Edition 2017

BAVARIA SCHWEISSTECHNIK®

Product Catalog

Bavaria Schweisstechnik

YOUR PARTNER FOR
Submerged Arc Welding
Electro Slag Welding

SAW / ESW technology
for your application

Notes for users

The following information and technical data have been compiled to assist in selecting the most suitable wire/strip-flux combination for each specific SA welding and ES welding requirement. Exact specific application as well as approvals should be discussed with us before use.
The properties listed in this booklet are characteristic values in the as-welded and/or post-weld heat-treated condition based on laboratory and approval tests. For multi-run technique they are based on the all-weld metal test specimen according to EN ISO 14171 using the test assembly in accordance with EN ISO 15792-1 (type 1.3) or AWS A5.17/A5.17M and A5.23/A5.23M when mentioned. For two-run technique the test assembly used is in accordance with EN ISO 15792-2 (type 2.5).
The European standards applying to the wire and strip electrodes and fluxes for submerged-arc welding (SAW) or electroslag welding (ES) are comparable to the corresponding ASME/AWS codes AWS A5.17/A5.17M and A5.23/A5.23M for carbon and low-alloy steel electrodes or AWS A5.9/A5.9M for stainless steel electrodes and AWS A5.14/A5.14M for nickel-base electrodes.
The properties as stated in the technical data sheets are indicative and should not be considered as guaranteed.

When welding in single- or two-run technique, mixing with the parent material and the heat input influences the mechanical properties of the weld joint. Thus, selection of the appropriate wire / flux-combination as well as procedure tests before use are crucial, including for approved wire/flux combinations. Details are available on request.

The national and international safety and health standards on the subject and the Material Safety Data Sheets must be strictly observed.

All information and data are based on knowledge at time of going to press (July 2017).

Subject to change without notice.

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General

Welding fluxes

Welding wires

Packaging types

History

1985 Founding of BAVARIA Schweisstechnik GmbH with equal shares held by Heinrich Haala and Kurt Lettner in Unterschleissheim

1990 A fire completely destroys the factory shed and the manufacturing plant in it

1991 Relocation and launch of the new company site

1993 Introduction of the Lloyds Register Quality System to assure and verify product quality and consistency

1994 Acquisition of all shares by Kurt Lettner from the Haala family

1994 Development and launch of medium basic welding fluxes for pipe production in the oil and gas industry

1995 Introduction of ISO 9000 (later 9001) to assure and verify product quality and consistency

2000 Expansion of sales activities in more than 25 countries

2005 Finished product storage capacity is increased to 1,300 tonnes

2006 Implementation of a pilot plant for welding flux development

2007 Development and manufacturing of products for deposition welding by ESW and submerged-arc welding technology

2009 With Hubert and Robert Lettner the next generation takes over

2012 Opening of the SA welding and ESW technology applications centre with a 4-wire SA plant and ESW plants for cladding with strips up to 90 mm

2013 Expansion of sales activities in more than 50 countries

2015 Commissioning of the second production line for manufacturing welding flux

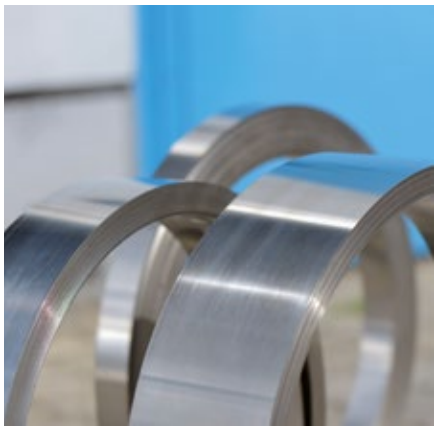
2016 Expansion of the company grounds by a locksmith's shop

The company

BAVARIA Schweisstechnik was founded in 1985 by Kurt Lettner. The experienced industrial chemist had previously developed flux at leading companies in the sector. His know-how has helped shape the development of submerged-arc welding technology since 1969 when it was still in its early stages and forms the foundation on which BAVARIA Schweisstechnik was established. In 2009, Robert and Hubert Lettner took over the company from their father and expanded it even further.

The globally active company has established itself since its founding as a specialist in flux, wires and strips which help to achieve optimal submerged-arc welding results even in unusual applications. Particularly our strict compliance to quality standards and close cooperation with the users enables us to respond to their needs flexibly, quickly, and in high-quality. Experienced specialist engineers and technicians assist our customers in selecting the appropriate combination and assist in all questions concerning applications – even on site if necessary.

From the company headquarters in Munich, customers in over 50 countries worldwide are supplied with fluxes and filler materials for even the most challenging uses. Shipping by sea, land and air is provided as a matter of course. Many manufacturers of welding filler materials use the know-how of BAVARIA Schweisstechnik and sell the products under their own brand name.



High-quality tailored products for all applications

“Our customers always receive high-quality flux, tailored to their specific requirements where necessary, and with the suitable filler materials on request, with prompt and efficient delivery and comprehensive technical support where needed at sensible prices.”

Recognised quality

The flux, welding wires and strips are manufactured by BAVARIA Schweisstechnik according to the highest quality demands. The company is certified according to EN ISO 9001:2015 and recognised as a manufacturer of filler materials in accordance with the relevant VdTUEV regulations. Inspections and audits by various quality control companies regularly confirm the success of our quality management. A variety of individual customer specifications also highlight the high quality of the products offered by BAVARIA Schweisstechnik. This guarantees perfect weld seams even in difficult applications, as well as a consistent high quality.

Normative references of this product catalogue

The information and data sheets in this brochure are based on the relevant normative references of European and US publications and standards at the time of going to press (July 2017). The normative references are cited at the appropriate locations in the technical data sheets and in the text. The references and publications are as follows:

EN 10204	Metallic products – Types of inspection documents.
EN 13479	Welding consumables – General product standard for filler metals and fluxes for fusion welding of metallic materials
EN 14532-1	Welding consumables – Part 1: Primary methods and conformity assessment of consumables for steel, nickel and nickel alloys
EN ISO 544	Welding consumables – Technical delivery conditions for filler material and fluxes – Type of product, dimensions, tolerances and marking –
EN ISO 3690	Welding and allied processes – Determination of hydrogen in deposited weld metal arising from the use of covered electrodes for welding mild and low alloy steels
EN ISO 9692–2	Welding and allied processes – Joint preparation – Part 2: Submerged arc welding of steels
EN ISO 13916	Welding – Guidance on the measurement of preheating temperature, interpass temperature and preheat maintenance temperature during welding
EN ISO 14171	Welding consumables – Solid wire electrodes, tubular cored electrodes and electrode/flux combinations for SAW of non alloy and fine grain steels – Classification
EN ISO 14174	Welding consumables – Fluxes for SA and ES welding – Classification
EN ISO 14341	Welding consumables - Wire electrodes and weld deposits for gas shielded metal arc welding of non alloy and fine grain steels – Classification
EN ISO 14343	Welding consumables – Wire electrodes, strip electrodes, wires and rods for arc welding of stainless and heat resisting steels – Classification
EN ISO 14344	Welding consumables – Procurement of filler materials and fluxes
EN ISO 15792–1	Welding consumables – Test methods – Part 1: Test methods for all–weld metal test specimens in steel, nickel and nickel alloys
EN ISO 15792–2	Welding consumables – Test methods – Part 2: Preparation of single-run and two-run technique test specimens in steel
EN ISO 18274	Welding consumables – Solid wire electrodes, solid strip electrodes, solid wires and solid rods for fusion welding of nickel and nickel alloys – Classification
EN ISO 24598	Welding consumables – Solid wire electrodes, tubular cored electrodes and electrode/flux combinations for SAW of creep-resisting steels – Classification
EN ISO 26304	Welding consumables – Solid wire electrodes, tubular cored electrodes and electrode/flux combinations for SAW of high strength steels – Classification
AWS Spec A5.01/A5.01M	Welding Consumables – Procurement of Filler Metals and Fluxes
AWS Spec A5.09/A5.09M	Specification for Bare Stainless Steel Welding Electrodes and Rods
AWS Spec A5.14/A5.14M	Specification for Nickel and Nickel-Alloy Bare Welding Electrodes and Rods
AWS Spec A5.17/A5.17M	Specification for Carbon Steel Electrodes and Fluxes for SAW
AWS Spec A5.23/A5.23M	Specification for Low Alloy Steel Electrodes and Fluxes for SAW

Quality and operating standards of the company

CERTIFICATE

The company

Bavaria Schweißtechnik GmbH
Wiesenweg 23
85716 Unterschleißheim

has been audited and approved as manufacturer of filler metals according to

VdTÜV-Merkblatt 1153
in connection with AD 2000-Merkblatt W 0

The scope of the audit and other relevant data are detailed in our report no. 2645617 with audit list and enclosure.

The company
has facilities permitting manufacturing and inspection in compliance with the current technical standards,
operates a quality system which guarantees that manufacturing and inspection of the filler metals stated in our report are in conformity with the technical rules and standards,
employs qualified supervisory and inspection pe

The certificate expires in December 2018.

Munich, December 06th, 2016

EQ2719282

Certificate of conformity of the factory production control

0036 - CPR - S 002

In compliance with Regulation 305/2011/EU of the European Parliament and of the Council of March 09th, 2011 (Construction Products Regulation - CPR), this certificate applies to the construction product

SAW wire electrodes acc. to EN ISO 14171, EN ISO 24598 and EN ISO 26304
SAW fluxes acc. to EN ISO 14174

for the use in metallic structures or in composite metal and concrete structures.

Produced and delivered by

BAVARIA SCHWEISSTECHNIK GmbH
Wiesenweg 23
D-85716 Unterschleissheim

This certificate attests that all provisions concerning the assessment and verification of constancy of performance described in annex ZA of the harmonised standard

EN 13479:2004

under system 2+ are applied and

the factory production control fulfils all the prescribed requirements set out above.

This certificate was first issued on February 8th 2006 and renewed on December 06th 2016 and will remain valid as long as the test methods and/or factory production control requirements included in the harmonised standard, used to assess the performance of the declared characteristics, do not change, and the product, and the manufacturing conditions in the plant are not modified significantly and latest on December 5th 2019.

Further information about the product parameters and description of the products are included in the annex 1 to this certificate.

Munich, December 06th 2016

Notified Body, No. 0036

(D. Zellmer)
(Subst. Head of the Certification Body)

CERTIFICATE

The Certification Body
of TÜV SÜD Management Service GmbH
certifies that

Bavaria Schweißtechnik GmbH
Wiesenweg 23
85716 Unterschleißheim
Germany

has established and applies
a Quality Management System for

Design, production and marketing of agglomerated and fused fluxes for the SAW-Process and ESW-process, as well as marketing of appropriate filler materials.

An audit was performed, Report No. 70016962.
Proof has been furnished that the requirements according to

ISO 9001:2015

are fulfilled.

The certificate is valid from 2016-07-15 until 2019-07-14.
Certificate Registration No.: 12 100 9745 TMS.

Product Compliance Management
Munich, 2016-06-17

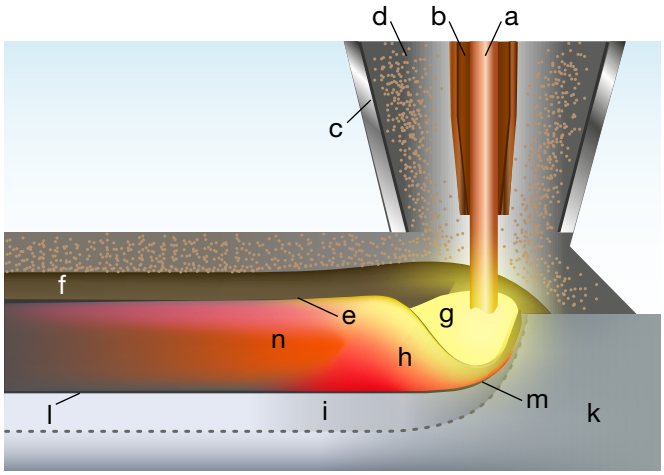
Submerged-arc welding (SAW)

Technical information about the process, filler metals and the application

In SA welding, an electric arc is created between a bare metal electrode and a workpiece. This arc and the molten metal are “submerged” in a blanket of granular fusible flux. The heat generated by the plasma of the arc together with the thermal reactions in the welding zone continuously melts the end of the electrode (solid wire, filler wire, strip electrode), parts of the flux and the edges/surface of the base material.

The arc and the molten weld pool are protected against atmospheric contamination by the cover of the liquid flux slag and the mound of unfused flux. Gases and vapours created during the melting of the metals and the flux form an arc cavity. Here intensive chemical reactions with a rapid and high exchange of elements between the liquefied droplets of the electrode, the molten base metal and the flux slag occur, continuing in the molten pool near the arc. The strong stirring motion in the weld pool increases the rate of reaction and distributes these reaction products (gases and slag particles) throughout the liquid metal as inclusions. The gases diffuse progressively, effecting a deoxidation of the weld metal; the inclusion/particles partly nucleate, and are trapped between the solidifying grains. The weld pool and, the liquid flux slag cool and solidify, forming the weld and a protective slag cover over it.

Schematic of the SA welding system



a = Wire/strip electrode
b = Contact nozzle (AC or DC connection)
c = Flux hopper
d = SA welding flux
e = Liquid flux slag
f = Solid slag
g = Arc cavity with arc and droplet transfer
h = Liquid weld metal
i = Heat affected zone (HAZ)
k = Base material with earth connection (AC or DC)
l = Finished weld
m = Melt front
n = Solidification zone

The SA process can be successfully applied for joining/surfacing of most unalloyed and low-alloy steels and many types of high-alloy stainless steels, using the single-wire technique (with AC or DC power sources) or the multi-wire method, such as TANDEM, with two and more independent arcs. Wire electrodes or strip electrodes are combined with suitable welding fluxes to meet the requirements of the base material and the material specifications.

Good welding results can be obtained if the key factors are considered:

- Base material, especially the welding technology and heat treatment characteristics.
- Weld seam preparation and weld construction.
- Fusion and dilution of the base metal due to the heat input of the process and, as a consequence, the cooling rate Dt 8/5 of the fusion zone.
- Welding parameters and performance.
- The SAW flux and its characteristics mainly with regard to its alloying behaviour in combination with a standard wire/strip electrode.
- Official regulations and requirements, and health standards.

Fluxes for SA welding

Fluxes for SA welding are manufactured from mineral constituents in two main forms: fused and agglomerated.

Agglomerated fluxes are a mixture of selected, finely crushed minerals from natural sources, partly heat-treated before manufacturing, and metallic additives. All constituents are thoroughly dry mixed and bonded with either potassium silicate or sodium silicate to create a moist mixture. This mixture is pelletised and shaped into grains by special equipment such as mixer and pelletiser unit. After baking and screening to the proper grain size, the flux is ready for testing and packaging.
Agglomerated flux made by BAVARIA is a heterogeneous product in which the individual powdered particles of the raw materials are bonded and baked together in their original and natural quality. That means: each grain of an agglomerated flux is heterogeneous, but all the heterogeneous grains are identical to each other. Thus, constant metallurgical reaction during welding and uniform welding characteristics with reproducible results can be obtained. It is also notable that BAVARIA fluxes are baked at a higher operating temperature (around 900 °C). Together with the pre-baked and selected raw materials, a low hydrogen potential is achieved with BAVARIA agglomerated fluxes.
Despite the very short time scales between melting and solidification during welding, agglomerated fluxes are active enough to generate ions and vapours which are beneficial for the metallurgical effects inside the arc cavity and the weld pool. Depending on the characteristics of the flux and the welding data, there are intensive metallurgical interactions between the reactants of the shielding flux slag, of the wire droplets and of the base material.

To produce **fused fluxes**, the raw materials (different ores and minerals) are completely melted in an electrical furnace at temperatures over 1,250 °C to create a homogeneous chemical product. After melting, the furnace charge is poured onto large chill blocks. After cooling, the solidified flux breaks into pieces which are crushed, screened for sizing, tested and packed. Based on the chemical composition and the cooling rates during chilling, fused flux can have glassy or crystalline, edgy grains with various colours. Fused fluxes are commonly manufactured without deoxidisers or ferro–alloys. So the metallurgical activity is kept quite constant, which is highly appreciated when welding stainless or heat-resistant steels.

Flux properties

SAW fluxes are granular, fusible mineral compounds. Compositional differences between the flux, the welded metal and the wire electrode must be considered. The differences are mentioned in the paragraph on classification of SAW fluxes as per EN ISO 14174.

SAW fluxes should:
- Increase the stability of the arc by improving the electrical conductivity and ionisation of the slag and arc plasma.
- Produce gases and vapours in the arc zone for stable droplet transfer and welding execution.
- Create a sufficiently viscous slag to protect the welding zone against atmosphere and to form the weld bead surfaces.
- Influence the metallurgy of the weld pool by burn-out or pick-up of alloy elements.
- Have good weldability such as self-detaching slags and excellent weld bead shaping.
- Be applicable for various welding problems and processes in combination with standard wire electrodes.

Flux basicity

In literature and technical data sheets, the degree of basicity or the basicity index (BI) of a SAW flux is used to describe the chemical characteristics of a SAW flux slag and its metallurgical nature. The BI defines the ratio between the basic and the acid oxides of a flux slag. The BI can be an additional and optional indication for the type of flux and its application; BI is not mentioned in the classification standards such as ISO 14174 or AWS A517/A5.23.

$$\frac{\%\ CaO + \%\ MgO + \%\ BaO + \%\ CaF_2 + \%\ Na_2O + \%\ K_2O + 0{,}5\ (\%\ MnO + \%\ FeO)}{\%\ SiO_2 + 0{,}5\ (\%\ AL_2O_3 + \%\ Ti\ O_2 + \%\ ZrO_2)}$$

(% by weight) / (% by weight)

Based on the calculations according to this formula, SAW fluxes can be classified into several chemical groups (similar to the coating of stick electrodes) for different applications.

Basicity index		Type of flux	Oxygen (O) content of weld metal (wt.–%)
BI	≤ 0.9	**Acid**	≥ 700 ppm
BI	0.9 – 1.2	**Neutral**	500 – 700 ppm
BI	1.2 – 2.0	**Semibasic / Basic**	300 – 500 ppm
BI	≥ 2.0	**High basic**	≤ 300 ppm

• Acid and neutral fluxes produce slags with lower melting range than the weld metals. This is advantageous for best deslagging capability. The electrical conductivity of the liquid flux slag is high enough to create very good surface appearance of the welds. Acid / neutral fluxes such as BF 1, BF 4, are mainly of the MS/CS/AR/AB types, which possess excellent weldability and are used for SAW of thin-walled metals, e.g. fillet welding of fin–tube walls or LPG cylinders.

• Semi-basic / basic fluxes solidify at temperatures similar to or higher than that of the weld metal with many gas/metal and flux/metal reactions. Microslag inclusions can partly remain as microconstituents and can act as nuclei during the matrix formation. On the other hand, the oxides swept into the weld pool drift to the top of the weld metal at quite early stages, so effecting good de-oxidation and structure in the weldment. Semi-basic / basic SAW–fluxes are used for single- and multi-wire processes in combination with compatible wires to achieve adequate mechanical properties with low-temperature impact toughness (–40 °C and lower). Fluxes such as BF 5.1, BF 6.30 and BF 6.5 provide good weldability with fine weld seam forming and self-detaching slag. Low diffusible hydrogen in the deposited weld metal can be achieved.

• High-basic fluxes possess low slag viscosity and low current carrying capacity. Small quantities of microslag inclusions and oxides have beneficial effects for the formation of tough cryogenic impact properties. High-basic fluxes such as BF 10 are commonly used with single-wire / tandem processes to reach –60 °C impact strength with suitable wire electrodes and low diffusible hydrogen levels.

Fluxes – grain size and distribution

Flux grain size and size distribution are important:
- for the influence on flux transport and extraction
- for the influence on the current-carrying capacity
- for the forming of a perfect weld bead (smoothness, shape, contact angle)
- for stabilisation of the arc and the effects during metal/slag transfer in the weld pool

In general:
- If amperage increases: average grain size should decrease (less coarse grains) and fine grains should be increased.
- If amperage with a given grain size is too high: arc may be inconsistent, and may cause rough, uneven weld seam edges.

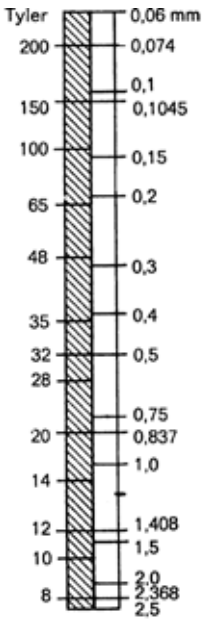
Coarse grain sizes are necessary:
- for rusty and dirty plates, to aid degassing from the weld pool.
- for correct feeding into the flux recycling system.
- for economic reasons (fewer dust particles during recycling).

Fine grain sizes are necessary:
- for dense shielding of the welding zone by the flux covering.
- to reduce atmospheric influence in flux feeding.
- to avoid “flash-through” during welding, so as to achieve higher welding speeds and current carrying capacities.

The **grain size** is usually marked for a flux with 2 mesh numbers (according to TYLER-ASTM Spec.E 11 or ISO 14174).

Largest and smallest grain size numbers give only the range and do not indicate whether the flux is: **coarse with some fines or fine with some coarse grains**. Important for the welding characteristics and the application of a flux are the grains between 0.5 mm and 1.6 mm, which should be more than 70 % in total.
To verify correct distribution during flux production, accurate grain size distribution is measured by weighing and sampling on standard mesh screens. Flux which remains on each screen is weighed as a percentage of the total sample.

Typical grain sizes acc. to EN ISO 14174	**acc. to Tyler**
2 – 20 (0.2 – 2.0 mm)	8 – 65 (8 and 65 mesh per sq. inch)
2 – 16 (0.2 – 1.6 mm)	10 – 65



Specification for welding flux BF 1: Grain size 2-16

>1.6	1.0 – 1.6	0.5 – 1.0	0.20 – 0.5	<0.2	[mm screen]
max 3	max 30	30 – 55	25 – 50	max 3	[%]
		Main grains 0.315 – 1.2 mm			

Specification for welding flux BF 6.5: Grain size 2-20

>2.0	1.6 – 2.0	1.0 – 1.6	0.5 – 1.0	0.315 – 0.5	0.2 -0.315	<0.2	[mm wiresize]
max 1	max 10	max 35	min 50	max 25	max 4	max 1	[%]
			Main grains 0.5 – 1.6 mm				

Aspects to be considered when selecting a flux for welding standard steels

In SA welding, the following factors and influences should be considered:

Heat input calculated according to the formula in Joule/cm:

$$\frac{\text{I (Ampere) x U (Volts) x 60}}{\text{welding speed (cm/min)}}$$

Usually the heat input is around 18,000 – 21,000 Joule when welding low-alloy CMn steels or fine-grain structural steel. That means: typical welding data are approximately 580 A / 30 V / 55 cm/min / 4 mm Ø.

Cooling rates: ($\Delta_{t\ 8/5}$) determines the hardness of the HAZ. The faster the rate, the harder the metallurgical structure and consequently the greater the risk of cracking. Adequate cooling rates are also necessary to achieve a proper transformation of the microstructure (mainly $\gamma \rightarrow \alpha$). Proper cooling rates (or preheating) can also help to reduce the risk of hydrogen-induced cracking in the welded metal.

Hydrogen in the SA weld seam can create porosity when excess dissolved hydrogen is trapped in the solidifying weld. The $\delta \rightarrow \gamma \rightarrow \alpha$ transformation ejects the “diffusible” hydrogen. Most of it escapes into the atmosphere within 24 hours. The remaining excess escapes over the next three weeks. The last remaining hydrogen in the metal is the so-called “residual” hydrogen.
Hydrogen in hardenable steel may cause welding problems known as cold cracking. The cracking risk for CMn steels can be expressed by the carbon equivalent CE (see formula). Steels with CE
$\geq$ 0.40 are susceptible to hydrogen-induced cracking; special precautions, such as appropriate preheating and interpass temperatures and subsequent soaking at 250 °C, must be taken.

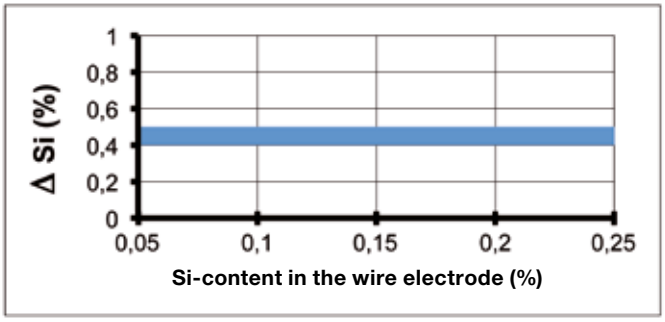
$$\mathbf{C_E = \%C + \%Mn / 6 + \%(Cu+Ni) / 15 + \%(Cr + Mo + V) / 5} \qquad \text{(\% by weight)}$$

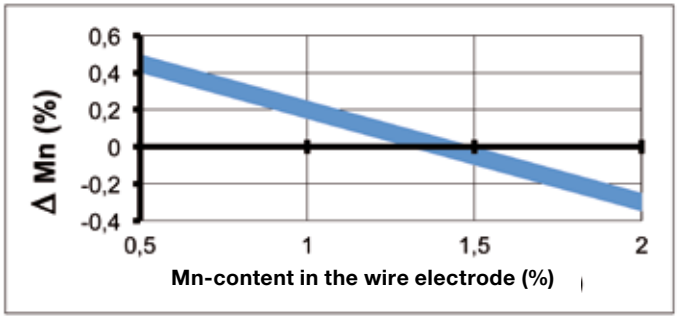
Hydrogen levels are measured according to ISO 3690 as H2 diff. in ml/100 g deposited weld metal. Typical levels for BAVARIA fluxes are max.5 ml/100g deposited metal with the designation H5 according to ISO 14174. In case of requirements H2 diff. below 4 ml/100g, other important factors for achieving lowest hydrogen levels such as power source (type of current) or flux recycling systems for example have to be discussed.

Gas/metal and flux/metal interactions: slag-metal reactions occur rapidly at high temperatures in the arc plasma (so-called droplet reactions), followed by less effective reactions with the molten metal at lower temperatures (weld pool reaction).
The reactions for silicon and manganese are described in the standard EN ISO 14174.

Metallurgical behaviour of a flux:
Pick-up or burn-out of silicon and manganese in combination with a standard wire S2 according to EN ISO 14171-A and standardised welding parameters (580 A (= +) / 29 V / 55 cm/min; 4 mm Ø)

Example: **BF 4**





The Si/Mn reaction diagrams of each flux are given on the flux data sheets. These flux reactions can be used to calculate the chemical composition of a weld in advance.

Chemical composition of each element “X” in the undiluted weld metal is:

$$X_{RSG} = X_{wire} \pm X_{flux}$$ (% by weight) X_{flux} = flux pick-up or burn-out of element X

For practical application, the seam preparation – and so the mix of base metal and weld metal – must be considered, too:

$$X_{weld\ metal} = (1 - D) \times (X_{wire} \pm X_{flux}) + (D \times X_{base\ metal})$$ in % by weight
D = dilution ratio

Note: typical SA weld seam preparations for steel are recommended in EN ISO 9692–2.

Storage and handling recommendations of BAVARIA SAW fluxes

General

As a result of carefully selected raw materials and optimized manufacturing conditions the BAVARIA fluxes have a guaranteed as-delivered low moisture content from the factory. That is valid for both agglomerated and fused fluxes. Commonly, the fluxes are delivered in plastic bags, steel drums or specially coated Big Bags, containing 25 to 1,250 kg. All flux packages are normally supplied on wooden pallets with a net weight up to 1,250 kg; pallets are shrink-wrapped with plastic foils before delivered from the factory. To maintain the as-delivered low moisture content as long as possible, the handling and storage of the flux must be according to the following recommendations of BAVARIA.

Transport

Transportation of the flux must be in covered vehicles. Packages must be shrink-wrapped in plastic or kept in dry cardboard or wooden boxes on undamaged pallets.
Unprotected containers and flux packages must not be exposed to direct wetness, like snow and rain. Damaged containers must be repacked within one hour, otherwise they should be scrapped. A maximum of two pallets may be stacked onto each other without additional supports.

Storage

General rule for stock is: first-in, first-out / separating flux types and flux lot number, including recycled fluxes. Fluxes shall be protected against exposure to weather. Unopened originally packed flux bags, drums or Big Bags shall be kept under properly maintained and controlled dry storage conditions as follows:

- Temperature 25 ± 10 °C
- Relative humidity as low as possible, not exceeding 70 %

Agglomerated fluxes stored according to these conditions have a lifetime of max. one year and fused fluxes of max. five years after date of delivery ex-factory.
Extended periods of storage $\geq$ 1 year or uncontrolled storage conditions require appropriate packaging to effectively stop moisture from the air diffusing into the flux, e.g. rubber – sealed drums, PE-coated aluminium bags or aluminium Big Bags which can be supplied on request. If the flux is supplied in aluminium sealed bags (big bags or 5 – 25 kg alu bags) it is not necessary to control the humidity and the temperature in the storage facility must be above 5° C.
The content of unprotected flux hoppers must be placed in a drying cabinet or should be kept in heated flux hoppers at 150 ± 25 °C.
Remaining flux from opened bags or drums must also be kept at 150 ± 25 °C before actual use.

Recycling

Moisture and oil shall be removed in a suitable way from the compressed air used in the flux-recovery system. Addition of new flux to the recovered flux quantity shall be according to the actual flux consumption to maintain almost the original grain size. Commonly the ratio is at least one part of new flux to three parts of recovered ones. Foreign material such as millscale, dross or other impurities from plate surfaces or preparation etc. and uncrushed flux slag from the welding process should be removed by adequate recovery devices such as sieves or dust separators.

Drying

When handled and stored as mentioned above, the BAVARIA fluxes can normally be used as they are. If, however, a severe application (as given by the material specification) is considered, redrying of the flux is recommended.

Drying shall be performed as printed on each flux label as follows:

- 200 ± 50 °C effective temperature of low-basic to semi-basic fluxes (200 – 250 °C max. 10 h)
- 300 + 50 °C effective temperature of high-basic fluxes (max. 10 h)

Drying shall be done in appropriate flux–redrying furnaces which should be constructed to allow steam, condensation moisture and vapour to effuse.
If a BAVARIA flux has picked up moisture (due to any unfavourable handling or storage) proper flux redrying as mentioned above can return the flux to its original state.
Redried flux, not immediately used, should be kept at 150 ± 25 °C before actual use.
For cleaning or collecting non-fused flux only proper wire-brushes should be used to avoid flux contamination.

SA wire electrodes for unalloyed and fine-grain steels

The wire electrodes are selected corresponding to the chemical composition of the base metal. In combination with an appropriate flux, the mechanical electrodes are classified according to ISO 14171-A or other standards such as ASME / AWS A5.17, A5.23. Chemical properties in the weld metal are obtained to meet certain requirements of the base metal. It should be noted that the mechanical properties of the all–weld metal test specimens used for the classification of a wire / flux–combination will vary from those obtained in production due to differences in welding procedures such as electrode size and welding parameters.

Wire electrodes for unalloyed steels, fine grain steels, for boiler and vessel constructions are mainly alloyed with manganese/silicon and further alloying elements like nickel, molybdenum and chromium. The most common types are:

Alloy	Wire electrode	Main application
Mn	S1/S4	CMn steel up to 420 N/mm² Y.S., boiler plates, fine-grain steel
MnSi	S2Si/S3Si	Fine-grain steel, offshore constructions
MnMo	S2Mo/S4Mo	Fine-grain steel up to P/S 460 N and corresponding pipeline steels, Mo-alloyed boiler plate and shipbuilding steel
MnCrMo	S CrMo1/S CrMo2	CrMo–alloyed boiler plates and pipe steel of quality 13CrMo4–5, 10CrMo9–10(ASTM A387, grade 11 – grade 22, grade 5)
	S CrMo5	X16CrMo 5
MnNi	S2Ni1/S2Ni3	Fine-grain steel with low temperature toughness
MnNiMo	S3Ni1Mo	Special heat-resistant steels (e.g. reactor structural steel) and high-strength fine=grain steels such as N-A-XTRA 70, HY 80 etc.
MnNiCrMo	S3NiMoCr	High-strength structural steels, Q+T types, such as HY 100
MnNiCu	S2NiCu1	Weather-resistant fine-grain steel e.g. COR-TEN or PATINAX

According to ISO 14171 and similar to AWS A5.17/5.23 the chemical compositions are as follows:

Symbol	Chemical composition in % by weight *)				
	Mn	Si	Mo	Ni	others
Si	≤ 2.25	0.15–0.40			
Mo	≤ 2.25		0.45–0.65		
MnMo	≤ 1.20		1.10–1.45		
MnMoTiBor	≤ 1.60		0.45–0.65		Ti ≤ 0.16 / B ≤ 0.016
Ni	0.8–1.3			0.80–1.20	
Ni1.5	0.8–1.7			1.20–1.80	
Ni2	0.8–1.3			1.80–2.40	
Ni3	0.8–1.3			2.80–3.70	
Ni1Mo	0.8–1.8		0.45–0.65	0.80–1.20	
SZ	not specified (on agreement between supplier and user)				
	*) If not specified: Mo <0.15, Ni <0.15, Cr <0.15, Cu <0.3, V <0.08, Nb <0.05.				

Storage and handling recommendations for solid wires for SAW processes

1. Products
All grades of solid wires supplied by BAVARIA are melted in an electric arc furnace/AOD converter combination and continuously cast in a billet caster. This ensures a uniform chemistry throughout the melt. Heat to heat tolerances for each element are kept at a low level.
During rolling and drawing, close control of diameter is observed as well as close control of the copper coating.
Commonly, for 20 up to 100 kg coils, the wire is layer wound on a basket, packed in shrink wrapped plastic and in cardboard boxes. Large PAY-OFF Packs (POP) of 250 kg and more are cardboard barrels with an inner core. So-called “crown-spools” or spiders with more than 700 kg net weight need an appropriate decoiling stand.
The wire end is usually anchored to the wire basket or wooden bobbin or to the core or crown to prevent loose wire-end short-circuits. At the wire start a label with all characteristics is attached.

2. Marking
All wire coils are provided with labels inside the package and outside. The minimum information given on each label is:
Company – Type designation – AWS Designation (where applicable) – Lot number – Diameter – Coil weight – Warning (according to AWS/ANS Z49) where applicable.
The label at the start of the wire shall always be maintained throughout the welding process for quality control reasons.

3. Storage and handling
The common rule: first in – first out should be observed. The wire electrodes should be kept in the original packaging, wire in damaged package must be properly repacked right away; otherwise it may have to be scrapped.
SAW solid wires can fundamentally be stored for an indefinite period as the surface is coppered. However, if the surface is wet even the coppering does not guarantee a one hundred percent protection against corrosion. Therefore the wire electrodes should be stored inside a building to protect against weather influences and precautions taken to prevent a wet wire surface during processing.
Sudden and drastic changes in temperature should be avoided to prevent the formation of condensation water.
Therefore wire electrodes transported from outside to heated production rooms should be left in the original packaging and not used before reaching ambient temperatures during cold winter months.
Moisture absorption of wire electrodes in the original package can be neglected in dry condition (in-house), even after long storage (> 2 years).
Redrying of wire is not usual. Wet or oily wire shall be discarded.
Unused wire shall be properly stored in the original package with the identification label at the wire-start in dry storage rooms.
Unused wire without identification labels shall be discarded, as shall wire with rusty, greasy or oily surfaces.
Depending on requirements, wires in the welding machines shall be protected by appropriate means against chemical attack.

4. Transportation
Wires must be transported in covered vehicles. Unprotected wire spools or coils must not be exposed to direct wetness like snow or water.

Classification of fluxes according to EN ISO 14174

Based on the following factors of influence, the standard EN ISO 14174 distinguishes fluxes:
- according to the method of manufacture in **Fused and Agglomerated** types
- according to the **typical chemical composition** of each flux based on its main constituents

Symbol	Characteristic chemical constituents	Limit values of constituents %	BAVARIA fluxes
CS **C**alcium–**S**ilicate	$CaO + MgO + SiO_2$ $CaO + MgO$	min. 55 min. 15	BF 8.1, BF 47, BF 47NiMo, WP 380
AR **A**luminate–**R**utile	$Al_2O_3 + TiO_2$	min. 40	BF 1
AB **A**luminate–**B**asic	$Al_2O_3 + CaO + MgO$ Al_2O_3 CaF_2	min. 40 min. 20 max. 22	BF 3, BF 3.5, BF 4, BF 5.1, BF 6.30, BF 6.30 MW, BF 6.4
AF **A**luminate–**F**luoride–Basic	$Al_2O_3 + CaF_2$	min. 70	BF 38
FB **F**luoride–**B**asic	$CaO + MgO + CaF_2 + MnO$ SiO_2 CaF_2	min. 50 max. 20 min. 15	BF 6.5, BF 8.5, BF 10, BF 10 MW, BF 16, BF 44, BF 46

- According to their **application in 3 classes:**

Class 1: Suitable for SAW of unalloyed and fine-grain steels, high-strength steels, creep-resistant steels, and atmospheric corrosion resisting steels. There are no alloys other than Mn + Si. Thus the weld metal analysis is predominantly influenced by the composition of the wire electrode and the metallurgical reactions. The fluxes are suitable for joint welding and/or overlay welding.

Class 2/2B: For joint welding of stainless and heat-resistant Cr(NiMo) steel and/or nickel and nickel-based alloys and corrosion-resistant overlay welding. Class 2 is mainly suited for joint welding and class 2B is used for fluxes especially designed for strip cladding.

Class 3: For hard-facing. Alloying elements such as C, Cr, Ni, Mo are transferred from the flux.

Additionally, the metallurgical behaviour in combination with the wire electrode S2 and specified welding conditions, the type of current (AC for AC/DC or DC only), and the diffusible hydrogen level achieved in the deposited metal should be indicated when classifying fluxes according to this flux standard ISO 14174.

Metallurgical behaviour (activity) of Class 1 flux is determined using a wire electrode ISO 14171-A – S2 to achieve an all–weld metal which is analysed. In symbols the burn-out/pick of Si and Mn as the contribution from the flux is classified. Ranging from:

1 (> 0.7 %) to **4** (0.1–0.3 %) is **burn–out** of Si and/or Mn,
the symbol **"5"** is nearly **neutral**,
pick–up of Si and/or Mn is ranging from **6** (0.1–0.3 %) to **9** (> 0.7 %).

Examples of classifications of BAVARIA fluxes are:

BF 1	**S A AR 1 76 AC**	**A**gglomerated flux of **A**luminate–**R**utile type for SAW of class **1**, structural steels, with pick–up of Si + Mn, suitable for AC/ DC.
BF 4	**S A AB 1 76 AC H5**	**A**gglomerated flux of **A**luminate–**B**asic type for SAW of class **1** steels, pick–up of Si + Mn, suitable for AC/DC, low H2–diff.
WP 380	**S F CS 2 DC**	Fused flux of **C**alcium–**S**ilicate type for joining and surfacing of class 2 creep-resistant, heat-resisting, stainless steels and nickel-based alloys with compatible solid wire electrodes and cored wires.
BF 47NiMo	**S A CS 3 NiMo AC**	Agglomerated, alloying flux for hard-facing acc. to class 3 of continuous casting rolls and similar applications in combination with compatible wire/strip electrodes.

Classification of wire/flux combinations according to EN ISO 14171-A and ASME/AWS A5.17/A5.17M and A5.23/A5.23M

The European standard EN ISO 14171 classifies the wire electrodes by chemical analysis and wire/flux combinations by the mechanical properties achieved in the all–weld metal for multi-run technique and/or in two-run technique using the test specimens in accordance with EN ISO 15792–1/EN ISO 15792–2. All–weld metal and Two-run test results are given in the as-welded condition. Appropriate typical results after post–weld heat–treatment (PWHT) are also quoted on flux data sheets.
EN ISO 14171 standard is similar to the American specification ASME – Code II, part "C": SFA 5.17 / 5.23 – identical to AWS specifications A5.17/A5.17M and A5.23/A5.23M – mainly with respect to the all–weld metal tests. The test specimens "All–weld metal" of ISO standard and AWS slightly vary concerning preparation/weld build–up and welding data. According to AWS, the results in the "as–welded" condition, classified by the letter "A" after the strength designator, as well as after a post-weld heat treatment according to specified conditions can be classified (with letter "P" as indication), whereas according to ISO 14171-A only the results of the "as-welded" condition are classified.

Example: All–Weld Metal of the wire/flux combination S2Mo + BF 6.5 acc. to **ISO 14171-A**

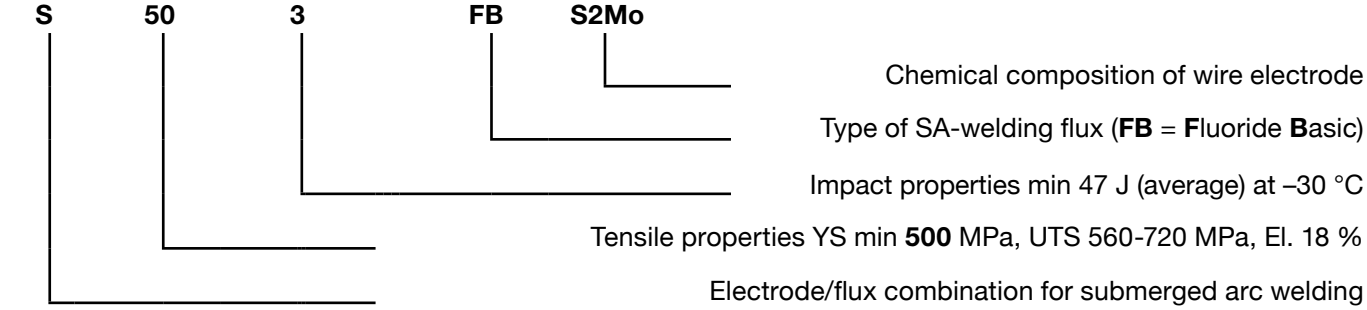
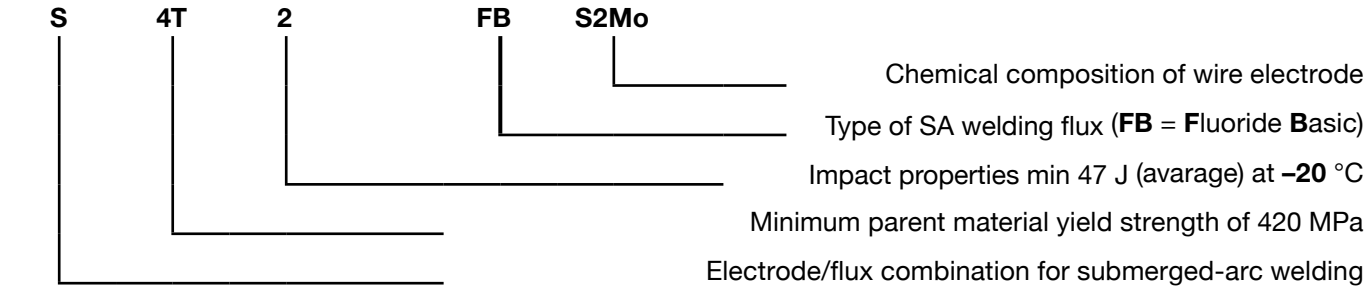


Table 1A of ISO 14171: Symbol for tensile properties by multi-run technique (all–weld metal)

Symbol	Minimum yield strength [1] MPa	Tensile strength MPa	Minimum elongation [2] %
35	355	440–570	22
38	380	470–600	20
42	420	500–640	20
46	460	530–680	20
50	500	560–720	18

[1] Lower yield (R_{eL}) shall be used when yielding occurs, otherwise the 0.2 % proof strength ($R_{p0.2}$)
[2] Gauge length = 5 x d

Example: Two-Run Classification of the wire / flux combination S2Mo + BF 6.5 acc. to **ISO 14171-A**



Two-run classification of butt weld: plate thickness 25 mm and specified minimum tensile strength < 50 MPa above specified minimum tensile strength of electrode/flux combination

Table 2A of ISO 14171: Symbol for tensile properties by two-run technique

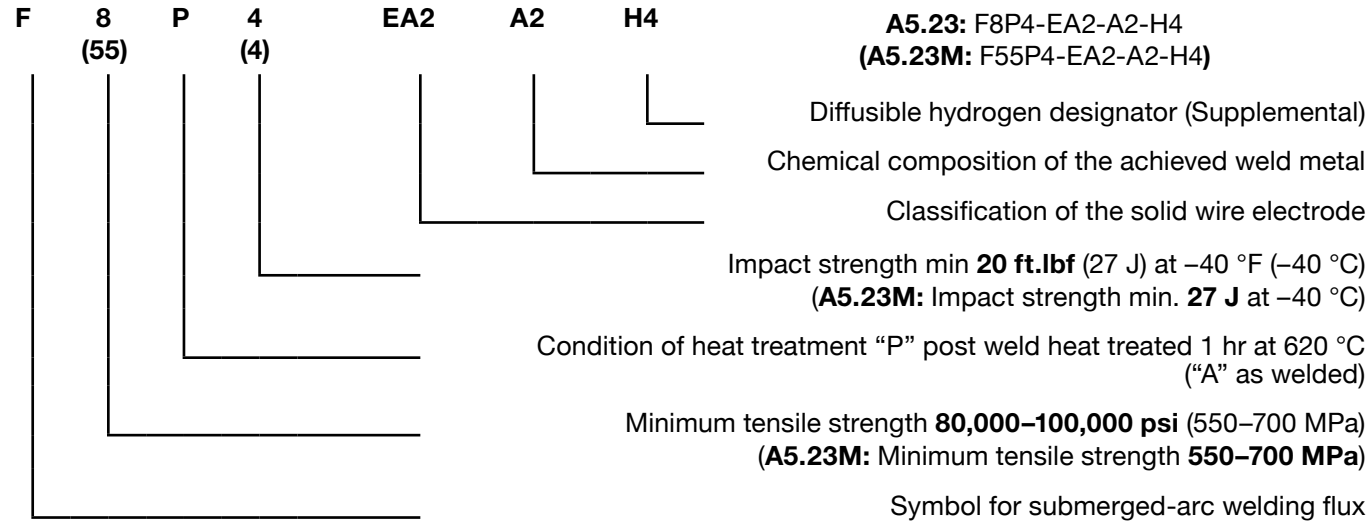
Symbol	Minimum parent metal yield strength MPa	Minimum tensile strength of the joint MPa
2T	275	370
3T	355	470
4T	420	520
5T	500	600

Table 3 of ISO 14171: Symbol for impact properties of all–weld metal and/or two-run welded joint

Symbol	Temperature for minimum average impact energy of 47 J acc. to ISO 14171-A at °C
Z	No requirements
A	+ 20
0	± 0
2	– 20
3	– 30
4	– 40
5	– 50
6	– 60
7	– 70
8	– 80
9	– 90
10	– 100

Classification according to ASME/AWS A5.17/A5.17M and A5.23/A5.23M

Example: All–weld metal of the wire/flux combination S2Mo + BF 6.5 according to **AWS A5.23 (A5.23M)**



Multiple pass classifications according to the tables of ASME / AWS A5.17 / A5.23:

Flux–electrode combination	Tensile strength		Yield strenth (0.2 % offset) minimum		Elong.	Impact strength minimum 20 ft.lbf		
							Test temp.	
Classification	psi x 1000	(MPa)	psi	(MPa)	% min.	Digit. *)	°F	(°C)
F6XX–EXX	60 / 80	(415/550)	48 000	(330)	22	0	0	(–18)
F7XX–EXX–XX	70 / 95	(480/660)	58 000	(400)	22	2	–20	(–29)
F8XX–EXX–XX	80 / 100	(550/690)	68 000	(470)	20	4	–40	(–40)
F9XX–EXX–XX	90 / 110	(620/760)	78 000	(540)	17	5	–50	(–46)
F10XX–EXX–XX	100 / 120	(690/830)	88 000	(610)	16	6	–60	(–51)
F11XX–EXX–XX	110 / 130	(760/900)	98 000	(680)	15	8	–80	(–62)
F12XX–EXX–XX	120 / 140	(830/970)	108 000	(750)	14	10	–100	(–73)
F13XX–EXX–XX	130 / 150	(900/1040)	118 000	(810)	14	15	–150	(–101)

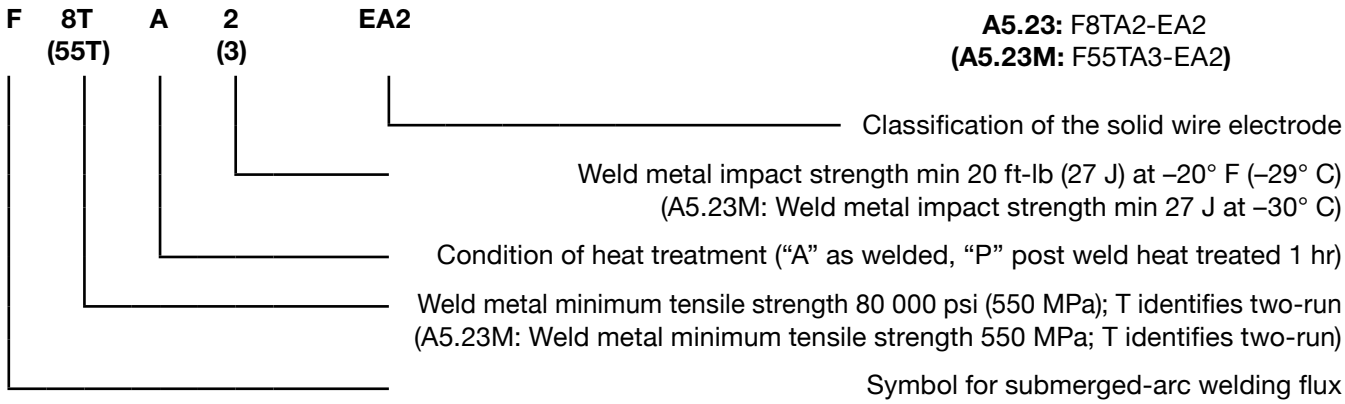
*) Z: No requirements

Multiple pass classifications according to the tables of ASME / AWS A5.17M / A5.23M:

Flux–electrode combination	Tensile strength	Yield strenth (0.2 % offset) minimum	Elong.	Impact strength minimum 27 J		
					Test temp.	
Classification	MPa	MPa	% min.	Digit. *)	°C	(°F)
F43XX–EXX	415/550	330	22	0	0	(+32)
F48XX–EXX–XX	480/660	400	22	2	–20	(–4)
F55XX–EXX–XX	550/700	470	20	3	–30	(–22)
F62XX–EXX–XX	620/760	540	17	4	–40	(–40)
F69XX–EXX–XX	690/830	610	16	5	–50	(–58)
F76XX–EXX–XX	760/900	680	15	6	–60	(–76)
F83XX–EXX–XX	830/970	740	14	7	–70	(–94)
F90XX–EXX–XX	900/1040	810	14	10	–100	(–148)

*) Z: No requirements

Example: Two-run classification of the wire/flux combination S2Mo + BF 6.5 acc. to **AWS A5.23(A5.23M)**



Two-run classifications according to the tables of ASME / AWS A5.17 / A5.23:
(Butt Weld: Plate thickness ½ in Grade AH36 or A 516 Grade 70)

Flux–electrode Combination	Tensile strength minimum		Yield strenth minimum		Elong.	Impact strength minimum 20 ft.lbf		
	All-meld metal Tension Specimen						Test temp.	
Classification	psi	(MPa)	psi	(MPa)	% min.	Digit *)	°F	(°C)
F6TXX–EXX	60 000	(415)	50 000	(350)	22	0	0	(–18)
F7TXX–EXX	70 000	(480)	60 000	(415)	22	2	–20	(–29)
F8TXX–EXX	80 000	(550)	70 000	(480)	20	4	–40	(–40)
F9TXX–EXX	90 000	(620)	80 000	(550)	17	5	–50	(–46)
F10TXX–EXX	100 000	(690)	90 000	(620)	16	6	–60	(–51)
F11TXX–EXX	110 000	(760)	100 000	(690)	15	8	–80	(–62)
F12TXX–EXX	120 000	(830)	110 000	(760)	14	10	–100	(–73)
F13TXX–EXX	130 000	(900)	120 000	(830)	14	15	–150	(–101)

*) Z: No requirements

Two-run classifications according to the tables of ASME / AWS A5.17M / A5.23M:
(Butt weld: Plate thickness 12 mm Grade AH36 or A 516 Grade 70)

Flux–electrode Combination	Tensile strength minimum	Yield strenth minimum	Elong.	Impact strength minimum 27 J		
	All-weld metal Tension Specimen				Test temp.	
Classification	MPa	MPa	% min.	Digit *)	°C	(°F)
F43XX–EXX	430	350	22	0	0	(+32)
F49XX–EXX	490	415	22	2	–20	(–4)
F55XX–EXX	550	490	20	3	–30	(–22)
F62XX–EXX	620	555	17	4	–40	(–40)
F69XX–EXX	690	625	16	5	–50	(–58)
F76XX–EXX	760	690	15	6	–60	(–76)
F83XX–EXX	830	760	14	7	–70	(–94)
F90XX–EXX	900	830	14	10	–100	(–148)

*) Z: No requirements

ASME/AWS flux classification

ASME / AWS A5.17/A5.17M and A5.23/A5.23M classify the flux types according to the change in their metallurgical behaviour.
Any flux produces an all–weld metal of somewhat different composition than that of the wire electrode due to chemical reactions and interactions in the arc and to the presence of metallic ingredients in the flux. So AWS specifications subdivide the fluxes according to their metallurgical reactions.

- **Neutral** fluxes do not significantly change the Mn + Si content in the weld metal as a result of changes in arc voltages. They do not contain many deoxidants and depend on the deoxidants in the wire or base material.
- **Active** fluxes contain deoxidising constituents such as FeMn, FeSi to provide improved resistance to porosity and cracking susceptibility, mainly in single / two-run technique. Si+Mn metallurgical reactions take place.
- **Alloy** fluxes are used to make alloyed weld metal in combination with alloyed and unalloyed wire electrodes. The alloys for the weld metal are added as ingredients in the flux (ferro–alloys, e.g. Cr). Alloy fluxes are mainly used for hard-facing. To maintain the active alloy ingredients the flux should be most carefully recycled.

Wall neutrality number

Wall Neutrality number “N” of a particular flux depends on the total change in silicon and in manganese.
Determination: 1 wire + 1 flux are deposited with 2 weld pads, using specified different welding parameters.

Calculation is: **$N = 100 (\Delta \%\ Si + \Delta \%\ Mn)$**
$N \leq 35$ Neutral flux

Example: **Basic flux** **acc. to ISO 14174** S A AB 1 67 AC H5 **(BF 5.1)**
acc. to A5.17M: F48A5–EM12(K)

Weld pad for chemical analysis of weld metal (% by weight)
(Test according to A 5.17/A5.17M: DCEP / 4.0 mm Ø wire / 550A / 7.0 mm/sec. [~16 ipm])

	C	Si	Mn	P	S	Cu
Wire EM12(K)	0.11	0.07	1.06	0.010	0.007	0.01
Pad 1(29V–DC+)	0.06 Δ–0.05	0.22 Δ +0.15	1.36 Δ +0.30	0.017 Δ +0.007	0.010 Δ +0.003	0.06 Δ +0.05
Pad 2(37V–DC+)	0.06 Δ–0.05	0.33 Δ +0.26	1.54 Δ +0.48	0.020 Δ +0.010	0.011 Δ +0.004	0.06 Δ +0.05

* Weld application sample

Wall Neutrality Number $N = 100 (\Delta \%\ Si + \Delta \%\ Mn)$

$$N = 100 (0.11 + 0.18) = 29$$

Typical chemical analysis of solid steel wire electrodes for SAW

Symbol EN ISO 14171-A/ EN ISO 14341-A/ EN ISO 24598-A/ EN ISO 26304-A	AWS A5.17/A5.23	C %	Si %	Mn %	Mo %	Ni %	Cr %	P %	S %	Cu %	Others in wt.-% Remarks:
BA-S1	EL12	0.08	0.07	0.44	0.01	0.05	0.04	0.015	0.015	0.14	
BA-S2	EM12(K)	0.11	0.12	1.07	0.01	0.04	0.03	0.007	0.008	0.09	
BA-S3	EH10K	0.11	0.12	1.61	0.03	0.02	0.05	0.015	0.012		
BA-S4	EH14	0.12	0.08	1.9	0.01	0.05	0.04	0.015	0.015	0.14	
BA-S2Si	EM12K	0.09	0.26	0.96	0.03	0.05	0.05	0.008	0.006		
BA-S3Si	EH12K	0.09	0.33	1.57	0.06	0.04	0.03	0.012	0.009		
BA-S2Mo	EA2	0.09	0.16	1.15	0.5	0.01	0.02	0.006	0.005		
BA-S3Mo	EA4	0.1	0.13	1.55	0.49	0.02	0.05	0.014	0.011		
BA-S4Mo	EA3	0.12	0.11	1.9	0.5	0.05	0.06	0.016	0.013		
BA-S2Ni1	ENi1	0.09	0.14	1.05	0.02	0.95	0.02	0.006	0.004	0.08	
BA-S2Ni2	ENi2	0.09	0.15	1.15	0.02	2.2	0.02	0.006	0.005		
BA-S2Ni3	ENi3	0.09	0.13	1.11	0.03	3.15	0.02	0.006	0.003	0.07	
BA-S2NiCu	EG (EW mod.)	0.1	0.23	0.98	0.04	0.78	0.07	0.012	0.01	0.48	
BA-S3NiMo1/4	ENi5	0.11	0.15	1.58	0.23	0.95	0.04	0.005	0.002		
BA-S3NiMo1	EF3	0.12	0.19	1.73	0.53	0.95	0.04	0.009	0.001		
BA-S3NiMo1,5	EF1	0.11	0.17	1.62	0.41	1.48	0.05	0.011	0.004		
BA-S3NiCrMo2,5	EM4-mod.	0.11	0.17	1.5	0.55	2.4	0.5	0.008	0.009		
BA-S2Ni1Si	ENi1K	0.09	0.65	1.05	0.05	0.09	0.02	0.012	0.01	0.1	
BA-S3TiB	EG	0.08	0.25	1.55	0.01	0.05	0.04	0.009	0.007	0.014	Ti 0.13 / B0.012
BA-S2MoTiB	EA2TiB	0.08	0.25	1.25	0.54			0.015	0.015	0.14	Ti 0.14 / B 0.012
BA-S3MoTiB	EG	0.08	0.3	1.48	0.5	0.02	0.03	0.01	0.008		Ti 0.15 / B 0.015
BA-S3Si1	EH11K	0.09	0.95	1.67	0.06	0.04	0.03	0.012	0.009	0.04	
BA-S2MoSi	EA3K mod.	0.1	0.6	1.2	0.5	0.02	0.02	0.01	0.01	0.05	
BA-S4MoSi	EA3K	0.1	0.63	1.82	0.55	0.02	0.02	0.012	0.01	0.1	
BA-S2CrMo1	EB2 (R)	0.1	0.17	0.98	0.52	0.03	1.2	0.008	0.009	0.1	EB2R: As / Sn / Sb je 0.005 / P 0.010 / S 0.010 / Cu 0.15
BA-S1CrMo2	EB3 (R)	0.1	0.18	0.64	1.02	0.02	2.4	0.008	0.007	0.09	EB3R: As / Sn / Sb je 0.005 / P 0.010 / S 0.010 / CU 0.15
BA-S CrMo5	EB6	0.08	0.3	0.5	0.6		6	0.015	0.015	0.14	
BA-S CrMo9	EB8	0.08	0.35	0.5	1		9	0.01	0.01	0.1	
BA-S CrMo91	EB91	0.1	0.25	0.5	1	0.6	8.7	0.008	0.008	0.08	V 0.20 / Nb 0.04
BA-S CrMoWV12	EG	0.25	0.25	0.85	1	0.6	11.5	0.01	0.01	0.15	V 0.30 / W 0.5

Typical chemical analysis of solid steel wire electrodes for SAW

Symbol		C %	Si %	Mn %	Mo %	Ni %	Cr %	P %	S %	Cu	Others in wt. %	Ma-terial Num-ber	Ap-prov-als
EN ISO 14343-A EN ISO 18274	AWS A5.9 / A5.14												
BA-WIRE 308H	ER308H	0.05	0.4	1.8	0.2	10	20	0.02	0.013	0.1			
BA-WIRE 308L	ER308L	0.02	0.4	1.8	0.1	10	20	0.02	0.013	0.1		1.4316	TUEV
BA-WIRE 309L	ER309L	0.015	0.4	1.8	0.1	13	23.5	0.02	0.013	0.15		1.4332	TUEV
BA-WIRE 309LMo	ER309LMo	0.018	0.4	1.6	2.7	13.5	23.5	0.02	0.013	0.15			
BA-WIRE 309LNb	ER(309LNb)	0.018	0.3	1.9	0.1	12.5	24	0.02	0.013	0.15	Nb 0.8		
BA-WIRE 310	ER310	0.12	0.3	1.9	0.1	21	26	0.015	0.013	0.2			
BA-WIRE 316H	ER316H	0.05	0.45	1.7	2.5	12.3	19	0.02	0.013	0.15			
BA-WIRE 316L	ER316L	0.015	0.4	1.7	2.7	12	19	0.02	0.013	0.15		1.4430	TUEV
BA-WIRE 317L	ER317L	0.015	0.5	1.9	3.6	13.7	19	0.015	0.013	0.1		1.4438	*)
BA-WIRE 318	ER318	0.03	0.45	1.4	2.6	11.5	19	0.015	0.013	0.1	Nb 0.60	1.4576	TUEV
BA-WIRE 320LR	ER320LR	0.015	0.1	1.6	2.5	34.2	19.7	0.01	0.009	3.5	Nb 0.25		
BA-WIRE 347	ER347	0.05	0.4	1.4	0.1	9.8	19.5	0.015	0.014	0.1	Nb 0.60	1.4551	TUEV
BA-WIRE 385	ER385	0.015	0.4	1.9	4.5	25	20	0.015	0.015	1.5			
BA-WIRE 410	ER410	0.1	0.4	0.4	0.2	0.1	13	0.015	0.015	0.2			
BA-WIRE 410NiMo	ER410NiMo	0.03	0.35	0.4	0.6	4.5	12	0.015	0.015	0.2			
BA-WIRE 420	ER420	0.3	0.35	0.45	0.2	0.25	13	0.02	0.02	0.3		1.4007	*)
BA-WIRE 430	ER430	0.04	0.35	0.5	0.1	0.1	16.5	0.015	0.015	0.2		1.4015	*)
BA-WIRE 2209	ER2209	0.015	0.5	1.6	3.3	9.1	23	0.015	0.012	0.1	N 0.16	1.4462	TUEV
BA-WIRE 2594NL	ER2594	0.015	0.35	0.4	4	9.5	25	0.015	0.012	0.1	N 0.25		
BA-WIRE 82	ERNiCr-3	< 0.1	0.2	3		Bal.	20.5	0.015	0.01	0.2	Nb 2.6 / Ti < 0.7 / Fe < 3.0	2.4806	*)
BA-WIRE 625	ERNiCrMo-3	< 0.1	0.2	0.2	9	Bal.	22	0.014	0.01	0.2	Nb 3.5 / Ti 0.1 / Fe 1.0 / Al 0.1	2.4831	*)
BA-WIRE 276	ERNiCrMo-4	0.008	0.03	0.4	15.7	58	15.8	0.005	0.004	0.03	W 3.7 / Fe 5.8 / Co 0.09 / V 0.06		

*) welded with SA flux WP 380 if the requirements and characteristics of the base metal are fully considered.

Single values are typical.
Further wire electrodes (solid- or metalpowder cored wires MPCW) available on request, especially electrodes for hardfacing and coating.

TUEV–certification:
approvals apply only to several individual wire/flux combinations. According to VdTUEV 1153 a wire/flux combination is approved for comparable base metals of similar mechanical properties. Wire electrodes of different suppliers acc.to standard are interchangeable. We only supply wire electrodes produced by qualified and approved manufacturers according to DIN EN ISO 9001 or TUEV.

Typical chemical analysis of strip electrodes for SAW

Symbol		C %	Si %	Mn %	Mo %	Ni %	Cr %	P %	S %	Cu %	Others in wt. %
EN ISO 14343-A EN ISO 18274	**AWS A5.9 / A5.14**										
BA-STRIP 308L	EQ308L	0.01	0.4	1.8	0.1	10	20	0.02	0.013	0.1	
BA-STRIP 309L	EQ309L	0.015	0.4	1.8	0.1	13	23.5	0.02	0.013	0.15	
BA-STRIP 309LMo	EQ309LMo	0.014	0.3	1.7	2.8	13.5	23.6	0.02	0.013	0.15	
BA-STRIP 309LNb	EQ(309LNb)	0.018	0.3	1.9	0.1	12.5	24	0.02	0.013	0.15	Nb 0.8
BA-STRIP 316L	EQ316L	0.015	0.4	1.7	2.7	12.5	19	0.018	0.013	0.15	
BA-STRIP 317L	EQ317L	0.015	0.5	1.9	3.6	13.7	19	0.015	0.013	0.15	
BA-STRIP 347	EQ347	0.02	0.4	1.7	0.1	10.3	20	0.015	0.014	0.1	Nb 0.6
BA-STRIP 385	EQ385	0.014	0.4	1.9	4.5	25	20	0.012	0.012	1.5	
BA-STRIP 430	EQ430	0.04	0.35	0.5	0.1	0.1	16.5	0.015	0.015	0.2	
BA-STRIP 2209	EQ2209	0.016	0.5	1.6	3.2	9.1	23	0.015	0.012	0.1	N 0.15
BA-STRIP 2594NL	EQ2594	0.015	0.35	0.4	3.8	9.5	25	0.015	0.012	0.1	N 0.25
BA-STRIP 82	EQNiCr-3	0.008	0.2	3		Bal.	20.5	0.01	0.01	0.2	Ti < 0.7 / Fe < 2.0 / Nb 2.6
BA-STRIP 625	EQNiCrMo-3	0.02	0.2	0.2	9	Bal.	22	0.014	0.009	0.2	Nb 3.5 / Ti 0.1 / Fe 0.8 / Al 0.1
BA-STRIP 276	EQNiCrMo-4	0.008	0.03	0.4	15.8	58	15.8	0.005	0.004	0.03	W 3.7 / Fe 5.8 / Co 0.09 / V 0.06

Single values are typical.
Further strip electrodes (solid- or metalpowder cored wires MPCW) available on request.

TUEV–certification:
approvals apply only to several individual strip/flux combinations. We only supply strip electrodes produced by qualified and approved manufacturers according to DIN EN ISO 9001 or TUEV.

Typical chemical analysis of solid wire electrodes for MIG/MAG Welding

Symbol		C %	Si %	Mn %	Mo %	Ni %	Cr %	P %	S %	Cu %	Others in wt. %	Material Number	Approvals
EN ISO 14343-A EN ISO 18274	AWS A5.9/A5.14												
BA-MIG 307Si	ER(307)	0.08	0.80	7.0	0.1	8.00	18.50	0.020	0.013	0.20		1.4316	
BA-MIG 308L	ER308L	0.02	0.40	1.8	0.1	10.00	20.00	0.020	0.013	0.10		1.4316	TUEV
BA-MIG 308LSi	ER308LSi	0.02	0.85	1.8	0.1	10.00	20.00	0.020	0.013	0.10			TUEV
BA-MIG 308H	ER308H	0.05	0.40	1.8	0.2	10.00	20.00	0.020	0.013	0.10			
BA-MIG 309L	ER309L	0.015	0.40	1.8	0.1	13.00	23.50	0.020	0.013	0.15		1.4332	TUEV
BA-MIG 309LSi	ER309LSi	0.015	0.80	1.8	0.1	13.00	23.50	0.020	0.013	0.15			TUEV
BA-MIG 309LMo	ER309LMo	0.018	0.40	1.6	2.7	13.50	23.50	0.020	0.013	0.15			
BA-MIG 309LNb	ER(309LNb)	0.018	0.30	1.9	0.1	12.50	24.00	0.020	0.013	0.15	Nb 0.8		
BA-MIG 310	ER310	0.12	0.30	1.9	0.1	21.00	26.00	0.015	0.013	0.20			
BA-MIG 312	ER312	0.1	0.40	1.8	0.15	9.30	29.50	0.020	0.013	0.15			
BA-MIG 316H	ER316H	0.05	0.45	1.7	2.7	12.30	19.00	0.020	0.013	0.15			
BA-MIG 316L	ER316L	0.015	0.40	1.7	2.7	12.00	19.00	0.020	0.013	0.15		1.4430	TUEV
BA-MIG 316LSi	ER316LSi	0.015	0.70	1.9	2.6	11.50	18.40	0.020	0.013	0.15			TUEV
BA-MIG 317L	ER317L	0.015	0.50	1.9	3.6	13.70	19.00	0.015	0.013	0.10		1.4438	
BA-MIG 318	ER318	0.04	0.45	1.7	2.6	12.00	19.00	0.020	0.013	0.15	Nb 0.60		
BA-MIG 318Si	ER318 sim.	0.04	0.80	1.7	2.6	12.00	19.00	0.015	0.013	0.10	Nb 0.60	1.4576	
BA-MIG 347	ER347	0.05	0.40	1.6	0.1	9.80	19.50	0.015	0.014	0.10	Nb 0.60	1.4551	
BA-MIG 347Si	ER347Si	0.05	0.80	1.6	0.1	9.80	19.50	0.015	0.014	0.10	Nb 0.60		
BA-MIG 385	ER385	0.015	0.40	1.9	4.5	25.00	20.00	0.015	0.015	1.50			
BA- MIG 410	ER410	0.1	0.40	0.4	0.2	0.10	13.00	0.015	0.015	0.20			
BA-MIG 410NiMo	ER410NiMo	0.03	0.35	0.4	0.6	4.50	12.00	0.015	0.015	0.20			
BA-MIG 420	ER420	0.3	0.35	0.45	0.25	0.30	13.00	0.020	0.02	0.30		1.4007	
BA-MIG 430	ER430	0.04	0.35	0.5	0.1	0.10	16.50	0.015	0.015	0.15		1.4015	
BA-MIG 2209	ER2209	0.015	0.50	1.6	3.3	9.10	23.00	0.015	0.012	0.10	N 0.16	1.4462	
BA-MIG 2594NL	ER2594	0.015	0.35	0.4	4.0	9.50	25.00	0.015	0.012	0.10	N 0.25		
BA-MIG 82	ERNiCr-3	< 0.1	0.20	3.0		Bal.	20.50	0.015	0.01	0.20	Nb 2.6 / Ti < 0.7 / Fe < 3.0	2.4806	
BA-MIG 625	ERNiCrMo-3	< 0.1	0.20	0.2	9.0	Bal.	22.00	0.014	0.01	0.20	Nb 3.5 / Ti 0.1 / Fe 1.0 / Al 0.1	2.4831	
BA-MIG 276	ERNiCrMo-4	0.008	0.03	0.4	15.7	58.00	15.80	0.005	0.004	0.03	W 3.7 / Fe 5.8 / Co 0.09 / V 0.06		

Single values are typical.

TUEV-certification:
Approvals apply to the individual wire.

Typical chemical analysis of solid Al-base wire electrodes for MIG/MAG Welding

Symbol		Si %	Fe %	Cu %	Mn %	Mg %	Cr %	Zn %	Ti %	Al %	Material Number	Approv-als
EN ISO 18274	AWS A5.9/A5.14											
BA-MIG AlSi5	ER4043	5.2	0.19	0.1	0.02	0.012	0.001	0.021	0.015	Rem		
BA-MIG AlMg5	ER5356	0.05	0.12	0.01	0.13	4.7	0.08	0.01	0.1	Rem		
BA-MIG AlMg4.5Mn	ER5183	0.1	0.1	0.05	0.7	4.8	0.1	0.1	0.1	Rem		

Single values are typical.

TUEV-certification:
Approvals apply to the individual wire.

Typical chemical analysis of solid Al-base wire rods for TIG Welding

Symbol		Si %	Fe %	Cu %	Mn %	Mg %	Cr %	Zn %	Ti %	Al %	Material Number	Approv-als
EN ISO 18274	AWS A5.9/A5.14											
BA-TIG AlSi5	ER4043	5.2	0.19	0.1	0.02	0.012	0.001	0.021	0.015	Rem		
BA-TIG AlMg5	ER5356	0.05	0.12	0.01	0.13	4.7	0.08	0.01	0.1	Rem		
BA-TIG AlMg4.5Mn	ER5183	0.1	0.1	0.05	0.7	4.8	0.1	0.1	0.1	Rem		

Single values are typical.

TUEV-certification:
Approvals apply to the individual wire.

Typical chemical analysis of solid wire rods for TIG Welding

Symbol		C %	Si %	Mn %	Mo %	Ni %	Cr %	P %	S %	Cu %	Others in wt. %	Material Number	Approvals
EN ISO 14343-A EN ISO 18274	**AWS A5.9/A5.14**												
BA-TIG 307Si	ER(307)	0.080	0.80	7.00	0.1	8.00	18.50	0.020	0.013	0.20		1.4316	
BA-TIG 308L	ER308L	0.020	0.40	1.80	0.1	10.00	20.00	0.020	0.013	0.10		1.4316	TUEV
BA-TIG308LSi	ER308LSi	0.020	0.85	1.80	0.1	10.00	20.00	0.020	0.013	0.10			TUEV
BA-TIG 308H	ER308H	0.050	0.40	1.80	0.2	10.00	20.00	0.020	0.013	0.10			
BA-TIG 309L	ER309L	0.015	0.40	1.80	0.1	13.00	23.50	0.020	0.013	0.15		1.4332	TUEV
BA-TIG 309LSi	ER309LSi	0.015	0.80	1.80	0.1	13.00	23.50	0.020	0.013	0.15			TUEV
BA-TIG 309LMo	ER309LMo	0.018	0.40	1.60	2.7	13.50	23.50	0.020	0.013	0.15			
BA-TIG 309LNb	ER(309LNb)	0.018	0.30	1.90	0.1	12.50	24.00	0.020	0.013	0.15	Nb 0.8		
BA -TIG 310	ER310	0.120	0.30	1.90	0.1	21.00	26.00	0.015	0.013	0.20			
BA-TIG 312	ER312	0.100	0.40	1.80	0.15	9.30	29.50	0.020	0.013	0.15			
BA-TIG 316H	ER316H	0.050	0.45	1.70	2.7	12.30	19.00	0.020	0.013	0.15			
BA-TIG 316L	ER316L	0.015	0.40	1.70	2.7	12.00	19.00	0.020	0.013	0.15		1.4430	TUEV
BA-TIG 316LSi	ER316LSi	0.015	0.70	1.90	2.6	11.50	18.40	0.020	0.013	0.15			TUEV
BA-TIG 317L	ER317L	0.015	0.50	1.90	3.6	13.70	19.00	0.015	0.013	0.10		1.4438	
BA-TIG 318	ER318	0.040	0.45	1.70	2.6	12.00	19.00	0.020	0.013	0.15	Nb 0.60		
BA-TIG 318Si	ER318 sim.	0.040	0.80	1.70	2.6	12.00	19.00	0.015	0.013	0.10	Nb 0.60	1.4576	
BA-TIG 347	ER347	0.050	0.40	1.60	0.1	9.80	19.50	0.015	0.014	0.10	Nb 0.60	1.4551	
BA-TIG 347Si	ER347Si	0.050	0.80	1.60	0.1	9.80	19.50	0.015	0.014	0.10	Nb 0.60		
BA-TIG 385	ER385	0.015	0.40	1.90	4.5	25.00	20.00	0.015	0.015	1.50			
BA- TIG 410	ER410	0.100	0.40	0.40	0.2	0.10	13.00	0.015	0.015	0.20			
BA-TIG 410NiMo	ER410NiMo	0.030	0.35	0.40	0.6	4.50	12.00	0.015	0.015	0.20			
BA-TIG 420	ER420	0.300	0.35	0.45	0.25	0.30	13.00	0.020	0.02	0.30		1.4007	
BA-TIG 430	ER430	0.040	0.35	0.50	0.1	0.10	16.50	0.015	0.015	0.15		1.4015	
BA-TIG 2209	ER2209	0.015	0.50	1.60	3.3	9.10	23.00	0.015	0.012	0.10	N 0.16	1.4462	
BA-TIG 2594NL	ER2594	0.015	0.35	0.40	4.0	9.50	25.00	0.015	0.012	0.10	N 0.25		
BA-TIG 82	ERNiCr-3	< 0.1	0.20	3.00		Bal.	20.50	0.015	0.01	0.20	Nb 2.6 / Ti < 0.7 / Fe < 3.0	2.4806	
BA-TIG 625	ERNiCrMo-3	< 0.1	0.20	0.20	9.0	Bal.	22.00	0.014	0.01	0.20	Nb 3.5 / Ti 0.1 / Fe 1.0 / Al 0.1	2.4831	
BA-TIG 276	ERNiCrMo-4	0.008	0.03	0.40	15.7	58.00	15.80	0.005	0.004	0.03	W 3,7 / Fe 5,8 / Co 0,09 / V 0,06		

Single values are typical.

TUEV-certification:
Approvals apply to the individual wire.

Welding fluxes

Agglomerated Welding Flux BF 1

BF 1

Flux type: **A**luminate-**R**utile

Classification: ISO 14174 **– S A AR 1 76 AC H5** *)
(EN 760 **– SA AR 1 76 AC**)

Characteristics:
Designed for all SAW-processes and welding of ordinary carbon-manganese, low alloy structural and boiler quality steels with yield strength up to 355 MPa (t < 25 mm) in combination with wire grades S1, S2, S2Mo and S CrMo1. The flux is suitable for high speed welding (up to 2 m/min.) and provides very good weld bead appearance and excellent slag release even with small angle preparation and fillet welds. The chemical nature of BF 1 flux provides high resistance to cracking on single pass applications. Additional features are resistance to porosity when welding rusty plates, heavy scale or other contaminations of plate surfaces (e.g. special primer-coatings) and low sensitivity to arc blow.

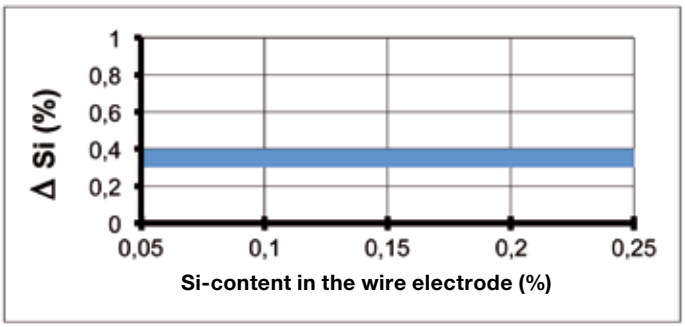
Application:
Preferentially used for single-run, two-run and fillet SA-welding. Main fields of application include structural steel-work, thin-walled containers, LP-gas cylinders and fin-tube walls.

Characteristic chemical Constituents:

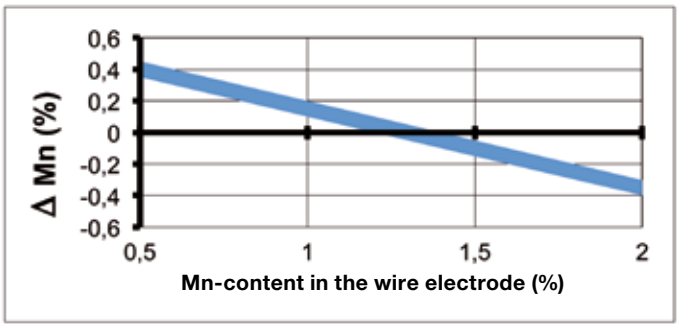
$SiO_2 + TiO_2$	$Al_2O_3 + MnO$	$CaO + MgO$	CaF_2
25 %	55 %	5 %	10 %
Basicity according to Boniszewski: ~0.6			

Metallurgical behaviour acc. to ISO 14174 type of current DC:

Pick-up Silicon



Pick-up / Burn-out Manganese



Flux density: 1.0 kg/dm³ (l)

Grain size acc. to ISO 14174: 4 – 16 (Tyler 10 x 65)

Current-carrying capacity: up to 800 A (DC or AC) using one wire

*) Diffusible hydrogen content H5: determined in deposited metal acc. to the method described in ISO 3690
Type of current DC; redrying conditions 200 ± 50 °C

All-weld metal multiple pass classification of wire-flux combinations:

Wire electrode (ISO 14171-A ISO 24598-A)	AWS A5.17/.23	Test assembly ISO 15792-1: type 1.3	AWS A5.17M/5.23M	AWS A5.17/5.23
BA-S1	EL12	ISO 14171-A- S 38 A AR S1	F48A0-EL12	F7AZ-EL12
BA-S2	EM12(K)	ISO 14171-A- S 42 A AR S2	F48A0-EM12(K)	F7AZ-EM12(K)
BA-S2Si	EM12K	ISO 14171-A- S 42 2 AR S2Si	F48A2-EM12K	F7A0-EM12K
BA-S2Mo	EA2	ISO 14171-A- S 46 2 AR S2Mo	F55A2-EA2-A2	F8A0-EA2-A2
BA-S2CrMo1	EB2	ISO 24598-A- S S CrMo1 AR	F55PZ-EB2-B2	F8PZ-EB2-B2

Two-run classification of wire-flux combinations:

Wire electrode (ISO 14171-A ISO 24598-A)	AWS A5.17/.23	Two-run / ISO 15792-2: type 2.5	AWS A5.17M/5.23M	AWS A5.17/5.23
BA-S2	EM12(K)	ISO 14171-A- S 3T A AR S2	F43TA0-EM12(K)	F6TAZ-EM12(K)
BA-S2Si	EM12K	ISO 14171-A- S 3T 2 AR S2Si	F43TA2-EM12K	F6TA0-EM12K
BA-S2Mo	EA2	ISO 14171-A- S 4T 2 AR S2Mo	F49TA2-EA2	F7TA0-EA2
BA-S4Mo	EA3	ISO 14171-A- S 5T 2 AR S4Mo	F55TA2-EA3	F8TA0-EA3
BA-S2CrMo1	EB2		F49TPZ-EB2	F7TPZ-EB2

Chemical composition of all-weld metal acc. to EN ISO 15792-1 and AWS A5.17/5.23: (characteristical values in wt. %)

Wire electrode		C	Si	Mn	Mo	Ni	Cr
BA-S1	EL12	0.04-0.08	0.3-0.6	0.8-1.1			
BA-S2	EM12(K)	0.04-0.08	0.3-0.6	1.0-1.4			
BA-S2Si	EM12K	0.04-0.08	0.4-0.8	1.0-1.4			
BA-S2Mo	EA2	0.04-0.08	0.3-0.7	1.0-1.4	0.4-0.6		
BA-S2CrMo1	EB2	0.04-0.08	0.3-0.7	0.9-1.3	0.4-0.6		1.0

Mechanical properties of all-weld metal acc. to EN ISO 15792-1 and AWS A5.17/5.23: (characteristical values)

Wire electrode		Heat treatment	YS MPa	UTS MPa	Elong. %	Impact ISO-V (J)				
						RT	± 0 °C +32 °F	-20 °C -4 °F	-30 °C -22 °F	-40 °C -40 °F
BA-S1	EL12	U	>400	>510	>24	>70	>40			
BA-S2	EM12(K)	U	>420	>530	>22	>70	>47			
BA-S2Si	EM12K	U	>430	>540	>22	>70	>47	>27		
BA-S2Mo	EA2	U	>480	>580	>20	>60	>47	>27		
BA-S2CrMo1	EB2	A *)	>470	>570	>20	>50				

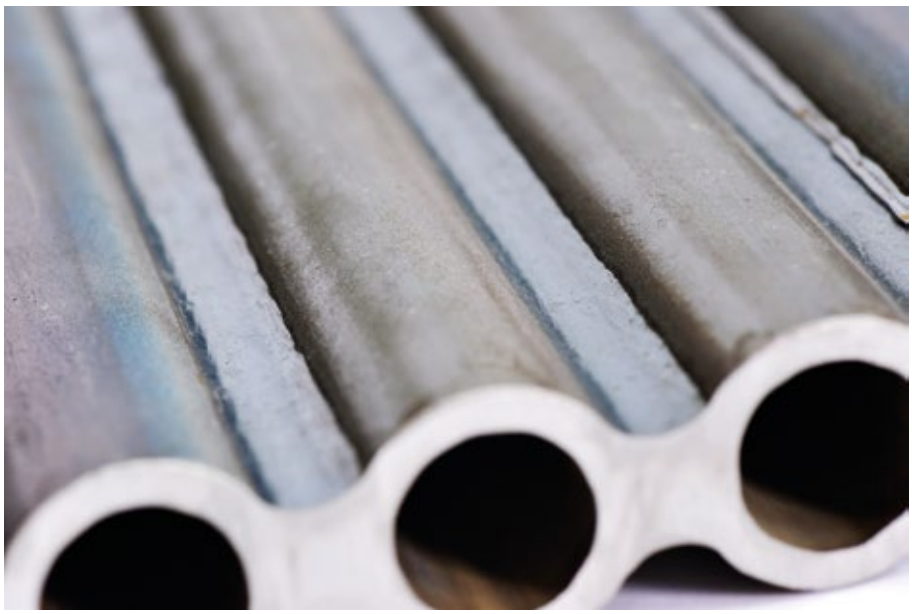
Post Weld Heat Treatment *) 680 °C / 10 h

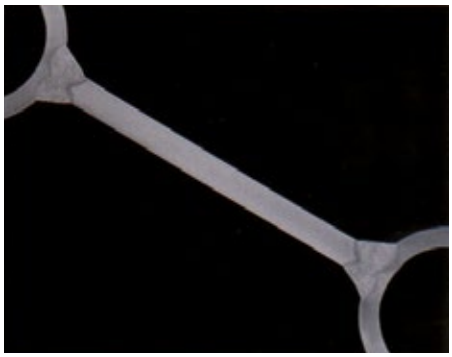
Approvals:	**with wire electrodes:**
VdTUEV 1153 / TÜV-Wien	S1, S2, S2Si, S2Mo and S CrMo1
Deutsche Bahn	S2Si, S2Mo

Packaging: 25 kg PE-bags or 500-1,250 kg Big Bags

Storage and redrying:
Unopened originally packed flux bags can be stored up to 1 year in dry storage rooms after date of delivery ex factory.
Redrying conditions specific to the flux: 200 ± 50 °C effective flux temperature.

BF 1 + EA2 Wire Electrodes for Fin Tube Welding





Characteristic for BF 1

- high speed welding
- no undercuts
- weld surface (not too concave)
- flux consumption

Agglomerated Welding Flux BF 3

BF 3

Flux type: **A**luminate-**B**asic

Classification: ISO 14174 **– S A AB 1 67 AC H5 *)**
(EN 760 **– SA AB 1 67 AC H5**)

Characteristics:
BF 3 is an agglomerated aluminate-basic flux with high current-carrying capacity, specially designed for the welding of wind towers by tandem arc. It is also suitable for joint welding of unalloyed and low alloy structural steels, pipe steels, boiler steels and fine grain steels. The flux is suitable for single and multilayer welding of lon- gitudinal, circumferential and fillet welds. It can be used for single, tandem, twin and multi wire welding systems. Excellent slag removal in narrow groove welds of thick wall sections. Typical characteristic of this flux is a medium Mn and Si pick up as well as very low diffusible hydrogen level. It is suitable for both AC and DC welding.

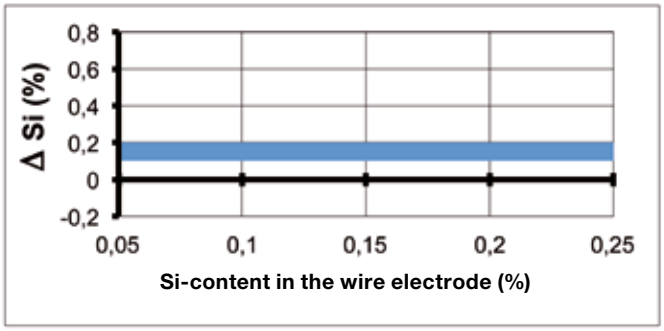
Application:
Joint welding of non-alloy and low alloy structural steels acc. to. EN 10025. Fine-grain structural steels with YS < 420 MPa and boiler steels such as P265GH (H II) and 16Mo3/A335 grade 91

Characteristic chemical Constituents:

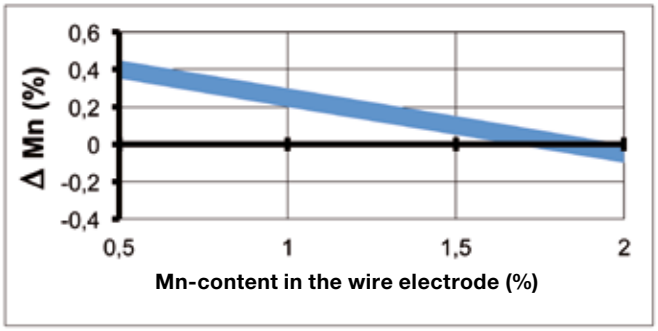
$SiO_2 + TiO_2$	$Al_2O_3 + MnO$	$CaO + MgO$	CaF_2
20 %	30 %	35 %	10 %
Basicity according to Boniszewski: ~1.9			

Metallurgical behaviour acc. to ISO 14174 type of current DC:

Pick-up Silicon



Pick-up / Burn-out Manganese



Flux density: 1.1 kg/dm³ (l)

Grain size acc. to ISO 14174: 2 – 20 (Tyler 8 x 48)

Current-carrying capacity: up to 1,500 A (DC or AC) using one wire

Packaging: 25 kg PE-bags or 500-1,250 kg Big Bags

Storage and redrying:
Unopened originally packed flux bags can be stored up to 1 year in dry storage rooms after date of delivery ex factory.
Redrying conditions specific to the flux: 200 ± 50 °C effective flux temperature.

*) Diffusible hydrogen content H5: determined in deposited metal acc. to the method described in ISO 3690
Type of current DC; redrying conditions 200 ± 50 °C

All-weld metal multiple pass classification of wire-flux combinations:

Wire electrode (ISO 14171-A ISO 24598-A)	Wire electrode AWS A5.17/.23	Test assembly ISO 15792-1: type 1.3		AWS A5.17M/5.23M	AWS A5.17/5.23
BA-S1	EL12	ISO 14171-A	S 38 2 AB S1	F48A2-EL12	F7A0-EL12
BA-S2	EM12(K)	ISO 14171-A	S 42 4 AB S2	F48A4/P4-EM12(K)	F7A4/P4-EM12(K)
BA-S2Si	EM12K	ISO 14171-A	S 42 4 AB S2Si	F48A4/P4-EM12K	F7A4/P4-EM12K
BA-S3Si	EH12 K	ISO 14171-A	S 46 4 AB S3Si	F55A4/F49P4-EH12K	F8A5/F7P4-EH12K
BA-S2Mo	EA2	ISO 14171-A	S 46 4 AB S2Mo	F55A4/P4-EA2-A2	F8A4/P4-EA2-A2
BA-S2Ni2	ENi2	ISO 14171-A	S 50 5 AB S2Ni2	F62A5/F55P5-ENi2-Ni2	F9A6/F8P6-ENi2-Ni2

Two-run classification of wire-flux combinations:

Wire electrode (ISO 14171-A ISO 24598-A)	Wire electrode AWS A5.17/.23	Two-run / ISO 15792-2: type 2.5		AWS A5.17M/5.23M	AWS A5.17/5.23
BA-S1	EL12	ISO 14171-A	S 2T 2 AB S1	F43TA2-EL12	F6TA0-EL12
BA-S2	EM12(K)	ISO 14171-A	S 3T 2 AB S2	F49TA2-EM12(K)	F7TA0-EM12(K)
BA-S2Si	EM12K	ISO 14171-A	S 3T 2 AB S2Si	F49TA2-EM12K	F7TA0-EM12K
BA-S3Si	EH12 K	ISO 14171-A	S 4T 3 AB S3Si	F55TA3-EH12K	F8TA2-EH12K
BA-S2Mo	EA2	ISO 14171-A	S 4T 2 AB S2Mo	F55TA2-EA2	F8TA2-EA2

Chemical composition of all-weld metal acc. to EN ISO 15792-1 and AWS A5.17/5.23: (characteristical values in wt. %)

Wire electrode		C	Si	Mn	Mo	Ni	Cr
BA-S1	EL12	0.05-0.08	0.2-0.4	0.9-1.3			
BA-S2	EM12(K)	0.05-0.08	0.2-0.4	1.4-1.8			
BA-S2Si	EM12K	0.05-0.08	0.2-0.5	1.4-1.8			
BA-S3Si	EH12K	0.05-0.08	0.2-0.5	1.6-2.0			
BA-S2Mo	EA2	0.04-0.08	0.2-0.4	1.3-1.7	0.5		
BA-S2Ni2	ENi2	0.05-0.08	0.2-0.4	1.1-1.5		2.0	

Mechanical properties of all-weld metal acc. to EN ISO 15792-1 and AWS A5.17/5.23: (characteristical values)

Wire electrode		Heat treatment	YS MPa	UTS MPa	Elong. %	Impact ISO-V (J)				
						± 0 °C +32 °F	-20 °C -4 °F	-40 °C -40 °F	-51 °C -60 °F	-73 °C -100 °F
BA-S1	EL12	AW	>400	>510	>24	>80	>47			
BA-S2	EM12(K)	AW	>420	>500	>22	>100	>70	>50		
		S *)	>400	>490	>22	>110	>80	>60		
BA-S2Si	EM12K	AW	>430	>520	>22	>100	>70	>50		
		S *)	>400	>490	>22	>110	>80	>60		
BA-S3Si	EH12K	AW	>470	>560	>22	>120	>90	>70		
		S *)	>400	>490	>22	>130	>100	>80		
BA-S2Mo	EA2	AW	>500	>570	>20	>100	>80	>47		
		S **)	>470	>570	>22	>110	>70	>47		
BA-S2Ni2	ENi2	AW	>540	>520	>22	>150	>120	>70	>47	
		S **)	>470	>550	>24	>150	>120	>100	>60	

Post Weld Heat Treatment: *) 580 °C / 1 h **) 620 °C / 15 h

Approvals: **with wire electrodes:**
VdTUEV 1153 / TÜV Wien S2, S2Si, S2Mo, S2Ni2
Deutsche Bahn S2, S2Si, S2Mo

Agglomerated Welding Flux BF 3.5

BF 3.5

Flux type: **A**luminate-**B**asic

Normbezeichnung: ISO 14174 **– S A AB 1 67 AC H5***)
(EN 760 **– SA AB 1 67 AC H5**)

Characteristics:
BF 3.5 is an agglomerated welding flux of the aluminate basic type. It is suitable for joint welding of low alloy structural steels, pipe steels, boiler steels and fine grain steels. The flux is suitable for single and multilayer welding of longitudinal and circumferential and fillet welds. It can be used for single, tandem, twin and multi wire welding systems. Excellent slag removal in narrow groove welds of thick wall sections. Typical characteristic of this flux is a medium Mn and Si pick up as well as very low diffusible hydrogen level. It is suitable for both AC and DC welding.

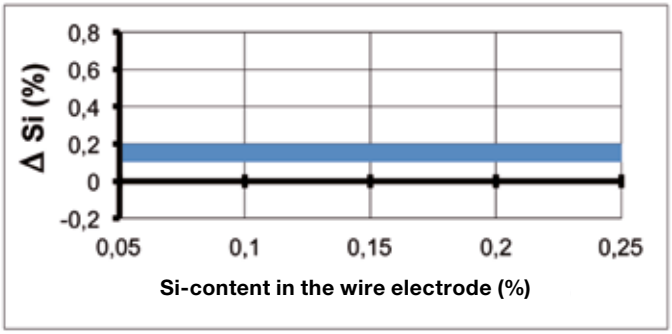
Application:
Joint welding of non-alloy and low alloy structural steels acc. to. EN 10025. Fine-grain structural steels with YS < 420 MPa and boiler steels such as P265GH (H II) and 16Mo3/A335 grade 91

Characteristic chemical Constituents:

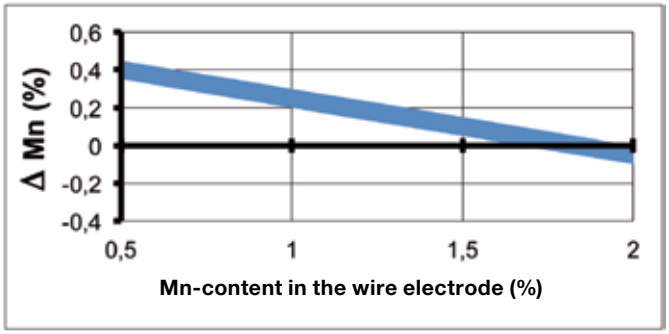
$SiO_2 + TiO_2$	$Al_2O_3 + MnO$	$CaO + MgO$	CaF_2
20 %	30 %	30 %	15 %
Basicity according to Boniszewski: ~1.7			

Metallurgical behaviour acc. to ISO 14174 type of current DC:

Pick-up Silicon



Pick-up / Burn-out Manganese



Flux density: 1.1 kg / dm³ (l)

Grain size acc. to ISO 14174: 2 – 16 (Tyler 10 x 65); 2 – 20 (Tyler 8 x 65)

Current-carrying capacity: up to 1,500 A (DC or AC) using one wire

Packaging: 25 kg PE-bags or 500-1,250 kg Big Bags

Storage and redrying:
Unopened originally packed flux bags can be stored up to 1 year in dry storage rooms after date of delivery ex factory.
Redrying conditions specific to the flux: 200 ± 50 °C effective flux temperature.

*) Diffusible hydrogen content H5: determined in deposited metal acc. to the method described in ISO 3690 Type of current DC; redrying conditions 200 ± 50 °C

All-weld metal multiple pass classification of wire-flux combinations:

Wire electrode (ISO 14171-A)	AWS A5.17/.23	Test assembly ISO 15792-1: type 1.3		AWS A5.17M/5.23M	AWS A5.17/5.23
BA-S1	EL12	ISO 14171-A-	S 38 2 AB S1	F48A2-EL12	F7A0-EL12
BA-S2	EM12(K)	ISO 14171-A	S 42 3 AB S2	F48A4/P4-EM12(K)	F7A4/P4-EM12(K)
BA-S2Si	EM12K	ISO 14171-A	S 42 3 AB S2Si	F48A4/P4-EM12K	F7A4/P4-EM12K
BA-S3Si	EH12K	ISO 14171-A	S 46 4 AB S3Si	F55A4/F49P4-EH12K	F8A5/F7P4-EH12K
BA-S2Mo	EA2	ISO 14171-A-	S 46 3 AB S2Mo	F55A3P3-EA2-A2	F8A2/P2-EA2-A2
BA-S2NiCu	EG	ISO 14171-A-	S 46 3 AB S2Ni1Cu	F55A3/F49P3-EG-G	F8A2/F7P2-EG-G

Two-run classification of wire-flux combinations:

Wire electrode (ISO 14171-A)	AWS A5.17/.23	Two-Run / ISO 15792-2: Form 2.5		AWS A5.17M/5.23M	AWS A5.17/5.23
BA-S1	EL12	ISO 14171-A-	S 2T 2 AB S1	F43TA2-EL12	F6TA2-EL12
BA-S2	EM12(K)	ISO 14171-A-	S 3T 2 AB S2	F49TA2-EM12(K)	F7TA2-EM12(K)
BA-S2Si	EM12K	ISO 14171-A	S 3T 2 AB S2Si	F49TA2-EM12K	F7TA2-EM12K
BA-S2Mo	EA2	ISO 14171-A-	S 4T 2 AB S2Mo	F55TA2-EA2	F8TA2-EA2

Chemical composition of all-weld metal acc. to EN ISO 15792-1 and AWS A5.17/5.23: (characteristical values in wt. %)

Wire electrode		C	Si	Mn	Mo	Ni	Cr
BA-S1	EL12	0.05-0.08	0.2-0.4	0.9-1.3			
BA-S2	EM12(K)	0.05-0.08	0.2-0.4	1.1-1.5			
BA-S2Si	EM12K	0.05-0.08	0.2-0.5	1.1-1.5			
BA-S3Si	EH12K	0.05-0.08	0.3-0.5	1.5-1.9			
BA-S2Mo	EA2	0.04-0.08	0.2-0.4	1.1-1.5	0.5		
BA-S2NiCu	EG	0.05-0.08	0.3-0.5	1.1-1.5		0.8	Cu: 0.5

Mechanical properties of all-weld metal acc. to EN ISO 15792-1 and AWS A5.17/5.23: (characteristical values)

Wire electrode		Heat treatment	YS MPa	UTS MPa	Elong. %	Kerbschlagarbeit ISO-V (J) bei				
						± 0 °C +32 °F	-20 °C -4 °F	-30 °C -22 °F	-40 °C -40 °F	-51 °C -60 °F
BA-S1	EL12	AW	>400	>500	>24	>70	>50			
BA-S2	EM12(K)	AW	>420	>500	>22	>100	>70	>47	>27	
		S *)	>400	>490	>22	>100	>70	>47	>27	
BA-S2Si	EM12K	AW	>430	>500	>22	>100	>70	>47	>47	
		S *)	>400	>490	>22	>100	>70	>47	>47	
BA-S3Si	EH12K	AW	>470	>560	>22	>100	>80	>60	>47	
		S *)	>400	>500	>22	>100	>80	>60	>27	
BA-S2Mo	EA2	AW	>490	>570	>20	>100	>80	>47		
		S **)	>470	>550	>22	>100	>80	>47		
BA-S2NiCu	EG	AW	>470	>550	>22	>100	>70	>47		
		S *)	>400	>500	>20	>100	>70	>47		

Post Weld Heat Treatment: *) 580 °C / 1 h **) 620 °C / 15 h

Approvals:
VdTUEV 1153 / TÜV Wien
DNV

with wire electrodes:
S2, S2Si
EM12(K), S2

Agglomerated Welding Flux BF 4

BF 4

Flux type: **A**luminate-**B**asic

Classification: ISO 14174 – **S A AB 1 76 AC H5 *)**
(EN 760 – **SA AB 1 76 AC H5**)

Characteristics:
Versatile flux for joint welding and surfacing with wire or strip electrodes. BF 4 is suitable for high speed welding of butt and fillet welds with single and multi-wire processes. Smooth weld bead appearance with flat weld interfaces free from undercut, self-de-slagging without any slag residuals, high current carrying capacity and low flux consumption (wire/flux ratio 1:0.9) are other special features of BF 4. Uniform mechanical property performance and low diffusible hydrogen levels make BF 4 flux suitable for most of the SAW processes with its wide range of applications.

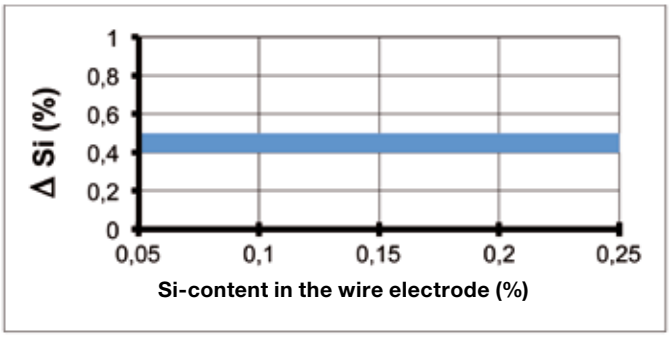
Application:
Joint welding of non-alloy and low alloy structural steels such as S 355 J2 G3 (St 52-3N) acc. to EN 10025, boiler steels such as P265GH (H II) and 16Mo3/A335 grade P1, as well as fine-grain structural steels with yield strength up to 420 MPa (t < 50 mm) in combination with compatible wires such as S2 or S2Mo. Surfacing with special hard facing wires and strips, including metal powder-cored wires (MPCW).

Characteristic chemical Constituents:

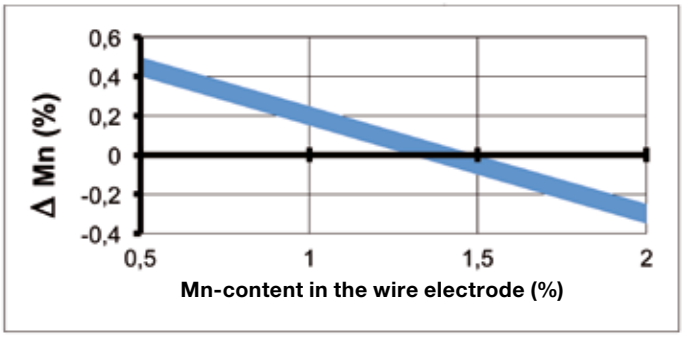
$SiO_2 + TiO_2$	$Al_2O_3 + MnO$	$CaO + MgO$	CaF_2
30 %	30 %	25 %	12 %
Basicity according to Boniszewski: ~1.1			

Metallurgical behaviour acc. to ISO 14174 type of current DC::

Pick-up Silicon



Pick-up / Burn-out Manganese



Flux density: 1.0 kg/dm³ (l)

Grain size acc. to ISO 14174: 2 – 20 (Tyler 8 x 65)
4 – 30 (Tyler 6 x 35)

Current-carrying capacity: up to 1,000 A (DC or AC) using one wire

*) Diffusible hydrogen content H5: determined in deposited metal acc. to the method described in ISO 3690
Type of current DC; redrying conditions 200 ± 50°C

BF 4 with tubular wire Ø 4,00 type 18.8.6 L
Excellent weld bead appearance, also in rail crossings and bends.

All-weld metal multiple pass classification of wire-flux combinations:

Wire electrode (ISO 14171-A)	AWS A5.17/.23	Test assembly ISO 15792-1: type 1.3	AWS A5.17M/5.23M	AWS A5.17/5.23
BA-S2	EM12(K)	ISO 14171-A- S 42 2 AB S2	F48A2/F43P2-EM12(K)	F7A0/F6P0-EM12(K)
BA-S2Si	EM12K	ISO 14171-A- S 42 2 AB S2Si	F48A2/F43P2-EM12K	F7A0/F6P0-EM12K
BA-S2Mo	EA2	ISO 14171-A- S 46 2 AB S2Mo	F55A2-EA2-A2	F8A0-EA2-A2

Two-run classification of wire-flux combinations:

Wire electrode (ISO 14171-A)	AWS A5.17/.23	Two-run / ISO 15792-2: type 2.5	AWS A5.17M/5.23M	AWS A5.17/5.23
BA-S2	EM12(K)	ISO 14171-A- S 3T 2 AB S2	F43TA2-EM12(K)	F6TA0-EM12(K)
BA-S2Mo	EA2	ISO 14171-A- S 4T 2 AB S2Mo	F49TA2-EA2	F7TA0-EA2

Chemical composition of all-weld metal acc. to EN ISO 15792-1 and AWS A5.17/5.23: (characteristical values in wt. %)

Wire electrode		C	Si	Mn	Mo	Ni	Cr
BA-S2	EM12(K)	0.04-0.08	0.4-0.8	1.0-1.4			
BA-S2Si	EM12K	0.04-0.08	0.5-0.9	1.0-1.4			
BA-S2Mo	EA2	0.04-0.08	0.4-0.8	1.0-1.4	0.4-0.6		

Mechanical properties of all-weld metal acc. to EN ISO 15792-1 and AWS A5.17/5.23: (characteristical values)

Wire electrode		Heat treatment	YS MPa	UTS MPa	Elong. %	Kerbschlagarbeit ISO-V (J) bei RT	± 0 °C +32 °F	-20 °C -4 °F	-30 °C -22 °F	-40 °C -40 °F
BA-S2	EM12(K)	AW	>400	>510	>24	>80	>60	>50		
		S *)	>360	>480	>25	>90	>70	>60		
BA-S2Si	EM12K	AW	>400	>510	>24	>80	>70	>50		
		S *)	>360	>480	>25	>90	>70	>60		
BA-S2Mo	EA2	AW	>470	>570	>20	>80	>60	>50		
		S **)	>440	>540	>22	>90	>70	>60		

Post Weld Heat Treatment *) 580 °C / 15 h **) 620 °C / 15 h

Approvals: **with wire electrodes:**
VdTUEV 1153 / TÜV-Wien S2 and S2Mo
Deutsche Bahn S2 and S2Mo

Packaging: 25 kg PE-bags or 500-1,250 kg Big Bags

Storage and redrying:
Unopened originally packed flux bags can be stored up to 1 years in dry storage rooms after date of delivery ex factory.
Redrying conditions specific to the flux: 200 ± 50 °C effective flux temperature.

Agglomerated Welding Flux BF 5.1

BF 5.1

Flux type: **A**luminate-**B**asic

Classification: ISO 14174 – **S A AB 1 67 AC H5 *)**
(EN 760 – **SA AB 1 67 AC H5**)

Characteristics:
A neutral, semi-basic agglomerated flux of the aluminate basic type suitable for joint welding of low-alloy structural steels, fine-grained steels and pipe steel qualities. Designed for DC and AC welding.
BF 5.1 is suitable for the two-run or multi-layer technique using single or multi-wire processes. The flux shows constant metallurgical characteristics (low Silicon and Manganese pick-up). In combination with appropriate wires, such as Mo-, Ni- or NiMo-alloyed types, uniform mechanical properties with low temperature toughness are achieved. Slag–detachability, even in narrow-groove welds of thick-walled sections, or at high preheating temperature (> 250 °C), together with finely rippled weld bead performance and smooth tie-ins, even when fillet welding using high currents, are additional features of the flux.
BF 5.1 is formulated to achieve very low diffusible hydrogen levels (< 4 ml/100 g weld deposit). The chemical composition of the flux, and its alloy vector, have been designed for achieving large amount of acicular ferrite with typical standard wires.

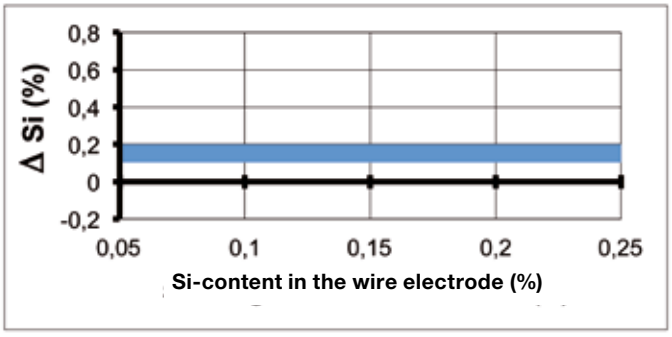
Application:
SA-welding of low-alloy structural steels (Y.S. up to 420 MPa), boiler and vessel materials, high-strength ship steels such as EH36; fine-grain structural steels up to Y.S. 460 MPa and pipe steel qualities up to X70 grade (ISO 3183/ API-5L).

Characteristic chemical Constituents:

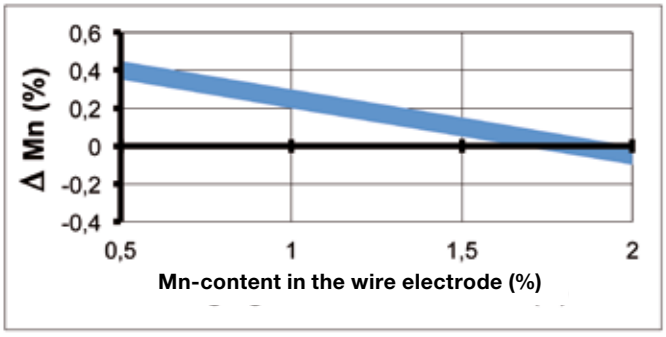
$SiO_2 + TiO_2$	$Al_2O_3 + MnO$	$CaO + MgO$	CaF_2
20 %	30 %	30 %	15 %
Basicity according to Boniszewski: ~1.7			

Metallurgical behaviour acc. to ISO 14174 type of current DC:

Pick-up Silicon



Pick-up / Burn-out Manganese



Flux density: 1.1 kg/dm³ (l)

Grain size acc. to ISO 14174: 3 – 20 (Tyler 8 x 48)

Current-carrying capacity: up to 1,000 A (DC or AC) using one wire

*) Diffusible hydrogen content H5: determined in deposited metal acc. to the method described in ISO 3690
Type of current DC; redrying conditions 200 ± 50 °C

All-weld metal multiple pass classification of wire-flux combinations:

Wire electrode (ISO 14171-A ISO 24598-A)	AWS A5.17/.23	Test assembly ISO 15792-1: type 1.3		AWS A5.17M/5.23M	AWS A5.17/5.23
BA-S1	EL12	ISO 14171-A-	S 38 3 AB S1	F48A3-EL12	F7A2-EL12
BA-S2	EM12(K)	ISO 14171-A	S 42 4 AB S2	F48A4/F43P4-EM12(K)	F7A4/F6P4-EM12(K)
BA-S3	EH10K	ISO 14171-A	S 46 5 AB S3	F55A5/F49P5-EH10K	F8A6/F7P6-EH10K
BA-S2Si	EM12K	ISO 14171-A	S 42 5 AB S2Si	F48A5/P5-EM12K	F7A6/P6-EM12K
BA-S3Si	EH12K	ISO 14171-A-	S 46 5 AB S3Si	F55A5/F49P5-EH12K	F8A6/F7P6-EH12K
BA-S2Mo	EA2	ISO 14171-A-	S 46 4 AB S2Mo	F55A4/P4-EA2-A2	F8A4/P4-EA2-A2
BA-S3Mo	EA4	ISO 14171-A-	S 50 4 AB S3Mo	F62A4/P4-EA4-A3	F9A4/P4-EA4-A3
BA-S2Ni1	ENi1	ISO 14171-A-	S 42 7 AB S2Ni1	F49A7/P7-ENi1-Ni1	F7A10/P10-ENi1-Ni1
BA-S2Ni2	ENi2	ISO 14171-A-	S 46 7 AB S2Ni2	F55A7/F49P7-ENi2-Ni2	F8A10/F7P10-ENi2-Ni2
BA-S3NiMo1	EF3	ISO 14171-A-	S 50 4 AB S3Ni1Mo	F62A4/P4-EF3-F3	F9A5/P5-EF3-F3
BA-S2NiCu1	EG	ISO 14171-A	S 46 4 AB S2Ni1Cu	F55A4-EG-G	F8A4-EG-G
BA-S2CrMo1	EB2	ISO 24598-A	S S CrMo1 AB	F55P4-EB2-B2	F8P4-EB2-B2

Two-run classification of wire-flux combinations:

Wire electrode (ISO 14171-A ISO 24598-A)	AWS A5.17/.23	Two-run / ISO 15792-2: type 2.5		AWS A5.17M/5.23M	AWS A5.17/5.23
BA-S2	EM12(K)	ISO 14171-A-	S 3T 2 AB S2	F43TA2-EM12(K)	F6TA0-EM12(K)
BA-S2Si	EM12K	ISO 14171-A	S 4T 3 AB S2Si	F49TA3-EM12K	F7TA2-EM12K
BA-S3Si	EH12K	ISO 14171-A-	S 4T 3 AB S3Si	F55TA3-EH12K	F8TA2-EH12K
BA-S2Mo	EA2	ISO 14171-A-	S 4T 3 AB S2Mo	F55TA3-EA2	F8TA2-EA2
BA-S2Ni1	ENi1	ISO 14171-A-	S 4T 3 AB S2Ni1	F49TA3-ENi1	F7TA2-ENi1
BA-S2Ni2	ENi2	ISO 14171-A-	S 4T 4 AB S2Ni2	F55TA4-ENi2	F8TA4-ENi2
BA-S3NiMo1	EF3	ISO 14171-A-	S 5T 3 AB S3Ni1Mo	F62TA3-EF3	F9TA2-EF3
BA-S2CrMo1	EB2			F49TA2-EB2	F7TA0-EB2

Chemical composition of all-weld metal acc. to EN ISO 15792-1 and AWS A5.17/5.23: (characteristical values in wt. %)

Wire electrode		C	Si	Mn	Mo	Ni	Cr
BA-S2	EM12(K)	0.05-0.08	0.2-0.4	1.1-1.5			
BA-S3	EH10K	0.05-0.08	0.2-0.4	1.5-1.9			
BA-S2Si	EM12K	0.05-0.08	0.3-0.5	1.1-1.5			
BA-S3Si	EH12K	0.05-0.08	0.3-0.5	1.5-1.9			
BA-S2Mo	EA2	0.05-0.08	0.2-0.4	1.1-1.5	0.5		
BA-S3Mo	EA4	0.05-0.08	0.2-0.4	1.5-1.9	0.5		
BA-S2Ni1	ENi1	0.05-0.08	0.2-0.4	1.1-1.5		0.8	
BA-S2Ni2	ENi2	0.05-0.08	0.2-0.4	1.1-1.5		2.0	
BA-S3NiMo1	EF3	0.05-0.08	0.2-0.4	1.5-1.9	0.5	0.9	
BA-S2Ni1Cu	EG	0.05-0.08	0.3-0.5	1.0-1.4		0.8	
BA-S2CrMo1	EB2	0.05-0.08	0.2-0.4	1.0-1.4	0.5		1.0

Mechanical properties of all-weld metal acc. to EN ISO 15792-1 and AWS A5.17/5.23: (characteristical values)

Wire electrode		Heat treatment	YS MPa	UTS MPa	Elong. %	Impact ISO-V (J)				
						± 0 °C +32 °F	-20 °C -4 °F	-40 °C -40 °F	-51 °C -60 °F	-73 °C -100 °F
BA-S1	EL12	AW	>400	>490	>24	>80	>60	>47(-30°C)		
BA-S2	EM12(K)	AW	>420	>510	>24	>100	>70	>47		
		S *)	>360	>450	>24	>100	>70	>27		
BA-S3	EH10K	AW	>470	>560	>23	>100	>70	>60	>47	
		S *)	>400	>490	>23	>110	>80	>60	>47	
BA-S2Si	EM12K	AW	>440	>520	>24	>100	>80	>60	>47	
		S*)	>400	>480	>24	>100	>80	>60	>47	
BA-S3Si	EH12K	AW	>470	>560	>23	>120	>100	>80	>47	
		S *)	>420	>520	>24	>120	>110	>70	>47	
BA-S2Mo	EA2	AW	>490	>580	>22	>90	>60	>47		
		S **)	>470	>560	>22	>100	>70	>27		
BA-S3Mo	EA4	AW	>540	>640	>22	>90	>60	>47		
		S **)	>540	>620	>22	>90	>60	>27		
BA-S2Ni1	ENi1	AW	>440	>530	>25		>140	>100	>60	>47
		S *)	>400	>490	>26		>150	>110	>120	>47
BA-S2Ni2	ENi2	AW	>480	>580	>22		>140	>100	>60	>47
		S *)	>460	>550	>23		>150	>110	>70	>47
BA-S3NiMo1	EF3	AW	>570	>670	>22	>110	>100	>47		
		S *)	>570	>670	>22	>120	>110	>47		
BA-S2NiCu1	EG	AW	>470	>570	>23	>90	>70	>47		
BA-S2CrMo1	EB2	S ***)	>470	>570	>22	>80	>47	>27		

Post Weld Heat Treatment: *) 580 °C/15 h **) 620 °C/15 h ***) 650 °C/15 h / 700 °C/2h

Approvals: **with wire electrodes:**
VdTUEV 1153 / TÜV-Wien S2, S2Si, S3Si, S2Mo, S2Ni1Cu and S CrMo1
Deutsche Bahn S2, S2Si, S3Si and S2Mo
ABS (American Bureau of Shipping) EH12K (S3Si)

Packaging: 25 kg PE-bags or 500-1,250 kg Big Bags

Storage and redrying:
Unopened originally packed flux bags can be stored up to 1 year in dry storage rooms after date of delivery ex factory.
Redrying conditions specific to the flux: 200 ± 50 °C effective flux temperature.

Agglomerated Welding Flux BF 6.30

BF 6.30

Flux type: **A**luminate-**B**asic

Classification: ISO 14174 – **S A AB 1 66 AC H5 *)**
(EN 760 – **SA AB 1 66 AC H5**)

Characteristics:
A semi-basic flux for joint welding of high quality steel pipes for pipeline transportation systems in the oil and gas industries. Especially recommended for single and multi-wire (up to 5 wires) submerged arc processes in the two-run technique. Very good weld appearance and slag release providing flat welds with low reinforcement and flat weld interfaces free from undercuts. High grain hardness and resistance to abrasion and a low consumption rate with good flux feeding properties in the transport and recovery system.
As a result of low hydrogen levels (less than 5 ml/100 g in the weld deposits) and oxygen levels of about 350 ppm as well as uniform metallurgical behaviour with low silicon and manganese pick-up, constant mechanical properties are obtained even when welding thick-walled tubes in the two-run technique.

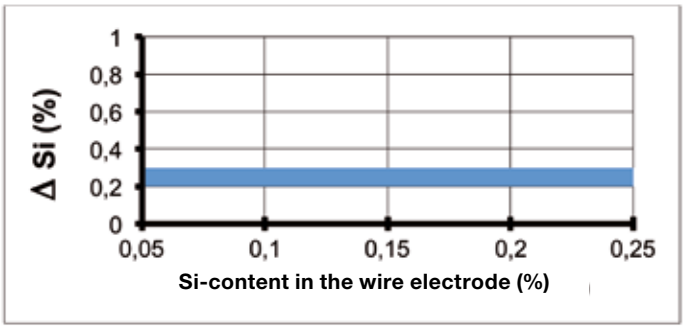
Application:
Production of longitudinal and spiral welded steel pipe grades L360 or X52 to L555 or X80 according to ISO 3183 / API Spec. 5L.

Characteristic chemical Constituents:

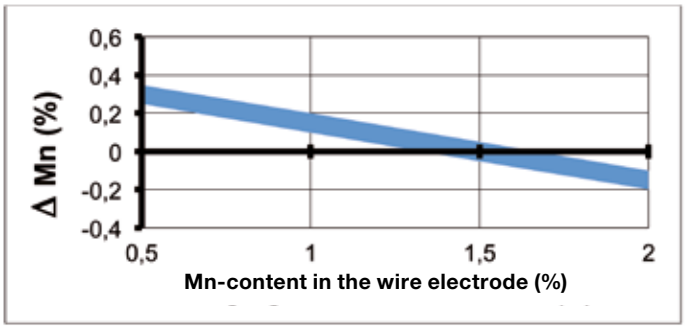
$SiO_2 + TiO_2$	$Al_2O_3 + MnO$	$CaO + MgO$	CaF_2
20 %	35 %	20 %	20 %
Basicity according to Boniszewski: ~1.4			

Metallurgical behaviour acc. to ISO 14174 type of current DC:

Pick-up Silicon



Pick-up / Burn-out Manganese



Flux density: 0.95 kg/dm³ (l)

Grain size acc. to ISO 14174: 2 – 16 (Tyler 10 x 65)

Current-carrying capacity: up to 1,000 A (DC or AC) using one wire

*) Diffusible hydrogen content H5: determined in deposited metal acc. to the method described in ISO 3690
Type of current DC; redrying conditions 200 ± 50 °C

All-weld metal multiple pass classification of wire-flux combinations:

Wire electrode (ISO 14171-A)	AWS A5.17/.23	Test assembly ISO 15792-1: type 1.3		AWS A5.17M/5.23M	AWS A5.17/5.23
BA-S2	EM12(K)	ISO 14171-A-	S 42 3 AB S2	F48A3-EM12(K)	F7A2-EM12(K)
BA-S2Si	EM12K	ISO 14171-A	S 42 3 AB S2Si	F48A3-EM12K	F7A2-EM12K
BA-S3Si	EH12K	ISO 14171-A-	S 46 4 AB S3Si	F55A4/F49P4-EH12K	F8A4/F7P4-EH12K
BA-S2Mo	EA2	ISO 14171-A-	S 46 3 AB S2Mo	F55A3/P3-EA2-A2	F8A2/P2-EA2-A2
BA-S3Mo	EA4	ISO 14171-A-	S 50 3 AB S3Mo	F55A3/P3-EA4-A4	F8A2/P2-EA4-A4
BA-S3NiMo1	EF3	ISO 14171-A	S 50 3 AB S3Ni1Mo	F62A3-EF3-F3	F9A2-EF3-F3
BA-S4MoSi	EA3K	ISO 14341-A	S 50 0 AB G4Mo	F62A2-EA3K-A3	F9A0-EA3K-A3

Two-run classification of wire-flux combinations:

Wire electrode (ISO 14171-A)	AWS A5.17/.23	Two-run / ISO 15792-2: type 2.5		AWS A5.17M/5.23M	AWS A5.17/5.23
BA-S2	EM12(K)	ISO 14171-A	S 3T 2 AB S2	F43TA2-EM12(K)	F6TA0-EM12(K)
BA-S2Si	EM12K	ISO 14171-A	S 3T 2 AB S2Si	F43TA2-EM12K	F6TA0-EM12K
BA-S3Si	EH12K	ISO 14171-A-	S 4T 3 AB S3Si	F49TA3-EH12K	F7TA2-EH12K
BA-S2Mo	EA2	ISO 14171-A-	S 5T 3 AB S2Mo	F62TA3-EA2	F9TA2-EA2
BA-S3Mo	EA4	ISO 14171-A-	S 5T 3 AB S3Mo	F62TA3-EA4	F9TA2-EA4
BA-S3NiMo1	EF3	ISO 14171-A	S 5T 3 AB S3Ni1Mo	F62TA3-EF3	F9TA2-EF3
BA-S2MoTiB	EA2TiB	ISO 14171-A	S 5T 5 AB S2MoTiB	F62TA5-EA2TiB	F9TA6-EA2TiB
BA-S3MoTiB	EG	ISO 14171-A	S 5T 5 AB SZ	F62TA5-EG	F9TA6-EG

Mechanical properties of two-run weld metal of pipe steels: (characteristical values)

Wire electrode		YS MPa	UTS MPa	Elong. %	Impact ISO-V (J) RT	± 0 °C +32 °F	-20 °C -4 °F	-30 °C -22 °F	-40 °C -40 °F	-51 °C -60 °F
BA-S2 [1]	EM12(K)	>400	>500	>22	>80	>50	>27			
BA-S2Si [1]	EM12K	>400	>500	>22	>80	>50	>27			
BA-S3Si [1]	EH12K	>460	>560	>22	>100	>80	>70	>40		
BA-S2Mo [2]	EA2	>560	>630	>17	>100	>90	>60	>40		
BA-S3Mo [2]	EA4	>570	>650	>17	>110	>90	>70	>50		
BA-S3NiMo1 [2]	EF3	>560	>650	>17	>110	>90	>70	>60		
BA-S2MoTiB [3]	EA2TiB	>560	>630	>17	>130			>80	>70	>60
BA-S3MoTiB [3]	EG	>570	>650	>17	>130		>90	>80	>70	>60

[1] Low Si-base material up to X60 acc. to API Spec. 5L
[2] Si-deoxidized base material X65 and higher acc. to API Spec. 5L
[3] Low temperature toughness: BA-S2MoTiB better suitable for base material with higher Mn-content / BA-S3MoTiB for base material with lower Mn-content
Mechanical properties are influenced up to 70% by dilution of base-material

Approvals:
TÜV approval VdTUEV 1153

with wire electrodes:
S2Mo

Chemical composition of all-weld metal acc. to EN ISO 15792-1 and AWS A5.17/5.23: (characteristical values in wt. %)

Wire electrode		C	Si	Mn	Mo	Ni	Cr
BA-S2	EM12(K)	0.05-0.08	0.2-0.5	1.0-1.4			
BA-S2Si	EM12K	0.05-0.08	0.3-0.6	1.0-1.4			
BA-S3Si	EH12K	0.05-0.08	0.3-0.6	1.4-1.8			
BA-S2Mo	EA2	0.05-0.08	0.2-0.5	1.1-1.4	0.4-0.6		
BA-S3Mo	EA4	0.05-0.08	0.2-0.5	1.3-1.7	0.4-0.6		
BA-S3NiMo1	EF3	0.05-0.08	0.2-0.5	1.5-1.8	0.4-0.6	0.8-1.0	
BA-S2MoTiB	EA2TiB	0.04-0.07	0.3-0.5	1.0-1.4	0.4-0.6	Ti 0.05	B 0.005
BA-S3MoTiB	EG	0.04-0.07	0.3-0.5	1.2-1.6	0.4-0.6	Ti 0.05	B 0.005
BA-S4MoSi	EA3K	0.05-0.08	0.4-0.8	1.4-1.9	0.4-0.6	Ti 0.05	B 0.005

Mechanical properties of all-weld metal acc. to EN ISO 15792-1 and AWS A5.17/5.23: (characteristical values)

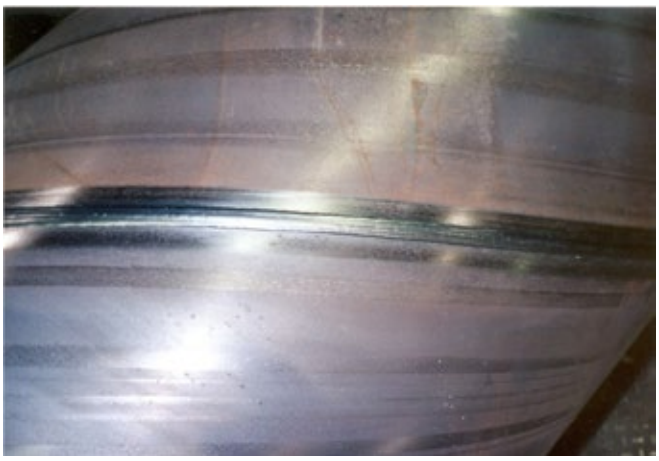
Wire electrode		Heat treatment	YS MPa	UTS MPa	Elong. %	Impact ISO-V (J)				
						RT	± 0 °C +32 °F	-20 °C -4 °F	-30 °C -22 °F	-40 °C -40 °F
BA-S2	EM12(K)	AW	>420	>510	>25	>110	>90	>70	>47	
BA-S2Si	EM12K	AW	>420	>510	>25	>110	>90	>70	>47	
BA-S3Si	EH12K	AW	>470	>550	>25	>130	>90	>80		>47
BA-S2Mo	EA2	AW	>490	>580	>23	>120	>80	>70	>47	
BA-S3Mo	EA4	AW	>520	>610	>22	>100	>70	>60	>47	
BA-S3NiMo1	EF3	AW	>580	>680	>20	>120	>80	>70	>47	
		S *)	>560	>660	>20	>130	>90	>60	>47	
BA-S4MoSi	EA3K	AW	>540	>630	>20	>80	>47	>27		

Post Weld Heat Treatment: *) 620 °C/2 h

Approvals:	**with wire electrodes:**
VdTUEV 1153 / TÜV-Wien	S2 and S2Mo
Deutsche Bahn	S2 and S2Mo

Packaging: 25 kg PE-bags or 500-1,250 kg Big Bags

Storage and redrying:
Unopened originally packed flux bags can be stored up to 1 year in dry storage rooms after date of delivery ex factory.
Redrying conditions specific to the flux: 200 ± 50 °C effective flux temperature.



Agglomerated Welding Flux BF 6.30 MW

BF 6.30 MW

Flux type: **A**luminate-**B**asic

Classification: ISO 14174 – **S A AB 1 66 AC H5 *)**
(EN 760 – **SA AB 1 66 AC H5**)

Characteristics:
A semi-basic flux for joint welding of high quality steel pipes for pipeline transportation systems in the oil and gas industries. Especially recommended for multi-wire (3 up to 5 wires) submerged arc processes in the two-run technique. Very good weld appearance and slag release providing flat welds with low reinforcement and flat weld interfaces free from undercut. High grain hardness and resistance to abrasion and a low consumption rate with good flux feeding properties in the transport and recovery system.
As a result of low hydrogen levels (less than 5 ml/100 g in the weld deposits) and oxygen levels of about 350 ppm as well as uniform metallurgical behaviour with low silicon and manganese pick-up, constant mechanical properties are obtained even when welding thick-walled tubes in the two-run technique.

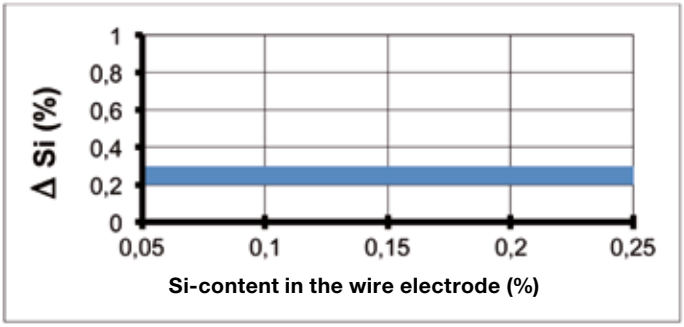
Application:
Production of longitudinal steel pipe grades L360 or X52 to L555 or X80 according to ISO 3183/API Spec. 5L.

Characteristic chemical Constituents:

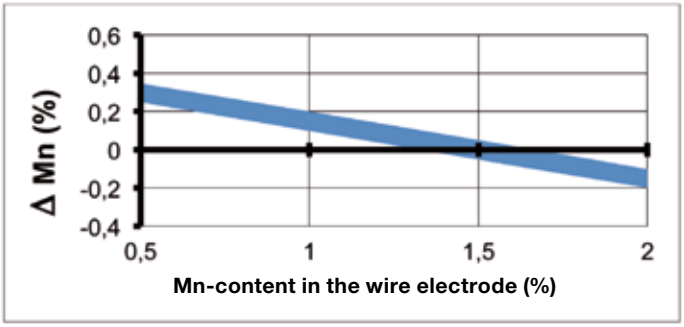
$SiO_2 + TiO_2$	$Al_2O_3 + MnO$	$CaO + MgO$	CaF_2
20 %	30 %	20 %	20 %
Basizitätsgrad nach Boniszewski: ~1.5			

Metallurgical behaviour acc. to ISO 14174 type of current DC:

Pick-up Silicon



Pick-up / Burn-out Manganese



Flux density: 0,95 kg/dm³ (l)

Grain size acc. to ISO 14174: 2 – 16 (Tyler 10 x 65)
2 – 20 (Tyler 8 x 65)

Current-carrying capacity: up to 1,500 A (DC or AC) using one wire

*) Diffusible hydrogen content H5: determined in deposited metal acc. to the method described in ISO 3690 Type of current DC; redrying conditions 200 ± 50 °C

All-weld metal multiple pass classification of wire-flux combinations:

Wire electrode (ISO 14171-A)	AWS A5.17/.23	Test assembly ISO 15792-1: type 1.3		AWS A5.17M/5.23M	AWS A5.17/5.23
BA-S2	EM12(K)	ISO 14171-A-	S 38 3 AB S2	F48A3-EM12(K)	F7A2-EM12(K)
BA-S2Si	EM12K	ISO 14171-A	S 38 3 AB S2Si	F48A3-EM12K	F7A2-EM12K
BA-S3Si	EH12K	ISO 14171-A-	S 46 4 AB S3Si	F55A4/F49P4-EH12K	F8A4/F7P4-EH12K
BA-S2Mo	EA2	ISO 14171-A-	S 50 4 AB S2Mo	F62A4-EA2-A2	F9A4-EA2-A2
BA-S3Mo	EA4	ISO 14171-A-	S 50 3 AB S3Mo	F62A4/P4-EA4-A4	F9A4/P4-EA4-A4
BA-S3NiMo1	EF3	ISO 26304-A-	S 55 4 AB S3Ni1Mo	F62A4/P4-EF3-F3	F9A4/P4-EF3F3
BA-S4MoSi	EA3K	ISO 14171-A-	S 50 2 AB G4Mo	F62A4-EA3K-A3	F9A4-EA3K-A3

Two-run classification of wire-flux combinations:

Wire electrode (ISO 14171-A)	AWS A5.17/.23	Two-Run / ISO 15792-2: Form 2.5		AWS A5.17M/5.23M	AWS A5.17/5.23
BA-S2	EM12(K)	ISO 14171-A	S 3T 2 AB S2	F43TA2-EM12(K)	F6TA0-EM12(K)
BA-S2Si	EM12K	ISO 14171-A	S 3T 2 AB S2Si	F43TA2-EM12K	F6TA0-EM12K
BA-S3Si	EH12K	ISO 14171-A-	S 4T 3 AB S3Si	F49TA3-EH12K	F7TA2-EH12K
BA-S2Mo	EA2	ISO 14171-A-	S 5T 3 AB S2Mo	F62TA3-EA2	F9TA2-EA2
BA-S3Mo	EA4	ISO 14171-A-	S 5T 3 AB S3Mo	F62TA3-EA4	F9TA2-EA4
BA-S3NiMo1	EF3	ISO 14171-A	S 5T 3 AB S3Ni1Mo	F62TA3-EF3	F9TA2-EF3
BA-S2MoTiB	EA2TiB	ISO 14171-A	S 5T 5 AB S2MoTiB	F62TA5-EA2TiB	F9TA6-EA2TiB
BA-S2MoTiB	EG	ISO 14171-A	S 5T 5 AB SZ	F62TA5-EG	F9TA6-EA2TiB
BA-S4MoSi	EA3K	ISO 14171-A	S 5T 3 AB G4Mo	F62TA3-EA3K	F9TA2-EA3K

Mechanical properties of two-run weld metal of pipe steels: (characteristical values)

Wire electrode		YS MPa	UTS MPa	Elong. %	Impact ISO-V (J)					
					RT	± 0 °C +32 °F	-20 °C -4 °F	-30 °C -22 °F	-40 °C -40 °F	-51 °C -60 °F
BA-S2 [1]	EM12(K)	>400	>500	>22	>80	>50	>27			
BA-S2Si [1]	EM12K	>400	>500	>22	>80	>50	>27			
BA-S3Si [1]	EH12K	>460	>560	>22	>100	>80	>70	>40		
BA-S2Mo [2]	EA2	>560	>630	>17	>100	>90	>60	>40		
BA-S3Mo [2]	EA4	>570	>650	>17	>110	>90	>70	>50		
BA-S3NiMo1 [2]	EF3	>560	>650	>17	>110	>90	>70	>60		
BA-S2MoTiB [3]	EA2TiB	>560	>630	>17	>130		>90	>80	>70	>60
BA-S3MoTiB [3]	EG	>570	>650	>17	>130		>90	>80	>70	>60
BA-S4MoSi [3]	EA3K	>570	>650	>17	>110	>90	>70	>50		

[1] Low Si-base material up to X60 acc. to API Spec. 5L
[2] Si-deoxidized base material X65 and higher acc. to API Spec. 5L
[3] Low temperature toughness: BA-S2MoTiB better suitable for base material with higher Mn-content / BA-S3MoTiB for base material with lower Mn-content
Mechanical properties are influenced up to 70% by dilution of base-material.

Chemical composition of all-weld metal acc. to EN ISO 15792-1 and AWS A5.17/5.23: (characteristical values in wt. %)

Wire electrode		C	Si	Mn	Mo	Ni	Cr
BA-S2	EM12(K)	0.05-0.08	0.2-0.5	1.0-1.4			
BA-S2Si	EM12K	0.05-0.08	0.3-0.6	1.0-1.4			
BA-S3Si	EH12K	0.05-0.08	0.3-0.6	1.4-1.8			
BA-S2Mo	EA2	0.05-0.08	0.2-0.5	1.1-1.4	0.4-0.6		
BA-S3Mo	EA4	0.05-0.08	0.2-0.5	1.3-1.7	0.4-0.6		
BA-S3NiMo1	EF3	0.05-0.08	0.2-0.5	1.5-1.8	0.4-0.6	0.8-1.0	
BA-S2MoTiB	EA2TiB	0.04-0.07	0.3-0.5	1.0-1.4	0.4-0.6	Ti 0.05	B 0.005
BA-S3MoTiB	EG	0.04-0.07	0.3-0.5	1.2-1.6	0.4-0.6	Ti 0.05	B 0.005
BA-S4MoSi	EA3K	0.05-0.08	0.4-0.8	1.4-1.9	0.4-0.6		

Mechanical properties of all-weld metal acc. to EN ISO 15792-1 and AWS A5.17/5.23: (characteristical values)

Wire electrode		Heat treatment	YS MPa	UTS MPa	A_5 %	Impact ISO-V (J)				
						RT	± 0 °C +32 °F	-20 °C -4 °F	-30 °C -22 °F	-40 °C -40 °F
BA-S2	EM12(K)	AW	>400	>510	>25	>110	>90	>70	>47	
BA-S2Si	EM12K	AW	>400	>510	>25	>110	>90	>70	>47	
BA-S3Si	EH12K	AW	>470	>550	>25	>130	>90	>80		>47
BA-S2Mo	EA2	AW	>540	>620	>23	>120	>80	>70	>47	
BA-S3Mo	EA4	AW	>550	>630	>22	>100	>70	>60	>47	
BA-S3NiMo1	EF3	AW	>580	>680	>20	>120	>80	>70	>50	>47
		S *)	>560	>660	>20	>130	>90	>60	>47	>47
BA-S4MoSi	EA3K	AW	>540	>630	>20	>80	>47	>47		

Post Weld Heat Treatment: *) 620 °C/2 h

Packaging: 25 kg PE-bags or 500-1,250 kg Big Bags

Storage and redrying:
Unopened originally packed flux bags can be stored up to 1 year in dry storage rooms after date of delivery ex-factory.
Redrying conditions specific to the flux: 200 ± 50 °C effective flux temperature.

Agglomerated Welding Flux BF 6.5

BF 6.5

Flux type: **F**luoride-**B**asic

Classification: ISO 14174 – **S A FB 1 67 AC H5** *)
(EN 760 – **SA FB 1 67 AC H5**)

Characteristics:
A semi-basic multi-purpose flux suitable for single and multi-wire (up to 5 wires) SAW-processes. The flux exhibits good weldability characteristics over a wide range of welding parameters and is characterized by a low consumption rate. BF 6.5 is especially recommended for longitudinal pipe fabrication (two-run or multi-layer technique) due to its high welding speed characteristic. Weld bead performance and slag release, even in narrow gaps, are excellent providing flat welds with low reinforcement and flat weld interfaces free from undercuts. The flux shows a high resistance to abrasion and a low consumption rate with good flux feeding properties in the transport and recovery system. As a result of low hydrogen levels (max. 5 ml/100 g), oxygen levels of about 350 ppm and low nitrogen levels (max. 70 ppm) in the weld deposits, uniform mechanical properties with low temperature toughness are obtained.

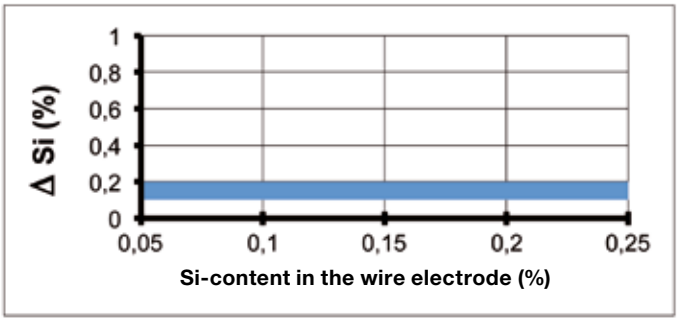
Application:
Manufacture of helical (spiral) and longitudinal seam steel pipes in grades L360 or X52 to L555 or X80 according to ISO 3183/API Spec. 5L with appropriate filler metals.
Non-alloy and low-alloy structural steels acc. to EN 10025; boiler steels such as 16Mo3/A335 grade P1 and 13CrMo4-5/A387 grade 12; fine-grain structural steels with yield strengths up to 700 MPa observing the specific material requirements.

Characteristic chemical Constituents:

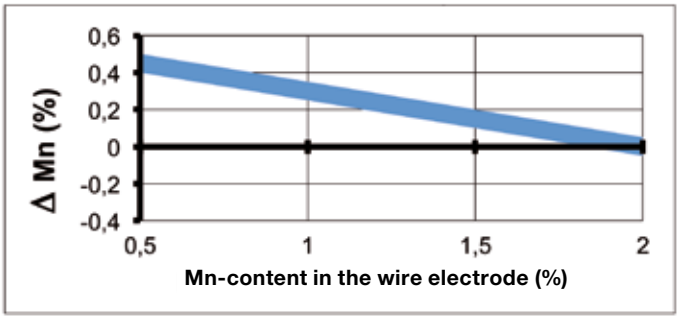
$SiO_2 + TiO_2$	$Al_2O_3 + MnO$	$CaO + MgO$	CaF_2
20 %	30 %	30 %	17 %
Basicity according to Boniszewski: ~1.7			

Metallurgical behaviour acc. to ISO 14174 type of current DC:

Pick-up Silicon



Pick-up / Burn-out Manganese

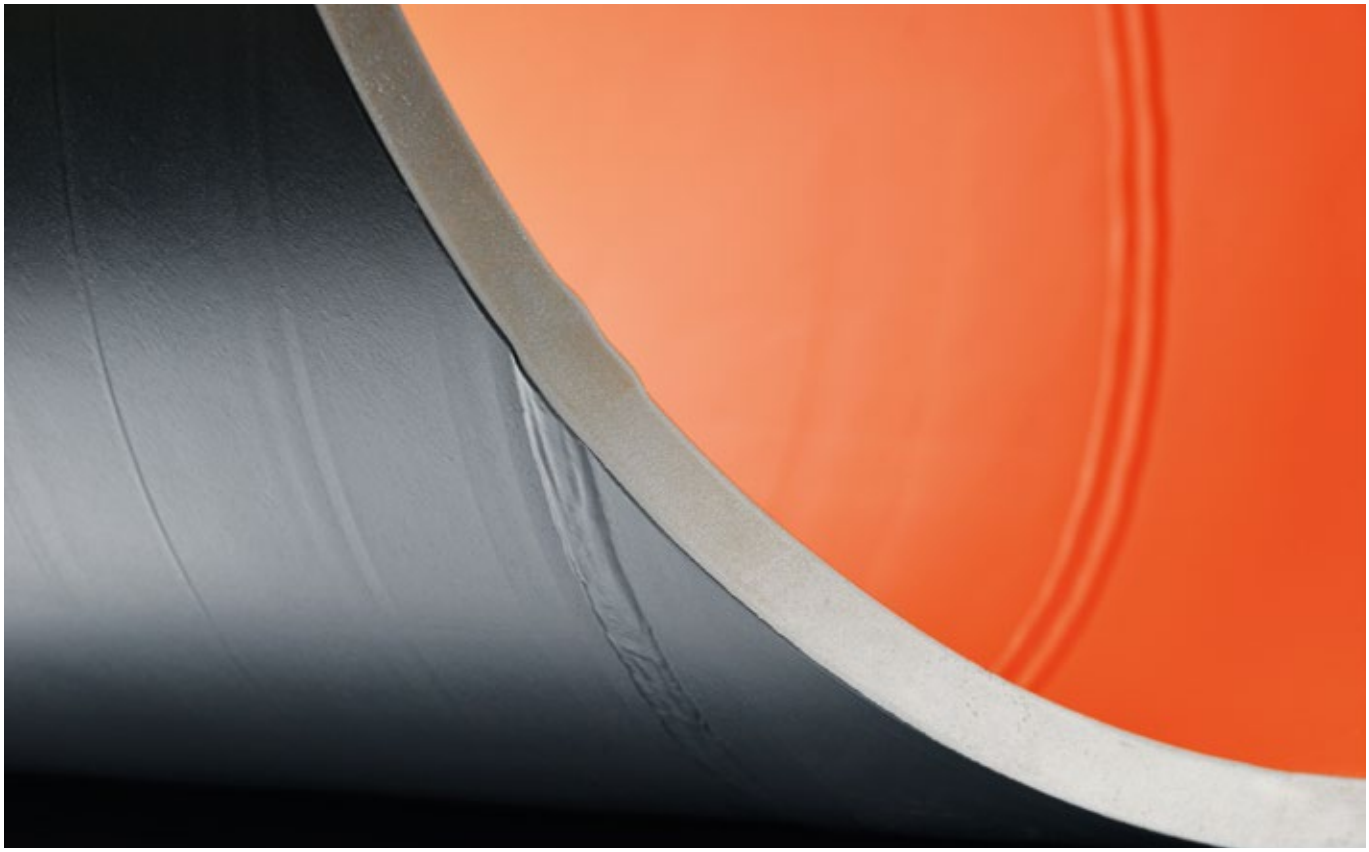


Flux density: 0.95 kg/dm³ (l)

Grain size acc. to ISO 14174: 2 – 20 (Tyler 8 x 65)

Current-carrying capacity: up to 1,000 A (DC or AC) using one wire

*) Diffusible hydrogen content H5: determined in deposited metal acc. to the method described in ISO 3690 Type of current DC; redrying conditions 200 ± 50 °C



SALZGITTER MANNESMANN GROSSROHR
Ein Unternehmen der Salzgitter Gruppe

Pipe

Quality:	L 485 MB
Dimension:	914 x 24.1 mm
Flux:	BF 6.5

BAVARIA SCHWEISSTECHNIK

All-weld metal multiple pass classification of wire-flux combinations for welding pipe steels:

Wire electrode (ISO 14171-A)	AWS A5.17/.23	Test assembly ISO 15792-1: type 1.3		AWS A5.17M/5.23M	AWS A5.17/5.23
BA-S2	EM12(K)	ISO 14171-A-	S 38 4 FB S2	F48A4/P4-EM12(K)	F7A4/P4-EM12(K)
BA-S2Si	EM12K	ISO 14171-A	S 38 4 FB S2Si	F48A4/P4-EM12K	F7A4/P4-EM12K
BA-S3	EH10K	ISO 14171-A	S 46 4 FB S3	F55A4-EH10K	F8A4-EH10K
BA-S3Si	EH12K	ISO 14171-A-	S 46 4 FB S3Si	F55A4-EH12K	F8A4-EH12K
BA-S2Mo	EA2	ISO 14171-A-	S 46 3 FB S2Mo	F55A3/P3-EA2-A2	F8A2/P2-EA2-A2
BA-S3Mo	EA4	ISO 14171-A-	S 50 3 FB S3Mo	F62A4-EA4-A4	F9A4-EA4-A4
BA-S2Ni1	ENi1	ISO 14171-A-	S 42 6 FB S2Ni1	F49A6/P6-ENi1-Ni1	F7A8/P8-ENi1-Ni1
BA-S3NiMo1	EF3	ISO 14171-A	S 50 4 FB S3Ni1Mo	F62A4-EF3-F3	F9A4-EF3-F3

Two-run classification of wire-flux combinations for welding pipe steels:

Wire electrode (ISO 14171-A)	AWS A5.17/.23	Two-run / ISO 15792-2: type 2.5		AWS A5.17M/5.23M	AWS A5.17/5.23
BA-S2Si	EM12K	ISO 14171-A	S 3T 2 FB S2Si	F43TA3-EM12K	F6TA2-EM12K
BA-S3Si	EH12K	ISO 14171-A-	S 4T 3 FB S3Si	F49TA3-EH12K	F7TA2-EH12K
BA-S2Mo	EA2	ISO 14171-A-	S 5T 2 FB S2Mo	F62TA3-EA2	F9TA2-EA2
BA-S3Mo	EA4	ISO 14171-A-	S 5T 3 FB S3Mo	F62TA3-EA4	F9TA2-EA4
BA-S3NiMo1	EF3	ISO 14171-A	S 5T 3 FB S3Ni1Mo	F62TA3-EF3	F9TA2-EF3
BA-S2MoTiB	EA2TiB	ISO 14171-A	S 5T 5 FB S2MoTiB	F62TA5-EA2TiB	F9TA6-EA2TiB
BA-S3MoTiB	EG		S 5T 5 FB SZ	F62TA5-EG	F9TA6-EG

Mechanical properties of two-run weld metal of pipe steels: (characteristical values)

Wire electrode		YS MPa	UTS MPa	Elong. %	Impact ISO-V (J					
					RT	± 0 °C +32 °F	-20 °C -4 °F	-30 °C -22 °F	-40 °C -40 °F	-51 °C -60 °F
BA-S2Si [1]	EM12K	>400	>500	>22	>100	>80	>50			
BA-S3Si [1]	EH12K	>460	>560	>22	>110	>90	>60	>27		
BA-S2Mo [2]	EA2	>560	>620	>17	>100	>80	>50			
BA-S3Mo [2]	EA4	>570	>650	>17	>100	>90	>60	>27		
BA-S3NiMo1 [2]	EF3	>570	>650	>17	>110	>90	>70	>27		
BA-S2MoTiB [3]	EA2TiB	>560	>630	>17	>100	>90		>80	>60	>50
BA-S3MoTiB [3]	EG	>570	>650	>17	>100	>90		>80	>60	>50

[1] Low Si-base material up to X60 acc. to API Spec. 5L

[2] Si-deoxidized base material X65 and higher acc. to API Spec. 5L

[3] Low temperature toughness: BA-S2MoTiB better suitable for base material with higher Mn-content / BA-S3MoTiB for base material with lower Mn-content

Mechanical properties are influenced up to 70% by dilution of base-material

Chemical composition of all-weld metal acc. to EN ISO 15792-1 and AWS A5.17/5.23: (characteristical values in wt. %)

Wire electrode		C	Si	Mn	Mo	Ni	Cr
BA-S2	EM12(K)	0.05-0.08	0.2-0.4	1.2-1.6			
BA-S2Si	EM12K	0.05-0.08	0.2-0.5	1.2-1.6			
BA-S3	EH10K	0.05-0.08	0.2-0.4	1.5-1.8			
BA-S3Si	EH12K	0.05-0.08	0.2-0.5	1.5-1.8			
BA-S2Mo	EA2	0.05-0.08	0.2-0.5	1.2-1.6	0.4-0.6		
BA-S3Mo	EA4	0.05-0.08	0.2-0.5	1.5-1.8	0.4-0.6		
BA-S2Ni1	ENi1	0.05-0.08	0.2-0.4	1.2-1.6		0.8	
BA-S3NiMo1	EF3	0.05-0.08	0.2-0.5	1.5-1.8	0.4-0.6	0.8-1.0	
BA-S2MoTiB	EA2TiB	0.04-0.07	0.2-0.5	1.2-1.6	0.4-0.6	Ti 0.05	B 0.005
BA-S3MoTiB	EG	0.04-0.07	0.2-0.5	1.4-1.8	0.4-0.6	Ti 0.05	B 0.005
BA-S2CrMo1	EB2	0.05-0.08	0.2-0.4	1.1-1.5	0.5		1.0

Mechanical properties of all-weld metal acc. to EN ISO 15792-1 and AWS A5.17/5.23: (characteristical values)

Wire electrode		Heat treatment	YS MPa	UTS MPa	Elong. %	Impact ISO-V (J)				
						RT	-20 °C -4 °F	-30 °C -22 °F	-40 °C -40 °F	-60 °C -76 °F
BA-S2	EM12(K)	AW	>400	>510	>24	>120	>80	>60	>47	
BA-S2Si	EM12K	AW	>400	>510	>24	>120	>80	>60	>47	
BA-S3Si	EH12K	AW	>470	>560	>23	>100	>80	>60	>60	
BA-S2Mo	EA2	AW	>500	>590	>22	>90	>60	>47		
		S *)	>480	>570	>22	>80	>70	>47		
BA-S3Mo	EA4	AW	>540	>630	>20	>80	>70	>47		
BA-S2Ni1	ENi1	AW	>430	>520	>22	>100	>90		>70	>47
		S **)	>400	>510	>22	>100	>90		>80	>47
BA-S3NiMo1	EF3	AW	>610	>720	>20	>100	>70	>60	>47	
		S **)	>570	>650	>20	>100	>70	>60	>47	
BA-S2CrMo1	EB2	A ***)	>400	>500	>20	>90	-10°C>40			

Post Weld Heat Treatment: *) 620 °C/15 h **) 580 °C/15 h ***) 690 °C/15 h

All-weld metal multiple pass classification of wire-flux combinations for welding boiler and pressure vessel steels:

Wire electrode (ISO 14171-A ISO 24598-A)	AWS A5.17/.23	RSG / ISO 15792-1: Form 1.3		AWS A5.17M/5.23M	AWS A5.17/5.23
BA-S2	EM12(K)	ISO 14171-A-	S 38 4 FB S2	F48A4/P4-EM12(K)	F7A4/P4-EM12(K)
BA-S3Si	EH12K	ISO 14171-A	S 46 4 FB S3Si	F55A4-EH12K	F8A4-EH12K
BA-S2Mo	EA2	ISO 14171-A-	S 46 3 FB S2Mo	F55A3/P3-EA2-A2	F8A2/P2-EA2-A2
BA-S2Ni1	ENi1	ISO 14171-A-	S 42 6 FB S2Ni1	F49A6/P6-ENi1-Ni1	F7A8/P8-ENi1-Ni1
BA-S3NiMo1	EF3	ISO 14171-A	S 50 4 FB S3Ni1Mo	F62A4/P4-EF3-F3	F9A4/P4-EF3-F30
BA-S2CrMo1	EB2	ISO 24598-A	S SCrMo1 FB	F49P0-EB2-B2	F7PZ-EB2-B2

Two-run classification of wire-flux combinations for welding boiler and pressure vessel steels:

Wire electrode (ISO 14171-A ISO 24598-A)	AWS A5.17/.23	Two-run / ISO 15792-2: type 2.5		AWS A5.17M/5.23M	AWS A5.17/5.23
BA-S2	EM12(K)	ISO 14171-A	S 3T 2 FB S2	F43TA2-EM12(K)	F6TA0-EM12(K)
BA-S3Si	EH12K	ISO 14171-A-	S 4T 3 FB S3Si	F49TA3-EH12K	F7TA2-EH12K
BA-S2Mo	EA2	ISO 14171-A-	S 5T 2 FB S2Mo	F62TA2-EA2	F9TA0-EA2
BA-S2Ni1	ENi1	ISO 14171-A-	S 4T 2 FB S2Ni1	F49TA3-ENi1	F7TA2-ENi1
BA-S3NiMo1	EF3	ISO 14171-A	S 5T 3 FB S3Ni1Mo	F62TA3-EF3	F9TA2-EF3
BA-S2CrMo1	EB2			F49TP0-EB2	F7TP0Z-EB2

Mechanical properties are influenced up to 70% by dilution of base-material

Approvals:	**with wire electrodes:**
VdTUEV 1153 / TÜV-Wien	S2, S3, S2Mo, S2Ni1 and S CrMo1
Deutsche Bahn	S2, S3, S2Mo and S2Ni1

Packaging: 25 kg PE-bags or 500-1,250 kg Big Bags

Storage and redrying:
Unopened originally packed flux bags can be stored up to 1 year in dry storage rooms after date of delivery ex factory.
Redrying conditions specific to the flux: 200 ± 50 °C effective flux temperature.

Agglomerated Welding Flux
BF 6.9 HELIX

Flux type: **A**luminate-**B**asic
Classification: ISO 14174 – **S A AB 1 67 AC H5** *)
(EN 760 – **SA AB 1 67 AC H5**)

Characteristics:
A semi-basic flux suitable for high speed welding with single and multi-wire submerged-arc processes.
BF 6.9 HELIX is designed for spiral pipe fabrication employing the two-run technique. Weld bead performance and slag release are excellent providing flat welds with low reinforcement and flat weld interfaces free from undercut. The flux shows a high resistance to pock-marks, flux-abrasion and a low consumption rate with good flux feeding properties in the transport and recovery system. As a result of low hydrogen levels (max. 5 ml/100g), oxygen levels of about 350 ppm and low nitrogen levels in the weld deposits, uniform mechanical properties with low temperature toughness are obtained. Due to achievable low hardness levels the weld deposits made with the flux BF 6.9 HELIX are also resistant to sour gas environment.

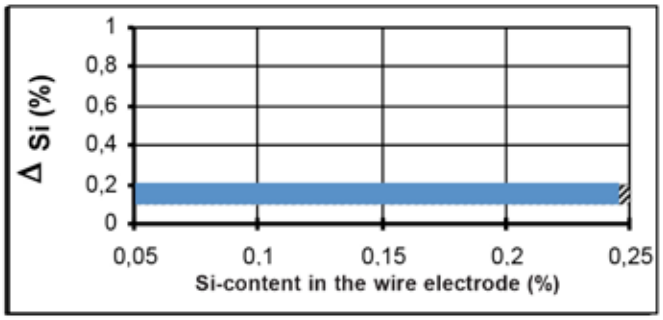
Application:
Low-alloy structural steels up to 500 N/mm2, boiler steels and especially pipe steel qualities acc. to EN 10208-2 / API-5L/5LX/5LS up to X 80 with special low-alloy filler materials.

Main constituents:

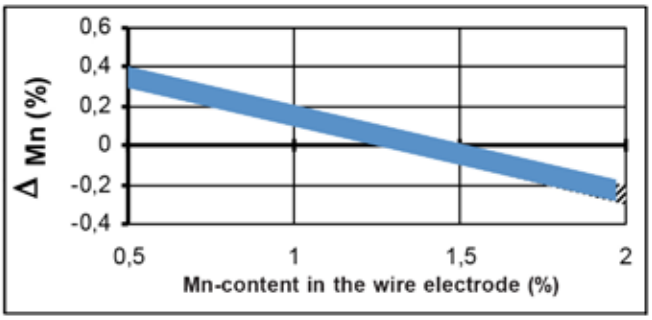
$SiO_2 + TiO_2$	$Al_2O_3 + MnO$	$CaO + MgO$	CaF_2
25 %	35 %	25 %	10 %
Basicity according to Boniszewski: ~1.2			

Metallurgical behaviour acc. to DIN EN 760:

Pick-up Silicon



Pick-up / Burn-out Manganese



Flux density: 0.95 kg/dm³ (l)

Grain size acc. to ISO 14174: 2 – 16 (Tyler 10 x 65)

Current-carrying capacity: 1,500 A (DC or AC) using one wire

*) Diffusible hydrogen content H5: determined in deposited metal acc. to the method described in ISO 3690 Type of current DC; redrying conditions 200 ± 50 °C

Mechanical properties up on request.

Packaging: 25 kg PE-bags or 500-1,250 kg Big Bags

Storage and redrying:
The flux can be stored up to 1 year after delivery in dry storage rooms. Flux that has picked up moisture has to be redried at 150 to 250 °C effective flux temperature.

All-weld metal multiple pass classification of wire-flux combinations:

Wire electrode (ISO 14171-A)	AWS A5.17/.23	Test assembly ISO 15792-1: type 1.3		AWS A5.17M/5.23M	AWS A5.17/5.23
BA-S2Si	EM12K	ISO 14171-A	S 38 4 AB S2Si	F48A3-EM12K	F7A2-EM12K
BA-S3Si	EH12K	ISO 14171-A-	S 42 4 AB S3Si	F48A4-EH12K	F7A4-EH12K
BA-S2Mo	EA2	ISO 14171-A-	S 46 3 AB S2Mo	F55A3-EA2-A2	F8A2-EA2-A2
BA-S3Mo	EA4	ISO 14171-A-	S 50 3 AB S3Mo	F62A3-EA4-A4	F9A2-EA4-A4

Two-run classification of wire-flux combinations:

Wire electrode (ISO 14171-A)	AWS A5.17/.23	Two-run / ISO 15792-2: type 2.5		AWS A5.17M/5.23M	AWS A5.17/5.23
BA-S2	EM12(K)	ISO 14171-A	S 3T 2 AB S2	F43TA2-EM12(K)	F6TA0-EM12(K)
BA-S2Si	EM12K	ISO 14171-A-	S 3T 2 AB S2Si	F43TA2-EM12K	F6TA0-EM12K
BA-S3Si	EH12K	ISO 14171-A-	S 4T 3 AB S3Si	F49TA3-EH12K	F7TA2-EH12K
BA-S2Mo	EA2	ISO 14171-A-	S 5T 2 AB S2Mo	F62TA2-EA2	F9TA0-EA2
BA-S3Mo	EA4	ISO 14171-A-	S 5T 3 AB S3Mo	F62TA3-EA4	F9TA2-EA4
BA-S3MoTiB	EG	ISO 14171-A-	S 5T 5 AB SZ	F62TA5-EG	F9TA6-EG

Mechanical properties of two-run weld metal of pipe steels: (standard values)

Wire electrode		YS MPa	UTS MPa	Elong. %	Impact ISO-V (J) RT	± 0 °C +32 °F	-20 °C -4 °F	-30 °C -22 °F	-40 °C -40 °F	-51 °C -60 °F
BA-S2	EM12(K)	>400	>500	>22	>130	>70	>50			
BA-S2Si	EM12K	>400	>500	>22	>130	>70	>50			
BA-S3Si	EH12K	>460	>560	>22	>130	>80	>50	>47		
BA-S2Mo	EA2	>560	>630	>17	>130	>90	>50			
BA-S3Mo	EA4	>570	>650	>17	>130	>100	>80	>47		
BA-S3MoTiB	EG	>570	>650	>17	>130	>130	>100	>90	>70	>50

*) Base material StE 480.7 TM acc. to EN 10208-2 (API-5L/5LX/5LS: X70)
Mechanical properties are influenced up to 70% by dilution of base-material.

Chemical composition of all-weld metal acc. to EN ISO 15792-1 and AWS A5.17/5.23: (standard values in wt. %)

Wire electrode		C	Si	Mn	Mo	Ni	Cr
BA-S2Si	EM12K	0.05-0.08	0.2-0.5	1.0-1.4			
BA-S3Si	EH12K	0.05-0.08	0.2-0.5	1.4-1.7			
BA-S2Mo	EA2	0.05-0.08	0.2-0.5	1.0-1.4	0.4-0.6		
BA-S2CrMo1	EB2	0.05-0.08	0.2-0.5	1.3-1.7	0.4-0.6		

Mechanical properties of all-weld metal acc. to EN ISO 15792-1 und AWS A5.17/5.23: (characteristical values)

Wire electrode		YS MPa	UTS MPa	Elong. %	Impact ISO-V (J) RT	-20 °C -4 °F	-30 °C -22 °F	-40 °C -40 °F	-51 °C -60 °F
BA-S2Si	EM12K	>400	>490	>24	>100	>60	>50		
BA-S3Si	EH12K	>470	>560	>23	>130	>80	>70	>47	
BA-S2Mo	EA2	>490	>580	>23	>110	>80	>47		
BA-S3Mo	EA4	>550	>630	>22	>110	>80	>47		

Agglomerated Welding Flux BF 8.1

BF 8.1

Flux type: **C**alcium-**S**ilicate

Classification: ISO 14174 – **S A CS 1 75 AC**
(EN 760 – **SA CS 1 75 AC**)

Characteristics:
Agglomerated, semi-basic, Calcium-Silicate flux with Manganese support for SA-overlay welding and shape-forming using single or multi-wire (TWIN-ARC) processes. BF 8.1 is particularly designed for the repair of worn pistons for large ship diesel engines.
The weld bead exhibits a flat smooth surface with good wetting and self-lifting slag detachability without residuals even at high intermediate welding temperatures above 300 °C. Stable chemical flux reactions and constant operating characteristics over a wide current range, also when welding AC, are advantages of this flux. Low consumption as well as low humidity are additional features of BF 8.1 together with low sensitivity to arc-blow and high resistance to porosity.

Application:
BF 8.1 is to be welded DC (+ or –) or AC in combination with non-alloyed and low-alloyed wires for overlay and build-up welding of heat-treatable, low-alloy steels which require preheat and interpass temperatures above 300 °C up to 500 °C.
Especially applied for recondition welding / form-welding of worn piston ring grooves and the surface of piston crowns.

Characteristic chemical Constituents:

$SiO_2 + TiO_2$	$Al_2O_3 + MnO$	$CaO + MgO$	CaF_2
25 %	15 %	35 %	20 %
Basicity according to Boniszewski: ~1.7			

Flux density: 0.95 kg/dm³ (l)

Grain size acc. to ISO 14174: 3 – 25 (Tyler 8 x 48)

Current-carrying capacity: up to 1,200 A (DC or AC) using one wire

Packaging: 25 kg PE-bags or 500-1,250 kg Big Bags

Storage and redrying:
Unopened originally packed flux bags can be stored up to 1 year in dry storage rooms after date of delivery ex factory.
Redrying conditions specific to the flux: 200 ± 50 °C effective flux temperature.

Chemical composition of deposited weld metal (in wt. %)
on steelplate A 516 Grade 70 (C=0.18 %, Si=0.34 %, Mn=1.18 %)

Wire electrode	C	Si	Mn	P	S	Cr	Mo
BA-S2 (ISO 14171-A) EM12(K) acc. to AWS A5.17	0.10	0.12	1.08	0.011	0.008	0.01	
8th layer	0.05	0.58	0.85	0.019	0.008	0.03	
BA-S3Si (ISO 14171-A) EH12K acc. to AWS A5.17	0.12	0.29	1.68	0.004	0.001		
8th layer	0.06	0.67	1.22	0.016	0.006		
BA-S2Mo (ISO 14171-A) EA2 acc. to AWS A5.17	0.10	0.11	1.04	0.007	0.010	0.01	0.52
8th layer	0.06	0.55	0.84	0.016	0.009	0.03	0.50
BA-S2CrMo1 (ISO 24598-A) EB2 acc. to AWS A 5.23	0.13	0.14	0.96	0.007	0.008	1.22	0.49
8th layer	0.07	0.59	0.86	0.017	0.007	1.11	0.47

Welding parameters: 600 A, 29 V, 55 cm/min / interpass temperature max. 200 °C / 30 mm stick–out, wire 4.0 mm diam.

Worn piston reconditioned by using SAW wire/flux combination as follows:

Wire: **BA-S2CrMo1 acc. to AWS 5.23** **EB2** **Ø 2.4 mm**
Flux: **BF 8.1**

Agglomeriertes Schweißpulver BF 8.5

BF 8.5

Flux type: **F**luoride–**B**asic

Classification: ISO 14174 – **S A FB 1 65 AC**
(EN 760 – **SA FB 1 65 AC**)

Characteristics:
A semi-basic, agglomerated, flux for shape-and overlay welding with single or multi-wire (TWIN-ARC) submerged-arc processes. BF 8.5 shows stable metallurgical reactions and constant operating characteristics over a wide current range, also when AC-power is applied. Low flux consumption, high resistance to porosity as well as low hydrogen potential and low sensitivity to arc-blow are typical for this flux.
The weld deposits exhibit smooth surface, good wetting and self-lifting slag detachability without “tiger-tracks”, even at high welding temperature (> 300 °C).
BF 8.5 is a non-alloyed, neutral flux with little pick-up of silicon and neutral manganese reactions (see chemical composition of weld pads).

Application:
The flux can be welded DC (electrode positive or negative) or AC in combination with appropriate solid or, especially, metal-powder cored wires as commonly used for hardfacing.
BF 8.5 is formulated specifically for build-up or shape-welding (in combination with standard CMn-/CMo-/CCr-Mo-wires) to restore worn surface to proper dimensions, or to profile the shape of a section.
This flux is not formulated for joining or groove welding. For these applications the basic fluxes BF 5.1, BF 16 or WP 380 (> 5 % Cr-alloys) are recommended.

Remarks:
All factors affecting the microstructure and chemistry during build-up and surfacing/hardfacing operations should be considered, such as:
- Substrate metal: affects the choice of build-up wire/flux combination and thermal treatment
- Surface requirement: considerations in selecting the final hard layer(s)
- Welding technology: influences dilution, chemistry and structure of the deposit.

Characteristic chemical Constituents:

$SiO_2 + TiO_2$	$Al_2O_3 + MnO$	$CaO + MgO$	CaF_2
20 %	25 %	35 %	15 %
Basicity according to Boniszewski: ~2.0			

Flux density: 0.95 kg/dm³ (l)

Grain size acc.to ISO 14174: 3 – 25 (Tyler 8 x 48)

Current–carrying capacity: up to 1,000 A (DC or AC) using one wire

Packaging: 25 kg PE-bags or 500-1,250 kg Big Bags

Storage and redrying:
Unopened originally packed flux bags can be stored up to 1 year in dry storage rooms after date of delivery ex factory.
Redrying conditions specific to the flux: 200 ± 50 °C effective flux temperature.

Chemical composition of wire and deposited weld metal (actual values in wt. %):
8 – layer weld pad on substrate metal (ASTM A36); 3,2 Ø mm wire; 500 A (=+); 29 V; 40 cm/min; T_A < 500 °C

Wire / Type of deposit	C	Si	Mn	Cr	Mo	Ni	Others	Hardness (HRC) as welded	Typical application
BA-S2(Si) /EM12(K)	0.10	0.07	1.05						Build-up, profiling
CMn	0.08	0.23	0.90					< 22	
BA-S4Mo /EA3	0.15	0.50	2.70		0.70				Build-up, profiling
CMnMo	0.11	0.60	2.56	0.10	0.64			32 – 37	Buttering, crane wheels
	0.10	0.60	2.60	2.3	0.80				Table rolls and shafts
CMnCrMo	0.07	0.98	2.51	2.7	0.77			37 – 42	
	0.2	0.5	1.6	5.0	0.4	<0.5			Case hardening
CCrMo	0.21	0.72	1.47	4.80	0.36	0.05	W 0.012 / V 0.012	42 – 45	565 °C/2hrs (annealed)
								32 – 37	
								47 – 52	(annealed+flame hard.)
	0.25	0.6	1.8	6.0	1.1		W 1.3 / V 0.2		Hot strip mill rolls
CCrMoWV	0.31	0.9	1.52	5.6	1.27		W 1.68/ V 0.24	47 – 57	Scale breaker, back up and profile rolls
	0.3	0.7	1.0	5.0	3.0	0.2			Wrapper rolls
CCrMoNi	0.32	0.59	1.08	5.0	3.41	0.25		52 – 57	
	0.35	0.5	1.5	6.0	1.5		W 1.4		
CCrMoW	0.38	0.57	1.72	5.9	1.41		W 1.42	52 – 57	Bells + hopper
	0.7	1.0	1.5	5.0	1.0		Nb > 2.25		Carbon scrapers
CCrMoNb	0.76	1.08	1.25	4.7	1.03		Nb > 2.25	55 – 62	
Martensitic	0.1	0.4	1.0	12.5	1.0	2.0			
stainless	0.11	0.66	0.98	12.1	0.71	2.3	V 0.13 / Nb 0.18	42 – 47	Continuous caster rolls
CrNiMoVNb									
	0.2	0.4	1.1	13.5	1.0	2.7	V 0.2 / Nb 0.2		Turbine rotor blades
	0.17	0.41	1.24	12.6	1.1	2.1	V 0.19 / Nb 0.17	42 – 47	

Hardness depends mainly on weld build-up and PWHT (see example BF 8.5 + CCrMo-Metal-Cored wire (4 mm Ø) – welding data: 550 A (= +); 29 V; 45 cm/min; T_A 230 °C)

Recommendations for hardfacing:
- **Cleaning** remove rust, grease, oil and dirt before welding.
- **Surface preparation** remove cracked, deformed and hardened surfaces by grinding or machining.
- **Deposit thickness** avoids excessive build-up of hardfacing materials. Use buttering layer materials before applying hardfacing deposits.
- **Thermal history** select appropriate preheat / interpass / soaking / PWHT according to the requirements.
- **Welding procedure** Use appropriate amperage (typical 130-140 A / per mm wire diameter) and voltage 27-30 V at travel speed about 40 ± 5 cm / min and preheat / interpass temperature according to the substrate material requirement. Low but appropriate heat input keeps dilution rate low and improves hardfacing deposits.

Agglomerated Welding Flux BF 10

BF 10

Flux type: **F**luoride-**B**asic

Classification: ISO 14174 – **S A FB 1 55 AC H5 *)**
(EN 760 – **SA FB 1 55 AC**)

Characteristics:
BF 10 is a fluoride-basic flux with high basicity and low impurity levels such as P and S. As a result of low oxygen levels in the weld deposits uniform mechanical properties with high toughness values at low temperature are achieved. Because of the almost neutral slag-reactions the chemical analysis of the weld metal can be excellently controlled through the selection of appropriate wire electrodes.
BF 10 is suitable for welding on D.C. and A.C. using single and tandem wire processes.

Application:
Low hydrogen levels after redrying according to the recommendation on the flux labels and optimum mechanical properties, whilst observing recommended heat control, enable the welding of:

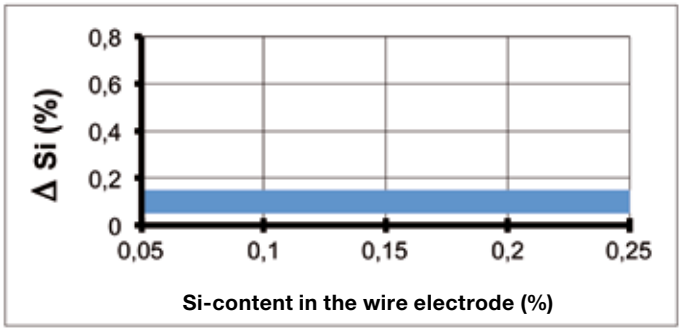
- thick-walled constructional steels with yield strengths of up to 420 MPa
- OFF-SHORE applications up to 460 MPa yield strength on steels such as BS 4360-Grade 50 D and S355 2G3 acc. to DIN EN 10025 (previous designation St 52-3N)
- fine grain structural steels for low temperature requirements with impact toughness at –60 °C or below
- high tensile fine grain steels such as S690QL1 and N-A-XTRA 70
- boiler and vessel steels such as 16Mo3/A204 grade A, 13CrMo4-5/A387 grade 12 or 10CrMo9-10/A387 grade 22

Characteristic chemical Constituents:

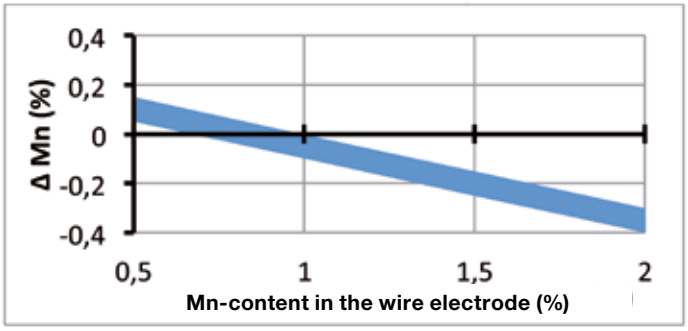
$SiO_2 + TiO_2$	$Al_2O_3 + MnO$	$CaO + MgO$	CaF_2
15 %	20 %	40 %	25 %
Basicity according to Boniszewski: ~3.0			

Metallurgical behaviour acc. to ISO 14174 type of current DC:

Pick-up Silicon



Pick-up / Burn-out Manganese



Flux density: 0.95 kg/dm³ (l)

Grain size acc. to ISO 14174: 2 – 20 (Tyler 8 x 65)

Current-carrying capacity: up to 800 A (DC or AC) using one wire

*) Diffusible hydrogen content H5: determined in deposited metal acc. to the method described in ISO 3690
Type of current DC; redrying conditions 300 – 350 °C

All-weld metal multiple pass classification of wire-flux combinations:

Wire electrode (ISO 14171-A ISO 24598-A ISO 26304-A)	AWS A5.17/.23	Test assembly ISO 15792-1: type 1.3		AWS A5.17M/5.23M	AWS A5.17/5.23
BA-S2	EM12(K)	ISO 14171-A-	S 38 6 FB S2	F48A6/P6-EM12(K)	F7A8-EM12(K)
BA-S3	EH10K	ISO 14171-A	S 46 6 FB S3	F55A6/F49P6-EH10K	F8A8/F7P8-EH10K
BA-S3Si	EH12K	ISO 14171-A-	S 46 6 FB S3Si	F55A6/F49P6-EH12K	F8A8/F7P8-EH12K
BA-S2Mo	EA2	ISO 14171-A-	S 46 4 FB S2Mo	F55A4/F49P4-EA2-A2	F8A4/F7P4-EA2-A2
BA-S2Ni1	ENi1	ISO 14171-A-	S 42 7 FB S2Ni1	F49A7/P7-ENi1-Ni1	F7A10/P10-ENi-Ni1
BA-S2Ni2	ENi2	ISO 14171-A-	S 46 8 FB S2Ni2	F55A7/F49P7-ENi2-Ni2	F8A10/F7P10-ENi-Ni2
BA-S2Ni3	ENi3	ISO 14171-A-	S 50 8 FB S2Ni3	F55A7/P7-ENi3-Ni3	F8A10/P10-Eni3-Ni3
BA-S3NiMo1/4	ENi5	ISO 14171-A-	S 46 6 FB S3Ni1Mo0,2	F55A6/P6-ENi5-Ni5	F8A8/P8-Eni5-Ni5
BA-S3NiMo1	EF3	ISO 26304-A-	S 55 6 FB S3Ni1Mo	F62A6/P6-EF3-F3	F9A8/P8-EF3-F3
BA-S3NiMo1,5	EM2 mod.	ISO 14171-A-	S 50 6 FB S3Ni1,5Mo	F62P6-EM2mod.-M2	F9P8-EM2mod.-M2
BA-S3NiCrMo2,5	EM4 mod.	ISO 26304-A	S 69 6 FB-S3Ni2,5CrMo	F76A6/P6-EM4 mod.-M4	F11A8/P8-EM4 mod.-M4
BA-S2CrMo1	EB2(R)	ISO 24598-A	S S CrMo1 FB	F55P2-EB2R-B2R	F8P0-EB2R-B2R
BA-S1CrMo2	EB3(R)	ISO 24598-A	S S CrMo2 FB	F55P2-EB3R-B3R	F8P0-EB3R-B3R

Chemical composition of all-weld metal acc. to EN ISO 15792-1 and AWS A5.17/5.23: (characteristical values in wt. %)

Wire electrode		C	Si	Mn	Mo	Ni	Cr
BA-S2	EM12(K)	0.05-0.09	0.1-0.3	0.8-1.2			
BA-S3	EH10K	0.05-0.09	0.1-0.3	1.1-1.5			
BA-S3Si	EH12K	0.05-0.09	0.2-0.5	1.2-1.6			
BA-S2Mo	EA2	0.05-0.09	0.1-0.3	0.8-1.2	0.5		
BA-S2Ni1	ENi1	0.05-0.09	0.1-0.3	0.8-1.2		1.0	
BA-S2Ni2	ENi2	0.05-0.09	0.1-0.3	0.8-1.2		2.0	
BA-S2Ni3	ENi3	0.05-0.09	0.1-0.3	0.8-1.2		3.0	
BA-S3NiMo1/4	ENi5	0.05-0.09	0.2-0.4	1.1-1.5	0.25	1.0	
BA-S3NiMo1	EF3	0.05-0.09	0.1-0.3	1.2-1.6	0.5	1.0	
BA-S3NiMo1,5	EM2 mod.	0.05-0.09	0.1-0.3	1.2-1.6	0.4	1.6	
BA-S3NiCrMo2,5	EM4 mod.	0.05-0.09	0.1-0.3	1.2-1.6	0.5	2.5	0.5
BA-S2CrMo1	EB2	0.05-0.09	0.1-0.3	0.5-0.9	0.5		1.2
BA-S1CrMo2	EB3	0.05-0.09	0.1-0.3	0.4-0.7	1.0		2.3

Mechanical properties of all-weld metal acc. to EN ISO 15792-1 and AWS A5.17/5.23: (characteristical values)

Wire electrode		Heat treat-ment	YS MPa	UTS MPa	Elong. %	Impact ISO-V (J)				
						RT	-20 °C -4 °F	-40 °C -40 °F	-60 °C -76 °F	-80 °C -112 °F
BA-S2	EM12(K)	AW	>400	>490	>26	>120	>100	>70	>47	
BA-S3	EH10K	AW	>470	>560	>25	>120	>100	>80	>47	
		S *)	>400	>500	>28	>120	>100	>80	>47	
BA-S3Si	EH12K	AW	>470	>550	>25	>120	>100	>80	>47	
		S *)	>430	>530	>26	>120	>100	>90	>47	
BA-S2Mo	EA2	AW	>490	>570	>23	>100	>90	>47		
		S **)	>440	>530	>24	>100	>90	>47		
BA-S2Ni1	ENi1	AW	>440	>540	>26	>160	>140	>120	>90	>47/-70°C
BA-S2Ni2	ENi2	AW	>470	>550	>25	>160	>140	>120	>80	>47
		S *)	>420	>520	>26	>160	>140	>120	>90	>47
BA-S2Ni3	ENi3	AW	>500	>590	>24	>160	>150	>120	>100	>27/-101°C
		S *)	>470	>560	>25	>160	>150	>120	>100	>27/-101°C
BA-S3NiMo1/4	ENi5	AW	>480	>560	>26	>160	>140	>120	>47	
		S *)	>470	>550	>26	>160	>150	>120	>47	
BA-S3NiMo1	EF3	AW	>570	>670	>22	>140	>110	>80	>47	
		S *)	>550	>640	>22	>150	>110	>80	>47	
BA-S3NiMo1,5	EM2mod.	AW	>590	>690	>22	>140	>100	>80		
		S ***)	>570	>660	>22	>150	>100	>70		
BA-S3NiCrMo2,5	EM4mod.	AW	>690	>820	>18	>140	>90	>70	>47	
BA-S2CrMo1	EB2	S ****)	>470	>570	>22	>100	>47			
BA-S1CrMo2	EB3	S ****)	>470	>570	>23	>100	>47			

Post Weld Heat Treatment: *) 590 °C/15 h **) 620 °C/15 h ***) 605 °C/2 h ****) 700 °C/10 h

Approvals: **with wire electrodes:**

VdTUEV 1153 / TÜV-Wien — S2, S3, S3Si, S2Mo, S2Ni2, S3Ni1Mo and S3Ni2,5CrMo, S3NiMo0,2, SCrMo1

Deutsche Bahn — S3, S3Si, S2Mo, S2Ni2, S3Ni1Mo, S3NiMo0,2, S3Ni2,5CrMo

ABS (American Bureau of Shipping) — EH12K (S3Si), EF3 (S3Ni1Mo)
EM4 mod. (S3Ni2,5CrMo)

DNV — EM4 mod. (S3Ni2,5CrMo)

Packaging: 25 kg PE-coated Aluminium bags

Storage and redrying:
Unopened originally packed flux bags can be stored up to 1 year in dry storage rooms after date of delivery ex factory.
Redrying conditions specific to the flux: 300 – 350 °C effective flux temperature.

Agglomerated Welding Flux BF 10 MW

BF 10 MW

Flux type: **F**luoride-**B**asic

Classification: ISO 14174 – **S A FB 1 55 AC H5 *)**
(EN 760 – **SA FB 1 55 AC**)

Characteristics:
BF 10 MW is a fluoride-basic flux with high basicity and low impurity levels such as P and S. As a result of low oxygen levels in the weld deposits uniform mechanical properties with high toughness values at low temperature are achieved. Designed for multi wire application where high deposition rate as well as good slag removal is required this flux shows excellent weldability and weld bead appearance.
BF 10 MW is suitable for welding on D.C. and A.C. using single, tandem and **M**ulti-**W**ire processes.

Application:
Low hydrogen levels after redrying according to the recommendation on the flux labels and optimum mechanical properties, whilst observing recommended heat control, enable the welding of:

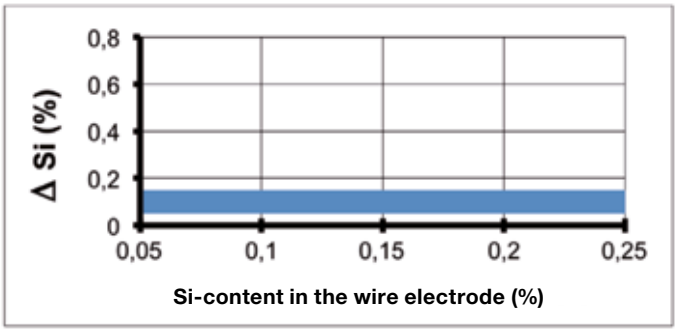
- thick-walled constructional steels with yield strengths of up to 420 MPa
- OFF-SHORE applications up to 550 MPa yield strength on steels such as BS 4360-Grade 50 D and S355 2G3 acc. to DIN EN 10025 (previous designation St 52-3N)
- fine grain structural steels for low temperature requirements with impact toughness at –60 °C or below
- high tensile fine grain steels such as S690QL1 and N-A-XTRA 70
- boiler and vessel steels such as 16Mo3/A204 grade A, 13CrMo4-5/A387 grade 12 or 10CrMo9-10/A387 grade 22

Characteristic chemical Constituents:

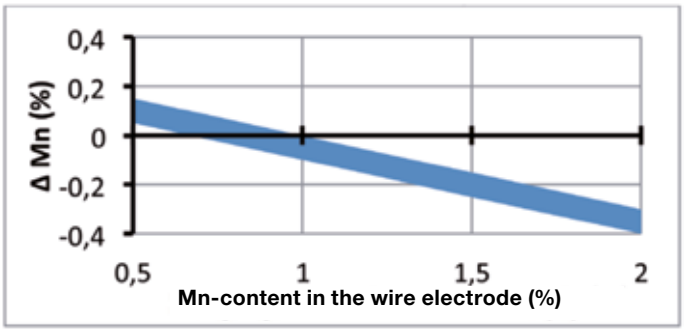
$SiO_2 + TiO_2$	$Al_2O_3 + MnO$	$CaO + MgO$	CaF_2
15 %	20 %	35 %	30 %
Basicity according to Boniszewski: ~3.2			

Metallurgical behaviour acc. to ISO 14174 type of current DC:

Pick-up Silicon



Pick-up / Burn-out Manganese



Flux density: 0.95 kg/dm³ (l)

Grain size acc. to ISO 14174: 2 – 20 (Tyler 8 x 65)

Current-carrying capacity: up to 800 A (DC or AC) using one wire

*) Diffusible hydrogen content H5: determined in deposited metal acc. to the method described in ISO 3690
Type of current DC; redrying conditions 300 – 350 °C

All-weld metal multiple pass classification of wire-flux combinations:

Wire electrode ISO 14171-A	AWS A5.17/.23	Test assembly ISO 15792-1: type 1.3	AWS A5.17M/5.23M	AWS A5.17/5.23
BA-S2	EM12(K)	ISO 14171-A- S 38 6 FB S2	F48A6/P6-EM12(K)	F7A8/P8-EM12(K)
BA-S3Si	EH12K	ISO 14171-A S 46 6 FB S3Si	F55A6/F49P6-EH12K	F8A8/F7P8-EH12K
BA-S2Mo	EA2	ISO 14171-A- S 46 4 FB S2Mo	F55A4/F49P4-EA2-A2	F8A4/F7P4-EA2-A2
BA-S2Ni1	ENi1	ISO 14171-A S 42 6 FB S2Ni1	F49A7/P7-ENi1-Ni1	F7A10/P10-ENi1-Ni1
BA-S2Ni2	ENi2	ISO 14171-A- S 46 8 FB S2Ni2	F55A7/F49P7-ENi2-Ni2	F8A10/F7P10-ENi2-Ni2
BA-S2Ni3	ENi3	ISO 14171-A- S 50 8 FB S2Ni3	F55A7/P7-ENi3-Ni3	F8A10/P10-ENi3-Ni3
BA-S3NiMo1/4	ENi5	ISO 14171-A- S 46 6 FB S3Ni1 Mo0,2	F55A6/P6-ENi5-Ni5	F8A8/P8-ENi5-Ni5
BA-S3NiMo1	EF3	ISO 26304-A S 55 6 FB S3Ni1Mo	F62A6/P6-EF3-F3	F9A8/P8-EF3-F3
BA-S3NiCrMo2,5	EM4 mod.	ISO 26304-A S 69 6 FB- S3Ni2, 5CrMo	F76A6/P6-EM4 mod.-M4	F11A8/P8-EM4 mod.-M4

Chemical composition of all-weld metal acc. to EN ISO 15792-1 and AWS A5.17/5.23: (characteristical values in wt. %)

Wire electrode		C	Si	Mn	Mo	Ni	Cr
BA-S2	EM12(K)	0.05-0.09	0.1-0.3	0.8-1.2			
BA-S3Si	EH12K	0.05-0.09	0.2-0.5	1.2-1.6			
BA-S2Mo	EA2	0.05-0.09	0.1-0.3	0.8-1.2	0.5		
BA-S2Ni1	ENi1	0.05-0.09	0.1-0.3	0.8-1.4		1.0	
BA-S2Ni2	ENi2	0.05-0.09	0.1-0.3	0.8-1.4		2.0	
BA-S2Ni3	ENi3	0.05-0.09	0.1-0.3	0.8-1.2		3.0	
BA-S3NiMo1/4	ENi5	0.05-0.09	0.2-0.4	1.1-1.5	0.25	1.0	
BA-S3NiMo1	EF3	0.05-0.09	0.1-0.3	1.2-1.6	0.5	1.0	
BA-S3NiCrMo2,5	EM4 mod.	0.05-0.09	0.1-0.3	1.2-1.6	0.5	2.5	0.5

Mechanical properties of all-weld metal acc. to EN ISO 15792-1 and AWS A5.17/5.23: (characteristical values)

Wire electrode		Heat treatment	YS MPa	UTS MPa	Elong. %	Impact ISO-V (J)				
						RT	-20 °C -4 °F	-40 °C -40 °F	-60 °C -76 °F	-80 °C -112 °F
BA-S2	EM12(K)	AW	>400	>490	>26	>120	>100	>70	>47	
BA-S3Si	EH12K	AW	>470	>560	>25	>120	>100	>80	>47	
		S *)	>430	>530	>26	>120	>100	>90	>47	
BA-S2Mo	EA2	AW	>490	>570	>23	>100	>90	>47		
		S **)	>440	>530	>24	>100	>90	>47		
BA-S2Ni1	ENi1	AW	>440	>540	>26	>160	>140	>120	>90	
BA-S2Ni2	ENi2	AW	>470	>550	>25	>160	>140	>120	>80	>47
		S *)	>420	>520	>26	>160	>140	>120	>90	>47
BA-S2Ni3	ENi3	AW	>500	>590	>24	>160	>150	>120	>100	>47
		S *)	>420	>520	>26	>160	>140	>120	>90	>47
BA-S3NiMo1/4	ENi5	AW	>480	>560	>26	>160	>140	>120	>47	
		S *)	>470	>550	>26	>160	>150	>120	>47	
BA-S3NiMo1	EF3	AW	>570	>670	>22	>140	>110	>80	>47	
		S *)	>550	>640	>22	>150	>110	>80	>47	
BA-S3NiCrMo2,5	EM4mod.	AW	>690	>820	>18	>140	>90	>70	>47	

Post Weld Heat Treatment: *) 590 °C/15 h **) 620 °C/15 h

Approvals:
VdTUEV 1153 / TÜV-Wien
DNV

with wire electrodes:
S3Si
EH12K (BA-S3Si), ENi5 (BA-S3NiMo1/4)

Packaging: 25 kg PE-coated Aluminium bags

Storage and redrying:
Unopened originally packed flux bags can be stored up to 1 year in dry storage rooms after date of delivery ex factory.
Redrying conditions specific to the flux: 300 – 350 °C effective flux temperature.

Further information on request

Agglomerated Welding Flux BF 38

BF 38

Flux type: **A**luminate-**F**luoride-Basic

Classification: ISO 14174 – **S A AF 2 5644 DC H5 *)**
(EN 760 – **SA AF 2 DC**)

Characteristics:
Specially designed for welding austenitic and austenitic-ferritic stainless steels (Duplex/Superduplex). This basic, but neutral flux will produce outstanding results in the welding of the standard austenitic and heat-resisting stainless steels, when using the corresponding wire electrodes according to EN ISO 14343 or ASME II C: SFA-5.9. Due to the basic flux characteristics of BF 38 most grades of the 300-stainless steels can be welded using single or multiple wire submerged-arc processes. It is also suited for joint-and overlay welding of nickel alloys, together with adequate Ni-base wire electrodes.
BF 38 produces smooth flat weld beads when fillet welding. If appropriate welding parameters are applied a finely ribbed surface along with self-releasing slag is yielded as well as weld beads that are free of slag inclusions.
The metallurgical behaviour of the flux is neutral (C-neutral, low Si pick-up and low Mn burn-out) without Cr- or other alloy compensation.

Application:
Joint welding and surfacing of:
- Austenitic-ferritic stainless steels (DSS) such as grade 2205 (Duplex S31805/S32205 = 1.4462) or grade 2507 (Superduplex S32750 = 1.4410)
- Austenitic CrNi(Mo)-steels (including Nb/Ti and ELC-grades); resistant against intergranular corrosion in both the as-welded and solution-treated condition
- High-alloy CrNi(Mo)-steels for use at low temperatures and heat resisting steels
- Nickel-base alloys using NiCr- and NiCrMo- wire electrodes acc. to AWS A5.14 / EN ISO 18274
- Welding of dissimilar metals such as low alloy steel with stainless steel or special cryogenic steel (e.g.9%Ni-steel) in flat or 2G-position

Characteristic chemical Constituents:

$SiO_2 + TiO_2$	$Al_2O_3 + MnO$	$CaO + MgO$	CaF_2
10 %	35 %	5 %	50 %
Basicity according to Boniszewski: ~1.9			

Flux density: 1.0 kg/dm³ (l)

Grain size acc. to ISO 14174: 2 – 16 (Tyler 10 x 65)

Current-carrying capacity: up to 900 A DC using one wire

Packaging: 25 kg PE-coated Aluminium bags

Storage and redrying:
Unopened originally packed flux bags can be stored up to 1 year in dry storage rooms after date of delivery ex factory.
Redrying conditions specific to the flux: 200 ± 50 °C effective flux temperature.

*) Diffusible hydrogen content H5: determined in deposited metal acc. to the method described in ISO 3690 Type of current DC; redrying conditions 200 ± 50 °C

Chemical composition of all-weld metal acc. to EN ISO 15792-1 and AWS A5.9/5.14 (standard values in wt. %)

Wire electrode		C	Si	Mn	Cr	Ni	Mo	Others
BA-WIRE 308L	ER308L	< 0.03	0.3 – 0.65	1.0 – 2.5	19.5 – 22.0	9.0 – 11.0		
BA-WIRE 309L	ER309L	< 0.03	0.3 – 0.65	1.0 – 2.5	23.0 – 25.0	12.0 – 14.0		
BA-WIRE 316L	ER316L	< 0.03	0.3 – 0.65	1.0 – 2.5	18.0 – 20.0	11.0 – 14.0	2.0 – 3.0	
BA-WIRE 317L	ER317L	< 0.03	0.3 – 0.65	1.0 – 2.5	18.5 – 20.5	13.0 – 15.0	3.0 – 4.0	
BA-WIRE 318	ER318	<0.08	0.3 – 0.65	1.0 – 2.5	18.0 – 20.0	11.0 – 14.0	Mo: 2.0 – 3.0	Nb: 10xC / max 1.0
BA-WIRE 347	ER347	< 0.08	0.3 – 0.65	1.0 – 2.5	19.0 – 21.5	9.0 – 11.0		
BA-WIRE 2209	ER2209	< 0.03	< 0.9	0.5 – 2.0	21.5 – 23.5	7.5 – 9.5	2.5 – 3.5	N: 0.08 – 0.2 Cu < 0.75
BA-WIRE 2594NL	ER2594	< 0.03	< 1.0	< 2.5	24.0 – 27.0	8.0 – 10.5	2.5 – 4.5	N: 0.2 – 0.3 W < 1.0 Cu < 1.5
BA-WIRE 625	ERNiCrMo-3	< 0.10	< 0.5	< 0.5	20.0 – 23.0	bal.	8.0 – 10.0	Nb+Ta: 3.15 – 4.15 Fe < 5.0 Ti < 0.4 Al <0.4

Mechanical properties of all-weld metal acc. to EN ISO 15792-1 and AWS A5.9/5.14 (standard values)

Wire electrode		Heat treatment	YS MPa	UTS MPa	Elong. %	Impact ISO-V (J)				
						+ 20 °C	- 40 °C	- 60 °C	- 120 °C	- 196 °C
BA-WIRE 308L	ER308L	AW	> 370	> 560	> 35	> 80				> 40
BA-WIRE 309L	ER309L	AW	> 370	> 520	> 30	> 100				
BA-WIRE 316L	ER316L	AW	> 370	> 520	> 30	> 100				> 40
BA-WIRE 317L	ER317L	AW	> 400	> 600	> 30	> 100		> 60		> 40
BA-WIRE 318	ER318	AW	> 370	> 560	> 25	> 100				
BA-WIRE 347	ER347	AW	> 370	> 560	> 30	> 100				
BA-WIRE 2209	ER2209	AW	> 570	> 750	> 20	> 80		> 50		
BA-WIRE 2594NL	ER2594	AW	> 620	> 820	> 18	> 60		> 40		
BA-WIRE 625	ERNiCrMo-3	AW	> 420	> 760	> 30	> 70		> 60		> 50

Approvals:
VdTUEV

with wire electrodes:
S 22 9 3 NL (ER2209)

Agglomerated ES–Flux BF 44 for strip cladding

BF 44

Flux type: **F**luoride-**B**asic

Classification: ISO 14174 – **ES A FB 2B 5644 DC**
(EN 760 – **SA FB 2 DC**)

Characteristics:
High basic, agglomerated and neutral flux (without alloy–compensation) designed for overlay welding and joint cladding together with stainless strip electrodes of the Cr–, CrNi(Mo)–steel types. Applicable for ES–process as well as, especially, for use with the ESO® (Extended Stick Out)–cladding system which enables highest possible deposit rates as a result of the Joule heat (I^2R–effect).
BF 44 gives excellent slag removal without slag residuals, especially in combination with Nb–alloyed strips, in the 1st layer on preheated substrates as well as in subsequent layers. The flux has low hydrogen potential, which makes it most suitable for overlay welding of heat resistant steels such as A387–types. Smooth weld bead appearance and notch–free transitions are features achievable with all cladding processes. Low but constant dilution rates can be gained when using process–characteristic welding parameters.
BF 44 shows constant chemical reactions as typical for a non–alloyed flux.

Application:
BF 44 can be used for joint cladding and surfacing of chemical plant components and equipments in the nuclear/offshore fields to yield corrosion resistant deposits in 1 or more layers. In combination with appropriate strip electrodes of the EQ300/EQ400 series according to A5.9 or according to EN ISO 14343 (EN 12072) constant weld overlays with low dilution rates are achievable.

Characteristic chemical Constituents:

$SiO_2 + Al_2O_3 + TiO_2$	CaO + MgO	CaF_2
20 %	5 %	70 %
Basicity according to Boniszewski: ~4.6		

Flux density: 1.0 – 1.1 kg/dm³ (l)

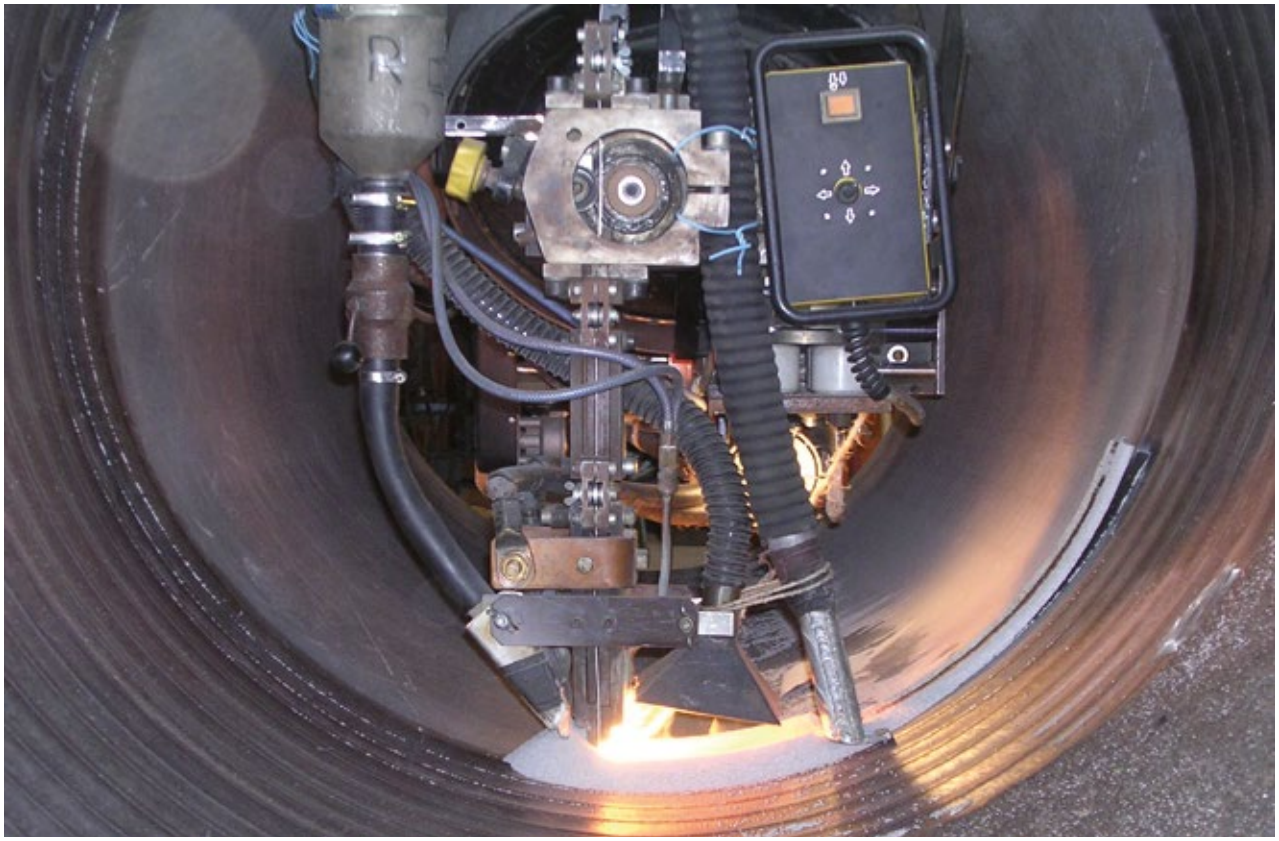
Grain size acc. to ISO 14174: 2 – 16 (Tyler 10 x 65)

Current-carrying capacity: up to 1,500 A DC using one strip electrode 60 x 0.5 mm

Packaging: 25 kg PE-coated Aluminium bags

Storage and redrying:
Unopened originally packed flux bags can be stored up to 1 year in dry storage rooms after date of delivery ex factory.
Redrying conditions specific to the flux: 300 – 350 °C effective flux temperature.

Further information on request



Strip cladding: BF 44 / BA-Strip 309LNb / Size: 60 x 0.5 mm

Agglomerated ES-Flux BF 46 for strip cladding

BF 46

Flux type: **F**luoride-**B**asic

Classification: ISO 14174 – **ES A FB 2B 5644 DC**
(EN 760 – **SA FB 2 DC**)

Characteristics:
High basic, agglomerated neutral flux (without alloy-compensation) designed for overlay welding and joint cladding together with the typical NiCr(Mo)-strip electrodes of the Alloy 600®, Alloy 625® and other NiCrMo–alloy types. Applicable for the different ElectroSlag (ES)-processes, with or without magnetic steering, as well as for cladding processes which produces higher deposition rates by ES-high speed welding or by the use of the ESO® (Extended Stick Out)-cladding system with the I^2R-effect benefit.
BF 46 gives excellent slag removal without slag residuals – in the 1st layer on preheated substrates as well as in subsequent layers or when joint cladding. Smooth weld bead finish and notch-free transitions are further features when appropriate process parameters are applied. Low and constant dilution rates are observed.
The flux has low hydrogen potential which makes it most suitable for overlay welding of heat resistant substrate materials such as A387-types.
BF 46 shows constant chemical reactions as typical for a non-alloyed flux.

Application:
BF 46 can be used for joint cladding and surfacing of chemical plant components and equipments in the nuclear/offshore fields to obtain high NiCr(Mo)-overlays such as Alloy 600®, Alloy 625® and similar Alloys (Alloy 59®,C276®). Dependent on the particular specifications and in combination with appropriate strip electrodes according to ASME II C SFA-5.14 or EN ISO 18274 constant weld overlays with low dilution rates are achieved in single- or multilayers. Strip-dimensions from 20x0.5 to 60x0.5 mm can be applied.

Characteristic chemical Constituents:

$SiO_2 + Al_2O_3 + TiO_2$	CaO + MgO	CaF_2
20 %	5 %	70 %
Basicity according to Boniszewski: ~4.6		

Flux density: 1.1 kg/dm³ (l)

Grain size acc. to ISO 14174: 2 – 16 (Tyler 10 x 65)

Current-carrying capacity: up to 1,500 A DC using one strip electrode 60 x 0.5 mm

Packaging: 25 kg PE-coated Aluminium bags

Storage and redrying:
Unopened originally packed flux bags can be stored up to 1 year in dry storage rooms after date of delivery ex factory.
Redrying conditions specific to the flux: 300 – 350 °C effective flux temperature.

Further information on request

Strip cladding: BF 46 / BA-Strip 625 / Size: 60 x 0.5 mm (picture 1) and 30 x 0.5 mm (picture 2)

Agglomerated Welding Flux BF 47

BF 47

Flux type: **C**alcium-**S**ilicate

Classification: ISO 14174 – **S A CS 2 5644 DC**
(EN 760 – **SA CS 2 DC**)

Characteristics:
Agglomerated and neutral flux (without alloy-compensation) designed for hardfacing, overlay strip welding and joint cladding together with stainless strip electrodes of the Cr-, CrNi(Mo)-steel types. Applicable for SAW-process as well as for use with the ESO® (Extended Stick Out)-cladding system which enables highest possible deposit rates as a result of the Joule heat (I^2R)-effect.
BF 47 gives excellent slag removal without slag residuals, in the 1st layer on preheated substrates as well as in subsequent layers. The flux has low hydrogen potential, which makes it most suitable for overlay welding of heat resistant steels such as A387-types. Smooth weld bead appearance and notch-free transitions are features achievable with all cladding processes. Constant dilution rates can be gained when using process–characteristic welding parameters.
BF 47 shows constant chemical reactions as typical for a non-alloyed flux.

Application:
BF 47 can be used for hardfacing, joint cladding and surfacing. In combination with appropriate strip electrodes of the EQ300/EQ400 (without Nb) series according to A5.9 or according to EN ISO 14343 (EN 12072) constant weld overlays are achievable. The flux is highly viscous and creates a reinforcing effect for the weld pool. This characteristic brings exceptional advantages when cladding small-diameter rolls.

Main constituents:

$SiO_2 + Al_2O_3 + TiO_2$	CaO + MgO	CaF_2
50 %	30 %	15 %
Basicity acc.to Boniszewski: ~1.2		

Flux density: 1.0 – 1.1 kg/dm³ (l)

Grain size acc.to ISO 14174: 2 – 20 (Tyler 8 x 65)

Current–carrying capacity: 1,500 A DC using one strip electrode 60 x 0.5 mm

Packaging: 25 kg PE-coated Aluminium bags

Storage and redrying:
Unopened originally packed flux bags can be stored up to 1 year in dry storage rooms after date of delivery ex factory.
Redrying conditions specific to the flux: 200 ± 50 °C effective flux temperature.

Further information on request

Agglomerated Welding Flux
BF 47NiMo

BF 47NiMo

Flux type: **C**alcium-**S**ilicate

Classification: ISO 14174 – **S A CS 3 5654 DC**
(EN 760 – **SA CS 3 NiMo DC**)

Characteristics:
Agglomerated and active flux (with Cr-compensating & Ni / Mo alloying characteristic) designed for hardfacing, overlay strip welding and joint cladding together with stainless strip electrodes of the Cr-, CrNi(Mo)-steel types. Applicable for SAW–process as well as for use with the ESO® (Extended Stick Out)-cladding system which enables highest possible deposit rates as a result of the Joule heat (I^2R)-effect.
BF 47NiMo gives excellent slag removal without slag residuals, in the 1st layer on preheated substrates as well as in subsequent layers. The flux has low hydrogen potential, which makes it most suitable for overlay welding of heat resistant steels such as A387-types. Smooth weld bead appearance and notch-free transitions are features achievable with all cladding processes. Constant dilution rates can be gained when using process-characteristic welding parameters.
BF 47NiMo shows constant chemical reactions as typical for a BAVARIA – alloyed flux.

Application:
BF 47NiMo can be used for hardfacing, joint cladding and surfacing. In combination with appropriate strip electrodes of the EQ300/EQ400 (without Nb) series according to A5.9 or according to EN ISO 14343 (EN 12072) constant weld overlays are achievable. The flux is highly viscous and creates a reinforcing effect for the weld pool. This characteristic brings exceptional advantages when cladding small-diameter rolls.

Main constituents:

$SiO_2 + Al_2O_3 + TiO_2$	CaO + MgO	CaF_2
50 %	30 %	15 %
Basicity acc.to Boniszewski: ~1.2		

Flux density: 1.0 – 1.1 kg/dm³ (l)

Grain size acc.to ISO 14174: 2 – 20 (Tyler 8 x 65)

Current–carrying capacity: 1,500 A DC using one strip electrode 60 x 0.5 mm

Packaging: 25 kg PE-coated Aluminium bags, drums 25 kg

Storage and redrying:
Unopened originally packed flux bags can be stored up to 1 year in dry storage rooms after date of delivery ex factory.
Redrying conditions specific to the flux: 200 ± 50 °C effective flux temperature

Further information on request

Fused Welding Flux WP 380

WP 380

Flux type: **C**alcium-**S**ilicate

Classification:

ISO 14174 (stainless steels)	– **S F CS 2 5742 DC**
ISO 14174 (low alloy steels)	– **S F CS 1 63 DC**
EN 760 (stainless steels)	– **SF CS 2 DC**

Characteristics:
Specially designed for welding austenitic stainless steels WP 380 is also suitable for welding both low-alloy steels for use at elevated temperatures as well as the combination with austenitic stainless steels. As a result of the semi-basic flux characteristics crack free welds are obtained for most grades of stainless steels welded with the corresponding wire electrodes. The metallurgical behaviour of the flux is neutral (C-neutral, low Si pick-up and low Mn burn-out) without Cr compensation.
It is suitable for welding DC using single or DC/AC for multi-wire processes and produces smooth weld beads free of slag residuals with flat weld interfaces even in narrow gaps and on preheated work pieces.

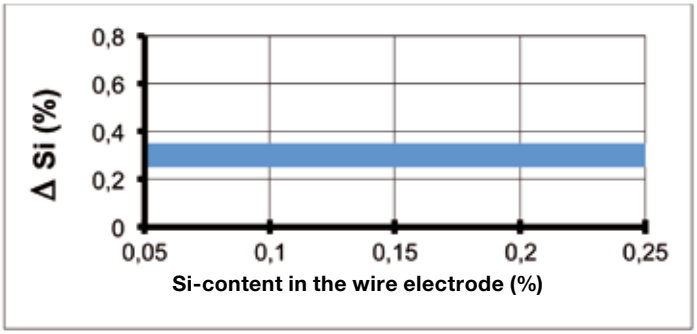
Application:
Joint welding and surfacing of:
- creep-resistant CrMo-steels such as 12CrMo19-5/A355 grade P22-P5 or X20CrMoWV12-1/A351 for boiler, vessel and pipe fabrication
- martensitic and ferritic Cr(NiMo)-steels acc. to EN 10088 with the appropriate wire electrodes in conjunction with the corresponding heat treatments
- austenitic CrNi(Mo)-steels (including ELC-grades) acc. to EN 10088; resistant against intergranular corrosion in both the as-welded and solution-treated condition
- high-alloy CrNi(Mo)-steels for use at low temperatures and heat-resistant steels
- high-alloy Cr(NiMo)-steels in combination with low-alloy steels (dissimilar joints)
- Nickel-base alloys using NiCr- and NiCrMo- wire electrodes acc. to AWS A5.14 / EN ISO 18274

Characteristic chemical Constituents:

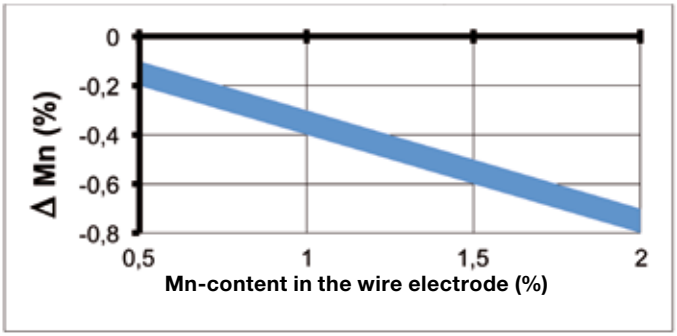
SiO_2	Al_2O_3	CaO + MgO	CaF_2
30 %	5 %	35 %	20 %
Basicity according to Boniszewski: ~1.3			

Metallurgical behaviour acc. to ISO 14174 type of current DC:

Pick-up Silicon



Pick-up / Burn-out Manganese



Flux density: 1.5 kg/dm³ (l)

Grain size acc. to ISO 14174 1 – 16 (Tyler 10 x 150)

Current-carrying capacity: up to 900 A DC using one wire

Chemical composition of all-weld metal acc. to EN ISO 15792-1 and AWS A5.9/5.23/5.14:

(characteristical values in wt. %)

Wire electrode		C	Si	Mn	Cr	Ni	Mo	Nb
BA-S2Mo	EA2	< 0.08	< 0.5	< 1.0			0.5	
BA-S CrMo5	EB6	< 0.08	< 0.7	< 0.6	5.5		0.6	
BA-S CrMo9	EB8	< 0.12	< 0.8	< 1.2	8.0-10.0		0.8-1.2	Cu: < 0.35
BA-S CrMo91	EB91	< 0.10	< 0.7	< 0.8	9	0.6	1.0	0.05 / V: 0.2
BA-WIRE 308L	ER308L	< 0.03	< 1.0	< 2.5	19.5-22.0	9.0-11.0		
BA-WIRE 309L	ER309L	< 0.03	< 1.0	< 2.5	23.0-25.0	12.0-14.0		
BA-WIRE 316L	ER316L	< 0.03	< 1.0	< 2.5	18.0-20.0	11.0-14.0	2.0-3.0	
BA-WIRE 318	ER318	< 0.08	< 1.0	< 2.5	18.0-20.0	11.0-14.0	2.0-3.0	8 x C/1.0 max
BA-WIRE 347	ER347	< 0.08	< 1.0	< 2.5	19.0-21.0	9.0-11.0		10 x C/1.0 max
BA-WIRE 2209	ER2209	< 0.03	< 0.9	< 2.0	21.5-23.5	7.5-9.5	2.5-3.5	N: 0.08-0.20
BA-WIRE 625	ERNiCrMo-3	< 0.04	< 0.5	< 0.5	20.0-23.0	> 58.0	8.0-10.0	Nb 3.15-4.15 Al 0.4 / Ti 0.4 / Fe 4
BA-WIRE 276	ERNiCrMo-4	< 0.02	< 0.4	< 1.0	14.5-16.0	> 50.0 Fe ≈ 4.0-7.0	15.0-17.0	W ≈ 4 / V: 0.35 Co < 2.5

Mechanical properties of all-weld metal acc. to EN ISO 15792-1 and AWS A5.9/5.23/5.14:

(characteristical values)

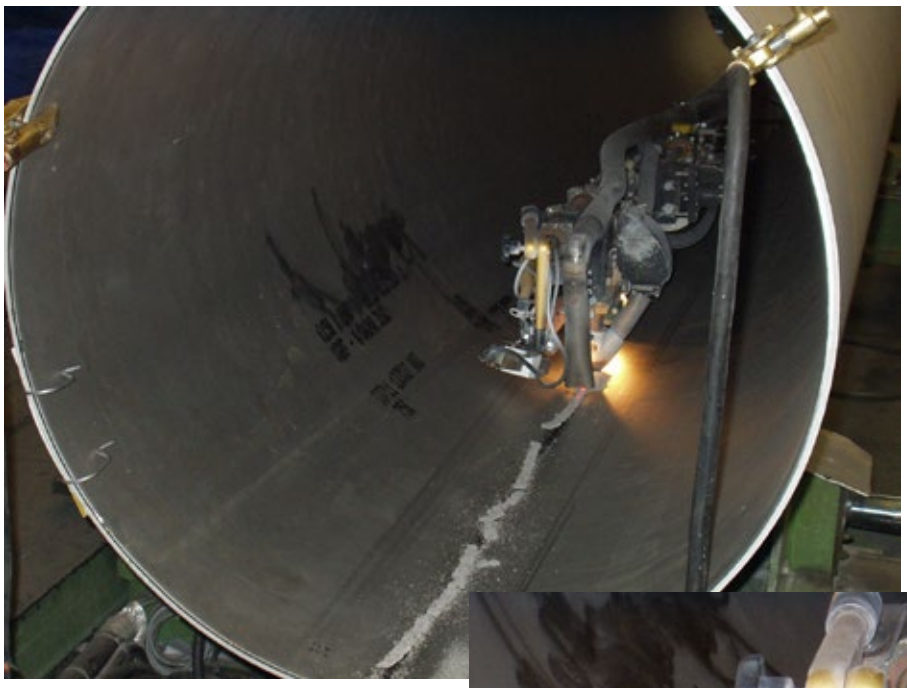
Wire electrode		Heat treat-ment	0.2 % Proof stress MPa	1.0 % Proof stress MPa	Tensile strength MPa	Elong. %	Impact ISO-V (J)		
							RT	-120 °C -184 °F	-196 °C -321 °F
BA-S2Mo	EA2	S	> 440		> 540	> 20	> 90		
BA-S CrMo5	EB6	A	> 470		> 600	> 18	> 70		
BA-S CrMo91 [1]	EB91	A	> 540		> 660	> 17	> 47		
BA-WIRE 308L	ER308L	AW ST1	> 340 > 250	> 370 > 280	> 540 > 520	> 35 > 35	> 70 > 80		> 40 > 50
BA-WIRE 309L	ER309L	AW	> 380		> 580	> 30	> 70		
BA-WIRE 316L	ER316L	AW ST2	> 350 > 270	> 380 > 300	> 550 > 520	> 30 > 35	> 70 > 80		> 40 > 50
BA-WIRE 318	ER318	AW ST2	> 370 > 290	> 410 > 330	> 580 > 550	> 30 > 35	> 80 > 80	> 40 > 60	
BA-WIRE 347	ER347	AW ST1	> 360 > 280	> 400 > 310	> 570 > 550	> 30 > 35	> 80 > 80		> 40 > 50
BA-WIRE 2209	ER2209	AW	> 550	> 600	> 750	> 25	> 80	-60°C: >40	
BA-WIRE 625 [2]	ERNiCrMo-3	AW	> 440		> 760	> 30	> 70	> 60	> 50
BA-WIRE 276 [2]	ERNiCrMo-4	AW	> 400		> 700	> 35	> 80		> 60

[1] Maximum wire diameter 2,4 mm
[2] Maximum wire diameter 2,0 mm
S = stress relieved 620 °C A = annealed 740 – 760 °C ST1 = solution treated 1,050 °C / water
ST2 = solution treated 1,080 °C / water

Approvals:	**with wire electrodes:**
VdTUEV 1153 /Deutsche Bahn	S 19 9 L (ER308L); S 19 9 Nb (ER347); S 19 9 Nb L (ER347L); S 19 12 3 L (ER316L); S 19 12 3 Nb (ER318); S 23 12 L (ER309L); S 22 9 3 N L (ER2209)
VdTUEV 1153	S CrMo91 (EB9)

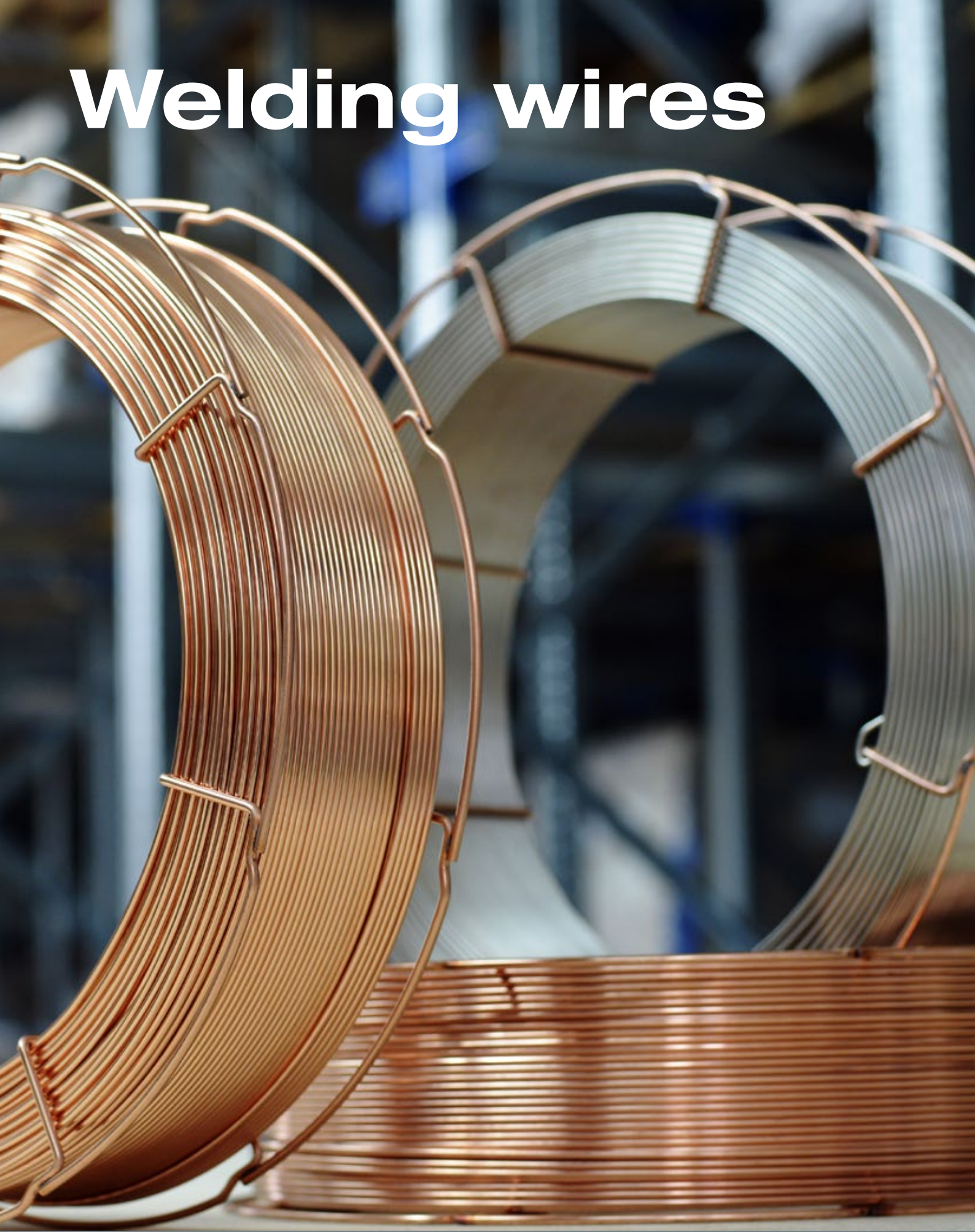
Packaging: 15 kg PE-coated Aluminium bags

Storage and redrying:
Unopened originally packed flux bags can be stored up to 2 years in dry storage rooms after date of delivery ex factory. Redrying conditions specific to the flux: 200 ± 50 °C effective flux temperature. Usually, if austenitic stainless steels are to be welded flux redrying can be neglected.



Versatile flux for welding stainless steels, but also suitable for welding Ni-alloys as well as low alloyed steels.

Welding wires



Solid Wire Electrode for Submerged Arc Welding

BA-S1

Classification:

EN ISO 14171-A	– **S1**
SFA 5.17 / AWS A5.17	– **EL12**

Typical analysis and chemical composition acc. to EN ISO 14171-A and AWS A5.17: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Cu total
Typical analysis BA-S1	0.08	0.07	0.44	0.01	0.05	0.04	0.015	0.015	0.14
S1 acc. to ISO 14171-A	0.05–0.15	0.15	0.35–0.60	0.15	0.15	0.15	0.025	0.025	0.30
EL12 acc. to AWS A5.17	0.04–0.14	0.10	0.25–0.60				0.030	0.030	0.35

Characteristics:
Wire electrode for submerged arc welding intended for welding mild steel used in pressure vessels, shipbuilding and steel structures.

Materials:
- Non alloy structural steels: According to EN 10025/ASTM:
  S185, S235JR, S235J0, S235J2,S275JR, S275J0, S275J2, S355JR,S355J0,S355J2, S275N, S355N, S275M, S355M, P235GH, P355GH, P275N, P355N, P355M, E295, E335, E360/A36, A106 grades A/B/C, A139, A210 grades A1/C, A216 grades WCA/WCB/WCC, A234 grade WPB, A266 grades 1/2/4, A283 grades A/B/C/D, A285 grades A/B/C, A299 grades A/B, A515 grades 60/65/70, A516 grades 55-70, A656 grade 50
  Suitable fluxes: BF 1, BF 3, BF 3.5, BF 5.1
- Pipe steels acc. to ISO 3183, EN 10208 and API-5:
  L210 – L360/X42 – X52
  Suitable fluxes: BF 6.30 and BF 6.5
- Boiler steels acc. to EN 10028/ASTM:
  P235GH, P355GH, P275N, P355N, P355M/A516 grade 55, A516 grade 70, A572 grade 42, A572 grade 50
  Suitable fluxes: BF 1, BF 3, BF 3.5, BF 5.1
- Shipbuilding steels:
  Grades A-E, AH36, DH36
  Suitable fluxes: BF 1, BF 3, BF 3.5, BF 5.1

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
2.0 – 5.0 mm; sizes and tolerances acc. to ISO 544 and AWS A5.17.

Wire electrode surface:
Copper-coated, smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-S2

Classification: EN ISO 14171-A (EN 756) – **S2**
SFA 5.17 / AWS A5.17 – **EM12(K)**

Typical analysis and chemical composition acc. to EN ISO 14171-A and AWS A5.17: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Cu total
Typical analysis BA-S2	0.11	0.12	1.07	0.01	0.04	0.03	0.007	0.008	0.09
S2 acc. to ISO 14171-A	0.07–0.15	0.15	0.80–1.30	0.15	0.15	0.15	0.025	0.025	0.30
EM12 acc. to AWS A5.17	0.06–0.15	0.10	0.80–1.25				0.030	0.030	0.35
EM12K acc. to AWS A5.17	0.05–0.15	0.10–0.35	0.80–1.25				0.030	0.030	0.35

Characteristics:
Wire electrode for submerged arc welding of non-alloy and fine grain steels, boiler steels and pipe steels.

Base Materials:
- Non-alloy structural steels acc. to EN 10025 and ASTM: S235JRG2/A570 grade 36 to S355J2G3R/A572 grade 50
  Suitable fluxes: BF 1, BF 3 and BF 4
- Fine grain steels acc. to EN 10025, EN 10028 and ASTM: up to P355N/S355NL/A516 grade 70
  Suitable fluxes: BF 1, BF 3, BF 4, BF 5.1, BF 6.5 and BF 10
- Pipe steels acc. to ISO 3183, EN 10208 and API-5: L415N/X60
  Suitable fluxes: BF 5.1, BF 6.30 and BF 6.5
- Boiler steels acc. to EN 10028 and ASTM: P235GH/A516 grade 55, P355GH/A516 grade 70 and S275J2G3/ A572 grade 42, S355J2G3/A572 grade 50
  Suitable fluxes: BF 1, BF 3, BF 4, BF 5.1 and BF 6.5

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
2.0 – 5.0 mm; Sizes and tolerances acc. to ISO 544 and AWS A5.17.

Wire electrode surface:
Copper-coated, smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-S3

Classification:
EN ISO 14171-A (EN 756) – **S3**
SFA 5.17 / AWS A5.17 – **EH10K**

Typical analysis and chemical composition acc. to EN ISO 14171-A and AWS A5.17: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Cu total
Typical analysis BA-S3	0.11	0.12	1.61	0.03	0.02	0.05	0.015	0.012	0.10
S3 acc. to ISO 14171-A	0.07–0.15	0.15	1.30–1.75	0.15	0.15	0.15	0.025	0.025	0.30
EH10K acc. to AWS A5.17	0.07–0.15	0.05-0.25	1.30–1.70				0.025	0.025	0.35

Characteristics:
Wire electrode for submerged arc welding of non-alloy and fine grain steels as well as boiler and vessel steels.

Base Materials:
- Non-alloy structural steels acc. to EN 10025 and ASTM: S235JRG2/A570 grade 36 to S355J2G3R/A572 grade 50
  Suitable fluxes: BF 3, BF 5.1 and BF 6.5
- Fine grain steels acc. to EN 10025, EN 10028 and ASTM: P355N/S355NL/A516 grade 70 and A633 grade E to P460N/S460NL
  Suitable fluxes: BF 3, BF 5.1, BF 6.5 and BF 10
- Boiler and vessel steels acc. to EN 10028 and ASTM: P355GH/A516 grade 70 and S355J2G3/A572 grade 50
  Suitable fluxes: BF 3, BF 5.1, BF 6.5 and BF 10

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
2.0 – 5.0 mm; Sizes and tolerances acc. to ISO 544 and AWS A5.17.

Wire electrode surface:
Copper-coated, smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-S4

Classification:

EN ISO 14171-A	–	**S4**
SFA 5.17 / AWS A5.17	–	**EH14**

Typical analysis and chemical composition acc. to EN ISO 14171-A and AWS A5.17: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Cu total
Typical analysis BA-S4	0.12	0.08	1.90	0.01	0.05	0.04	0.015	0.015	0.14
S4 acc. to ISO 14171-A	0.07–0.15	0.15	1.75–2.25	0.15	0.15	0.15	0.025	0.025	0.30
EH14 acc. to AWS A5.17	0.10–0.20	0.10	1.70–2.20				0.030	0.030	0.35

Characteristics:
Wire electrode for submerged arc welding intended for welding mild steel used in pressure vessels, shipbuilding and steel structures.

Base Materials:

- Non alloy structural steels, acc. to EN 10025/ASTM:
  S185, S235JR, S235J0, S235J2,S275JR, S275J0, S275J2, S355JR,S355J0,S355J2, S275N, S355N, S275M, S355M, S460N, S460M,E295, E335, E360/A36, A106 grades A/B/C, A139, A210 grades A1/C, A216 grades WCA/WCB/WCC, A234 grade WPB, A266 grades 1/2/4, A283 grades A/B/C/D, A285 grades A/B/C, A299 grades A/B, A515 grades 60/65/70, A516 grades 55-70, A656 grade 50
  Suitable fluxes: BF 1, BF 3, BF 4, BF 5.1, BF 10
- Pipe steels acc. to ISO 3183, EN 10208 and API-5: L210 – L450/X42 – X65
  Suitable fluxes: BF 5.1, BF 6.30 and BF 6.5
- Boiler steels acc. to EN 10028/ASTM:
  P235GH, P355GH, P275N, P355N, P355M, P460N, P460M/A516 grade 55, A516 grade 70, A572 grade 42, A572 grade 50
  Suitable fluxes: BF 1, BF 3, BF 4, BF 5.1and BF 6.5, BF 10
- Shipbuilding steels: Grades AH40, EH40
  Suitable fluxes: BF 1, BF 3, BF 4, BF 5.1, BF 10

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
2.0 – 5.0 mm; sizes and tolerances acc. to ISO 544 and AWS A5.17.

Wire electrode surface:
Copper-coated, smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-S2Si

Classification:
EN ISO 14171-A (EN 756) – **S2Si**
SFA 5.17 / AWS A5.17 – **EM12K**

Typical analysis and chemical composition acc. to EN ISO 14171-A and AWS A5.17: (Weight Percent)

electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Cu total
Typical analysis BA-S2Si	0.09	0.26	0.96	0.03	0.05	0.05	0.008	0.006	
S2Si acc. to ISO 14171-A	0.07–0,15	0.15–0.40	0.80–1.30	0.15	0.15	0.15	0.025	0.025	
EM12K acc. to AWS A5.17	0.05–0.15	0.10–0.35	0.80–1.25				0.030	0.030	

Characteristics:
Wire electrode with higher Si-content for submerged arc welding of non-alloy and fine grain steels, boiler steels and pipe steels.

Base Materials:
- Non-alloy structural steels acc. to EN 10025 and ASTM: S235JRG2/A570 grade 36 to S355J2G3R/A572 grade 50
  Suitable fluxes: BF 1, BF 3 and BF 4
- Fine grain steels acc. to EN 10025, EN 10028 and ASTM: up to P355N/S355NL/A516 grade 70
  Suitable fluxes: BF 1, BF 3, BF 4, BF 5.1, BF 6.5 and BF 10
- Pipe steels acc. to ISO 3183, EN 10208 and API-5: L415N/X60 and L450Q/X65
  Suitable fluxes: BF 5.1, BF 6.30 and BF 6.5
- Boiler steels acc. to EN 10028 and ASTM: P235GH/A516 grade 55, P355GH/A516 grade 70 and S275J2G3/A572 grade 42, S355J2G3/A572 grade 50
  Suitable fluxes: BF 1, BF 3, BF 4, BF 5.1 and BF 6.5

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
2.0 – 5.0 mm; Sizes and tolerances acc. to ISO 544 and AWS A5.17.

Wire electrode surface:
Copper-coated, smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-S3Si

Classification: EN ISO 14171-A (EN 756) – **S3Si**
SFA 5.17 / AWS A5.17 – **EH12K**

Typical analysis and chemical composition acc. to EN ISO 14171-A and AWS A5.17: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Cu total
Typical analysis BA-S3Si	0.09	0.33	1.57	0.06	0.04	0.03	0.012	0.009	0.06
S3Si acc. to ISO 14171-A	0.07–0.15	0.15–0.40	1.30–1.85	0.15	0.15	0.15	0.025	0.025	0.30
EH12K acc. to AWS A5.17	0.06–0.15	0.25–0.65	1.50–2.00				0.025	0.025	0.35

Characteristics:
Wire electrode with higher Si-content for submerged arc welding of non-alloy and fine grain steels (especially Off-Shore), higher strength shipbuilding steels, pipe steels, boiler and vessel steels.

Base Materials:
- Non-alloy structural steels acc. to EN 10025 and ASTM: S235JRG2/A570 grade 36 to S355J2G3R/A572 grade 50
  Suitable fluxes: BF 3 and BF 5.1
- Fine grain steels acc. to EN 10025, EN 10028 and ASTM: P355N/S355NL/A516 grade 70 / 633 grade E and P460N/S460NL
  Suitable fluxes: BF 3, BF 5.1, BF 6.5 and BF 10
- Off-shore structural steels up to 460 MPa yield strength and BS 4360-grade 50 D
  Suitable fluxes: BF 5.1 and BF 10
- Shipbuilding steels: higher strength
  Suitable fluxes: BF 5.1 and BF 10
- Pipe steels acc. to ISO 3183, EN 10208 and API-5: L360N/X52 to L485Q/X70
  Suitable fluxes: BF 5.1, BF 6.30 and BF 6.5
- Boiler and vessel steels acc. to EN 10028 and ASTM: P235GH/A516 grade 55, P355GH/A516 grade 70 and S275J2G3/A572 grade 42, S355J2G3/A572 grade 50
  Suitable fluxes: BF 3, BF 5.1, BF 6.5 and BF 10

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
2.0 – 5.0 mm; Sizes and tolerances acc. to ISO 544 and AWS A5.17.

Wire electrode surface:
Copper-coated, smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-S2Mo

Classification:

EN ISO 14171-A (EN 756)	– **S2Mo**
EN ISO 24598-A (EN 12070)	– **S Mo**
SFA-5.23 / AWS A5.23	– **EA2**

Typical analysis and chemical composition acc. to EN ISO 14171-A and AWS A5.23: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Others
Typical analysis BA-S2Mo	0.09	0.16	1.15	0.50	0.01	0.02	0.006	0.005	Cu 0.07
S2Mo acc. to ISO 14171-A	0.07–0.15	0.05–0.25	0.80–1.30	0.45–0.65	0.15	0.15	0.025	0.025	Cu total 0.30
S Mo acc. to ISO 24598-A	0.08–0.15	0.05–0.25	0.80–1.20	0.45–0.65	0.3	0.2	0.025	0.025	V 0.03 Nb 0.01 Cu 0.3
EA2 acc. to AWS A5.23	0.05–0.17	0.20	0.95–1.35	0.45–0.65			0.025	0.025	Cu total 0.35

Characteristics:
Mo-alloyed wire electrode for submerged arc welding of fine grain steels, pipe steels and heat-resistant boiler and vessel steels.

Base Materials:
- Fine grain steels acc. to EN 10025, EN 10028 and ASTM: P420N/S420NL/A633 grade E and P460N/S460NL
  Suitable fluxes: BF 3, BF 4, BF 5.1, BF 6.5 and BF 10
- Pipe steels acc. to ISO 3183, EN 10208 and API-5: L415N/X60 to L485Q/X70
  Suitable fluxes: BF 5.1, BF 6.30 and BF 6.5
- Heat-resistant steels acc. to EN 10028 and ASTM: 16 Mo 3/A204 grade A and A209 grade T1, S275J2G3/A572 grade 42 and S355J2G3/A572 grade 50
  Suitable fluxes: BF 1, BF 3, BF 4, BF 5.1, BF 6.5 and BF 10

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
2.0 – 5.0 mm; Sizes and tolerances acc. to ISO 544 and AWS A5.23.

Wire electrode surface:
Copper-coated, smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-S3Mo

Classification:

EN ISO 14171-A (EN 756) – **S3Mo**
SFA-5.23 / AWS A5.23 – **EA4**

Typical analysis and chemical composition acc. to EN ISO 14171-A and AWS A5.23: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Cu total
Typical analysis BA-S3Mo	0.10	0.13	1.55	0.49	0.02	0.05	0.014	0.011	0.08
S3Mo acc. to ISO 14171-A	0.07–0.15	0.05–0.25	1.30–1.75	0.45–0.65	0.15	0.15	0.025	0.025	0.30
EA4 acc. to AWS A5.23	0.05–0.15	0.20	1.20–1.70	0.45–0.65			0.025	0.025	0.35

Characteristics:
Mo-alloyed wire electrode with higher Mn-content for submerged arc welding of fine grain steels, pipe steels and heat-resistant boiler and vessel steels.

Base Materials:

- Fine grain steels acc. to EN 10025, EN 10028 and ASTM: P460N/S460NL to P500Q/S500QL
  Suitable fluxes: BF 5.1, BF 6.5 and BF 10
- Pipe steels acc. to ISO 3183, EN 10208 and API-5: L360N/X52 to L555Q/X80
  Suitable fluxes: BF 5.1, BF 6.30 and BF 6.5
- Heat-resistant steels acc. to EN 10028 and ASTM: 16 Mo 3/A204 grade A and A209 grade T1, P355GH/A516 grade 70 and S355J2G3/A572 grade 50
  Suitable fluxes: BF 5.1, BF 6.5 and BF 10

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
2.0 – 5.0 mm; Sizes and tolerances acc. to ISO 544 and AWS A5.23.

Wire electrode surface:
Copper-coated, smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-S4Mo

Classification:

EN ISO 14171-A (EN 756)	– **S4Mo**
SFA-5.23 / AWS A5.23	– **EA3**

Typical analysis and chemical composition acc. to EN ISO 14171-A and AWS A5.23: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Cu total
Typical analysis BA-S4Mo	0.12	0.11	1.90	0.50	0.05	0.06	0.016	0.013	0.09
S4Mo acc. to ISO 14171-A	0.07–0.15	0.05–0.25	1.75–2.25	0.45–0.65	0.15	0.15	0.025	0.025	0.30
EA3 acc. to AWS A5.23	0.05–0.17	0.20	1.65–2.20	0.45–0.65			0.025	0.025	0.35

Characteristics:
Mo-alloyed wire electrode with high Mn-content for submerged arc welding in the two-run technique of fine grain steels, pipe steels and heat-resistant boiler and vessel steels.

Base Materials:

- Fine grain steels acc. to EN 10025, EN 10028 and ASTM: P460N/S460NL to P500Q/S500QL
  Suitable fluxes: BF 5.1 and BF 6.5
- Pipe steels acc. to ISO 3183, EN 10208 and API-5: L485Q/X70 to L555Q/X80
  Suitable fluxes: BF 6.30 and BF 6.5
- Heat-resistant steels acc. to EN 10028 and ASTM: 16 Mo 3/A204 grade A and A209 grade T1
  Suitable flux: BF 10

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
2.0 – 5.0 mm; Sizes and tolerances acc. to ISO 544 and AWS A5.23.

Wire electrode surface:
Copper-coated, smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-S2Ni1

Classification:

EN ISO 14171-A (EN 756) – **S2Ni1**
SFA-5.23 / AWS A5.23 – **ENi1**

Typical analysis and chemical composition acc. to EN ISO 14171-A and AWS A5.23: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Cu total
Typical analysis BA-S2Ni1	0.09	0.14	1.05	0.02	0.95	0.02	0.006	0.004	0.08
S2Ni1 acc. to ISO 14171-A	0.07–0.15	0.05–0.25	0.80–1.30	0.15	0.80–1.20	0.15	0.020	0.020	0.30
ENi1 acc. to AWS A5.23	0.12	0.05–0.30	0.75–1.25	0.30	0.75–1.25	0.15	0.020	0.020	0.35

Characteristics:
Ni-alloyed wire electrode for submerged arc welding in the multi-run technique of fine grain steels in vessel and apparatus construction as well as pipe steels for low temperature toughness requirements down to –60 °C.

Base Materials:

- Fine grain steels acc. to EN 10025, EN 10028 and ASTM: P355ML2/S355ML and P420ML2/S420QL1 and ASTM A633 grade E
  Suitable fluxes: BF 5.1, BF 6.5 and BF 10
- Pipe steels acc. to ISO 3183, EN 10208 and API-5: L360M/X52 to L415M/X60
  Suitable fluxes: BF 5.1, BF 6.5 and BF 10

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
2.0 – 5.0 mm; Sizes and tolerances acc. to ISO 544 and AWS A5.23.

Wire electrode surface:
Copper-coated, smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-S2Ni2

Classification:

EN ISO 14171-A (EN 756)	–	**S2Ni2**
SFA-5.23 / AWS A5.23	–	**ENi2**

Typical analysis and chemical composition acc. to EN ISO 14171-A and AWS A5.23: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Cu total
Typical analysis BA-S2Ni2	0.09	0.15	1.15	0.02	2.2	0.02	0.006	0.005	0.09
S2Ni2 acc. to ISO 14171-A	0.07–0.15	0.05–0.25	0.80–1.30	0.15	1.80–2.40	0.15	0.020	0.020	0.30
ENi2 acc. to AWS A5.23	0.12	0.05–0.30	0.75–1.25		2.10–2.90		0.020	0.020	0.35

Characteristics:
Ni-alloyed wire electrode for submerged arc welding of fine grain steels with low temperature toughness and nickel-alloy steels in vessel, apparatus and tank construction as well as pipe manufacture.

Base Materials:
- Fine grain steels acc. to EN 10025, EN 10028 and ASTM: P355ML2/S355ML to P460ML2/S460QL1 and ASTM A633 grade E
  Suitable fluxes: BF 5.1 and BF 10
- Nickel-alloy steels 14Ni6, 12Ni14 and 13MnNi6-3
  Suitable Flux: BF 10

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
2.0 – 5.0 mm; Sizes and tolerances acc. to ISO 544 and AWS A5.23.

Wire electrode surface:
Copper-coated, smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-S2Ni3

Classification:
EN ISO 14171-A (EN 756) – **S2Ni3**
SFA-5.23 / AWS A5.23 – **ENi3**

Typical analysis and chemical composition acc. to EN ISO 14171-A and AWS A5.23: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Cu total
Typical analysis BA-S2Ni3	0.09	0.13	1.11	0.03	3.15	0.02	0.006	0.003	0.07
S2Ni3 acc. to ISO 14171-A	0.07–0.15	0.05–0.25	0.80–1.30	0.15	2.80–3.70	0.15	0.020	0.020	0.30
ENi3 acc. to AWS A5.23	0.13	0.05–0.30	0.60–1.20		3.10–3.80	0.15	0.020	0.020	0.35

Characteristics:
Ni-alloyed wire electrode for submerged arc welding of fine grain steels with low temperature toughness and nickel-alloy steels up to 3.5 % Ni in vessel, apparatus and tank construction as well as pipe manufacture for low temperature toughness requirements down to –100 °C.

Base Materials:
- Fine grain steels acc. to EN 10025, EN 10028 and ASTM: P355ML2/S355ML to P460ML2/S460QL1 and ASTM A633 grade E
  Suitable flux: BF 10
- Nickel-alloy steels 10Ni14 and 12Ni14
  Suitable flux: BF 10

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
2.0 – 5.0 mm; Sizes and tolerances acc. to ISO 544 and AWS A5.23.

Wire electrode surface:
Copper-coated, smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-S2NiCu

Classification:

EN ISO 14171-A (EN 756) – **S2Ni1Cu**
SFA-5.23 / AWS A5.23 – **EG / (EW mod.)**

Typical analysis and chemical composition acc. to EN ISO 14171-A and AWS A5.23: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Cu total
Typical analysis BA-S2NiCu	0.10	0.23	0.98	0.04	0.78	0.07	0.012	0.010	0.48
S2Ni1Cu acc. to ISO 14171-A	0.08–0.12	0.15–0.35	0.70–1.20	0.15	0.65–0.90	0.40	0.020	0.020	0.40–0.65
EW acc. to AWS A5.23	0.12	0.20–0.35	0.35–0.65		0.40–0.80	0.50–0.80	0.025	0.030	0.30–0.80

Characteristics:
NiCu-alloyed wire electrode for submerged arc welding of weathering steels and special structural steels in steel construction as well as plant and bridge construction.

Base Materials:
- Weathering steels and special structural steels: S235JRW, S235J2G3Cu, S355J2G1W, S355J2G3Cu and Corten A, Patinax 37
  Suitable fluxes: BF 3, BF 4, BF 5.1, BF 6.5 and BF 10

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
2.0 – 5.0 mm; Sizes and tolerances acc. to ISO 544 and AWS A5.23.

Wire electrode surface:
Copper-coated, smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-S3NiMo1/4

Classification:

EN ISO 14171-A	–	**S3Ni1Mo0,2**
SFA-5.23 / AWS A5.23	–	**ENi5**

Typical analysis and chemical composition acc. to EN ISO 14171-A and AWS A5.23: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Cu total
Typical analysis BA-S3NiMo1/4	0.12	0.15	1.58	0.23	0.95	0.04	0.005	0.002	0.08
S3Ni1Mo0,2 acc. to ISO 14171-A	0.07–0.15	0.10–0.35	1.20–1.60	0.15–0.30	0.80–1.20	0.15	0.015	0.015	0.30
ENi5 acc. to AWS A5.23	0.12	0.05–0.30	1.20–1.60	0.10–0.30	0.75–1.25		0.020	0.020	0.35

Characteristics:
NiMo-alloyed wire electrode with higher Mn-content for submerged arc welding of high tensile pipe steels and high tensile fine grain steels in vessel and apparatus construction as well as Off-Shore applications. Especially suitable for low temperature applications because of low Mo-content. Best suitable if requirements for sour-gas environment are to match Ni < 1.0 %

Base Materials:
- Pipe steels acc. to ISO 3183, EN 10208 and API-5: L450Q/X65 to L555Q/X80
  Suitable fluxes: BF 6.30 and BF 6.5
- Fine grain steels acc. to EN 10025, EN 10028: P420ML/S420NL to S550QLQuenched and tempered steels such as N-A-XTRA 70, 20MnMoNi5
  Suitable fluxes: BF 5.1, BF 6.5 and BF 10

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
2.0 – 5.0 mm; Sizes and tolerances acc. to ISO 544 and AWS A5.23.

Wir electrode surface:
Copper-coated, smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-S3NiMo1

Classification:

EN ISO 14171-A (EN 756) – **S3Ni1Mo**
SFA-5.23 / AWS A5.23 – **EF3**

Typical analysis and chemical composition acc. to EN ISO 14171-A and AWS A5.23: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Cu total
Typical analysis BA-S3NiMo1	0.12	0.19	1.73	0.53	0.95	0.04	0.009	0.001	0.07
S3Ni1Mo acc. to ISO 14171-A	0.07–0.15	0.05–0.25	1.30–1.80	0.45–0.65	0.80–1.20	0.20	0.020	0.020	0.30
EF3 acc. to AWS A5.23	0.10–0.18	0.30	1.50–2.40	0.40–0.65	0.70–1.10		0.025	0.025	0.35

Characteristics:
NiMo-alloyed wire electrode with higher Mn-content for submerged arc welding of high tensile fine grain steels in vessel and apparatus construction, high tensile pipe steels and high strength pipe steels.

Base Materials:

- Fine grain steels acc. to EN 10025, EN 10028: P460N/S460NL to S550QLQuenched and tempered steels such as N-A-XTRA 70, 20MnMoNi5, HY80
  Suitable fluxes: BF 5.1, BF 6.5 and BF 10
- Pipe steels acc. to ISO 3183, EN 10208 and API-5: L485Q/X70 to L555Q/X80
  Suitable fluxes: BF 6.30 and BF 6.5
- Shipbuilding steels: high strength up to 460 MPa yield strength
  Suitable flux: BF 10

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
2.0 – 5.0 mm; Sizes and tolerances acc. to ISO 544 and AWS A5.23.

Wire electrode surface:
Copper-coated, smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-S3NiMo1,5

Classification:

EN ISO 14171-A (EN 756) – **S3Ni1,5Mo**
SFA-5.23 / AWS A5.23 – **EF1**

Typical analysis and chemical composition acc. to EN ISO 14171-A and AWS A5.23: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Cu total
Typical analysis BA-S3NiMo1,5	0.11	0.17	1.62	0.41	1.48	0.05	0.011	0.004	0.10
S3Ni1,5Mo acc. to ISO 14171-A	0.07–0.15	0.05–0.25	1.20–1.80	0.30–0.50	1.20–1.80	0.20	0.020	0.020	0.30
EF1 acc. to AWS A5.23	0.07–0.15	0.15–0.35	0.90–1.70	0.25–0.55	0.95–1.60		0.025	0.025	0.35

Characteristics:
NiMo-alloyed wire electrode with higher Mn-content for submerged arc welding of high tensile fine grain steels in vessel and apparatus construction and high tensile pipe steels.

Base Materials:

- Fine grain steels acc. to EN 10025, EN 10028: P460N/S460NL to S550QLQuenched and tempered steels such as N-A-XTRA 70, 20MnMoNi5-5, HY80
  Suitable fluxes: BF 5.1, BF 6.5 and BF 10
- Pipe steels acc. to ISO 3183, EN 10208 and API-5: L485Q/X70 to L555Q/X80
  Suitable fluxes: BF 6.30 and BF 6.5

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
2.0 – 5.0 mm; Sizes and tolerances acc. to ISO 544 and AWS A5.23.

Wire electrode surface:
Copper-coated, smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-S3NiCrMo2,5

Classification:

EN ISO 26304-A	– **S3Ni2,5CrMo**
SFA-5.23 / AWS A5.23	– **EM4 mod.**

Typical analysis and chemical composition acc. to EN ISO 26304-A and AWS A5.23: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Others
Typical analysis BA-S3NiCrMo2,5	0.10	0.17	1.50	0.55	2.40	0.50	0.008	0.007	Cu total 0.08
S3Ni2,5CrMo acc. to ISO 26304-A	0.07–0.15	0.10–0.25	1.20–1.80	0.40–0.70	2.00–2.60	0.30–0.85	0.020	0.020	Cu total 0.30
EM4 acc. to AWS A5.23	0.10	0.20–0.60	1.40–1.80	0.30–0.65	2.00–2.80	0.60	0.010	0.015	V 0.03 Ti/Zr/Al 0.10 Cu 0.25

Characteristics:
NiCrMo-alloyed wire electrode with higher Mn-content for submerged arc welding of high tensile quenched and tempered fine grain steels in vessel and apparatus construction as well as high tensile pipe steels.

Base Materials:
- Fine grain steels acc. to EN 10025, EN 10028: S620QL to S690QL
  Suitable flux: BF 10
- Pipe steels acc. to ISO 3183, EN 10208 and API-5: L625M/X90 to L690M/X100
  Suitable fluxes: BF 6.30 and BF 6.5
- Shipbuilding steels: high strength fine grain steels up to 690 MPa yield strength
  Suitable flux: BF 10

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
2.0 – 5.0 mm; Sizes and tolerances acc. to ISO 544 and AWS A5.23.

Wire electrode surface:
Copper-coated, smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-S2Ni1Si

Classification: SFA-5.23 / AWS A5.23 – **ENi1K**

Typical analysis and chemical composition acc. to AWS A5.23: (Weight Percent)

electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Cu total
Typical analysis BA-S2Ni1Si	0.09	0.65	1.05	0.05	0.90	0.02	0.012	0.010	0.10
ENi1K acc. to AWS A5.23	0.12	0.40–0.80	0.80–1.40	–	0.75–1.25	–	0.020	0.020	0.35

Characteristics:
Ni-alloyed wire electrode for submerged arc welding in the multi-run technique of fine grain steels in vessel and apparatus construction as well as pipe steels for low temperature toughness requirements down to –60 °C.

Base Materials:
- Fine grain steels acc. to EN 10025, EN 10028 and ASTM: P355ML2/S355ML and P420ML2/S420QL1 and ASTM A633 grade E
  Suitable flux: BF 5.1
- Pipe steels acc. to ISO 3183, EN 10208 and API-5: L360M/X52 to L415M/X60
  Suitable fluxes: BF 6.30, BF 6.5

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
2.0 – 4.0 mm; sizes and tolerances acc. to ISO 544 and AWS A5.23.

Wire electrode surface:
Copper-coated, smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-S3TiB

Classification:

EN ISO 14171-A	– **SZ**
SFA-5.23 / AWS A5.23	– **EG**

Typical analysis: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Ti	B	N	Cu total
Typical analysis BA-S3TiB	0.07	0.25	1.65	0.003	0.02	0.03	0.009	0.005	0.115	0.011	0.0030	0.01

Characteristics:
Wire electrode for submerged arc welding intended for welding pipeline steel. Developed for multi-wire welding with two-run technique, for applications in sour gas service.
Exclusively for as-welded applications.

Base Materials:
- According to EN 10208-2/ISO 3183: L360 – L555
  According to API 5L: grades X52 – X80
  Suitable fluxes: BF 6.30, BF 6.5

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
2.0 – 5.0 mm; sizes and tolerances acc. to ISO 544 and AWS A5.23.

Wire electrode surface:
Smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-S2MoTiB

Classification:

EN ISO 14171-A	– **S2MoTiB**
SFA-5.23 / AWS A5.23	– **EA2TiB**

Typical analysis and chemical composition acc. to EN ISO 14171-A and AWS A5.23: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	P	S	Ti	B	Cu total
Richtanalyse BA-S2MoTiB	0.08	0.20	1.25	0.54	0.015	0.015	0.14	0.012	0.10
S2MoTiB nach ISO 14171-A	0.05–0.15	0.15–0.35	1.00–1.35	0.40–0.65	0.025	0.025	0.10–0.20	0.005–0.020	0.30
EA2TiB nach AWS A5.23	0.05–0.17	0.35	0.95–1.35	0.45–0.65	0.025	0.025	0.05–0.30	0.005–0.030	0.35

Characteristics:
Wire electrode for submerged arc welding with Ti and B to achieve optimum impact properties with the two-run technique with pipe-mill fluxes.
Exclusively for as-welded applications.

Base Materials:
- According to EN 10208-2/ISO 3183: L360 – L555
- According to API 5L: grades X52 – X80
  Suitable fluxes: BF 6.5, BF 6.30

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
2.0 – 5.0 mm; sizes and tolerances acc. to ISO 544 and AWS A5.23.

Wire electrode surface:
Copper-coated, smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-S3MoTiB

Classification:

EN ISO 14171-A	– **SZ**
SFA-5.23 / AWS A5.23	– **EG**

Typical analysis and chemical composition acc. to EN ISO 14171-A and AWS A5.23: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Others
Typical analysis BA-S3MoTiB	0.08	0.30	1.25	0.50	0.02	0.03	0.008	0.004	Ti 0.15 B 0.015 Cu 0.05
SZ acc. to ISO 14171-A	0.10	0.15–0.35	1.30–1.60	0.45–0.65	0.15	0.10	0.015	0.010	Ti 0.10–0.18 B 0.010–0.018 Cu 0.30
EG acc. to AWS A5.23	0.10	0.15–0.35	1.30–1.60	0.45–0.65	0.15	0.10	0.015	0.010	Ti 0.10–0.18 B 0.010–0.018 Cu 0.30

Characteristics:
Mo-alloyed wire electrode with higher Mn-content and micro alloying additions Ti/B for submerged arc welding in the two-run technique of pipe steels for high toughness requirements also at low temperatures at –46 °C or below.

Base Materials:
- Pipe steels acc. to ISO 3183, EN 10208 and API-5: L415M/X60 to L555M/X80
  Suitable fluxes for spiral welding: BF 6.30 and BF 6.5
  Suitable fluxes for longitudinal welding: BF 6.30 and BF 6.3

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
2.0 – 5.0 mm; Sizes and tolerances acc. to ISO 544 and AWS A5.23.

Wire electrode surface:
Copper-coated, smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-S3Si1

Classification:
EN ISO 14341-A – **G3Si1**
SFA 5.17 / AWS A5.17 – **EH11K**

Typical analysis and chemical composition acc. to AWS A5.17: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Cu total
Richtanalyse BA-S3Si1	0.09	0.95	1.67	0.06	0.04	0.03	0.012	0.009	0.04
EH11K nach AWS A5.17	0.06–0.15	0.80–1.15	1.40–1.85				0.030	0.030	0.35

Characteristics:
Wire electrode with higher Si- and Mn-content for submerged arc welding of pipe steels with low Si- and Mn-content.

Base Materials:
- Pipe steels acc. to ISO 3183, EN 10208 and API-5: L360N/X52 to L485Q/X70
  Suitable fluxes: BF 6.30 and BF 6.5

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
2.0 – 5.0 mm; Sizes and tolerances acc. to ISO 544 and AWS A5.17.

Wire electrode surface:
Copper-coated, smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-S2MoSi

Classification:

EN ISO 14341-A	–	**G2Mo**
SFA-5.23 / AWS A5.23	–	**EA3K mod.**

Typical analysis and chemical composition acc. to AWS A5.23: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Cu total
Typical analysis BA-S2MoSi	0.10	0.60	1.20	0.50	0.02	0.02	0.010	0.010	0.05
EA3K mod. acc. to AWS A5.23	0.05–0.15	0.50–0.80	0.95–1.30	0.40–0.60			0.025	0.025	0.35

Characteristics:
Mo-alloyed wire electrode with higher Si-content for submerged arc welding of pipe steels with low Si-content.

Base Materials:
- Pipe steels acc. to ISO 3183, EN 10208 and API-5: L360N/X52 to L555Q/X80
  Suitable fluxes: BF 6.30 and BF 6.5

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
2.0 – 5.0 mm; Sizes and tolerances acc. to ISO 544 and AWS A5.23.

Wire electrode surface:
Copper-coated, smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-S4MoSi

Classification:

EN ISO 14341-A	– **G4Mo**
SFA-5.23 / AWS A5.23	– **EA3K**

Typical analysis and chemical composition acc. to AWS A5.23: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Cu total
Typical analysis BA-S4MoSi	0.10	0.63	1.82	0.55	0.02	0.02	0.012	0.010	0.10
EA3K acc. to AWS A5.23	0.05–0.15	0.50–0.80	1.60–2.10	0.40–0.60			0.025	0.025	0.35

Characteristics:
Mo-alloyed wire electrode with higher Si- and Mn-content for submerged arc welding of pipe steels with low Si- and Mn-content.

Base Materials:
- Pipe steels acc. to ISO 3183, EN 10208 and API-5: L360N/X52 to L555Q/X80
  Suitable fluxes: BF 6.30 and BF 6.5

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
2.0 – 5.0 mm; Sizes and tolerances acc. to ISO 544 and AWS A5.23.

Wire electrode surface:
Copper-coated, smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-S2CrMo1

Classification:

EN ISO 24598-A (EN 12070)	– **S CrMo1**
SFA-5.23 / AWS A5.23	– **EB2(R)**

Typical analysis and chemical composition acc. to EN ISO 24598-A and AWS A5.23: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Others
Typical analysis BA-S2CrMo1	0.10	0.17	0.98	0.52	0.03	1.20	0.008	0.009	Cu total 0.10
S CrMo1 acc. to ISO 24598-A	0.08–0.15	0.05–0.25	0.60–1.00	0.40–0.65	0.3	0.90–1.30	0.020	0.020	V 0.03 Nb 0.01 Cu 0.3
EB2 acc. to AWS A5.23	0.05–0.17	0.05–0.30	0.45–1.00	0.45–0.65		1.00–1.75	0.025	0.025	Cu 0.35
EB2R: As / Sn / Sb 0,005							0.010	0.010	Cu 0.15

Characteristics:
CrMo-alloyed low impurity wire electrode for submerged arc welding of quenched and tempered steels and heat-resistant steels in boiler and pressure vessel construction as well as pipe manufacture.

Base Materials:
- Quenched and tempered steels acc. to EN 10025, EN 10028 and ASTM: such as 25CrMo4/AISI 4130
  Suitable fluxes: BF 8.1 and BF 10
- Heat-resistant steels acc. to EN 10028 and ASTM: 13CrMo4-5/A182-F12/A213 grade T12/A387 grade 12
  Suitable fluxes: BF 1, BF 5.1, BF 6.5, BF 8.1 and BF 10

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
2.0 – 5.0 mm; Sizes and tolerances acc. to ISO 544 and AWS A5.23.

Wire electrode surface:
Copper-coated, smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-S1CrMo2

Classification:

EN ISO 24598-A (EN 12070)	–	**S CrMo2**
SFA-5.23 / AWS A5.23	–	**EB3(R)**

Typical analysis and chemical composition acc. to EN ISO 24598-A and AWS A5.23: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Others
Typical analysis BA-S1CrMo2	0.10	0.18	0.64	1.02	0.02	2.4	0.008	0.007	Cu total 0.09
S CrMo2 acc. to ISO 24598-A	0.08–0.15	0.05–0.25	0.30–0.70	0.90–1.15	0.3	2.2–2.8	0.020	0.020	V 0.03 Nb 0.01 Cu 0.3
EB3 acc. to AWS A5.23	0.05–0.15	0.05–0.30	0.40–0.80	0.90–1.10		2.25–3.00	0.025	0.025	Cu 0.35
EB3R: As / Sn / Sb 0,005							0.010	0.010	Cu 0.15

Characteristics:
CrMo-alloyed low impurity wire electrode (suitability for step-cooling) for submerged arc welding of heat-resistant steels in boiler and pressure vessel construction as well as pipe manufacture.

Base Materials:
- Heat-resistant steels acc. to EN 10028 and ASTM: 10CrMo9-10/A182-F22/A387 grade 22
  Suitable fluxes: BF 10 and BF 16

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
2.0 – 5.0 mm; Sizes and tolerances acc. to ISO 544 and AWS A5.23.

Wire electrode surface:
Copper-coated, smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-S CrMo5

Classification:

EN ISO 24598-A	–	**S CrMo5**
SFA-5.23 / AWS A5.23	–	**EB6**

Typical analysis and chemical composition acc. to EN ISO 24598-A and AWS A5.23: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Cu total
Typical analysis BA-S CrMo5	0.08	0.30	0.50	0.60	0.1	6.0	0.015	0.015	0.14
S CrMo5 acc. to ISO 24598-A	0.03–0.10	0.20–0.50	0.40–0.75	0.50–0.80	0.3	5.5–6.5	0.020	0.020	0.3 V 0.03 Nb 0.01
EB6 acc. to AWS A5.23	0.10	0.05–0.50	0.35–0.70	0.45–0.70	–	4.50–6.50	0.025	0.025	0.35

Characteristics:
Submerged arc welding wire suited for high temperature creep resistant 5%Cr0.5%Mo steels. The 5%Cr0.5%Mo creep resistant alloy is used for hot hydrogen service, high temperature strength at service temperatures up to +600 °C. Typical applications are found in oil refineries.

Base Materials:
- 5%Cr0.5%Mo creep heat-resistant steels. X12CrMo5, GX12CrMo5
  ASTM: A182/A336 grade F5, A199/A213 grade T5, A217 grade C5, A234 grade WP5, A335 grade P5, A387 grade 5
  Suitable flux: WP 380

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
1.6 –3.2 mm; sizes and tolerances acc. to ISO 544 and AWS A5.23.

Wire electrode surface:
Copper-coated, smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-S CrMo9

Classification:

EN ISO 24598-A	– **S CrMo9**
SFA-5.23 / AWS A5.23	– **EB8**

Typical analysis and chemical composition acc. to EN ISO 24598-A and AWS A5.23: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	V	Nb	Cu total
Typical analysis BA-S CrMo9	0.08	0.35	0.50	1.0	–	9.0	0.010	0.010	–	–	0.10
S CrMo9 acc. to ISO 24598-A	0.06–0.10	0.3–0.6	0.3–0.7	0.8–1.2	1.0	8.5–10.5	0.025	0.025	0.15	0.01	0.30
EB8 acc. to AWS A5.23	0.10	0.05–0.5	0.3–0.65	0.8–1.2	–	8.0–10.5	0.025	0.025	–	–	0.35

Characteristics:
Submerged arc welding wire for high temperature, creep resistant steel 9%Cr-1%Mo martensitic steel. Approved for service temperatures up to 600 °C. Used for heat exchangers, boiler superheater tubing, piping and pressure vessels for the oil and gas industries.

Base Materials:
- 9%Cr-1%Mo creep heat-resistant martensitic steels.
  ASTM: A182 F9, A199 T9, A200 T9, A213 T9, A234 WP9, A335 grade 9, A336 F9, A387 grade 9
  DIN: X12CrMo 9-1, X7CrMo 9-1, GS-12CrMo 10-1
  Suitable flux: WP 380

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
2,0 – 4,0 mm; sizes and tolerances acc. to ISO 544 and AWS A5.23.

Wire electrode surface:
Copper-coated, smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-S CrMo91

Classification:

EN ISO 24598-A	–	**S CrMo91**
SFA-5.23 / AWS A5.23	–	**EB91**

Typical analysis and chemical composition acc. to EN ISO 24598-A and AWS A5.23: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	V	Nb	Cu total
Typical analysis BA-S CrMo91	0.10	0.25	0.50	1.00	0.60	8.70	0.008	0.008	0.20	0.04	0.08
S CrMo91 acc. to ISO 24598-A	0.07–0.15	0.60	0.4–1.5	0.8–1.2	0.4–1.0	8.0–10.5	0.020	0.020	0.15–0.30	0.03–0.10	0.25 N 0.02–0.07
EB91 acc. to AWS A5.23	0.07–0.13	0.50	1.25	0.85–1.15	1.0	8.50–10.50	0.010	0.010	0.15–0.25	0.02–0.10	0.10 N 0.03–0.07 Al 0.04

Characteristics:
Submerged arc welding wire for high temperature, creep resistant, modified 9%Cr1%Mo martensitic steel (T91/P91). Approved for service temperatures up to 650 °C. Alloy T91/P91 is widely used in the power generating, ultra-super-critical (USC) power plant boilers and turbines, chemical and oil and gas industries.

Base Materials:
- P91, 9%Cr1%Mo modified, creep resisting martensitic steels. X10CrMoVNb9-1
  ASTM: A182/A336 grade F91, A213 grade T91, A217 grade C12A, A234 grade WP91, A335 grade P91, A387 grade 91
  Suitable flux: WP 380

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
1.6 – 2.4 mm; sizes and tolerances acc. to ISO 544 and AWS A5.23.

Wire electrode surface:
Copper-coated, smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-WIRE 308H

Classification: SFA-5.9 / AWS A5.9 – **ER308H**

Typical analysis and chemical composition acc. to AWS A5.9: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Cu total
Typical analysis BA-WIRE 308H	0.05	0.4	1.8	0.2	10.0	20.0	0.020	0.013	0.1
ER308H acc. to AWS A5.9	0.04–0.08	0.30–0.65	1.0–2.5	0.50	9.0–11.0	19.5–22.0	0.03	0.03	0.75

Application:
BA-WIRE 308H is a submerged arc welding wire intended for welding 18% Cr – 10% Ni austenitic stainless steels for service temperature up to +700 °C, base material 1.4948/AISI 30H.

Base Materials:
- 1.4948 X6CrNi18-11, 1.4878 X12CrNiTi18-9 AISI 304/304H, 321H, 347H
  Suitable fluxes: BF 38, WP 380

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
1.6 – 4.0 mm; sizes and tolerances acc. to ISO 544 and AWS A5.9.

Wire electrode surface:
Smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-WIRE 308L

Classification:

EN ISO 14343-A	– **S 19 9 L**
SFA-5.9 / AWS A5.9	– **ER308L**

Typical analysis and chemical composition acc. to EN ISO 14343-A and AWS A5.9: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Cu total
Typical analysis BA-WIRE 308L	0.02	0.4	1.8	0.1	10.0	20.0	0.020	0.013	0.1
S 19 9 L acc. to ISO 14343-A	0.03	0.65	1.0–2.5	0.5	9.0–11.0	19.0–21.0	0.03	0.02	0.5
ER308L acc. to AWS A5.9	0.03	0.30–0.65	1.0–2.5	0.75	9.0–11.0	19.5–22.0	0.03	0.03	0.75

Also available BA-W308LF with low ferrite content.

Application:
BA-WIRE 308L is a submerged arc welding wire intended for welding 18% Cr – 10% Ni austenitic stainless steels 1.4306 type 304, 304L. Suitable for service temperatures from –196 °C to +350 °C.

Base Materials:
- 1.4306/X2CrNi19-11, 1.4301/X5CrNi18-10, 1.4311/X2CrNiN18-10, 1.4312/GX10CrNi18-8, 1.4541/X6CrNiTi18-10, 1.4546/X5CrNiNb18-10, 1.4550/X6CrNiNb18-10
  AISI 304, 304L, 304LN, 302, 321, 347; ASTM A157 grade C9; A320 grade B8C or D
  Suitable fluxes: BF 38, WP 380

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most sui- table flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
1.6 – 4.0 mm; sizes and tolerances acc. to ISO 544 and AWS A5.9.

Wire electrode surface:
Smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-WIRE 309L

Classification:

EN ISO 14343-A	– **S 23 12 L**
SFA-5.9 / AWS A5.9	– **ER309L**

Typical analysis and chemical composition acc. to EN ISO 14343-A and AWS A5.9: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Cu total
Typical analysis BA-WIRE 309L	0.015	0.4	1.8	0.1	13.0	23.5	0.020	0.013	0.15
S 23 12 L acc. to ISO 14343-A	0.03	0.65	1.0–2.5	0.5	11.0–14.0	22.0–25.0	0.03	0.02	0.5
ER309L acc. to AWS A5.9	0.03	0.30–0.65	1.0–2.5	0.75	12.0–14.0	23.0–25.0	0.03	0.03	0.75

Application:
BA-WIRE 309L is a submerged arc welding wire suitable for joining stainless Cr-Ni steels type 309, Cr-steels and dissimilar steels like austenitic stainless steels to mild or low-alloyed steels, buffer layers and overlays on C-Mn, mild steel or low alloy steels and for joining 304L/321. Also recommended for welding12%Cr ferritic steels.

Base Materials:
- Dissimilar joints between mild steels, low alloy steels, high tensile low alloy steels, ferritic Cr steels, austenitic Cr-Ni steels and manganese steels.
  Surfacing/overlay for the first layer.
  Suitable fluxes: BF 38, WP 380

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
1.6 – 4.0 mm; sizes and tolerances acc. to ISO 544 and AWS A5.9.

Wire electrode surface:
Smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-WIRE 309LMo

Classification:

EN ISO 14343-A	– **S 23 12 2 L**
SFA-5.9 / AWS A5.9	– **ER309LMo**

Typical analysis and chemical composition acc. to EN ISO 14343-A and AWS A5.9: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Cu total
Typical analysis BA-WIRE 309LMo	0.018	0.4	1.6	2.7	13.5	23.5	0.020	0.013	0.15
S 23 12 2 L acc. to ISO 14343-A	0.03	1.0	1.0–2.5	2.0–3.5	11.0–15.5	21.0–25.0	0.03	0.02	0.5
ER309LMo acc. to AWS A5.9	0.03	0.30–0.65	1.0–2.5	2.0–3.0	12.0–14.0	23.0–25.0	0.03	0.03	0.75

Application:
BA-WIRE 309LMo is a submerged arc welding wire similar to BA-WIRE 309L with the addition of 2.0 – 3.5 % molybdenum to increase pitting corrosion resistance. Also used for surfacing of base metals to improve their resistance to corrosion. BA-WIRE 309LMo is suitable for joining stainless steels to carbon steels or low-alloy steels such as 316L to mild steel and for overlay welding where higher Mo content is desired in the second and third layers.

Base Materials:
- Dissimilar joints between mild steels, low alloy steels, high tensile low alloy steels, ferritic Cr steels, austenitic Cr-Ni steels and manganese steels.
  Surfacing/overlay for the first layer.
  Suitable fluxes: BF 38, WP 380

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
1.6 – 4.0 mm; sizes and tolerances acc. to ISO 544 and AWS A5.9.

Wire electrode surface:
Smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-WIRE 309LNb

Classification:

EN ISO 14343-A	– **S 23 12 Nb**
SFA-5.9 / AWS A5.9	– **ER(309LNb)**

Typical analysis and chemical composition acc. to EN ISO 14343-A and AWS A5.9: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	Nb	P	S	Cu total
Typical analysis BA-WIRE 309LNb	0.018	0.3	1.9	0.1	12.5	24.0	0.8	0.020	0.013	0.15
S 23 12 Nb acc. to ISO 14343-A	0.08	1.0	1.0–2.5	0.5	11.0–14.0	22.0–25.0	10x%C–1.0	0.03	0.02	0.5
ER(309LNb) acc. to AWS A5.9	0.03	0.30-0.65	1.0–2.5	0.75	12.0–14.0	23.0–25.0	10x%C–1.0	0.03	0.03	0.75

Application:
BA-WIRE 309LNb is a submerged arc welding wire niobium-stabilized similar to BA-WIRE 309L with the addition of Nb. Suitable for overlay on carbon and low-alloy steels, when a type 347 overlay is required.

Base Materials:
- Steel cladding when chemistry of AISI 347 or AISI 321 is required for the first layer. Overlay welding of 2.25Cr-1Mo steels.
  Suitable fluxes: BF 38, WP 380

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
1.6 – 4.0 mm; sizes and tolerances acc. to ISO 544 and AWS A5.9.

Wire electrode surface:
Smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-WIRE 310

Classification:

EN ISO 14343-A	– **S 25 20**
SFA-5.9 / AWS A5.9	– **ER310**

Typical analysis and chemical composition acc. to EN ISO 14343-A and AWS A5.9: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Cu total
Typical analysis BA-WIRE 310	0.12	0.3	1.9	0.1	21.0	26.0	0.015	0.013	0.2
S 25 20 acc. to ISO 14343-A	0.08–0.15	2.0	1.0–2.5	0.5	18.0–22.0	24.0–27.0	0.03	0.02	0.5
ER310 acc. to AWS A5.9	0.08–0.15	0.30–0.65	1.0–2.5	0.75	20.0–22.5	25.0–28.0	0.03	0.03	0.75

Application:
BA-WIRE 310 is a submerged arc welding wire used for joining heat resistant fully austenitic steels type 25Cr/20Ni. Service temperature up to 1,100 °C in air and up to 1,050 °C in oxidizing sulphurous atmospheres and in reducing sulphurous atmospheres up to 650 °C. Service temperatures between +650 and +900 °C should be avoided due to the risk of embrittlement.

Base Materials:
- Austenitic steels:
  1.4841/ X15CrNiSi25-20, 1.4845/ X12CrNi25-21, 1.4828/ X15CrNiSi20-12,
  1.4840 /G-X15CrNi25-20, 1.4846/ G-X40CrNi25-21, 1.4826/ G-X40CrNiSi22-9
- Ferritic-perlitic steels:
  1.4713/ X10 CrAl7, 1.4724/ X10CrAl13, 1.4742/ X10CrAl18, 1.4762/ X10CrAl25,
  1.4710/ G-X30CrSi6, 1.4740/ G-X40CrSi17 AISI 305, 310, 314; ASTM A297 HF; A297 HJ
  Suitable fluxes: BF 38, WP 380

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
1.6 – 3.2 mm; sizes and tolerances acc. to ISO 544 and AWS A5.9.

Wire electrode surface:
Smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-WIRE 316H

Classification: SFA-5.9 – **ER316H**

Typical analysis and chemical composition acc. to AWS A5.9: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Cu total
Typical analysis BA-WIRE 316H	0.05	0.45	1.7	2.5	12.3	19.0	0.020	0.013	0.15
ER316H acc. to AWS A5.9	0.04–0.08	0.30–0.65	1.0–2.5	2.0–3.0	11.0–14.0	18.0–20.0	0.03	0.03	0.75

Application:
BA-WIRE 316H is a submerged arc welding wire intended for welding austenitic stainless steels that will operate at high temperatures of 500 – 800 °C, under long term creep conditions. BA-WIRE 316H is also suitable for welding 321/321H and 347/347H grades in high temperature service. Recommended for welding steam piping, superheater headers for the petrochemical industry and power plants.

Base Materials:
- 316/316H, CF10M, BS 316S51, 316S52, 316S53, 316C16, 316C71, UNS S31609
  Suitable fluxes: BF 38, WP 380

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
1.6 – 4.0 mm; sizes and tolerances acc. to ISO 544 and AWS A5.9.

Wire electrode surface:
Smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-WIRE 316L

Classification:

EN ISO 14343-A	– **S 19 12 3 L**
SFA-5.9	– **ER316L**

Typical analysis and chemical composition acc. to EN ISO 14343-A and AWS A5.9: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Cu total
Typical analysis BA-WIRE 316L	0.015	0.4	1.7	2.7	12.0	19.0	0.020	0.013	0.15
S 19 12 3 L acc. to ISO 14343-A	0.03	0.65	1.0–2.5	2.5–3.0	11.0–14.0	18.0–20.0	0.03	0.02	0.5
ER316L acc. to AWS A5.9	0.03	0.30–0.65	1.0–2.5	2.0–3.0	11.0–14.0	18.0–20.0	0.03	0.03	0.75

Application:
BA-WIRE 316L is a submerged arc welding wire intended for welding austenitic stainless steels 1.4435 / 316L. Suitable for service temperature from –120 °C to +400 °C.

Base Materials:
- 1.4401/X5CrNiMo17-12-2, 1.4404/X2CrNiMo17-12-2, 1.4435/X2CrNiMo18-14-3, 1.4436/X3CrNiMo17-13-3, 1.4571/X6CrNiMoTi17-12-2, 1.4580/X6CrNiMoNb17-12-2, 1.4583/X10CrNiMoNb18-12, 1.4409/GX2CrNiMo 19-11-2 UNS S31653; AISI 316L, 316Ti, 316Cb
  Suitable fluxes: BF 38, WP 380

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
1.6 – 4.0 mm; sizes and tolerances acc. to ISO 544 and AWS A5.9.

Wire electrode surface:
Smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-WIRE 317L

Classification:

EN ISO 14343-A	– **S 19 13 4 L**
SFA-5.9	– **ER317L**

Typical analysis and chemical composition acc. to EN ISO 14343-A and AWS A5.9: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Cu total
Typical analysis BA-WIRE 317L	0.015	0.5	1.9	3.6	13.7	19.0	0.015	0.013	0.1
S 19 13 4 L acc. to ISO 14343-A	0.03	1.0	1.0–5.0	3.0–4.5	12.0–15.0	17.0–20.0	0.03	0.02	0.5
ER317L acc. to AWS A5.9	0.03	0.30–0.65	1.0–2.5	3.0–4.0	13.0–15.0	18.5–20.5	0.03	0.03	0.75

Application:
BA-WIRE 317L is a submerged arc welding wire intended for welding 19Cr/13Ni/3.5Mo austenitic stainless steels type 317L. The increased Mo content compared to grade 316L assures increased resistance to pitting and crevice corrosion. Also suitable for the welding of 316 or 316L or grade 316LN when it is necessary to provide better pitting corrosion resistance. Suitable for service temperatures from –60 °C to +300 °C.

Base Materials:
- 1.4435/ X2CrNiMo18-14-3, 1.4429/ X2CrNiMoN17-13-3, 1.4438/ X 2 CrNiMo 18-15-4 AISI 316L, 316 LN, 317LN, 317L.
  Suitable fluxes: BF 38, WP 380

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
1.6 – 4.0 mm; sizes and tolerances acc. to ISO 544 and AWS A5.9.

Wire electrode surface:
Smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-WIRE 318

Classification:

EN ISO 14343-A	– **S 19 12 3 Nb**
SFA-5.9	– **ER318**

Typical analysis and chemical composition acc. to EN ISO 14343-A and AWS A5.9: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	Nb	P	S	Cu total
Typical analysis BA-WIRE 318	0.03	0.45	1.4	2.6	11.5	19.0	0.60	0.015	0.013	0.1
S 19 12 3 Nb acc. to ISO 14343-A	0.08	0.65	1.0–2.5	2.5–3.0	11.0–14.0	18.0–20.0	10x%C–1.0	0.03	0.02	0.5
ER318 acc. to AWS A5.9	0.08	0.30–0.65	1.0–2.5	2.0–3.0	11.0–14.0	18.0–20.0	8x%C–1.0	0.03	0.03	0.75

Application:
BA-WIRE 318 is a submerged arc welding wire intended for welding 19Cr/12Ni/3Mo stabilized Ti grades like 1.4571/316Ti. Also suitable for the welding of similar unstabilized grades 316 or 316L. BA-WIRE 318 is suitable for service temperatures from –120 °C to +400 °C and has high resistance to intergranular corrosion.

Base Materials:
- 1.4571/ X6CrNiMoTi17-12-2, 1.4580/ X6CrNiMoNb17-12-2, 1.4401/ X5CrNiMo17-12-2, 1.4581/ GX5CrNiMoNb19-11-2, 1.4437/ GX6CrNiMo18-12, 1.4583/ X10CrNiMoNb18-12, 1.4436/ X3CrNiMo17-13-3 AISI 316L, 316Ti, 316Cb
  Suitable flux: WP 380

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
1.6 – 4.0 mm; sizes and tolerances acc. to ISO 544 and AWS A5.9.

Wire electrode surface:
Smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-WIRE 320LR

Classification: SFA-5.9 – **ER320LR**

Typical analysis and chemical composition acc. to AWS A5.9: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	Nb	P	S	Cu total
Typical analysis BA-WIRE 320LR	0.015	0.1	1.6	2.5	34.20	19.70	0.25	0.010	0.009	3.5
ER320LR acc. to AWS A5.9	0.025	0.15	1.5–2.0	2.0–3.0	32.0–36.0	19.0–21.0	8x%C–0.40	0.015	0.02	3.0–4.0

Application:
BA-WIRE 320LR is a submerged arc welding wire intended for welding steels of similar composition in wrought and cast forms. BA-WIRE 320LR has composition similar to ER320, except that carbon, silicon, phosphorus and sulphur levels are kept at a lower level. The low melting residuals are limited in this alloy to reduce micro-fissuring. The weld metal provides exceptionally good corrosion resistance to a wide range of chemical environments.

Base Materials:
- ER320 stainless steels.
  Suitable fluxes: BF 38, WP 380

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
1.6 – 4.0 mm; sizes and tolerances acc. to ISO 544 and AWS A5.9.

Wire electrode surface:
Smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-WIRE 347

Classification:

EN ISO 14343-A	–	**S 19 9 Nb**
SFA-5.9	–	**ER347**

Typical analysis and chemical composition acc. to EN ISO 14343-A and AWS A5.9: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	Nb	P	S	Cu total
Typical analysis BA-WIRE 347	0.05	0.4	1.4	0.1	9.8	19.5	0.60	0.015	0.014	0.1
S 19 9 Nb acc. to ISO 14343-A	0.08	0.65	1.0–2.5	0.5	9.0–11.0	19.0–21.0	10x%C >1.0	0.03	0.02	0.5
ER347 acc. to AWS A5.9	0.08	0.30–0.65	1.0–2.5	0.75	9.0–11.0	19.0–21.5	10x%C >1.0	0.03	0.03	0.75

Application:
BA-WIRE 347 is a submerged arc welding wire intended for welding Ti or Nb stabilized 18Cr/10Ni with corrosion-resistant austenitic stainless steels, grades 321 and 347. Also suitable for the welding of similar unstabilized grades 304 or 304L. BA-WIRE 347 has high resistance to intergranular corrosion.

Base Materials:
- 1.4550/X6CrNiNb18-10, 1.4541/X6CrNiTi18-10, 1.4552/GX5CrNiNb19-11, 1.4301/X5CrNi18-10, 1.4312/GX10Cr- Ni18-8, 1.4546/X5CrNiNb18-10, 1.4311/X2CrNiN18-10, 1.4306/X2CrNi19-11
  AISI 347, 321, 302, 304, 304L, 304LN, ASTM A296 grade CF 8 C, A157 grade C9, A320 grade B8C or D
  Suitable flux: WP 380

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
1.6 – 4.0 mm; sizes and tolerances acc. to ISO 544 and AWS A5.9.

Wire electrode surface:
Smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-WIRE 385

Normbezeichnung:

EN ISO 14343-A	– **S 20 25 5 Cu L**
SFA-5.9	– **ER385**

Typical analysis and chemical composition acc. to EN ISO 14343-A and AWS A5.9: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Cu total
Typical analysis BA-WIRE 385	0.015	0.4	1.9	4.5	25.0	20.0	0.015	0.015	1.5
S 20 25 5 Cu L acc. to ISO 14343-A	0.03	1.0	1.0–4.0	4.0–6.0	24.0–27.0	19.0–22.0	0.03	0.02	1.0–2.0
ER385 acc. to AWS A5.9	0.025	0.50	1.0–2.5	4.2–5.2	24.0–26.0	19.5–21.5	0.02	0.03	1.2–2.0

Application:
BA-WIRE 385 is a submerged arc welding wire suitable for welding steels of grade 20Cr/25Ni/4.
5Mo/1.5Cu type (AISI 904L).
BA-WIRE 385 has high resistance to corrosion in severe, non-oxidising environments, sulphuric, phosphoric and other inorganic and organic acids, also good resistance to corrosion in concentrated nitric acid. Due to the low carbon, high alloy content of the wire the resistance to intergranular corrosion and stress corrosion cracking is increased, as well as a higher resistance to crevice and pitting corrosion when compared to standard grades AISI 304L and AISI 316L.
Suitable for some offshore applications, including overlays on mild and low alloy steels.

Base Materials:
- Similar Cr/Ni steels with high Mo content
  1.4539 /X1NiCrMoCu25-20-5, 1.4439/ X2CrNiMoN17-13-5, 1.4537/ X1CrNiMoCuN25-25-5 UNS N08904, S31726
  Suitable fluxes: BF 38, WP 380

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
1.6 – 4.0 mm; sizes and tolerances acc. to ISO 544 and AWS A5.9.

Wire electrode surface:
Smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-WIRE 410

Classification:

EN ISO 14343-A	– **S 13**
SFA-5.9	– **ER410**

Typical analysis and chemical composition acc. to EN ISO 14343-A and AWS A5.9: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Cu total
Typical analysis BA-WIRE 410	0.10	0.4	0.4	0.2	0.1	13.0	0.015	0.015	0.2
S 13 acc. to ISO 14343-A	0.15	1.0	1.0	0.5	0.5	12.0–15.0	0.03	0.02	0.5
ER410 acc. to AWS A5.9	0.12	0.5	0.6	0.75	0.6	11.5–13.5	0.03	0.03	0.75

Application:
Wire electrode for submerged arc welding intended for welding 13 % chromium steels. Service temperatures up to +450 °C.

Base Materials:
- 1.4006 X12Cr13, 1.4021 X20Cr13
  AISI 410, 420
  Suitable fluxes: BF 38, WP 380

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
1.6 – 4.0 mm; sizes and tolerances acc. to ISO 544 and AWS A5.9.

Wire electrode surface:
Smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-WIRE 410NiMo

Classification:

EN ISO 14343-A	– **S 13 4**
SFA-5.9	– **ER410NiMo**

Typical analysis and chemical composition acc. to EN ISO 14343-A and AWS A5.9: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Cu total
Typical analysis BA-WIRE 410NiMo	0.03	0.35	0.4	0.6	4.5	12.0	0.015	0.015	0.2
S 13 4 acc. to ISO 14343-A	0.05	1.0	1.0	0.4–1.0	3.0–5.0	11.0–14.0	0.03	0.02	0.5
ER410NiMo acc. to AWS A5.9	0.06	0.5	0.6	0.4–0.7	4.0–5.0	11.0–12.5	0.03	0.03	0.75

Application:
Wire electrode for submerged arc welding intended for welding martensitic 13 % chromium-nickel steels. Also used for overlaying mild and low alloy steels. Applications in turbines, valve bodies, high-pressure piping, offshore, and power generation.

Base Materials:
- 1.4407 (G-X5CrNiMo13-4); 1.4414 (G-X4CrNiMo13-4)
  1.4313 (X4CrNi13-4); 1.4413 (X3CrNiMo13-4)
  Suitable fluxes: BF 38, WP 380

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
1.6 – 4.0 mm; sizes and tolerances acc. to ISO 544 and AWS A5.9.

Wire electrode Surface:
Smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-WIRE 420

Classification: SFA-5.9 – **ER420**

Typical analysis and chemical composition acc. to AWS A5.9: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Cu total
Typical analysis BA-WIRE 420	0.30	0.35	0.45	0.20	0.25	13.0	0.02	0.02	0.3
ER420 acc. to AWS A5.9	0.25–0.40	0.5	0.6	0.75	0.6	12.0–14.0	0.03	0.03	0.75

Application:
Wire electrode for submerged arc welding often used for surfacing applications which need superior resistance to abrasion. It requires preheat and inter-pass temperatures of not less than 225 °C, followed by slow cooling. Post weld heat treatment is used to temper the weld deposit.
BA-WIRE 420 is similar to BA-WIRE 410, but with higher chromium and carbon content which increases the wear resistance.

Base Materials:
- AISI 420, X12Cr13: hardfacing results in higher hardness than with ER410.
  Suitable fluxes: BF 38, WP 380

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
1.6 – 4.0 mm; sizes and tolerances acc. to ISO 544 and AWS A5.9.

Wire electrode surface:
Smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-WIRE 430

Classification:

EN ISO 14343-A	– **S 17**
SFA-5.9	– **ER430**

Typical analysis and chemical composition acc. to EN ISO 14343-A and AWS A5.9: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	P	S	Cu total
Typical analysis BA-WIRE 430	0.04	0.35	0.5	0.1	0.1	16.5	0.015	0.015	0.2
S 17 acc. to ISO 14343-A	0.12	1.0	1.0	0.5	0.5	16.0–19.0	0.03	0.02	0.5
ER430 acc. to AWS A5.9	0.10	0.5	0.6	0.75	0.6	15.5–17.0	0.03	0.03	0.75

Application:
Wire electrode for submerged arc welding intended for welding ferritic and martensitic chromium steels with 15-17%Cr, AISI 430.Also suitable for surfacing gas, water and steam valves and fittings. Service temperatures up to +450 °C. Scaling resistant up to +950 °C.

Base Materials:
- Surfacing: all weldable backing materials, unalloyed and low-alloyed.
  Joining: corrosion resistant Cr-steels as well as other similar-alloyed steels with C-contents up to 0.20 %.
  1.4510 X3CrTi17
  AISI 430 Ti; AISI 431
  Suitable fluxes: BF 38, WP 380

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
1.6 – 4.0 mm; sizes and tolerances acc. to ISO 544 and AWS A5.9.

Wire electrode surface:
Smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-WIRE 2209

Classification:

EN ISO 14343-A	– **S 22 9 3 N L**
SFA-5.9	– **ER2209**

Typical analysis and chemical composition acc. to EN ISO 14343-A and AWS A5.9: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	N	P	S	Cu total
Typical analysis BA-WIRE 2209	0.015	0.5	1.6	3.3	9.1	23.0	0.16	0.015	0.012	0.1
S 22 9 3 N L acc. to ISO 14343-A	0.03	1.0	2.5	2.5–4.0	7.0–10.0	21.0–24.0	0.10–0.20	0.03	0.02	0.5
ER2209 acc. to AWS A5.9	0.03	0.90	0.5–2.0	2.5–3.5	7.5–9.5	21.5–23.5	0.08–0.20	0.03	0.03	0,75

Application:
BA-WIRE 2209 is a duplex stainless steel submerged arc welding wire suitable for welding duplex stainless steels grades 2205 and 2304. Weld metal exhibits corrosion resistance similar to grade 904L in most applications. BA-WIRE 2209 is also suitable to weld grade 2205 or grade 2304 to mild steel.

Base Materials:
- 1.4462/ X2CrNiMoN22-5-3, 1.4362/ X2CrNiN23-4,1.4462/ X2CrNiMoN22-5-3 with 1.4583/ X10CrNiMoNb18-12
  UNS S31803, S32205
  Suitable fluxes: BF 38SD, WP 380

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
1.6 – 4.0 mm; sizes and tolerances acc. to ISO 544 and AWS A5.9.

Wire electrode surface:
Smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-WIRE 2594NL

Classification:

EN ISO 14343-A	– **S 25 9 4 N L**
SFA-5.9	– **ER2594**

Typical analysis and chemical composition acc. to EN ISO 14343-A and AWS A5.9: (Weight Percent)

Wire electrode	C	Si	Mn	Mo	Ni	Cr	W	N	P	S	Cu total
Typical analysis BA-WIRE 2594NL	0.015	0.35	0.4	4.0	9.5	25.0	–	0.25	0.015	0.012	0.1
S 25 9 4 N L acc. to ISO 14343-A	0.03	1.0	2.5	2.5–4.5	8.0–10.5	24.0–27.0	1.0	0.20–0.30	0.03	0.02	1.5
ER2594 acc. to AWS A5.9	0.03	1.0	2.5	2.5–4.5	8.0–10.5	24.0–27.0	1.0	0.20–0.30	0.03	0.02	1.5

Application:
BA-WIRE 2594NL welding wire has been developed for welding super-duplex stainless steels 2507 and other super-duplex stainless steels. The wire has excellent resistance to stress corrosion (SCC) in chloride-bearing environments and excellent resistance to pitting and crevice corrosion. BA-WIRE 2594NL is also suitable for welding duplex stainless steel grade 2205 and corresponding duplex steels when high corrosion resistance is required.

Base Materials:
- UNS S32760 UNS J93380, 1.4508, 1.4501, ASTM A890 6A, ASTM A182 F55 ACI, CD3MWCuN, UNS 32750, 2507, UNS S32550, S32520, UNS S39274, UNS S32950, UNS J93404, 1.4469
  ASTM A890 5A, ACI CE3M
  Suitable flux: BF 38SD

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
1.6 – 3.2 mm; sizes and tolerances acc. to ISO 544 and AWS A5.9.

Wire electrode surface:
Smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-WIRE 82

Classification: EN ISO 18274 – **S Ni 6082**
SFA-5.14 – **ERNiCr-3**

Typical analysis and chemical composition acc. to EN ISO 18274 and AWS A5.14: (Weight Percent)

Wire electrode	Ni	Si	C	Cr	Mn	Ti	Fe	Nb	S	P	Cu total
Typical analysis BA-WIRE 82	Bal.	0.2	< 0.1	20.5	3.0	< 0.7	< 3.0	2.6	0.010	0.015	0.2
S Ni 6082 acc. to ISO 18274	> 67.0	0.5	0.10	18.0–22.0	2.5–3.5	0.7	3.0	2.0–3.0	0.015	0.020	0.5
ERNiCr-3 acc. to AWS A5.14	> 67.0	0.50	0.10	18.0–22.0	2.5–3.5	0.75	3.0	2.0–3.0	0.015	0.03	0.5

Application:
BA-WIRE 82 is a wire electrode for SA welding of nickel base alloys. The weld metal exhibits good mechanical properties with hot cracking resistance and high corrosion resistance, resistance to oxidation, as well as creep resistance at high temperatures.

Base materials:
- INCONEL alloys 600, 601, 690, INCOLOY 800 and 800HT and INCOLOY alloy 330, ASTM B 163, B 166, B 167 and B 168 having UNS number N06600.
- Surfacing of mild steel.
- Dissimilar welding of stainless steels to nickel alloys and carbon.
  Suitable fluxes: BF 38, WP 380

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
1.2 – 2.4 mm; sizes and tolerances acc. to ISO 544 and AWS A5.14.

Wire electrode surface:
Smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-WIRE 625

Classification:

EN ISO 18274	– **S Ni 6625**
SFA-5.14	– **ERNiCrMo-3**

Typical analysis and chemical composition acc. to EN ISO 18274 and AWS A5.14: (Weight Percent)

Wire electrode	Ni	Si	C	Cr	Mn	Ti	Fe	Nb	Al	Mo	S	P	Cu total
Typical analysis BA-WIRE 625	Bal.	0.2	< 0.1	22.0	0.2	0.1	1.0	3.5	0.1	9.0	0.010	0.014	0.2
S Ni 6625 acc. to ISO 18274	> 58.0	0.5	0.1	20.0-23.0	0.5	0.4	5.0	3.0–4.2	0.4	8.0–10.0	0.015	0.020	0.5
ERNiCrMo-3 acc. to AWS A5.14	> 58.0	0.50	0.10	20.0–23.0	0.5	0.40	5.0	Nb+Ta 3.15–4.15	0.40	8.0–10.0	0.015	0.020	0.50

Application:
BA-WIRE 625 welding wire has been developed for welding INCONEL alloy 625, INCOLOY alloy 825, INCOLOY alloy 25-6MO, alloy 20, welding the clad side of joints in steel with nickel-chromium molybdenum alloys, cladding steel with nickel-chromium molybdenum weld metal, surfacing of mild steel and for dissimilar welding of stainless steels to nickel alloys and carbon steels. The weld metal is highly resistant to stress corrosion cracking and pitting. BA-WIRE 625 is recommended for applications with service temperature range from cryogenic to 540 °C.

Base Materials:
- INCONEL alloy 625, INCOLOY alloy 825, INCOLOY alloy 25-6Mo, alloy 20, 9 % nickel steels. 2.4856 NiCr22Mo9Nb, 2.4858 NiCr21Mo, 2.4816 NiCr15Fe, 1.4583
- X10CrNiMoNb18-12, 1.4876 X10NiCrAlTi32-20H, 1.4876 X10NiCrAlTi32-20, 1.4529 X1NiCrMoCuN25-20-7, X2CrNiMoCuN20-18-6, 2.4641 NiCr- 21Mo6Cu
- ASTM B 443, B 444, B 446 having UNS number N06625.

Suitable fluxes: BF 38, WP 380

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

Diameter:
1.2 – 2.0 mm; sizes and tolerances acc. to ISO 544 and AWS A5.14.

Wire electrode surface:
Smooth finish free from surface defects and foreign matter.

Solid Wire Electrode for Submerged Arc Welding

BA-WIRE 276

Classification:

EN ISO 18274	–	**S Ni 6276**
SFA-5.14	–	**ERNiCrMo-4**

Typical analysis and chemical composition acc. to EN ISO 18274 and AWS A5.14: (Weight Percent)

Wire electrode	Ni	Si	C	Cr	Mn	W	Fe	Co	V	Mo	S	P	Cu total
Typical analysis BA-WIRE 276	58.0	0.03	0.008	15.8	0.4	3.7	5.8	0.09	0.06	15.7	0.004	0.005	0.03
S Ni 6276 acc. to ISO 18274	> 50.0	0.08	0.02	14.5–16.5	1.0	3.0–4.5	4.0–7.0	2.5	0.3	15.0–17.0	0.015	0.020	0.5
ERNiCrMo-4 acc. to AWS A5.14	Bal.	0.08	0.02	14.5–16.5	1.0	3.0–4.5	4.0–7.0	2.5	0.35	15.0–17.0	0.03	0.04	0.50

Application:
BA-WIRE 276 welding wire has been developed for welding INCONEL alloy C-276 and other nickel-chromium molybdenum alloys, cladding steel, welding carbon steel to nickel base alloys and stainless steels to nickel alloys. The weld metal is highly corrosion resistant and exhibits excellent resistance against pitting and crevice corrosion as well as high strength and toughness. Very good mechanical properties down to –196 °C.

Base Materials:
- INCONEL alloy C-276, ASTM B 574, B 575, B 619, B 622 and B 628 having UNS number N10276.
- 5 to 9 % Ni steels for cryogenic service.

Suitable fluxes: BF 38, WP 380

Flux type suitability is strongly dependent on its application. In combination with the wire electrode the most suitable flux should match the requirements of the plate material as closely as possible under the existing welding conditions. Further information can be obtained from the technical flux data sheets.

Package forms:
Coils, spools, drums and spiders as standard package forms for SAW-wire electrodes, different package forms on request.

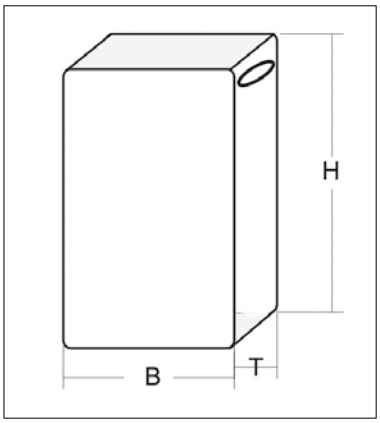
Diameter:
1.2 – 2.0 mm; sizes and tolerances acc. to ISO 544 and AWS A5.14.

Wire electrode surface:
Smooth finish free from surface defects and foreign matter.

Packaging types for welding flux

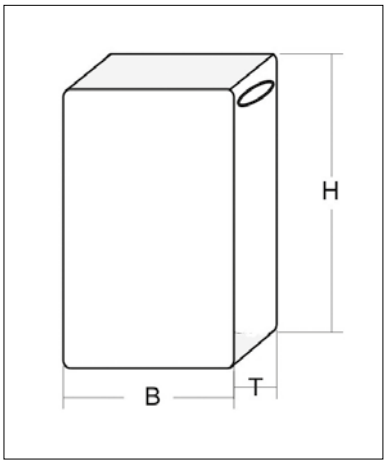
Plastic bag 25 kg

Material: Polyethylen (PE)
Measures: B 450 mm, H 500 mm, T 160 mm
Capacity: max. 25 kg



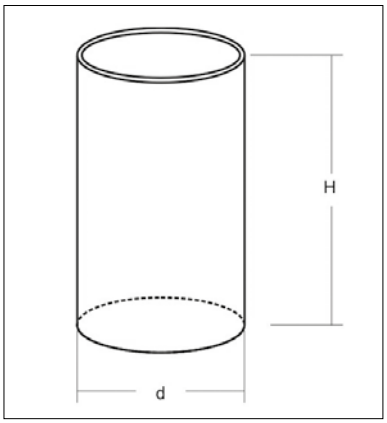
Aluminium bag 15 / 25 kg

Material: PE-coated Aluminium bag
Measures: B 370 mm, H 620 mm, T 100 mm
Capacity: max. 25 k



Drum 25 kg

Material: Steel
Measures: H 445 mm, d 300 mm
Capacity: max. 25 kg



Big Bag 400 – 625 kg and 1000 – 1250 kg

Material:
Polyprylene fabric (PP)

Big Bag (400-625 kg):
Measures: 910 mm x 910 mm x 600 mm

Big Bag (1000-1250 kg):
Measures: 910 mm x 910 mm x 1200 mm

Big Bag with Alu-Inliner 400 – 600 kg and 1000 – 1250 kg

Material:
PP fabric with aluminium inliner

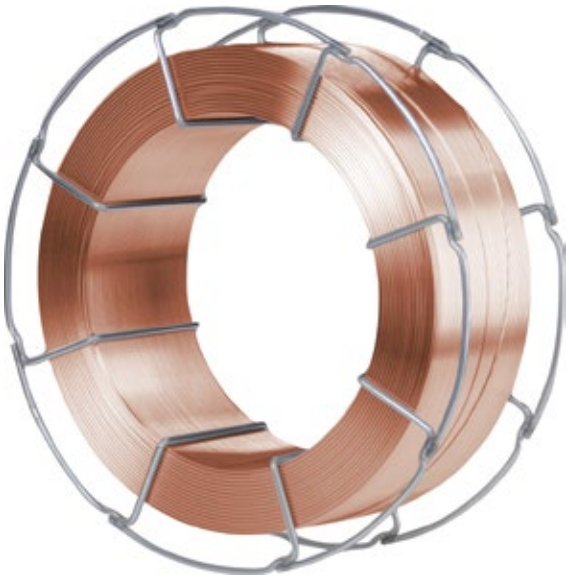
Big Bag (400-600 kg):
Measures: 910 mm x 910 mm x 650 mm

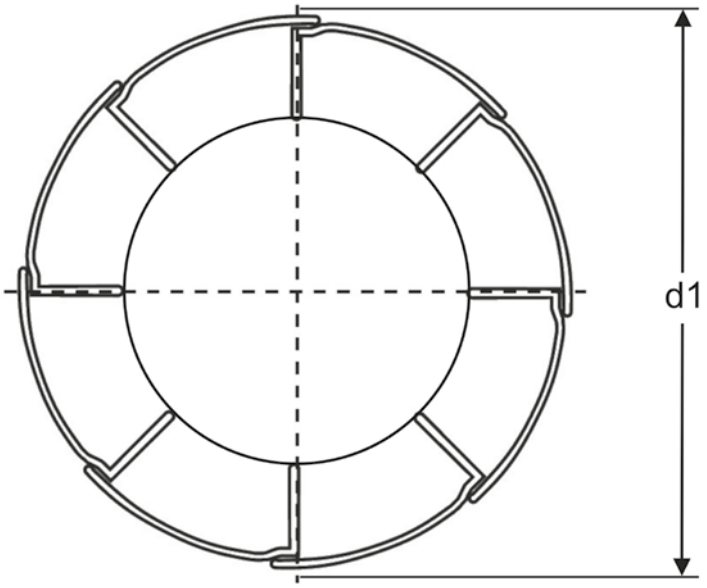
Big Bag (1000-1250 kg):
Measures: 910 mm x 910 mm x 1250 mm

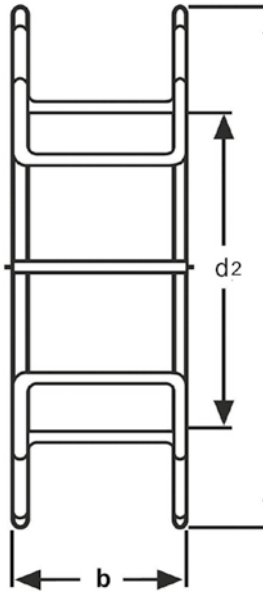
Packaging types for wire electrodes

Spool B300 / BS 300

Material: Steel wire/Aluminium wire





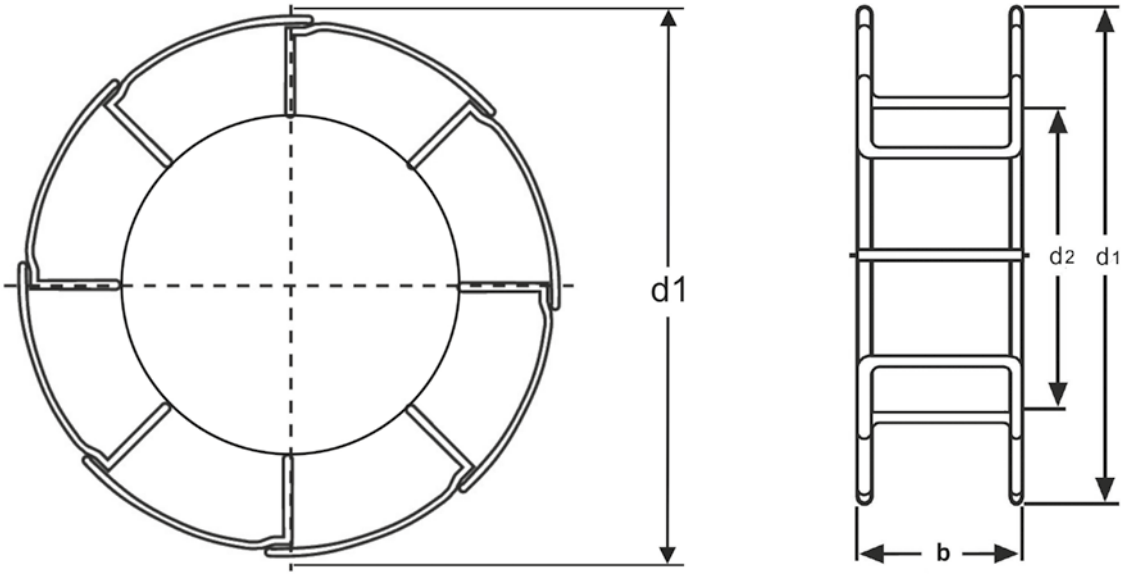


Description	EN ISO 544	Outer Ø d1 in mm	Inner Ø d2 in mm	Other Diam. in mm	Width b in mm	Weight approx. kg
Basket spool	B 300	300	180		100	15/18/20
Basket spool	BS 300	300	51.5		100	7/15/18/20

Spool for solid and metal-powder cored wire electrodes (wire Ø 1.2-5.0 mm)

Spool K415

Material: Steel wire

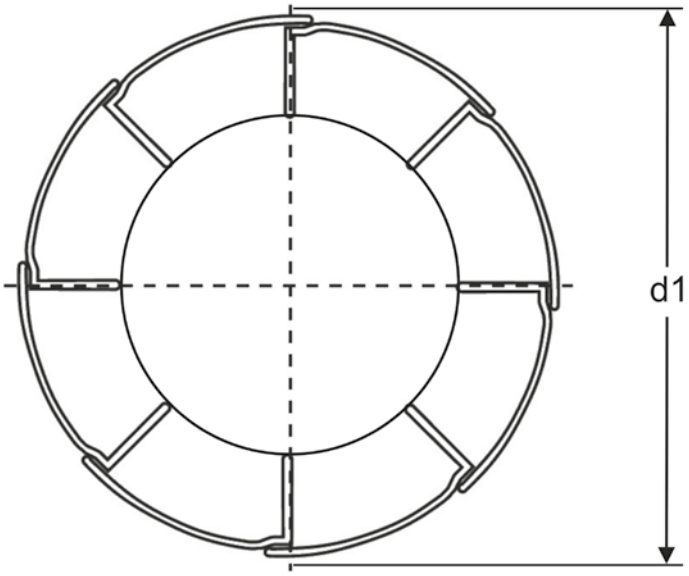


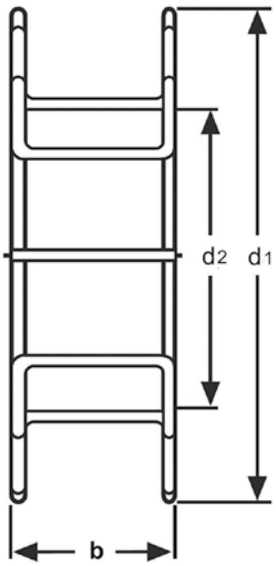
Description	EN ISO 544	Outer Ø d1 in mm	Inner Ø d2 in mm	Width b in mm	Weight approx. kg
Basket spool	B 450	415	308	103	20/25/30

Spool for solid and metal-powder cored wire electrodes (wire Ø: 1.2 – 5.0 mm)

Spool K435/70
K435/100

Material: Steel wire



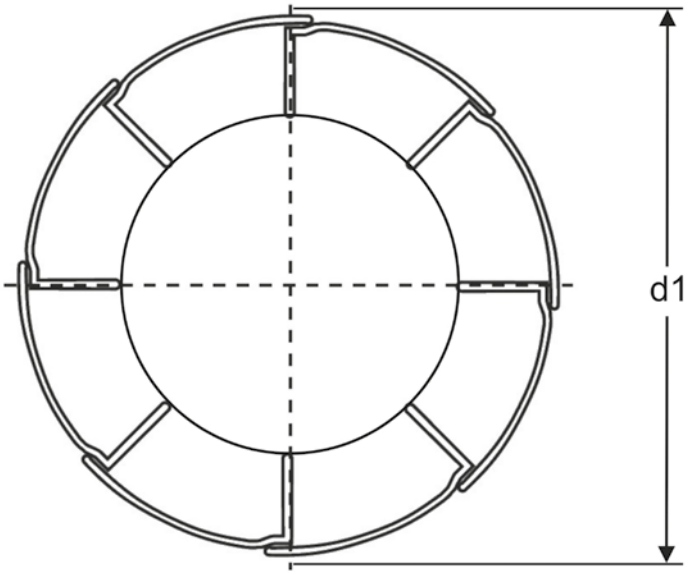


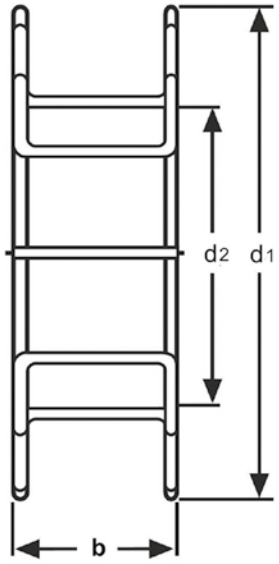
Description	EN ISO 544	Outer Ø d1 in mm	Inner Ø d2 in mm	Width b in mm	Weight approx. kg
Basket spool	B 435	435	300	70	15/20/25
Basket spool	B 435	435	300	100	20/25/30

Spool for solid and metal-powder cored wire electrodes (wire Ø 1.2-5.0 mm)

Spool K570

Material: Steel wire



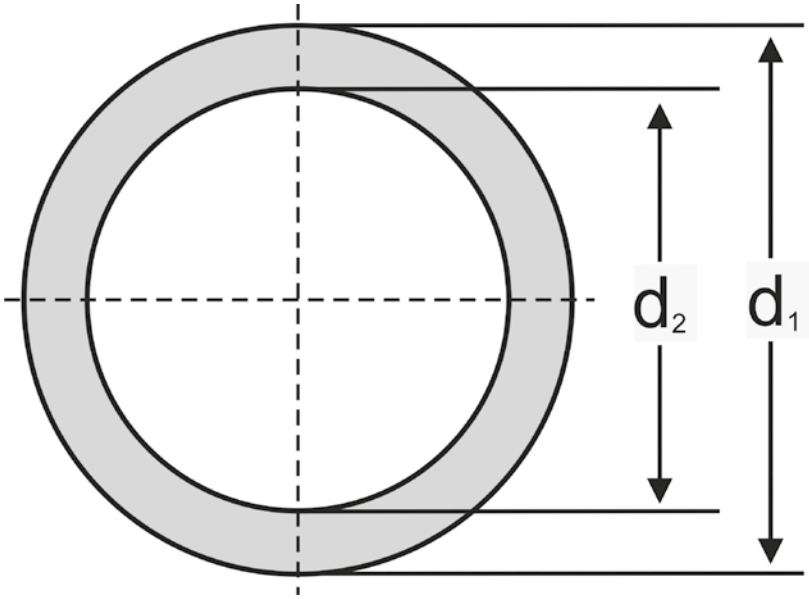


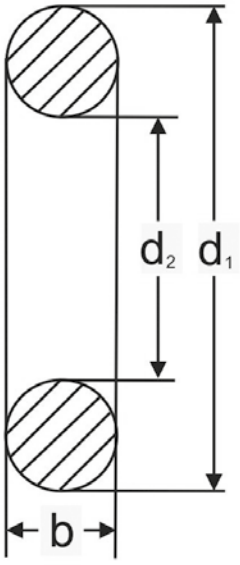
Description	Outer-Ø d1 in mm	Inner-Ø d2 in mm	Width b in mm	Weight approx. kg
Basket Spool	760	570	115	90-100

Spool for solid and metal-powder cored wire electrodes (wire Ø 1.2-5.0 mm)

Coil R282 / E300

Material: -



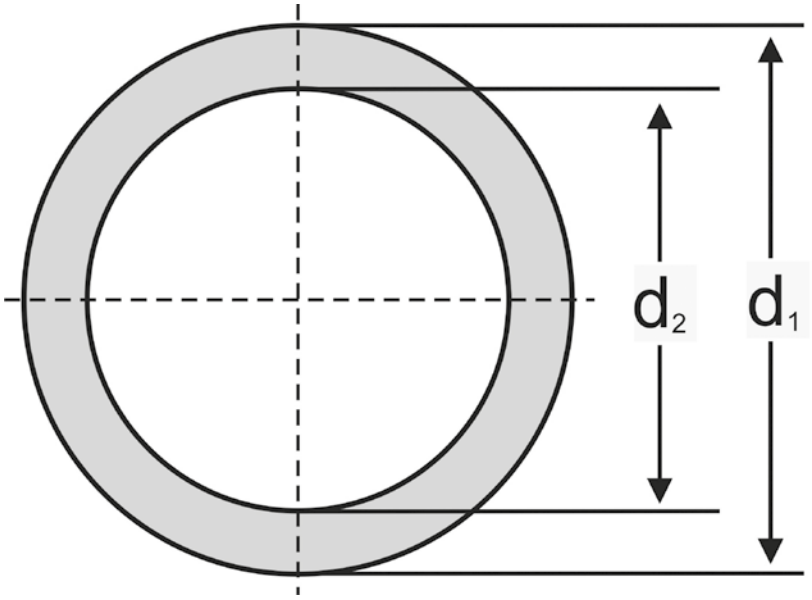


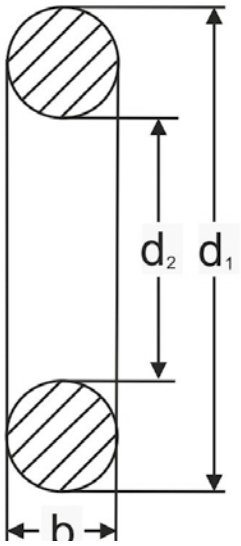
Description	Outer-Ø d1 in mm	Inner-Ø d2 in mm	Width b in mm	Weight approx. kg
Coil	282	-	65 without cardboard core	20
Coil	300	-	95	50

Coil for solid and metal-powder cored wire electrodes (wire Ø 1.2-5.0 mm)

Coil E 570

Material: -



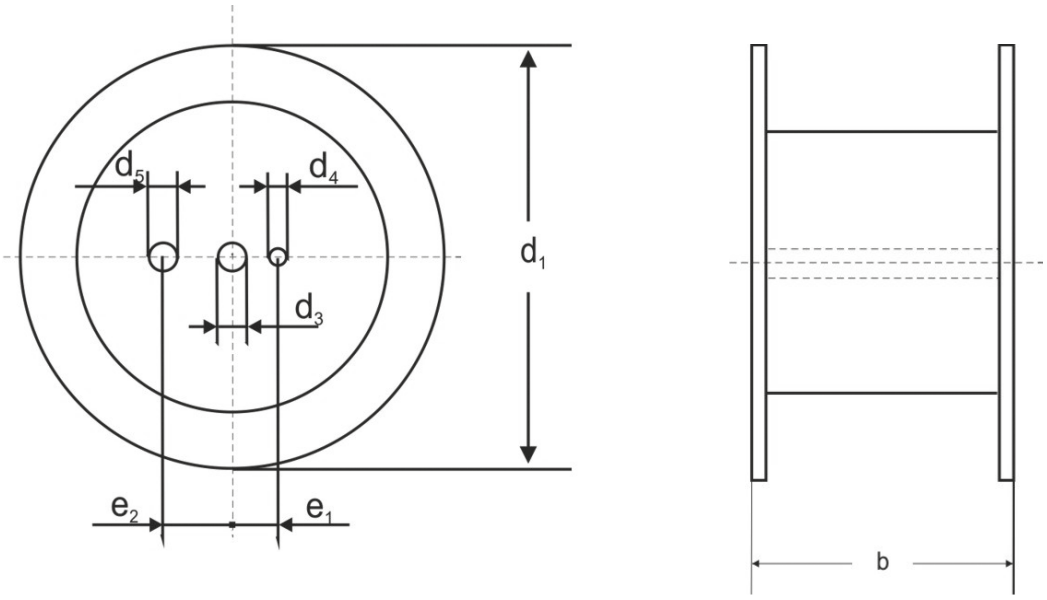


Description	Outer Ø d1 in mm	Inner Ø d2 in mm	Width b in mm	Weight approx. kg
Coil	800	570	100	90-100

Coil for solid and metal-powder cored wire electrodes (wire Ø 1.2-5.0 mm)

Spool G 300

Material: Wood, steel

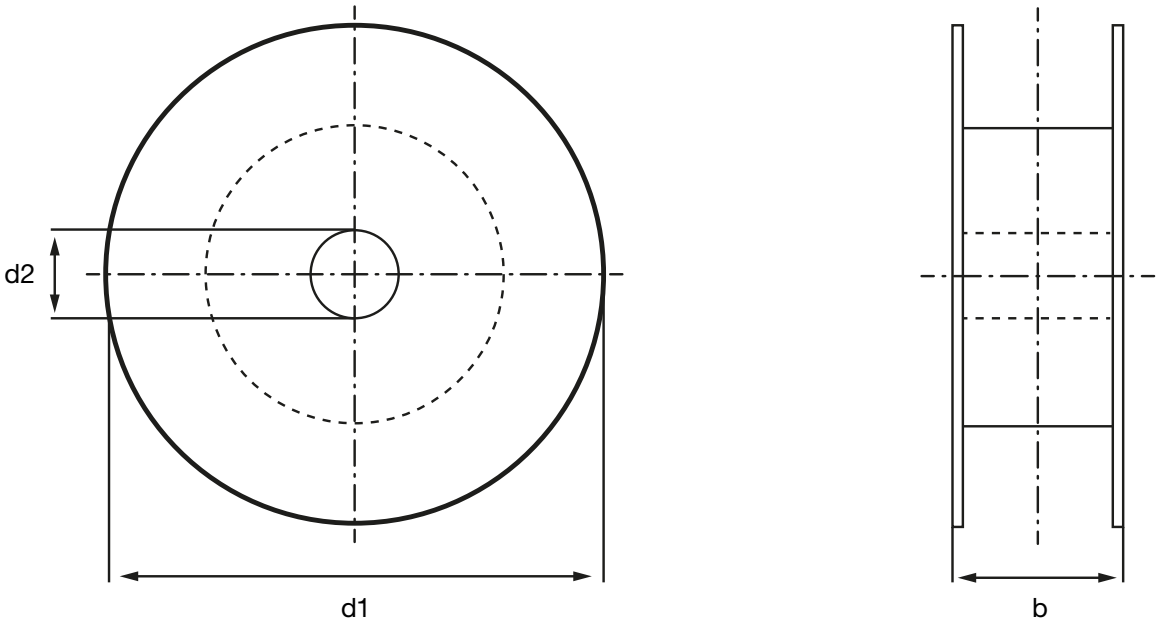


Description	EN ISO 544	Outer Ø d1 in mm	Inner Ø d2 in mm	Width b in mm	Other measures in mm	Weight approx. kg
Spool	S 760 E	760	-	290	d_3=40.5/d_4=25/d_5=35 e_1=65/e2=110	250/450
Spool	S 760 A	760	-	345	d_3=35/d_4=16,7/d_5=16.7 e_1=63.5/e2=63.,5	250/450

Spool for solid and metal-powder cored wire electrodes (wire Ø 1.2-5.0 mm)

Plastic Spool S 200

Material: Steel wire/Aluminium wire

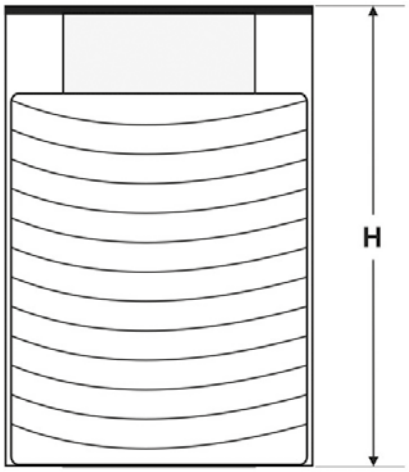


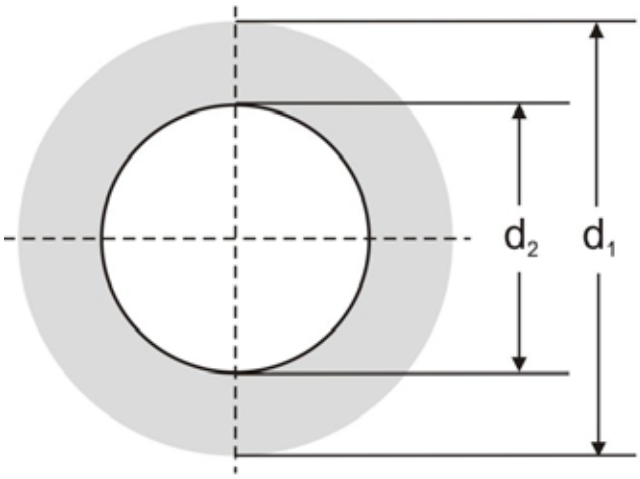
Description	EN ISO 544	Outer Ø d1 in mm	Inner Ø d2 in mm	Width b in mm	Weight approx. kg
Plastic spool	S 200	200	50,5	55	2/5

Spool for solid and metal-powder cored wire electrodes (wire Ø: 0,8 – 1,6 mm)

Pop drum

Material: Cardboard core



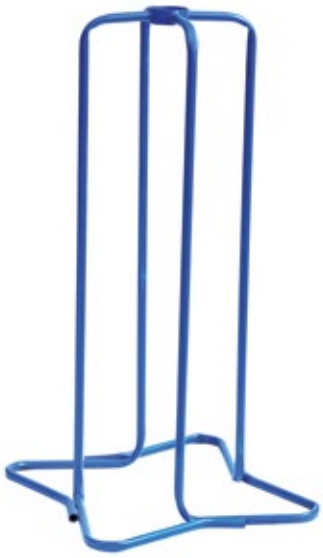


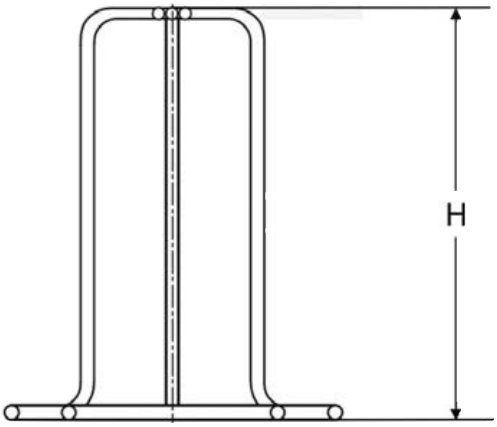
Outer Ø d_1 in mm	Inner Ø d_2 in mm	Height H in mm	Weight approx. kg
800	500	900	550
800	500	1350	850-1000

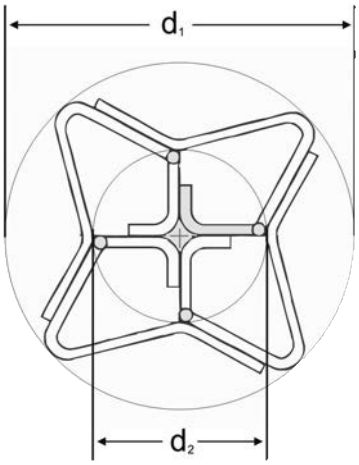
Pop Drum for solid and metal-powder cored wire electrodes (wire Ø 1.2 – 5.0 mm)

Spider (one way)

Material: Steel





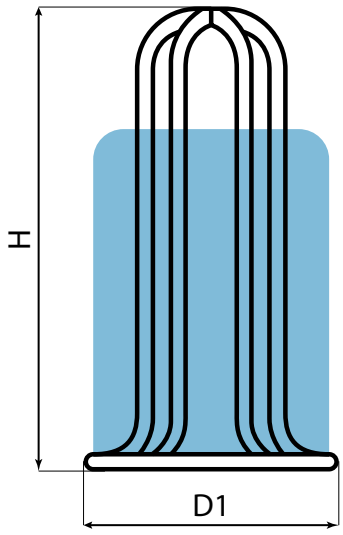


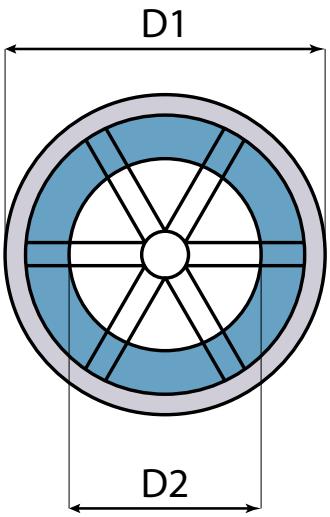
Outer Ø d_1 in mm	Inner Ø d_2 in mm	Height H in mm	Weight approx. kg
950	500	1400	max. 1250

Spider for solid and metal-powder cored wire electrodes (wire Ø 1.2-5.0 mm)

Spider (multi use)

Material: Steel



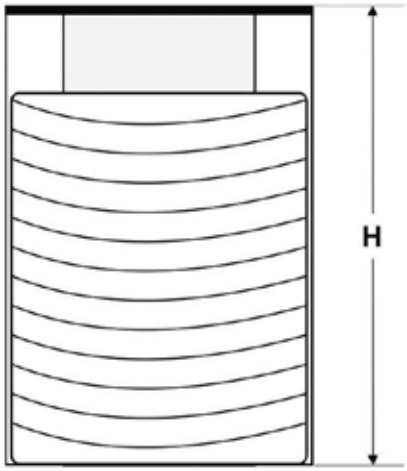


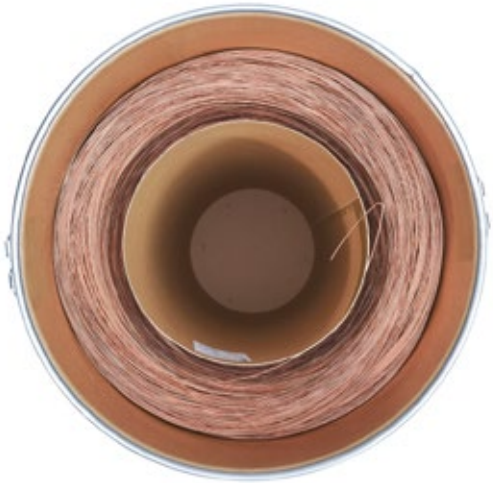
Outer Ø d1 in mm	Inner Ø d2 in mm	Height H in mm	Weight approx. kg
900	480	1600	max. 1250

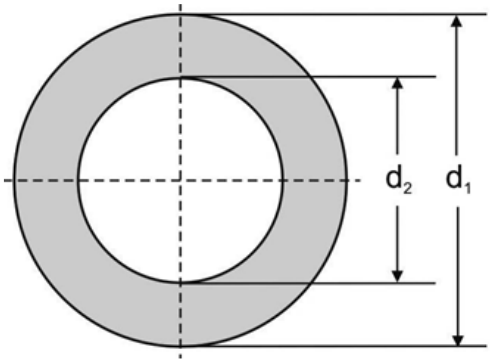
Spider for solid and metal-powder cored wire electrodes (wire Ø 1.2 – 5.0 mm)

Drum

Material: Cardboard





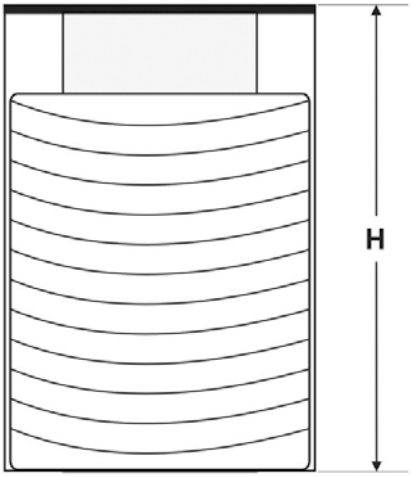


Outer Ø d1 in mm	Inner Ø d2 in mm	Height H in mm	Weight approx. kg
570	315	1000	max. 400

Drum for solid and metal-powder cored wire electrodes (wire Ø: 2.4 – 5.0 mm)

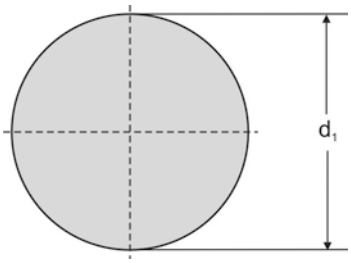
Round Drum

Material: Cardboard



Picture of self-winding spool (wire Ø: ≤ 2.0 mm)

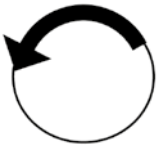
Outside Ø d1 in mm	Height H in mm	Weight approx. kg
750	950	max. 750



Decoiling directions for spiders and drums available clockwise or anti-clockwise:

Please mark when ordering:

clockwise



anti-clockwise

Packaging can be adjusted on request.

Packaging types for solid wire rods for TIG welding

Cardboard packaging

Material: Steel wire/Aluminium wire

Description	EN ISO 544	Length in mm	Height in mm	Width in mm	Weight approx. kg
Cardboard box	–	1.035	43	58	2,5/5

Cardboard box for solid wire rods (wire Ø: 1,0 – 4,0 mm)

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