

## SPECIAL ALLOYS



**BUTTING**

### Progress by Tradition

BUTTING was founded in 1777 as a coppersmith's, by the ancestors of the current owner, Hermann Butting. In 1945, the family company moved its headquarters to Knesebeck and started producing soldered, and later welded, copper pipes. In the late 1950s, stainless steel gradually replaced copper as the main raw material for BUTTING products. The company has been in private ownership for seven generations, and its staff of over 1,300 now

handle approx. 40,000 tons of stainless steel of various grades every year.

### Diverse Range of Products

The production of high-quality longitudinally welded pipes made from stainless steel – in both standard and special sizes – has long been the focal point of our business since the development of stainless steels. Few companies in Europe can point to such longstanding experience and diversity as BUTTING in the production

of stainless steel pipes in sizes ranging from NB 15 to NB 1,800. Alongside the production of longitudinally welded pipes, BUTTING manufactures and supplies a wide range of pipework components. Our customers can cover all their pipework and component needs with us – from a single source. The combination of pipes and fittings of proven BUTTING quality into special ready-to-install piping components within our extensive prefabrication capacity also guarantees you optimum cost-effectiveness and reliability.



## Your Materials Specialist

BUTTING provides products from a diverse range of high-performance materials for specific corrosive applications in various industries. Besides austenitic, duplex and superduplex steels and titanium, BUTTING has focussed on the fabrication of special materials. A family company, it has extensive experience built up over many years of forming, joining and heat-treating high-alloy nickel-based materials.

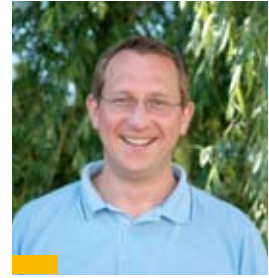
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### Stainless Steels



### Nickel-base Alloys



### Titanium & Titanium Alloys



### Stainless Steels with high Corrosion Resistance



## Close to Customers worldwide

For seven generations, the name BUTTING has stood for quality and flexibility. Pipes and pipework components are now produced in a number of production halls on our site in Knesebeck, which occupies over 380,000 m<sup>2</sup>.

The history of BUTTING is one of continuous healthy growth, with its roots in a far-sighted entrepreneurial spirit. It was this thinking that prompted Dr Hannshermann Butting to establish an affiliated company in Schwedt/Oder following German reunification in 1991. Today, BUTTING Schwedt



**III. 1: Progress by tradition – we are proud of our 230-year history**

is our expert unit for vessel and pipework construction and for international installations.

Since 2004, BUTTING has been present in China. We have a production facility in Malu on the outskirts of Shanghai, producing pipes and customised pieces for the Chinese market. Our aim is to inspire our customers. For some services and/or products this requires geographical proximity to our customers. For the same reason, we decided in 2005 to establish a branch in Canada. We wanted to use BUTTING Canada in Calgary to provide our Canadian customers with our many years of experience in processing stainless steels more quickly and directly.



**III. 2: A team with visions: (from left) Managing Directors Markus Bartsch, Hermann Butting, Dr Iris Rommerskirchen, Thomas Schüller, Dr Jens-Peter Lux**

## Our core Competences

Over the last few years, BUTTING has invested in the latest manufacturing techniques, environmental protection and quality assurance systems, to expand its core competences in the fields of materials, forming and welding technology.

We consider all the material properties of stainless steels throughout the value creation process. Our know-how and our capabilities in surface engineering guarantee you BUTTING products with maximum corrosion resistance.

At BUTTING, the use of compatible weld procedures for the materials in question guarantees you problem-free product deployment, based on over 50 years of experience in the welding of stainless steels. The daily work of our welding engineers is to use and optimise familiar weld procedures and tackle new challenges.

## Worldwide Yardstick for Quality

Since BUTTING was founded, reliable quality management has been a prominent pillar of our corporate philosophy. All over the world, the name BUTTING stands for high quality pipes, fittings and components. The high quality and reliability of our products are shown by the variety of applications in which they are used in all branches of industry, such as chemical plants, the aircraft and aerospace industry, power plants, environmental technology and shipbuilding industry.

The constant development of new products and processes and the continuous improvement of the status quo have a long tradition at BUTTING. Combining craftsmanship and engineering knowledge, we have been facing the challenges of tomorrow together with our customers for over 230 years, according to the motto "Nothing is impossible".

**III. 3: Your partner for longitudinally welded pipes and piping components**



## Experience with Materials

Since corrosion resisting steels were first developed, BUTTING has been processing these materials and has since gathered extensive experience in forming, welding and heat treatment of these for all types of industry. As early as 1979, the world's first longitudinally welded duplex pipes were produced for an on-shore project run by NAM. For over 20 years, we have been supplying pipes in high-alloy nickel-based steels for the construction of chemical plants, off-shore installations and ship-building.

## Materials Variety

The BUTTING production programme offers a diverse spectrum of high-performance materials for specific corrosive applications in a variety of industries. In this area, the individual requirements of our customers demand ever more innovative solutions, and set our metallurgists, welding engineers and production specialists all kinds of challenges.

These are some of the types of corrosion resisting steels that we process:

- Ferritic (1.4003, 1.4512, 1.4575 etc.)
- Ferritic-austenitic (1.4462, 1.4362, 1.4501, 1.4507)



**III. 4: BUTTING works a variety of materials into longitudinally welded pipes**

- Austenitic (1.4541, 1.4571, 1.4301, 1.4306, 1.4307, 1.4401, 1.4404, 1.4432)
- Austenitic special steels
- Ferritic heat resisting steels
- Highly corrosion resisting steels
- Creep-resistant, cryogenic, non-magnetic steels
- Aluminium and forgeable aluminium alloys
- Titanium and titanium alloys
- Clad materials
- 13 % Cr steels

## Optimised Material Properties

Where there are special requirements, e.g. in relation to corrosion resistance, workability, strength or micro-structure, BUTTING optimises the properties of the parent metal and the longitudinal weld by heat treatment and/or surface treatment, to adapt them to the requirements.

## Prevention of Damage

The aim of processing and using pipes, vessels and components in corrosion resisting stainless steels and special alloys is to avoid corrosion damage. In pursuit of this goal, BUTTING deploys its broad experience and technical knowledge in material science, process technology and welding and forming technology. An essential factor in choosing the right material, and so avoiding corrosion damage, is an intensive dialogue with the user.

## Individual Advice

Our expert staff will be happy to advise you on the subject of material selection, corrosion, heat treatment and surface treatment.

**III. 6: Highly corrosion-resistant materials have been processed in Kneesebeck for over 25 years**



**III. 5: Duplex pipes immediately after heat treatment**



## Selection of the right Material is crucial

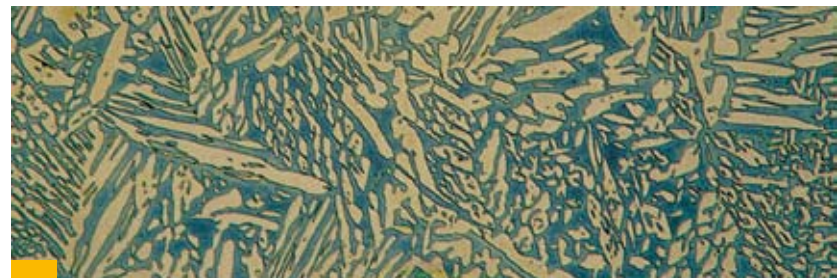
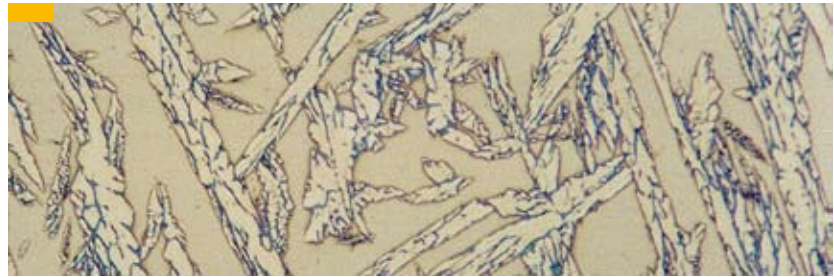
The correct selection of the appropriate material is crucial for its specific usability. In order to fight against possible forms of corrosion in various sectors of industry, a large number of steels and alloys has been developed. Individual requirements should be tested, and materials specific to the project should be chosen after consultation with experts, taking account of the availability of raw materials. However, appropriate processing and operating conditions in accordance with the materials remain basic necessities.

The basic qualities of certain selected materials will be briefly outlined below.

### Strain caused by chlorine-containing attacking Agents

For strains in connection with halogene ions (chlorides, fluorides, iodides, bromides) the use of steels with increasing contents of chromium and molybdenum is recommended. Besides the estimation of the halogene-ion content there are also aggravating high temperatures and low pH-values.

III. 7: Structure of a weld in duplex, not heat treated, approx. 60 % ferrite



III. 8: Structure of a weld in duplex with PWHT, approx. 40 % ferrite

Technically available steels are (in the order of their increasing alloy grade):

- 1.4571 (1.4404)
- 1.4435
- 1.4439/1.4462
- 1.4539
- 1.4529
- 1.4501

In case of especially high strains copper nickel alloys, high molybdenum-nickel alloys, e. g. 2.4610 and titanium will be considered.

### Strain caused by sulphuric attacking Agents

Besides increased molybdenum contents above all copper alloy steels offer higher resistance.

Technically available steels are (in the order of their increasing resistance in sulphuric dilutions):

- 1.4571
- 1.4439
- 1.4505
- 1.4539
- Sandvik SX
- 1.4591 (Alloy 33)

In case of especially high strains (above all at high temperatures) lead lining and nickel alloys are suitable.

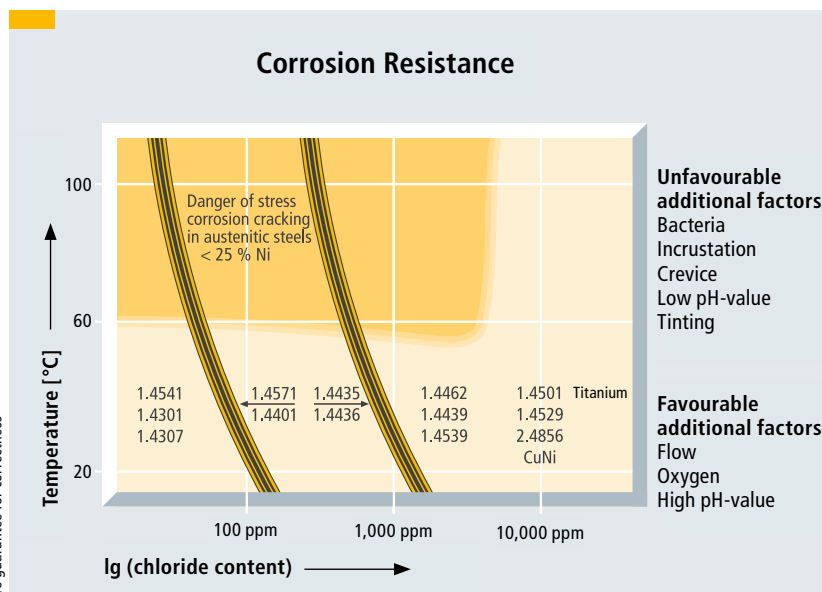
### Strain caused by phosphoric attacking Agents

Mainly in pure phosphoric acids up to high temperatures the austenitic molybdenum alloyed steels have proved their worth. As to contaminated phosphoric acids high-alloyed special steels are to be used.

Technically available steels are (in the order of their increasing resistance):

- 1.4571
- 1.4435
- 1.4439
- 1.4462
- 1.4539
- 1.4562

Chart 1: Resistance of stainless steels to pitting corrosion and stress corrosion cracking in waters



## Strain caused by nitric attacking Agents

Generally the resistance of stainless steels to nitric acids up to temperatures of about 50 °C is good. In case of higher temperatures special steels are to be used and attention must be paid to a high freedom from ferrite and only slightest contamination at the grain boundaries.

Technically available steels:

- 1.4306
- 1.4306 Electroslag Remelting Process
- 1.4335
- 1.4465
- 1.4361 (highly-concentrated nitric acid)



III. 9: Split pipe with welded seam in material SF-CU (CU 75), 1,451 × 35 mm

## Strain caused by organic attacking Agents

Stainless steels are resistant in most of the organic solutions and chemicals, e.g. greases, oils, benzene, phenols and other



III. 11: Installation of special alloy products at a chemical plant

carbon-hydrogen compounds and compared with unalloyed steels there is the advantage that these materials will not be contaminated by traces of rust.

Chlorinated hydrocarbons may represent a certain danger if they contain residual moisture and if chlorine ions are split off by the influence of oxygen and light (shares of ultraviolet radiation) and build up in the aqueous phase. In this case similar considerations as under section "Strain caused by chlorine-containing attacking Agents" would apply.

Generally it is recommended to consult an expert prior to the material selection for a specific project. Producers of stainless steels and special alloys, like ThyssenKrupp Nirosta, ThyssenKrupp VDM or Outokumpu can be contacted. Furthermore, there are independent associations, like DECHEMA, with the aim to support the end user and to be in an open dialogue with him.

The expert staff of BUTTING is also at your disposal for any advice you may need regarding material selection, corrosion and heat treatment.



III. 10: Prefabricated piping components made from duplex steel for the shipbuilding industry

## Stainless steels with high corrosion resistance

### 1.4361 – X1CrNiSi18-15-4

acc. to DIN EN 10088-2

**equivalent to:**

Cronifer 1815 LC Si, Uranus S1

**resistant to:**

sulphuric acid, high concentration and boiling nitric acid

**to be used in:**

chemical industry, sulphuric acid plants, production, storage and transport of nitric acids

### 1.4462 – X2CrNiMoN22-5-3

acc. to VdTÜV-Wbl. 418 and DIN EN 10088-2

**equivalent to:**

Uranus 45 N, FAL 2205, Cronifer 2205 LCN

**resistant to:**

waters contaminated by chlorides with high temperatures, sea water (partially), brackish water, solid matters causing wear

**to be used in:**

sour gas conditions, petro-chemical industry, sea water technology, desalination plants

### 1.4529 – X1NiCrMoCuN25-20-7

acc. to VdTÜV-Wbl. 502 and DIN EN 10088-2

**equivalent to:** Cronifer 1925 hMo

**resistant to:**

sulphuric acid, waters and acids containing chlorides, sea water

**to be used in:** paper and pulp industry, oil and gas industry, sea water lines in desalination plants, desulphurization plants

### 1.4539 – X1NiCrMoCu25-20-5

acc. to VdTÜV-Wbl. 421 and DIN EN 10088-2

**equivalent to:**

904 L, Uranus B 6, Cronifer 1925 LC

**resistant to:**

media containing phosphor, sulphur and chlorides

**to be used in:**

sulphuric acid plants, desulphurization plants, fertilizer plants, chemical industry, installation of line pipes, sour gas conditions, biodiesel plants

### 1.4547 – X1CrNiMoCuN20-18-7

acc. to DIN EN 10088-2

**equivalent to:**

254 SMO, Cronifer 2521 Nb

**resistant to:**

sulphuric acid, waters and acids containing chlorides, sea water

**to be used in:**

paper and pulp industry, oil and gas industry, sea water lines in desalination plants, desulphurization plants

### 1.4828 – X15CrNiSi20-12

acc. to SEW 470 and DIN EN 10095

**equivalent to:**

Uginox R20-12, Cronifer 2012

**resistant to:**

nitrogen containing gases with low oxygen content in temperatures of up to 1,000 °C

**to be used in:** furnace production, petro-chemical industry

### 1.4841 – X15CrNiSi25-21

acc. to SEW 470 and DIN EN 10095

**equivalent to:** Cronifer 2520

**resistant to:**

oxidizing and reducing (low sulphur content) gases in temperatures up to approx. 1,100 °C

**to be used in:** furnace production, petro-chemical industry

### 1.4876 – X10NiCrAlTi32-20

acc. to SEW 470, VdTÜV-Wbl. 412 and DIN EN 10095

**equivalent to:**

Nicrofer 3220/3220H, Alloy 800

**resistant to:**

long term stresses in hot gases/steam in temperatures up to 1,100 °C

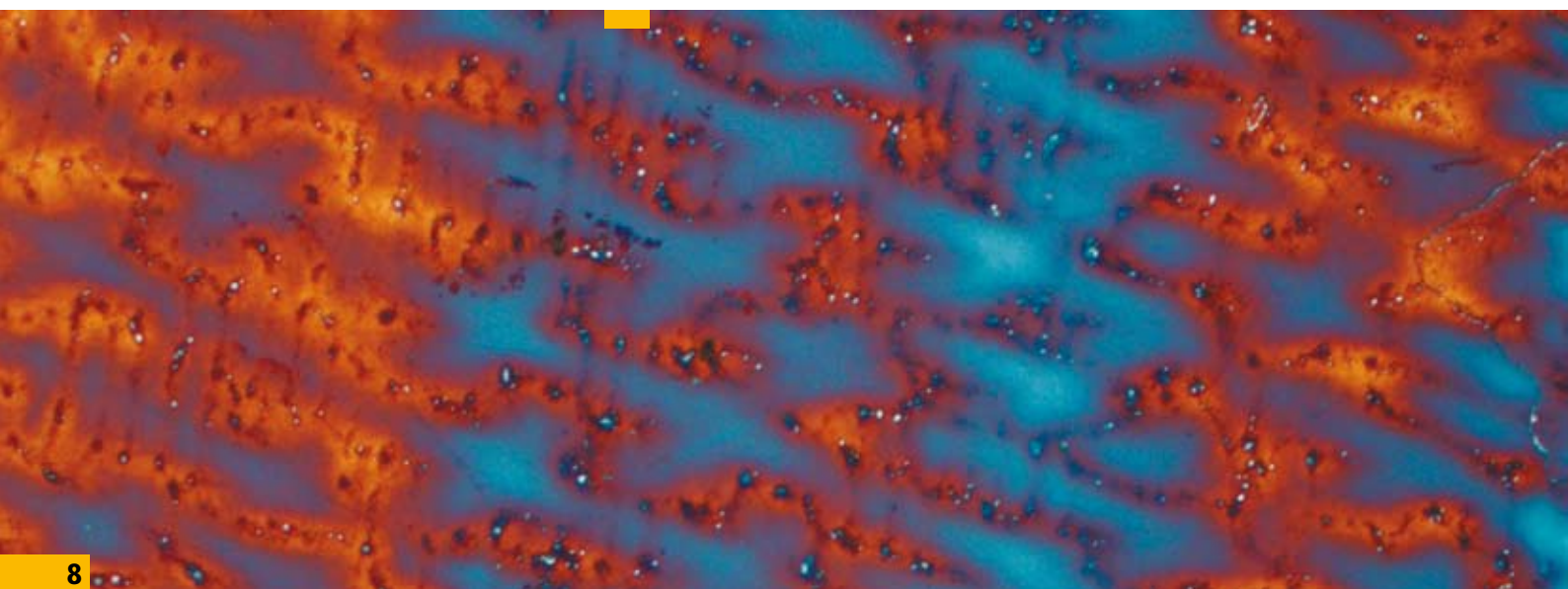
**to be used in:**

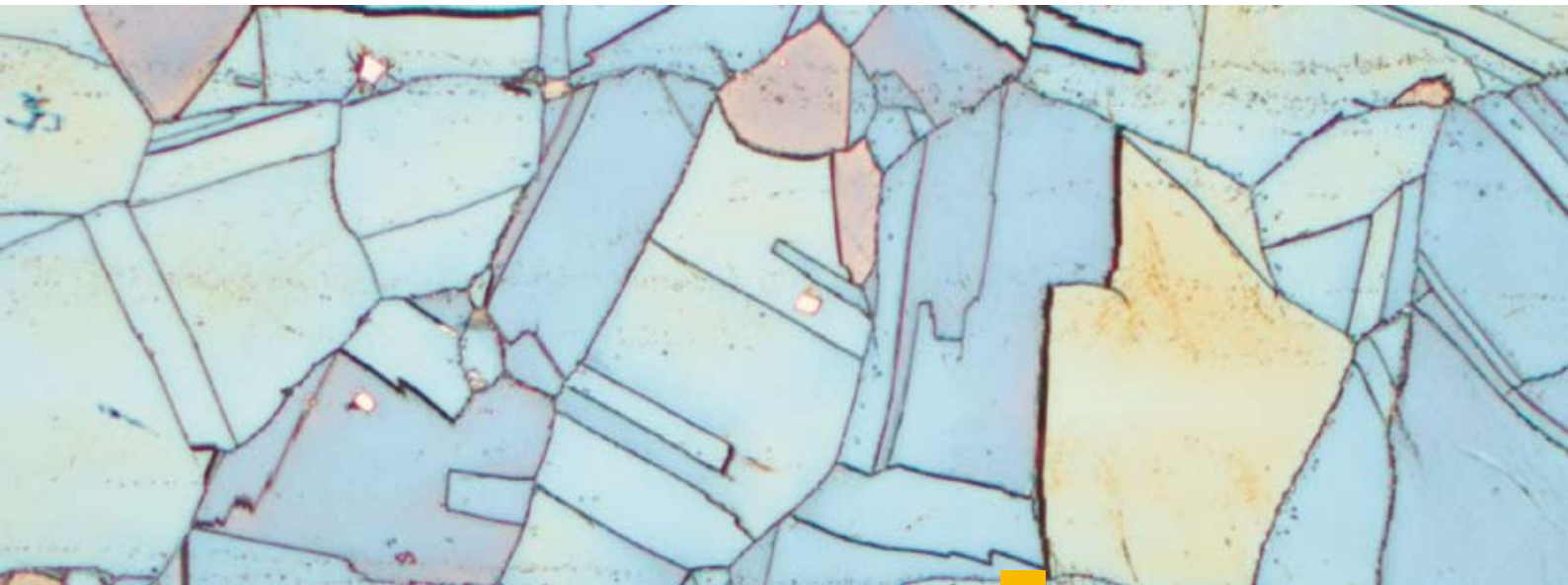
heat exchangers, steam reactors, furnace production, petrochemical industry

## Heat resisting Steels

These steels are noted for their high resistance to the attack of hot gases and incineration products at temperatures of 550 °C and above.

**III. 12: Structure of a weld in grade 1.4876**  
**Pipe size: 810 mm OD × 14.5 mm**  
**Etching medium: Beraha III**  
**Magnification 100:1**





**Ill. 13: Structure of parent metal of grade 1.4876**  
Pipe size: 810 mm OD × 14.5 mm  
Etching medium: Beraha III  
Magnification 100:1

## Nickel Alloys

### **CW352H** (was 2.0872) – **CuNi10Fe1Mn**

acc. to VdTÜV-Wbl. 420, DIN EN 1652

**equivalent to:**

Cunifer 10, Cupronickel 90/10

**resistant to:**

sea water, brackish water and industrial water

**to be used in:**

sea water linepipe systems in the ship-building industry, offshore applications, sea water desalination plants

### **2.4066/2.4068 – Ni99.0/LC - Ni99.0**

acc. to DIN 17740/2.4068, VdTÜV-Wbl. 345

**equivalent to:**

Nickel 99.2/LC-Nickel 99.2/Nickel 200/  
Nickel 201

**resistant to:**

numerous organic solutions and caustic lyes

**to be used in:**

production of soda lyes, chlorines, hydrochloric gases, soap and washing agents, in the food industry

### **2.4360 – NiCu30**

acc. to VdTÜV-Wbl. 263, DIN 17743

**equivalent to:**

Monel 400, Alloy 400, Nicorros

**resistant to:**

flowing sea water, hydrofluoric acid, sulphuric acid and non-oxidizing diluted acids, lyes and lye solutions

**to be used in:**

salt production, sea water desalination plants, processing of nuclear fuels

### **2.4602 – NiCr21Mo14W**

acc. to VdTÜV-Wbl. 479, DIN 17744

**equivalent to:**

Hastelloy C-22, Nicrofer 5621 hMoW, Inconel 622

**resistant to:**

aggressive, oxidizing and reducing media – also at elevated temperatures

**to be used in:**

power engineering in the chemical industry, production of acetic and formic acid, chlorous acid and phosphoric acid applications, exhaust gas cleaning systems

### **2.4605 – NiCr23Mo16Al**

acc. to VdTÜV-Wbl. 505

**equivalent to:**

Nicrofer 5923 hMo, Alloy 59

**resistant to:**

highly corrosive media under oxidizing and reducing conditions, mineral acids, e. g. nitric acids, phosphoric acids, sulphuric acids, hydrochloric acids

**to be used in:**

flue gas desulphurization plants, pharmaceutical industry, power plants operated with solid burnables, heating systems in waste treatment plants

### **2.4610 – NiMo16Cr16Ti**

acc. to VdTÜV-Wbl. 424, DIN 17744

**equivalent to:**

Nicrofer 6616 hMo, Alloy C-4

**resistant to:**

aggressive chloride and sulfate containing attacking agents under oxidizing and reducing conditions, diluted hydrochloric acids

**to be used in:**

chemical reactors, chlorination

### **2.4633 – NiCr25FeAlY**

acc. to DIN 17742, VdTÜV-Wbl. 540

**equivalent to:**

Nicrofer 6025 H/HT, Alloy 602 CA

**resistant to:**

thermal stresses up to 1,200 °C, even under extreme conditions, e. g. cyclic heating and cooling, oxidizing atmospheres containing sulphur, at elevated temperatures

**to be used in:**

furnace production, thermal and chemical processes, power plants

### **2.4819 – NiMo16Cr15Fe6W4**

acc. to VdTÜV-Wbl. 400, DIN 17744

**equivalent to:**

Nicrofer 5716 hMoW, Alloy C-276

**resistant to:**

humid chlorine gas, hypochlorite and chlorine dioxide solutions, concentrated solutions of oxidizing salts

**to be used in:**

chemical and petrochemical processes, equipment and components in flue gas desulphurization plants, sour gas applications, sulphuric acid coolers, paper and pulp industry, production and fabrication of organic acids

## Delivery Programme of special Steels

The BUTTING production programme offers a large range of high-alloy steels for specific corrosive applications. The grades described below are only an

extract from this programme, however offer individual solutions to nearly any use.

**Table 1: Excerpt of the BUTTING delivery programme for special alloys**

Material grade	UNS-No.	Other commercial designation	Abbreviation	DIN or SEW for parent metal (coil, plate) and pipe	ASTM for the parent metal/pipe	VdTÜV-Werkstoffblatt (data sheet)	Density (g/cm <sup>3</sup> )
1.4361	S30600		X1CrNiSi18-15-4	DIN EN 10088-2	A240/A269, A312	—	7.7
1.4429	S31653		X2CrNiMoN17-13-3	DIN EN 10088-2/ DIN EN 10217-7, DIN EN 10296-2	A240 / A312	—	8.0
1.4439	S31726		X2CrNiMoN17-13-5	DIN EN 10088-2/ DIN EN 10217-7, DIN EN 10296-2	A240/A249, A269, A312, A376, A409	405	8.0
1.4462	S31803	Duplex	X2CrNiMoN22-5-3	DIN EN 10088-2/ DIN EN 10217-7, DIN EN 10296-2	A240/A790, A928	418	7.8
1.4465			X1CrNiMoN25-25-2	SEW 400	—	486	8.0
1.4529	N08926		X1NiCrMoCuN25-20-7	DIN EN 10088-2/ DIN EN 10217-7	B625, A240/A312, B673, B674	502	8.1
1.4539	N08904	904L	X1NiCrMoCuN25-20-5	DIN EN 10088-2/ DIN EN 10217-7, DIN EN 10296-2	A240/A312	421	8.0
1.4547	S31254	254SMO	X1CrNiMoCuN20-18-7	DIN EN 10088-2/ DIN EN 10217-7, DIN EN 10296-2	A240/A312, A358	473	8.0
1.4562	N08031	Alloy 31	X1NiCrMoCu32-28-7	SEW 400	B625/B619, B626	509	8.0
1.4563	N08028	Alloy 28	X1NiCrMoCu31-27-4	DIN EN 10088-2/ DIN EN 10217-7	B709	483	8.0
1.4565/1.4565S	S34565		X2CrNiMnMoNbN25-18-5-4	DIN EN 10088-2	A240/A312	537	8.0
1.4591	R20033		X1CrNiMoCuN33-32-1	SEW 400	B625/B619, B626	516	7.9
1.4828	S30900		X15CrNiSi20-12	DIN EN 10095, SEW 470/ DIN EN 10296-2	A167	—	7.9
1.4841	S31000		X15CrNiSi25-21	DIN EN 10095/ SEW 470	A167	—	7.9
1.4876	N08800	Alloy 800	X10NiCrAlTi32-20	DIN EN 10095, SEW 470	A240, B409/B514, B515	412, 434	8.0
1.4958	N08810	Alloy 800H	X5NiCrAlTi31-20	DIN EN 10028-7	A240, B409/B514, B515	—	8.0
1.4959	N08811	Alloy 800HT	X8NiCrAlTi32-21	DIN EN 10028-7	A240, B409/B515	—	8.0
CW352H (was: 2.0872)	C70600		CuNi10Fe1Mn	DIN EN 1652	B122, B171/B466, B467	420	8.9
CW354H (was: 2.0882)	C71500		CuNi30Mn1Fe	DIN EN 1652	B122, B171/B467	420	8.9
2.4066	N02200	Ni 200	Ni99.0	DIN 17740/DIN 17751	B162/B725	—	8.9
2.4068	N02201	Ni 201	LC-Ni99.0	DIN 17740/DIN 17751	B162/B725	345	8.9
2.4360	N04400	Alloy 400	NiCu30	DIN 17743, DIN 17750/DIN 17751	B127	263	8.8
2.4600	N10675		NiMo28Fe4Co2Cr	DIN 17744, DIN 17750/DIN 17751	B333/B619, B626	512, 517	9.2
2.4602	N06022	Alloy 22	NiCr21Mo14W	DIN 17744, DIN 17750/DIN 17751	B575/B619, B626	479	8.7
2.4605	N06059	Alloy 59	NiCr23Mo16Al	DIN 17744, DIN 17750/DIN 17751	B575/B619, B626	505	8.6
2.4610	N06455	Alloy C4	NiMo16Cr16Ti	DIN 17744, DIN 17750/DIN 17751	B575/B619, B626	424	8.6
2.4633	N06025	Alloy 602 CA	NiCr25FeAlY	DIN 17742, DIN 17750/DIN 17751	B168/B516, B517, B546	540	7.9
2.4650	N07263		NiCo20Cr20Mo5Ti2A6	DIN 17744, DIN 17750	—	—	8.4
2.4816	N06600	Alloy 600	NiCr15Fe8	DIN EN 10095, DIN 17742, DIN 17750/DIN 17751	B168/B516, B517	305	8.5
2.4819	N10276	Alloy C-276	NiMo16Cr15Fe6W4	DIN 17744, DIN 17750/DIN 17751	B575/B619, B626	400	8.9
2.4851	N06601	Alloy 601	NiCr23Fe15Al	DIN EN 10095 DIN 17742, DIN 17750/DIN 17751	B168	—	8.2
2.4856	N06625	Alloy 625	NiCr22Mo9Nb	DIN EN 10095, DIN 17744, DIN 17750/DIN 17751	B443/B444, B704, B4705	499	8.4
2.4858	N08825	Alloy 825	NiFe30Cr21Mo3	DIN 17744, DIN 17750/DIN 17751	B424/B704, B705	432	8.1

## Longitudinally welded Pipes

BUTTING produces high-quality longitudinally welded pipes for use all over the world. Since stainless steels were first developed, we have been working a wide variety of material grades into pipes and components. Our experience and diversity in the production of stainless steel pipes is unique across Europe. Our know-how in forming, welding and materials technology and our quality assurance are in evidence every day as we satisfy requirements from all kinds of industry.

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

- Continuous production from coil
- Pipe production from plates

## Comprehensive manufacturing Equipment

The continuous, fully-automated production process is the most technically sophisticated and economical process for manufacturing longitudinally welded pipes and profiles. In the process, cold forming, welding, heat treatment, calibration and non-destructive testing take place on-line, i.e. in a carefully calculated work sequence. On several production lines, BUTTING can produce pipes from coil with diameters from 20 mm to 762 mm and



**III. 15: Production of a pipe by forming a plate**

wall thicknesses up to 16 mm. The normal length manufactured is 6 or 12 m. However, shorter fixed lengths or lengths up to a maximum of 18 m can be manufactured in the line, in a number of sizes without circumferential weld.

Longitudinally welded pipes with wall thicknesses up to 70 mm and a maximum outside diameter of 3,000 mm can be produced from individual plates on our state-of-the-art production facilities, with no outsourcing of individual production steps, in standard lengths up to 24 m.

## Special Requirements

All technical product features such as dimension, production conditions, inspection requests or mechanical technological



**III. 16: Continuous forming of the coil by cold-forming**

### III. 14: Orbital weld with high-quality welded seam



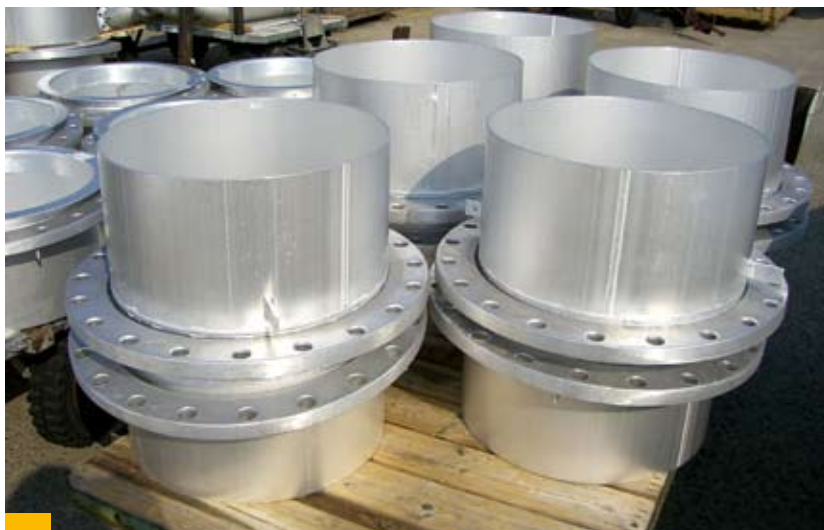
properties can be harmonised with us and optimised with regard to the application. The customer requirements may refer to a special tolerance of the outside or inside diameter for special geometries as well as for round section pipes. Tighted diameter tolerances are feasible by hydraulic calibration.

## Welding Technologies for all Requirements

BUTTING has both the processing facilities as well as qualified and certified staff to carry out all the usual welding processes. For welding thick-walled plates, including those of high alloy materials, we are one of the few manufacturers in Europe to use not only the submerged arc welding method, but also the efficient electron beam welding process, with its excellent performance and reproducibility.

## Elbows and Fittings

Along with longitudinally welded pipes, BUTTING also produces and supplies pipe fittings made to project requirements from all the stainless steel materials that we handle. In addition to an extensive stock of standard grades these fittings are produced on an order-by-order basis, to particular geometries and from special alloys for a variety of different applications.



III. 17: Piping components with flanges made from light metal

## Elbows

Depending on the outside diameter, we produce pipe elbows without 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 even bigger 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 or ASTM standards, or on the basis of the customer's specifications.

The branches are produced as saddles, as extruded or butt-welded branches.



III. 19: Production of project-specific shaped parts to the highest quality standards

## 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 Components

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

## 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 NB 400 in size are produced continuously from coils, or in individual production, from plates. Cold formed angles from plate are used to make larger welded collars up to NB 1,000.

## Reducers

Depending on the size, BUTTING produces reducers both from longitudinally welded pipe and plate. The customer can specify an eccentric or concentric (conical) shape – also with cylindrical ends. Depending on requirements, the tolerances and testing for these fittings are defined according to DIN, ASTM or the customer's specifications.

III. 18: Prefabricated piping component for the petrochemical industry in material 2.4819/Alloy C276



III. 20: Producing fittings for pipework systems for well equipment from a copper-nickel alloy

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 components.

## Many Years of Experience

The prefabrication of pipes and vessels involves installation work carried out under workshop conditions. The fewer welds have to be made and pickled on site, the higher the quality of the joints and surfaces.

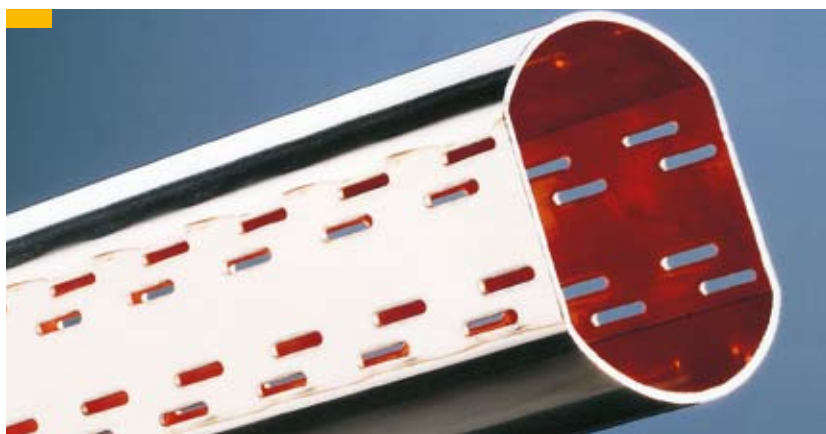


**III. 21: Pipes in 1.4539 with special flange for a seawater desalination plant**

The following clear arguments favour prefabrication:

- Minimisation of joint welds on the construction site, for example due to bending rather than welding elbows or using pipe sockets instead of welding tees
- Improved production quality and less extensive testing due to the use of a wide range of modern workshop facilities

**III. 22: "Beam Screen Pipe" for the LHC-project at CERN – a longitudinally laser welded pipe in a special shape, made from a perforated coil, coated with copper**



- Less space required on construction site
- Shorter installation times on site
- Full-body pickling of all ready-to-install pipe components – the most reliable and environmentally-friendly method for sustainable corrosion resistance
- Increase in planning security for the assembly schedule through high-quality factory prefabrication that is completed on time

Prefabrication at BUTTING allows an efficient and integrative construction site planning. Furthermore prefabricated piping components guarantee a significantly higher product quality, a fast assembly and provide extensive savings potentials for installation, maintenance and repair of piping systems.

## Preliminary Service – CAD

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.

## Reliable Vessels

Since BUTTING was founded, the construction and assembly of vessels has been part of its wide range of services. BUTTING Anlagenbau makes both one-piece and multi-part vessels based on extensive factory prefabrication, in accordance with customers' specifications. The vessel production line guarantees a top-quality production process and is



**III. 23: Protective sleeve in grade 2.4856 (Inconel 625) in the exhaust gas system of a large Diesel engine**

equipped with the latest metal-forming and welding technology. For decades, the company has been building up its reputation in the chemical industry and shipbuilding industry through the supply of pressure tanks made from special materials.



**III. 24: Pressure vessels in 1.4565 for installation in submarines**

## Everything from one Source

BUTTING offers their customers "vessels, pipelines and assemblies – a one-stop service": the effective cooperation of material guidance and pipeline planning, the combination of pipeline and vessel construction, of CAD planning and economical prefabrication, the optimized shipping handling and site organisation and the high-quality assembly achievement may be of use for the realisation of your investment. We like to support you providing our expert knowledge and experience.

## The Surface Condition counts

After their fabrication, stainless steels must have the same corrosion resistance – especially when used as welded joints – as the parent metal. It is therefore very important to provide a bright metallic surface, i. e. it must be completely free from tinting, scale and ferrite contamination. This is why BUTTING recommends the prefabrication of pipework components at the factory, as the whole component can then be treated to full-body pickling. This production step also minimises the time-consuming and cost-intensive process of environmentally unfriendly pickling on the construction site.



III. 25: Externally ground pipes in copper-nickel alloy

III. 26: Full-body pickling of pipes in a copper-nickel alloy using adequate pickling media

III. 27: Pipe pickling installation offering big capacities



## Care right down the Line

The value added processes at BUTTING take into account the material properties of corrosion-resistant steels. Prior to the start of production, the materials are stored properly. During production, it is ensured that the raw material is processed using corrosion-resistant steel tools only. Due to the large number of high alloy special steels and their different requirements in the process industry, BUTTING uses various customized methods for surface treatment.

## Optimum pickling Conditions

BUTTING subjects all stainless steel pipes, fittings and components to this kind of full-body pickling. Chemical full-body pickling remains the most reliable method of eliminating ferrite contamination and tinting, as well as grease left over from production. This ensures that the part is clean and that the necessary corrosion

resisting passive layer is formed even in otherwise inaccessible places. We have a number of 20.0 x 4.0 x 2.0 m pickling baths, plus 16 pipe pickling baths up to 27 m long. Hydrofluoric acid, nitric acid, sulphuric acid, hydrogen peroxides and other agents are utilized. Easy filling and draining of the basins, as well as storage of the required chemicals, enable the use of individual pickling media to suit the material to be pickled. In our factories, very large components and vessels can also be treated by spray pickling, if required.

## Alternative Surface Treatments

BUTTING has the skill and capacity for various forms of surface finishing. In addition to chemical surface treatment, customer-specific requirements are met by means of mechanical processes, in particular grinding inside and outside surfaces. Our products can also be treated by shot-blasting with different types of grit.





## Approved worldwide

The Quality Management System of BUTTING is approved by Germanischer Lloyd according to DIN EN ISO 9001:2000. BUTTING also holds approvals from classification companies and third party inspectorates, like Bureau Veritas and BDLI and renowned companies.

BUTTING also holds the following approvals:

- Weld procedure qualification acc. to AQUAP
- FRAMA TOM ANP-KTA 1401, iAEA 50-C-Q and TÜV-Nord Anlagentechnik AVS D 100/50, KTA 3211.1, KTA 3211.3
- Approval by Germanischer Lloyd for the welding of materials in defence engineering
- TÜV in accordance with the AD Merkblatt WO/HPO and TRD 100/201 and DIN EN 729-2
- Extensive verification of suitability acc. to DIN 18 800 part 7
- Approval acc. to HPO with DIN EN 729-2 and DGRL 97/23/EG
- Approval acc. to the Water Resources Act (WHG) § 19 I



III. 28: Burkhard Hirtz at tensile test with microstrain measurement



- Statement of Assessment ASD-EASE acc. to EN 9100 (without design)
- Environmental Management System acc. to DIN EN ISO 14001
- Work Safety Management System acc. to OHSAS 18001

BUTTING complies with many testing and accreditation requirements:

- § 20 of the rules and regulations of radiation protection
- Accreditation of the laboratory acc. to DIN EN ISO/IEC 17025:2000 etc.

The family business is also certified for projects according to Norsok.

## A great Number of Testing Installations

As regards **non-destructive testing**, the equipment for the following testing methods is available at BUTTING:

- Radiography
- Radioscopy

## III. 29: Digital X-ray equipment: symbol of quality assurance at highest technical level

- Radiology for pipes of up to 18 metres
- Eddy-current testing
- Ultrasonic testing
- Hydrostatic pressure testing
- Endoscope
- X-ray flash device
- Surface roughness measurements
- Dye-penetrant testing and magnetic particle inspection

The following **destructive tests** are performed in the internal laboratory:

- Corrosion tests
- Hardness tests
- Ferrite determination
- Tensile tests with microstrain measurement
- Hot tensile tests
- Bend tests
- Charpy-impact tests, also at low temperatures
- Technological testing
- Metallographic examinations
- Spectroscopic analysis

## III. 30: Corrosion test by Reinhold Hoffmann



## Successful for Decades

BUTTING pipes in special materials can be found in many projects all over the world – from Europe and Asia to Australia and America. Since the mid-1980s, we have been producing pipes and pipework components from special alloys, such as nickel-based alloys, for various projects with the highest technical demands. We have supplied well-known customers in the chemical, oil and gas industries all over the world, including BP, Lurgi, Statoil, Agip, ENI, Bayer and BASF.

## Years of Experience

We have always supported projects all over the world with our long-standing experience and competence in the production of special alloys. For example, Haldor Topsoe in Denmark has been an established customer for many years. Only recently, we were contracted to supply pipes in materials 1.4959 (UNS N08811) and 2.4633 (Alloy 602CA). The 174 × 3.0 mm pipes will be used in flue gas systems.

## Special Alloys for special Demands

An oil sand company in Canada, Syncrude Ltd., has built one of the world's largest flue gas scrubbers in the western province



III. 31: Pipes for a desulphurization plant in Qatar

of Alberta, which extracts the oil locked in the sand by various scrubbing processes. The pipework systems needed for the scrubbing process, with their mountings and a maintenance platform, were produced by BUTTING. The order was for a total weight of around 180 tons of stainless steel in the nickel-based alloys 2.4605 (Alloy 59) and 2.4819 (Alloy C276). It was the first time we had processed nickel-based materials on this scale for a single project. The specification provided by the American process engineers placed the strictest demands not only on the welds but also on the quality of production. Not only that; almost 1,000 components in nickel-based alloys had to be turned out in 27,000 production hours in just 27 weeks.

Thanks to our production planning and flexibility, and ability of our project managers, we were actually able to bring the requested delivery date forward – to the delight of the project managers in Canada.

## Worldwide Deployment

For the expansion of one of the largest and most efficient refineries in India, BUTTING was recently given an order to supply pipes made of Alloy 625 (UNS N06625) and Alloy 20 (UNS N08020). In the range of 16" to 30", a total of 89 tons of sheet steel was made into pipes. For example, our delivery included pipes 610 × 17.48 mm.

III. 32: Central pipe for an injection stage in the world's largest exhaust gas scrubbing system in Canada



Through our affiliated company BUTTING Shanghai, we received an order from Bayer Integrated Site Shanghai to produce and supply pipes for conveyor lines in material grades 904L and Alloy C4 (UNS N06455) for the MDI project.

### Project-specific Requirements

Because of their acknowledged quality, BUTTING pipes in special materials were also used for the Umm Shaif project. We received the order from Hyundai Heavy Industries in Korea to produce just over 140 tons of pipes in material 2.4856/Alloy 625 (UNS N06625). The pipes, with an outside diameter of up to 32" will be deployed in the gas injection facility in one of the world's largest offshore plants in Abu Dhabi.

BUTTING was selected as a supplier to the largest international project so far for the oil and gas industry in Kazakhstan by the engineering company responsible, Petrofac International Ltd.; the investment runs to more than 5.5 billion US dollars. We supplied the Karachaganak project with longitudinally welded pipes in sizes from 6" to 18" in material 2.4858/Alloy 825 (UNS N08825). We had to meet the highest demands with regard to tolerances and weld quality.



**III. 33: Seawater-cooled flue gas manifold for a hazardous material accident ship in material 1.4565**

High quality standards were a criterion when BUTTING was contracted to produce and supply pipes for the Darquain oil field. Just over 250 tons of pipes in sizes from 4" to 20" in materials such as 2.4856/Alloy 625 (UNS N06625) and 2.4858/Alloy 825 (UNS N08825) will prove their worth in natural gas transport around 100 km southwest of Ahvaz in the Iranian province of Khuzestan.



**III. 34: Pressure vessels in 1.3964 for the shipbuilding industry**



**III. 36: Prefabricated well heads in special materials**

### Diverse Applications

Apart from the sectors we have already discussed, BUTTING pipes in special materials are also used as heat exchanger tubes in the chemical and petrochemical industries. For example, BUTTING used coiled steel to produce 25 x 1.5 mm tubes in material 2.4602/Alloy C22 (UNS N06600) for this purpose in the USA. Tubes in these smaller dimensions have also been supplied to German users in material 2.4610/Alloy C4 (UNS N06455).

For an Asian seawater desalination plant, BUTTING processed more than 162 tons of superduplex steel plate. Pipes in various dimensions with large wall thicknesses such as 36" x 23.84 mm had to be supplied, to meet the increased pressure requirements demanded by the operating conditions.

To guarantee corrosion resistance in the aggressive saline seawater encountered in the drilling industry, many projects have

already had well heads fitted by BUTTING with pipes and prefabricated components in duplex and superduplex materials. For example, we handled the production of components weighing 1 ton each, with pipes of OD 508 x 9.53 mm and the complete assembly 3,155 x 1,000 mm. This order posed a particular challenge because of the tight tolerances with respect to shape and position.

Because of our many years of experience in working special materials, BUTTING regularly receives orders to supply pipes and prefabricated piping components for the shipbuilding industry. For example, pipework components in material 1.4432 (min. 2.5% Mo) were supplied to Croatian shipbuilders. But we also frequently deliver products in materials 1.4435, 1.4439 and 1.4529, as well as UNS C70600 and UNS C71500, for cooling water and steam pipes in chemical tankers.

We will be happy to send you an up-to-date reference list on request.

**III. 35: Superduplex pipes in 12 metre lengths**



**Safe Transport**

In order to avoid damages or impairment of the quality of the pipes, elbows and fittings during transport, BUTTING has developed various packing methods. Besides standard cases and seaworthy crates, special wooden skids to ensure easy loading and off-loading of containers for export are produced by BUTTING.

**Special Project Requirements**

The packaging is always project-specific and tailor-made dependent on the product and transport conditions. In the case of special requirements for inside surfaces, e. g. for piggable pipes, these are protected by plastic caps. Ground pipes are protected with plastic foil. The pipes and piping components are put together in bundles and protected by wooden constructions to avoid any direct contact with the transport and handling equipment.

**Our Packing – your additional Benefit**

Logistic processes are rendered more efficient by the packing we use, e. g. the loading and off-loading times are reduced, less safety measures are needed, easier trans-shipments in the case of collect freight and storage without any additional equipment.

**III. 37: Transport by rail**



**III. 40: Packaged pipes in a copper-nickel alloy**



**III. 38: Pipes in material 1.6780/HY 80 packaged for a specific project**



**III. 41: Heavy transport of a segment elbow for a flood control reservoir**

Besides the transport by trucks, it is also possible to ship by rail via our own rail link in Knesebeck. Transport by barge is also possible via the harbour in Wittingen, which has direct access to the Elbe-Lateral-Canal.

In Schwedt direct access to the European waterways is possible now via the new Oder harbour.

**All-round-Service**

BUTTING offers its customers an all-round-service – from the selection of the right materials to the dispatch of piping components ready for use. For many projects all over the world BUTTING has proved a reliable partner owing to deliveries on time. Please let us assist you with your projects.

**III. 39: Transport by air freight to guarantee delivery on schedule via Hanover airport**





**Longitudinally welded pipes**

Produced continuously from coil in sizes of 15 mm – 762 mm OD and wall thicknesses up to 16 mm

From plate: in sizes of 33.7 mm – 3,000 mm OD and wall thicknesses up to 70 mm

Pipes in special shapes

In random lengths up to 24m with circumferential welds



**Clad pipes**

Mechanically bonded BuBi®-pipes in sizes of 114.3 mm – 660 mm OD

Metallurgically clad pipes

In random lengths up to 24m with circumferential welds

**Material selection**

- Steels containing 10.5% Cr min, e.g.
  - Stainless steels
  - Heat resisting steels
  - Creep resisting steels
- Nickel alloys
- Titanium
- Aluminium and aluminium alloys
- Special alloys
- Clad materials



**Vessel construction**

Up to 6,000 mm OD: complete prefabrication at the mill

Above 6,000 mm OD: prefabrication at the mill and assembly on site

**Approvals**

- By TÜV acc. to AD-WO/HPO and TRD 100/201 and DIN EN 729-2
- DGRL (pressure equipment directive)
- Acc. to the Water Resources Act (WHG) § 19 I
- Quality Management System acc. to DIN EN ISO 9001:2000
- Accreditation of the laboratory acc. to DIN EN ISO/IEC 17025:2000
- Statement of Assessment ASD-EASE acc. to EN 9100 (without design)
- Environmental Management System acc. to DIN EN ISO 14001
- Work Safety Management acc. to OHSAS 18001



**Pre-fabrication**

Piping components ready for assembly

Pipe bends acc. to drawings, piping segments, isometric drawings



**Fittings**

Tees, reducers, special fittings

Pipe bends acc. to DIN 2605

Collars acc. to DIN 2642

Elbows with long radii



**Piping technology**

Pipes with special tolerances, e.g. furnace rollers, jackets for pumps

Pipes with special surface requirements, e.g. for the pharmaceutical industry, architecture

Further processing of pipes using forming, grinding, laser cutting, e.g. jackets for pumps, valves and lamps

Special products, e.g. BUTTING HeRo® (an uncooled furnace roller)



**Assemblies**

Vessels

Linepipes

Special constructions, equipment



**Surface treatment**

Pickling (also on subcontract basis)

Blasting, peening (also on subcontract basis)

Grinding (also on subcontract basis)



**Services**

Expert technical and metallurgical guidance

CAD-facilities, isometric drawings

Metallurgical testing and non-destructive testing

**Photographs**

Cover: BUTTING laboratory

Aerial view: Thomas Keller

Inside: Heike Butting, BUTTING laboratory Company archives Rutzen & Scherer, V. Konow, S. Wilke, A. Cordes S. Salzbrunn



Areal view BUTTING Knesebeck



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