



## SHIPBUILDING TECHNOLOGY



**BUTTING**

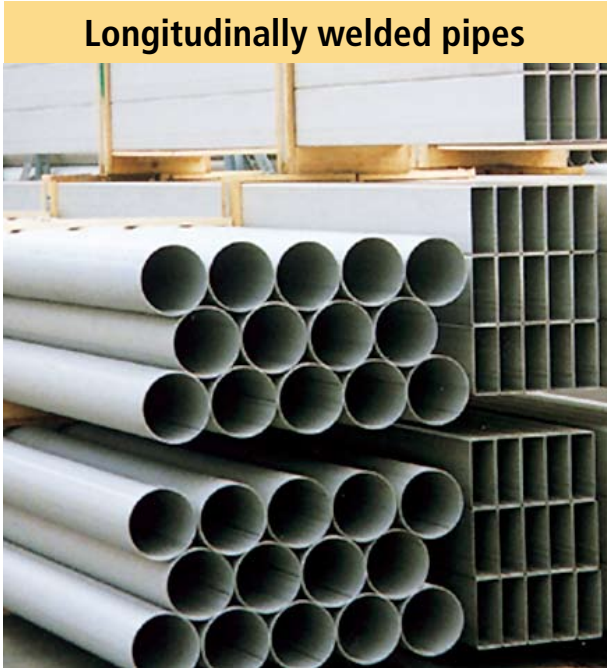
## At home on all seas

BUTTING has been working for the shipbuilding industry around the globe since 1973. In collaboration with yards from Denmark and Croatia to Korea and China, we have equipped over 200 gas and chemical tankers with pipework and fittings.

We make up the individual package which is right for you and supply you round the clock with "everything from one source". Alongside quality pipes, we are also your contact for flanges, elbows, prefabricated connection pieces and vessels. From the planning phase through to the commissioning of ready-to-install pipe systems, including special alloys, expert engineers and experienced fitters are there to help you.

We also supply the Navy, for example: advanced drive systems for German naval shipbuilding are produced by BUTTING using pipe bodies and castings.

The high quality of our wide-ranging production programme – supported by distinctive factory prefabrication – also guarantees that the products are always operationally reliable.





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### Vessels



### Prefabrication



### Manifolds



### Tees



Leading producer of longitudinally welded stainless steel pipes



### Progress by tradition

For seven generations, the name BUTTING has represented quality and flexibility in the metal-working industry. In this family-owned business, more than 1,000 employees now process over 40,000 tonnes of stainless steel every year, generating revenues of 340 million euros. Founded in Crossen in 1777 as a coppersmith's handicraft business, BUTTING developed in the fourth generation into an industrial undertaking specialising in the production of copper pipes.

At the end of the Second World War in 1945, the Butting family left their home with a horse-drawn carriage and what could be carried on the covered wagon. During the flight to the West, a cart-wheel

broke on the cobbled streets of Knesebek. The crisis gave an opportunity, the "location decision" for the reconstruction of our company. First located in the rifle club's house in Knesebek, the company sold semi-finished products and flat products from copper, brass and light metal as a small commercial enterprise. In 1949, the reconstruction of the coppersmith with workshop managers and foremen from Crossen started in the factory premises of a closed-down brickworks.

### A growing company

Nowadays, BUTTING in Knesebek is one of the biggest employers in the region. After German reunification in 1991, BUTTING founded a subsidiary at Schwedt on the river Oder, which in the



We are proud of our 230-year history

first few years provided a stainless steel pipe service as maintenance for the local paper industry.

Today, BUTTING in Schwedt is our expert unit for vessel and pipework construction and for international installations. Since 2004, BUTTING has been represented in China, initially with a presence in the centre of Shanghai.

Since autumn 2005, we have had a production hall for pipeline construction and customer prefabrication on the outskirts of Shanghai, in Malu. Our pipe storage area for the short-term demand of our Chinese customers is also located there. It is our aim to inspire our customers, to win BUTTING fans. This requires proximity for several services or products. For the same reason, we decided to found an establishment in Canada in 2005. With the help of BUTTING Canada in Calgary, we want to offer our longstanding experience in the manufacture of stainless steels faster and directly to our Canadian customers.



A team with a vision: (L to R) Managing Directors Markus Bartsch, Hermann Butting, Dr Iris Rommerskirchen, Thomas Schüller, Dr Jens-Peter Lux

## Longitudinally welded pipes

The production of high-quality longitudinally welded pipes has been the focal point of our business since the development of stainless steels. Few other companies in Europe can point to so much experience and diversity in the production of stainless steel pipes.

True to our motto "Everything from one source", BUTTING is also the right contact for you when it comes to supplying the appropriate pipe fittings for a project. We produce a whole range of top-quality semi-finished products for fittings or special items for you from our quality pipes in the corrosion resisting materials that we handle.

And we continue to demonstrate our expertise in forming and welding technology and materials.

BUTTING basically has two different production processes available for manufacturing pipes:

- Continuous production from coils
- Discontinuous production from individual plates

## Extensive production facilities

The continuous, fully-automated production process is the most technically sophisticated and economical process for manufacturing longitudinally welded

Continuous production of pipes from coil



pipes. In this continuous production process, BUTTING is able to manufacture from coils, on several production lines, pipes in diameters ranging from 20 to 762 mm, with wall thicknesses up to 16 mm. Wall thicknesses up to 70 mm and outside diameters up to 3,000 mm can be achieved with our state-of-the-art production facilities by the discontinuous production process using individual steel plates and without outsourcing individual production steps.

## Welding technologies for all requirements

Only the right welding process for the stainless steel materials used can guarantee problem-free product deployment. BUTTING has both the processing facilities and qualified and certified staff to carry out all the usual arc and electron beam welding processes.

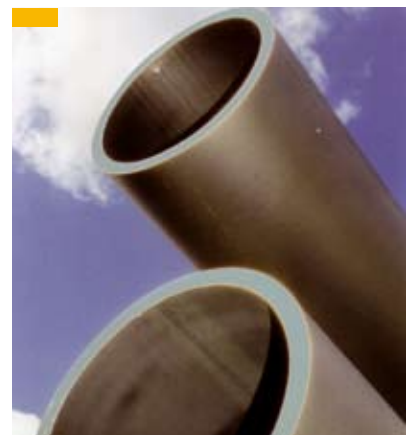
When producing pipes from steel coils, we mainly use the reliable plasma-TIG process. For more demanding requirements, e.g. for absolutely smooth pipes and components, we are increasingly using the laser beam welding process.

Manual MAG welding of a welded flange



For welding thick-walled steel plates – including high-alloy plates – we are one of the few manufacturers in Europe to use not only the submerged arc welding method but also the efficient electron beam (EB) welding process, with its excellent performance and reproducibility. This method is particularly suited to oxygen-sensitive materials such as titanium or niobium.

Thick-walled pipes from plate



So that you get "everything from one source", diversity is important to us

## Wide range of fittings

Along with longitudinally welded pipes, BUTTING also produces and supplies pipe fittings made to project requirements from all the corrosion resisting materials that we handle. For this, the company maintains diverse stocks of selected fittings. On an order-by-order basis, these fittings are produced to particular dimensions and from special materials for a variety of different applications.

## Elbows

Depending on the outside diameter, we produce elbows free from folds from longitudinally welded BUTTING pipes to customers' requirements by means of a bending process using rollers, cylinders or mandrels or from two halves made of plate. The various production methods enable pipe elbows to be manufactured according to DIN 2605, type 3 or 5, or with



**Prefabricated flanged pipes in duplex steel for on-deck pipework**

even greater radii – or on request with a tangent without a circumferential weld. Three-dimensional multiple bends with graded radii can be made in accordance with customers' isometric drawings.

## Tees and branches

Tees and branches are manufactured from high-quality BUTTING piping. The tolerances, construction types and testing of butt-welded or saddle-shaped tees can be chosen according to DIN 2615/2609 or ASTM standards, or on the basis of the customer's specifications. The branches are produced as saddles, extruded or butt-welded branches.

## Collars

BUTTING manufactures slip-on collars and welding neck collars without bevels, similar to DIN 2642, using semi-automatic presses. Large quantities of these fittings up to DN 400 in size are produced continuously from coils, or in individual production, from steel plates. Cold formed angle sections canted from plate are converted and welded into larger collars up to DN 1,000.

To match our stock of standard pipes, we can provide a wide range of welded and slip-on collars from stock.

## Reducers

Depending on the size, BUTTING produces reducers both from longitudinally welded pipe and steel strip. The customer can specify an eccentric or concentric (conical) shape – with cylindrical ends an option.



**Manifolds for the 3. Maj shipyard in Croatia**

## Flanges

Flanges are wrought or produced from plate and machined all round. Flanges are constructed according to DIN or ASTM B16.5 with the corresponding pressure ratings.

## Special fittings

Combining craftsmanship and state-of-the-art production facilities, BUTTING produces ready-to-install special fittings such as non-standard fittings or other special constructions to customer specifications.

As part of our extensive value creation process, the use of excellent raw materials and high-quality semi-finished products such as our own pipes, elbows and reducers, a high level of automation and technically qualified specialists guarantee you first-class quality – even with complex designs.

One contact, one guarantee of quality.

Depending on requirements, the tolerances and testing for these fittings are defined according to DIN 2609, ASTM A403 or the customer's specifications.

## Welded-on flanges fitted at the factory improve quality



## Fittings with collars and slip-on flanges



## Partner to the shipbuilding industry

BUTTING has been a supplier of pipes, fittings, flanges and ready-to-install pipe-work components to the shipbuilding industry for over 30 years.

At an early stage, we opted for the maximum use of prefabricated pipes for this industry, based on models or pipework plans and isometric drawings. Clear arguments, and the general lack of space in shipyards and the demanding requirements for the welds speak for themselves.

### Prefabricated pipe fittings with flanged ends



What was initially limited to German shipyards has since become a global success story for BUTTING. For example, we have equipped and supplied pipes for many gas and chemical tankers in collaboration with shipyards in Croatia, Italy, Portugal, France, Poland, Romania, China, Denmark, the Netherlands and Germany in the last few years.

This was possible because BUTTING satisfies both material and quality requirements for these specialist ships and offers complete package deliveries. The high quality of the wide-ranging production programme – supported by distinctive factory prefabrication – also guarantees that the products are always operationally



**Pressure vessels for emergency air systems in submarines**

reliable at low investment and follow-up costs, and increases the profitability of your project.

## Factory prefabrication

The prefabrication of pipes and vessels involves installation work carried out under workshop conditions. The less pipe connections have to be manufactured and pickled in the shipyard, the higher is the quality of the welds and surfaces, thereby cutting maintenance and repair costs.

The following clear arguments favour prefabrication:

- Minimisation of welds at the assembly site, for example due to bending rather than welding elbows or using pipe nozzles instead of welding tees
- Improved production quality and less extensive testing due to the use of a wide range of modern workshop facilities
- Less space required at the shipyard
- Shorter installation time on site
- Full body pickling of all ready-to-install pipe components – the most reliable



**Sea water-cooled exhaust manifolds for a clean-up ship**

and environmentally-friendly method for sustainable corrosion resistance

- Certification by classification societies at BUTTING and thus consignment of parts ready for installation to the production site
- Increase in planning security for the assembly schedule through high-quality factory prefabrication that is completed on time

## Precise planning

To pre-plan factory prefabrication on paper, we use the latest 3D CAD systems. Our CAD service department supports responsiveness on site by drawing up assembly documents. A well-versed team at the factory and on site ensures that projects are handled smoothly.

To summarise: apart from significantly higher product quality, you will be won over by the major savings that can be made on the installation, maintenance and repair of pipe systems thanks to our factory prefabrication.

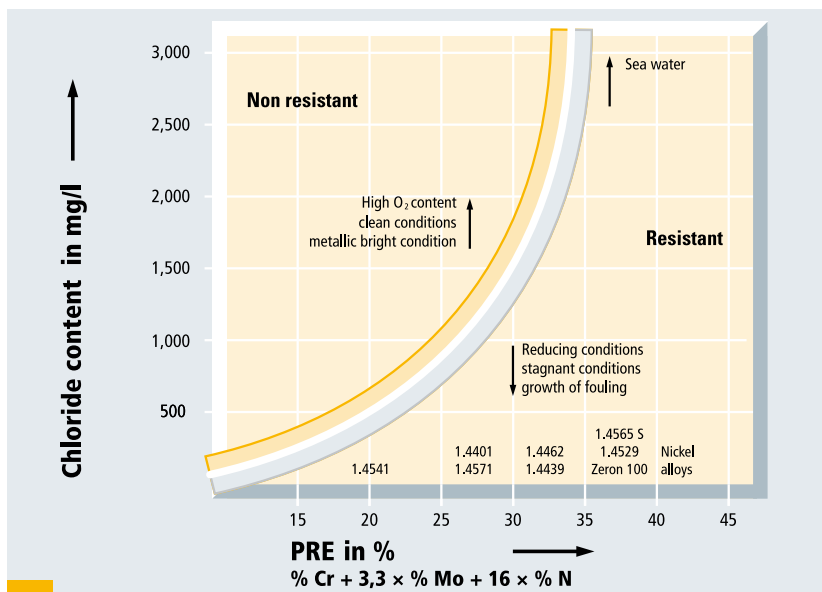
### Fully prefabricated modules implemented as “construction kits” on the ship



## Longstanding experience with materials

BUTTING has been processing stainless steels ever since they were developed and has concentrated on special alloys right from the start. We can therefore rely on our long experience in the forming, welding and heat-treatment of nickel alloys. By 1979, we were already producing longitudinally welded duplex pipes for an on-shore project. For over 30 years, we have been supplying pipes in nickel alloys (e.g. Alloy C4) for shipbuilding, the domestic chemical industry and off-shore installations.

The BUTTING processing programme offers a diverse spectrum of high-performance materials for specific and corrosive environments. The fabrication of innovative material grades for individual solutions is a daily challenge to our metallurgists, welding engineers and production staff.



Pitting and stress corrosion resistance of stainless steels in water

## Optimised material properties

Where there are special requirements, e.g. corrosion resistance, formability, strength or micro-structure, BUTTING optimises the properties of the parent metal and the longitudinal weld by heat treat-

ment, to adapt them to the requirements. There are various online and offline processes available for this: solution annealing, stabilising annealing, stress relieve annealing, recrystallisation annealing and soft annealing; followed by surface treatments such as peening, grinding and full-body pickling.

Material comparison table

Material grade no.	AISI/UNS	Chemical composition (%)						Other elements	Density (g/cm³)
		C ≤	Si ≤	Mn ≤	Cr	Mo	Ni		
<b>Stainless steels</b>									
1.4306	304 L	0.03	1.0	2.0	18.0 – 20.0		10.0 – 12.0		7.97
1.4541	321	0.08	1.0	2.0	17.0 – 19.0		9.0 – 12.0	Ti	7.97
1.4571	316 Ti	0.08	1.0	2.0	16.5 – 18.5	2.0 – 2.5	10.5 – 13.5	Ti	7.98
1.4404	316 L	0.03	1.0	2.0	16.5 – 18.5	2.0 – 2.5	10.0 – 13.0		8.00
1.4432	316 L	0.03	1.0	2.0	16.5 – 18.5	2.5 – 3.0	10.5 – 13.0		8.00
1.4435	316 L	0.03	1.0	2.0	17.0 – 19.0	2.5 – 3.0	12.5 – 15.0		8.01
1.4429	316 LN	0.03	1.0	2.0	16.5 – 18.5	2.5 – 3.0	11.0 – 14.0	N	8.01
1.4439	317 LMN	0.03	1.0	2.0	16.5 – 18.5	4.0 – 5.0	12.5 – 14.5	N	8.01
1.4539	904 L	0.02	0.7	2.0	19.0 – 21.0	4.0 – 5.0	24.0 – 26.0	Cu, N	8.00
1.4462	UNS S 31803	0.03	1.0	2.0	21.0 – 23.0	2.5 – 3.5	4.5 – 6.5	N	7.82
1.3952	316 LN	0.03	1.0	2.0	16.5 – 18.5	2.5 – 3.0	13.0 – 15.0	N	7.95
1.3964		0.03	1.0	4.0–6.0	20.0 – 21.5	3.0 – 3.5	15.0 – 17.0	N, Nb	7.91
<b>Copper based alloys</b>									
CW352H	C70600	0.05		0.5–1.0			9.0 – 11.0	Fe, Cu	8.90
CW354H	C71500	0.05		0.5–1.5			30.0 – 32.0	Fe, Cu	8.90
<b>Nickel based alloys</b>									
2.4360	UNS N04400	0.15	0.5	2.0			≥63	Fe, Cu	8.80