

Welding Solutions for the LNG Industry



voestalpine Böhler Welding

Metallurgical Expertise for Best Welding Results

voestalpine Böhler Welding (formerly Böhler Welding Group) is a leading manufacturer and worldwide supplier of filler metals for industrial welding and brazing applications. With more than 100 years of experience, the enterprise has decisively influenced the development of welding technology, setting the benchmark with its innovative solutions. The solidity is also reflected in the confidence of our employees who, as owners of the enterprise, hold a good portion of the shares.



As a part of the voestalpine Group, Austria's largest steel manufacturer and one of the world's leading suppliers of specialized steel products, we are a part of a global network of metallurgy experts.

Our customers benefit from:

- Comprehensive welding and steel know-how under one roof
- Coordinated complete solutions comprised of steel and welding filler metals
- A partner offering maximum economic stability and technological expertise

Customer first

Absolute customer focus is our guiding principle. We see ourselves as a provider of solutions to challenging welding projects. We ensure that our customers get the right filler metals, use them correctly, and that all welding process parameters are adjusted for the best possible performance. We consider it as our responsibility to guarantee that we deliver to our customers, now and in the future, the best possible solutions. We also strive to develop new products, optimize existing products, and streamline processes so as to achieve very short turnaround times.

Experienced and committed employees

We rely on committed employees who have been trained to the highest standards. It is their knowledge, skills, and personal commitment that ensure the long-term success of our company and its customers. In combination with our premium quality products, the individual technical support provided by our globally acting application technicians and specialist welding engineers empowers our customers to master even the most difficult and challenging welding tasks.



Three competencies – three brands

In our efforts to afford our customers the best possible support and promote development in line with specific targets, we have built our core competences within Joint Welding, Repair & Maintenance Welding and Soldering & Brazing. This way we offer our customers the largest and most comprehensive product portfolio of filler materials within our three brands:

- Böhler Welding
- UTP Maintenance
- Fontargen Brazing

Welding Solutions for demanding industries

We focus on industries with high technological standards and deliver products tailored to

industry-specific requirements. In the development and optimization of filler materials, we collaborate closely with customers, manufacturers, and research institutes.

Whether destined for use in challenging scenarios or in standard applications – our high quality filler materials are ideally suited for all applications in the following industry sectors:

- Oil and Gas
- Pipeline
- Chemical
- Power Generation
- Transportation & Automotive
- Maintenance & Repair
- Brazing Industries

Welding Solutions for the LNG industry

Transporting Liquefied Gas means controlling physics, under every circumstance.

Avoiding problems is paramount in the construction of LNG-equipment

The transportation and delivery of natural gas is a prime technical challenge.

Only the liquefaction of natural gas to improve the transportability under extreme low temperatures is a masterly performance, when you think of the difficult areas where it is done. Liquefying the gas to minus 162 degrees Celsius and maintaining it in its liquid phase at external temperatures as low as -40 and high as 60 degrees Celsius puts an extreme high demand on the materials which are used and the building quality.

Climatic challenges like high humidity and salinity in the air in coastal areas, extreme dryness and high wind speeds over land or extreme cold and precipitation in natural gas transportation sites make LNG-projects a special challenge for man and material.

Physical conditions as low temperatures and high mechanical loads make the use of special materials and alloys necessary in order to ensure and increase the functionality and service life of the installation.

The **geographical remoteness** of the plants makes special demands against logistics.

The material supply must be organized just in time, since storekeeping is very difficult in most cases. A detailed planning and reliable partners are needed.

To establish a LNG plant is a **project of immense extent**. The control of innumerable factors, from which each particular factor can become a serious problem in no time, makes the management of a project a major achievement of which high demands are asked from suppliers and partners.

The best way to minimize the risks, is therefore problems not to arise. To avoid risks, material-requirements, specifications and descriptions of the process down to the smallest detail are required. Suppliers must be understood as part of these requirements and be contacted as soon as soon as they are needed.

On the total project a relatively small percentage of filler materials are used, however this is a very important part, because the quality of these materials affects greatly the quality of the installation and especially affects the efficiency and safety of the project.

The main applications and constructions in the LNG segment are:

Process equipment	Separation, drying, cooling, liquefaction, regasification
Transportation:	Single & double walled pipelines, LNG-transport tankers
Storage:	Onshore tanks and semi-submersibles, floating storage units

An overview of the applicable base materials with corresponding welding consumables is given in the table on page 9.





Value Chain for LNG

1. Gas Treatment and Gas processing

For the upstream activities for exploration and production high quality material are required due to the extreme harsh environment conditions and the high mechanical stresses

2. Gas Liquefaction

The Liquefaction train is the key part in the whole LNG chain. High investments are needed to build the gigantic systems with different components made from different materials. Liquefaction of natural gas can be done onshore or offshore.

3. LNG Transportation

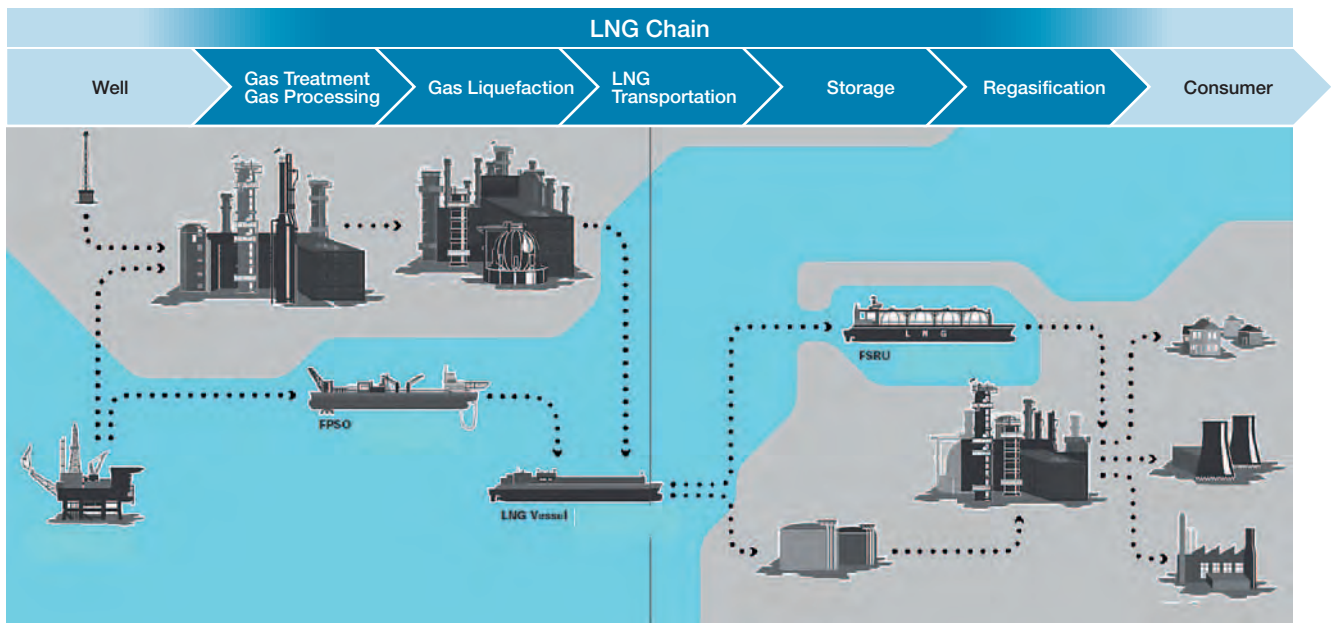
Transportation of LNG is the reason of the liquefaction. It is much more cost effective over long distance because of the reduction in volume after liquefaction

4. Storage and regasification

Storage tanks with a capacity up to 200.000 m³ are the main components on the import terminal. Big gas reserves are stored under cryogenic conditions at -163°C. Regasification can be done onshore or offshore.

5. Consumer downstream

Regasified LNG will be used in gas fired Power stations, the gas grid to millions of households or supplied



Being at the right time in the right place – something else is out of the question

You work with a reliable partner hand in hand and that for many years

Who can rely on its partner will be more successful – who implements projects of enormous size and complexity avoids every risk. Also when choosing the right technology partner. Therefore a competent partner is characterized by reliability and high quality standards. voestalpine Böhler Welding has decades of experience with the requirements in the construction of LNG facilities. With specially developed, tested, and certified welding filler materials, complex safety specifications can be met.

New technological challenges, in which special materials or physical characteristics face engineers with new challenges, enable the welding-engineers from voestalpine Böhler Welding Group to develop completely new welding consumables and to integrate the required quantity in the production process. Unprecedented demands on the weldability of the material can be met in this way.

As a partner of our customers we take responsibility and keep our word

Whoever builds an LNG facility needs one thing above all: binding commitments. With our experience we can realistically assess the demands placed on us and the materials.

We then give our word, when we are sure, to be able to redeem our promise 100%. This applies to all aspects – technology, logistics and quality. No matter what happens, resolving of unforeseen situations is always our top priority. We know this, and we focus on it. Our experts and consultants are available around the clock and come to any place in the world to work together with your engineers and welders to find quick solutions. But even if more material is required in the short term, we have the capacity to respond flexibly.

Well specified products and materials ensure a trouble-free use

The procedures described in the welding procedure specification are binding for our products. Project-engineers and project managers can rely on the fact the products of voestalpine Böhler Welding Group meet the required standards in each case or even exceed in weldability. Also here: „sure is safe.“

Storage is very difficult and expensive at LNG construction sites. Therefore we foresee that the ordered material in the required packaging is supplied on the agreed date and at the agreed place. Just-in-time; you have the materials when they are required.

The right choice of welding consumables depends on the application, the base-material and the specification. voestalpine Böhler Welding offers a complete range of high quality welding consumables. Some typical applications can be found in the table on the right. For further technical questions and requirements we recommend contacting our experts.

Liquefaction temperature for some types of gas and its suitable material for transport or storage:

Gas	Liquefaction temperature (°C)	Type of parent materials
Ammonia	- 33,4	Carbon steel
Propane (LPG)	- 42,1 - 45,5	Fine grain steel
Propylene	- 47,7	2,5 % Ni steel
Carbon dioxide	- 78,5	3,5 % Ni steel
Acetylene	- 84,0	
Ethane	- 88,4	
Ethylene (LEG)	- 103,8	5 - 9 % Ni-steel
Methane (LNG)	- 163,0	
Oxygen	- 182,9	
Argon	- 185,9	
Nitrogen	- 195,8	Austenitic stainless steel
Hydrogen	- 252,8	
Helium	- 268,9	All alloys



Everything goes as planned – rely on it

You have one less thing to worry about, because we take care of it. Through the use of high performance welding consumables you will not only ensure quality. You will also automatically increase the economic viability of the project. When welds are made without any problem and welded easily, the welder will create more seams per hour while maintaining the quality.

When you use our products, less time for reworking of welding seams is required, because smooth welds and easy slag -detachability allow the welder to work more efficiently and also the quality of the weld increases.

An increase in efficiency is also reflected in the consumption of the material to be welded. The electrodes and flux-cored wires of voestalpine Böhler Welding Group are characterized by a special production process, particularly enabling easy striking and especially re-striking. The first advantage is that the electrode is welded entirely and produces fewer to no rejects; second advantage is that errors in the weld by poor striking are excluded and repairs are not necessary.

Easier welding in any position will open up new areas of effectiveness.

Position-weldability is not only, but mostly in tank construction, e.g. welding in overhead position, often a great challenge for the welder and so also for the quality of the weld. voestalpine Böhler Welding consumables are characterized by very easy and good weldability in position. The welding of joints in all positions is thus significantly easier and safer.

In the construction of a LNG plant it is of vital importance to meet all required standards of quality. This is easier when you are using an experienced partner who ensures proof of quality of its products. In countless LNG projects we have gained experience and know-how. This helps our customers because they have a partner who understands the customer-application, is accurately acquainted with the requirements and is able to meet these requirements 100%.

To have the best solution means to aim at the right brand

Proven products provide security for many years.

voestalpine Böhler Welding Group has a large variety of filler products in its product portfolio the right selection of the products depends on the requirements of the project.

For the use in LNG projects voestalpine Böhler Welding offers 2 technological competent brands:



Suggested filler metals for the welding of LNG-projects

Base Material	Steel-Designation	SMAW	GTAW	GMAW	FCAW	SAW	
						Wire	FLUX
Carbon Steel	ASTM A 516 GR.70	Böhler Fox EV 60	Böhler Ni1-IG	Böhler Ni1-IG	Böhler Ti 60 FD	Union S 3 NiMo 1	UV 418 TT
Fine Grain Steel	EN 10028-3 P355						
2.5 Ni Steel	ASTM A203 Gr.D.	Böhler Fox 2.5 Ni	Böhler 2.5 Ni-G	Böhler 2.5 Ni-G	–	Union S 2 Ni 2,5	UV 418 TT
	EN 10028-3 P460NL2						
3.5 Ni Steel	ASTM A 203 Gr. E-F	Phoenix SH Ni 2 K 80	Union I Ni 3.5	–	–	Union S 2 Ni 3,5	UV 418 TT
	EN 10028-4 12Ni14						
5% Ni Steel	ASTM 645	Thermanit 19/15	Thermanit 19/15	Thermanit 19/15	Bohler EAS 4	Thermanit 19/15	Marathon 104
	EN 10028-4 X12Ni5			Thermanit 17/15 TT	PW-FD	Thermanit 17/15 TT	
9% Ni Steel	EN 10028-4 X7Ni 9, X8Ni 9	UTP Soudonel D	UTP A 6222-Mo	UTP A 6222 Mo-3	UTP AF6222	Thermanit NiMo C 276	Marathon 104
	ASTM A 553	Thermanit 13/65	Thermanit 625	Thermanit 625	MO PW	Thermanit 625	Marathon 444
	ASTM A 353	TTW-150					
		UTP 7013 Mo					
Stainless Steel	304L	Böhler Fox EAS2	Bohler EAS 2-IG	Bohler EAS 2-IG (Si)	Böhler EAS 2 PW-FD (LF)	Böhler EAS 2-UP	Böhler BB 202
	316L	Böhler Fox EAS 4 M (LF)	Bohler EAS 4 M-IG	Bohler EAS 4 M-IG (Si)	Böhler EAS 4 PW-FD (LF)	Böhler EAS 4 M-UP	
	347	Böhler FOX SAS 2	Bohler SAS 2-IG	Bohler SAS 2-IG (Si)	Böhler SAS 2 PW-FD (LF)	Böhler SAS 2-UP	
Aluminium	AlMg 4.5 Mn	–	Bohler S-Al Mg 4.5 Mn	Bohler S-Al Mg 4.5 Mn	–	–	–
Invar	Fe 36 Ni	–	–	UTP A 8036	–	–	–

Protective packaging for durability and safety.

voestalpine Böhler Welding products are available in moisture-resistant, hermetically sealed packaging. This increases the shelf life of the products as well as the safety by reducing the absorption of moisture. This is of great importance, especially when working under difficult climatic conditions.



References

Who does his job well, no need to shy away from the comparison.
“reliable and flexible“ – that is what our customers say.

Technologically at the top, our products provide the required quality of course.
In addition, personal consulting, reliable delivery and flexibility make the difference. Voestalpine Böhler Welding contributed to the largest LNG projects in the past decades and applies to its customers as a reliable and competent partner.

We have successfully supplied to more than 40 projects in the last 25 years.
Some of the largest projects of the last years:

Belgium: Zeebrugge,
Antwerp-Zwijndrecht

Egypt: Damietta

Spain: Cartagena, Barcelona, Huelva,
Bilbao, Sagunto

Portugal: Sines

United Kingdom: Isle of Grain II and III, Dragon

France: Dunkerque, Fos sur Mer

USA: Golden Pass, Sabine Pass I and II,
Freeport LNG, Cove Point, Elba Island

Canada: Canaport

Italy: Venice, ALT

South Korea: Tongyeong, Kwangyang

Mexico : Costa Azul, Manzanillo

Algeria: Arzew

Angola: Soyo

China: Dapeng Guandong, Shanghai,
Jiangsu, Dalian, Beihai, Yizheng Jiangsu,

Singapore: Singapore LNG

Australia: Pluto, Gorgon, Gorgon Offshore,
Newcastle/Tomago

Poland: Swinoujscie




**It is very easy to work on a solution with
voestalpine Böhler Welding.**

No matter if you need only an estimation of the amount of material or work on a specific project, we offer help and advice. We deliver the ordered products on time to the agreed date at the agreed place. In case of need also overnight airfreight.

Check the price – the price reflects the quality.

If you are looking for a new supplier, please pay attention to the price. Make sure, what you get for it. The products of voestalpine Böhler Welding Group offer highest security and are manufactured in accordance with strict quality-guidelines. voestalpine Böhler Welding products provide you added value in addition - you have a partner who advises you and stands by your side in your responsibilities.

a If the product list is missing, please contact us.



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voestalpine Böhler Welding

Welding know-how joins steel

Customers in over 120 countries join the expertise of voestalpine Böhler Welding. Focused on filler metals, voestalpine Böhler Welding offers extensive technical consultation and individual solutions for industrial welding and soldering applications. Customer proximity is guaranteed by 40 subsidiaries in 28 countries, with the support of 2,200 employees, and through more than 1,000 distribution partners worldwide. voestalpine Böhler Welding offers three specialized and dedicated brands to cater our customers' and partners' requirements.



Böhler Welding – More than 2,000 products for joint welding in all conventional arc welding processes are united in a product portfolio that is unique throughout the world. Creating lasting connections is the brand's philosophy in welding and between people.



UTP Maintenance – Decades of industry experience and application know-how in the areas of repair as well as wear and surface protection, combined with innovative and custom-tailored products, guarantee customers an increase in the productivity and protection of their components.



Fontargen Brazing – Through deep insight into processing methods and ways of application, Fontargen Brazing provides the best brazing and soldering solutions based on proven products with German technology. The expertise of this brand's application engineers has been formulated over many years of experience from countless application cases.

forwarded by:

Global Industry Segment Management
LNG

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