well as no Ammonia residues that could harm the product.

Our atmospheres also deliver lower and more consistent dew point values as compared to Exothermic and Dissociated Ammonia atmospheres, and in most cases are non-flammable (composition dependent).

Atmosphere monitoring and control

Our innovative Advanced Atmosphere Control System regulates the dew point (the amount of water moisture) and/or the residual Oxygen (O_2) for controlled heat treatment of metals in Hydrogen (H_2) or Nitrogen/Hydrogen (N_2/H_2) atmospheres. Instead of using fixed flows and atmosphere blends, we can tailor the atmosphere to your needs, reducing atmosphere costs and rework.

The full performance of the system can be achieved in combination with our Air Products Smart Technology offering.

Benefits include:

- Online measurement of hydrogen concentration and partial pressure of oxygen
- Reliable calculation of the dew point (alternative measurement)
- High quality products, less waste
- Product-related optimization and regulation of the inert gas composition (which can reduce H_2)

Cryogenic rapid cooling

By feeding liquid nitrogen into the cooling zone of the furnace, our cryogenic gases can improve production and deliver:

- Higher cooling rates
- Increased productivity

Air Products Smart Technology

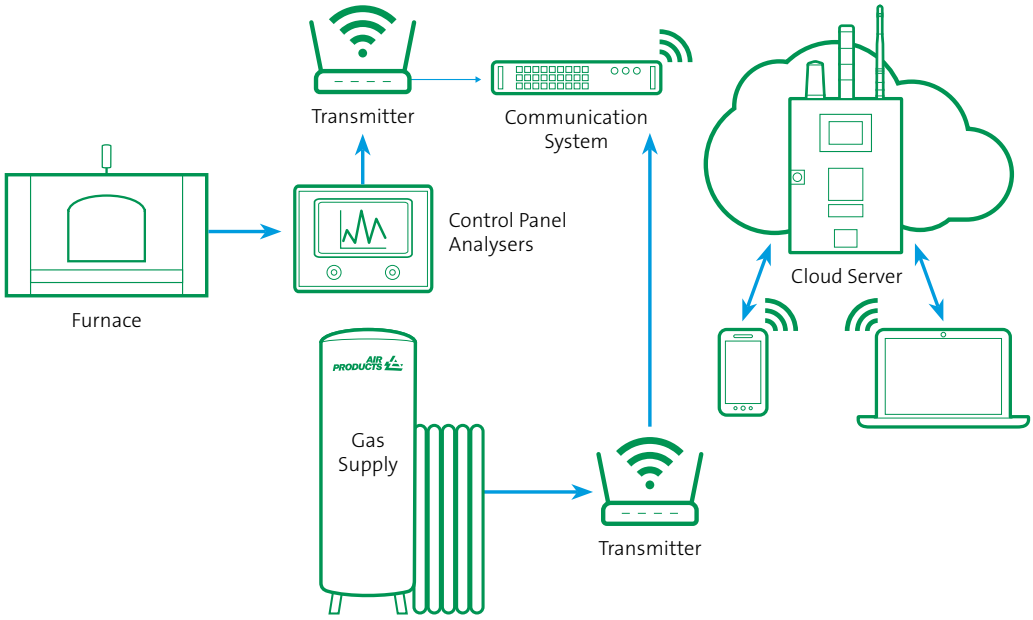
Our gas supply systems and equipment can be remotely monitored using our Smart Technology. This enables our process experts with remote access so they can give you advice on how to improve and optimise your process.

Targeted monitoring of the inert gas atmosphere can reduce the gas costs and maintain constant product quality.

Any deviations from normal process settings can be documented and the reason for deviations, investigated faster. As a result, downtime, rework, and waste can be reduced. Our Smart Technology can also be used in our oxy-fuel solutions for melting.

Features

- Continuous monitoring of all key parameters
- Data collection onto a single platform combining highest standards of confidentially and data security
- Data available to key stakeholders from any location
- Ability to spot trends in datasets for further analysis
- Configurable maintenance alerts for optimal operation



Whether you need indication of copper reaching the desired process values during the melting process or monitor the condition of protective atmosphere during heat treatment operation, Air Products Smart Technology is the answer.

Air Products Smart will help you optimise your process, reduce emissions and operating costs.

Improved Quality | Increased Production | Reduced Cost | Reduced Carbon Footprint | Help with Maintenance

Generating a Cleaner Future.

At Air Products, we are Generating a Cleaner Future with innovative gas solutions based on the technology and knowledge of our industry experts.

Examples include:

- Oxy-fuel combustion systems and low carbon intensity fuels, such as hydrogen, which offer a practical way to decarbonise and reduce the carbon footprint of industrial production.
- Air Products Smart Technologies that analyse potential savings and develops process optimisations to improve processes and product reliability.

Please contact us for any additional information and to discuss your needs:

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