



**WELDING CONSUMABLES  
FOR THE OFFSHORE INDUSTRY**

Since BÖHLER WELDING is one of the pioneer suppliers of arc welding consumables the dedication to sophisticated applications became apparent very soon.

So when oil and gas production from offshore fields took a greater significance, BÖHLER WELDING started to engage and take interest in this emerging business.

Enormous elemental forces and an aggressive environment demand from the engineers courage and inventiveness. BÖHLER WELDING faces this very challenge alongside the leading fabricators for the offshore industry.

BÖHLER WELDING has achieved a world leading position in advanced welding technology for duplex stainless steels and other corrosion resistant alloys, which are of increasing importance for

today's main offshore applications, from the wellhead to the topside.

BÖHLER WELDING consumables are world-famous for onshore pipeline joints and fabrication. They are also well established and qualified in the field of reeled offshore subsea pipeline laying from barges.

A wide range of state-of-the-art electrodes and wires are shown on page 7 of this brochure.

Specific customer and process requirements can be met with regards to documentation, certification, testing, packing and marking of products.

Contact us for more detailed information.

**BÖHLER WELDING consumables are available in moisture resistant and hermetically sealed packs.**





# Welding solutions for all offshore applications

## Platform Topside

The product range of BÖHLER WELDING encompasses a well balanced and homogenous inventory of welding consumables for the welding of mild steels, high strength low alloy steels, standard and super austenitic stainless steels, duplex and super duplex stainless steels as well as for nickel base, copper base, nickel and titanium alloys.

## Pipelines

The extensive range includes: cellulosic and basic vertical down electrodes, specifically designed electrodes for vertical up welding, solid and flux cored wires for the semi and fully automatic welding processes.

## Subsea Templates, Manifolds

An increasing number of deep-water projects require long-term corrosion resistance to prevent failures and repairs. BÖHLER WELDING provides the appropriate filler metals for subsea fabrication of components such as: pipespools, manifold systems, wellheads, umbilicals, pumps and valves.



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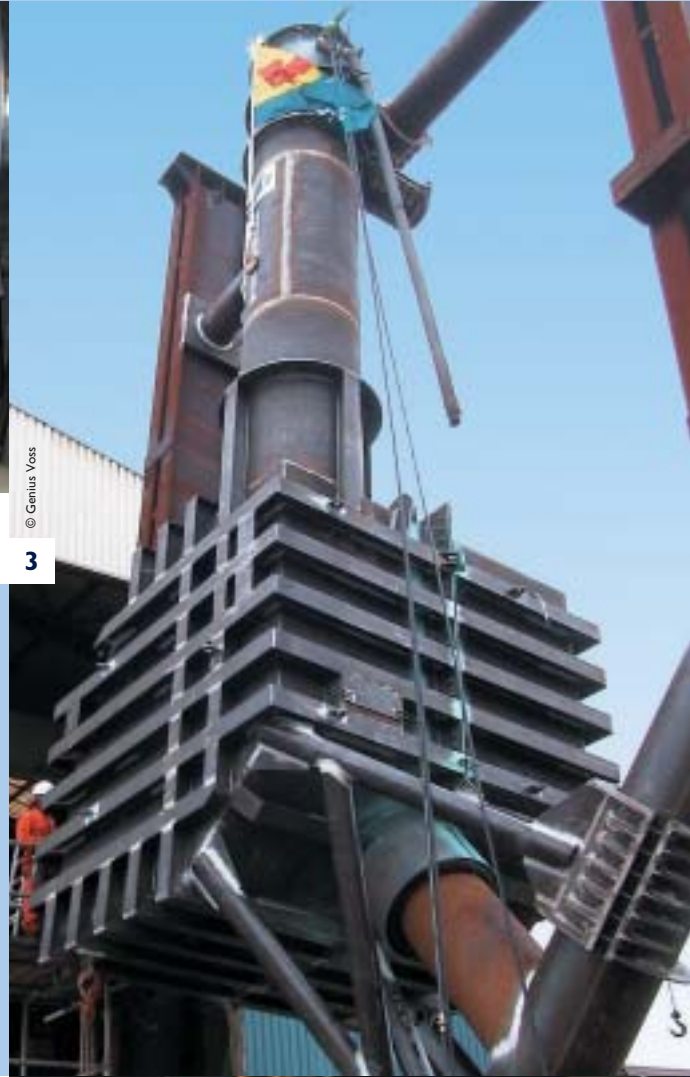
# References



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Lloyd's Register



ABS

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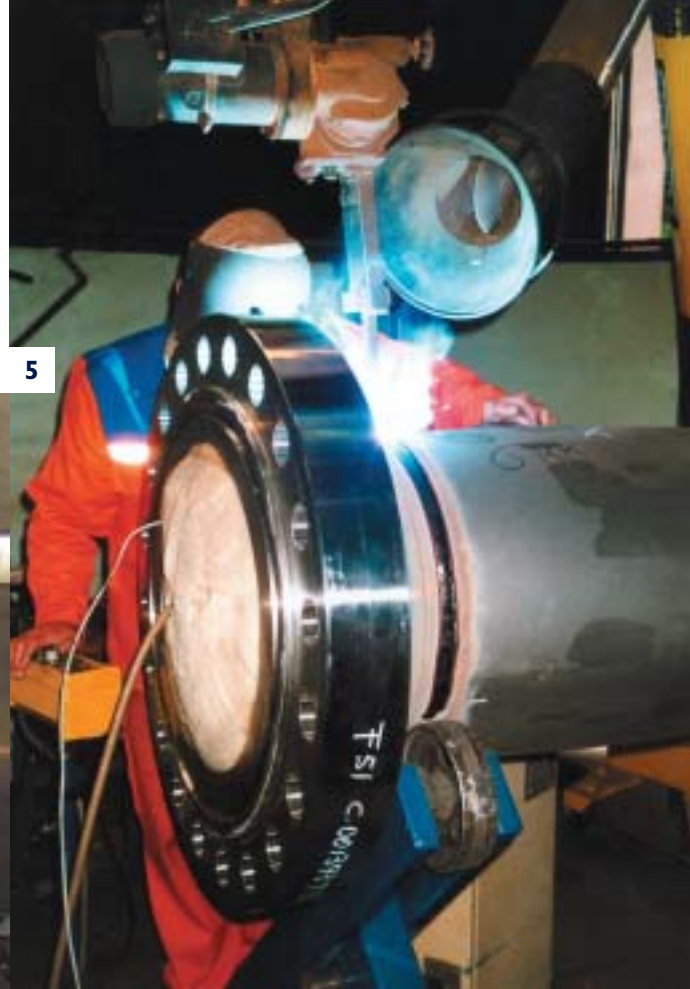


- 1 GTAW Welding duplex stainless steel 25Cr
- 2 Certificates
- 3 FCAW application on a high strength steel Cofferdam
- 4 GTAW application, Duplex stainless steel 22Cr
- 5 Duplex pipe/flange, FCAW cap layer



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# Welding consumables for high demanding industries

## Your renowned partner for the industry

BÖHLER WELDING provides a full range of welding consumables for all joint welding applications and steel base materials, with a particular focus on medium to high alloyed consumables and super alloys. Recommendations concerning benefits to customers resulting from expert operational advice have made BÖHLER WELDING products popular in exacting sectors such as offshore installations, pipeline construction, refineries and petrochemical plants, power stations and chemical plants.

You can choose from 240 BÖHLER WELDING consumable grades. And if need be, our technicians will develop new welding consumables tailored to your components.

## Comitted to quality and service

- The ingenious quality management system of BÖHLER WELDING is in compliance with EN ISO 9001:
- First class raw materials and exactly specified pre-materials with a certificate of origin are used.
- Well-trained and highly motivated staff works on state-of-the-art processing equipment.
- Environmental issues are being implemented in the production in accordance with EN ISO 14001
- The products are checked at pre-defined quality control checkpoints without a compromise and must pass the most stringent criteria.
- More than 1.500 approvals from authorities all over the world confirm the acceptance in the market.
- A comprehensive worldwide sales network of well-stocked partners ensures rapid and punctual delivery in more than 70 countries, on every continent.

Your nearest sales partner can be found on the Internet at <http://www.boehler-welding.com>



For all seasons





# Selection guide

	Welding processes						Page
	Base metal UNS/ASTM AISI/API	SMAW	FCAW	GTAW	GMAW	SAW	
<b>Mild steels</b> Re < 380 MPa	A106Gr.B	FOX EV 50	HL 51-FD	EML 5		EMS 2 + BB 400	8
<b>API Pipe steels</b>	API 5L-X52	FOX EV PIPE FOX BVD 85	Ti 52-FD	EML 5	SG 3-P	EMS 2 + BB 400	9,10 9
	API X56-X65	FOX BVD 85 FOX BVD 90 M	Ti 60-FD	I 52 Ni	SG 3-P (max. X60) K-Nova Ni	EMS 2 + BB 400	9,10 9,10
	API X60-X65	FOX EV 60 PIPE FOX BVD 85		I 52 Ni	K-Nova Ni		9,10 9
	API X70	FOX EV 70 PIPE FOX BVD 90			K-Nova Ni		9,10 9
<b>High strength steels</b> Re > 380 MPa	S420-S460	FOX EV 60	Ti 60-FD	EML 5	K-Nova Ni	3NiMo1-UP + BB 420TTR	11,12
	S500	FOX EV 65		I 52 Ni	K-Nova Ni	3NiMo1-UP + BB 420TTR	11,12
	AISI 4130	FOX EV 75			NiMo 1-IG	3NiMo1-UP + BB 420TTR	11,12
	S690Q	FOX EV 85		I 52 Ni (Root pass only)	NiCrMo2.5-IG	3 NiCrMo2.5-UP + BB 420TTR, BB 420TTRC	11,12
<b>Stainless steels</b> Martensitic 13Cr 4Ni		FOX CN 13/4 FOX CN 13/4 Supra	CN 13/4-MC	CN 13/4-IG	CN 13/4-IG		13 13
Austenitic 316L	S31600	FOX EAS 4 M-A FOX EAS 4 M	EAS 4 PW-FD EAS 4M-FD	EAS 4M-IG	EAS 4M-IG (Si)	EAS 4M-UP + BB 202	14 14
310	S31000	FOX FFB-A FOX FFB		FFB-IG	FFB-IG		15 15
904	N08904	FOX CN 20/25M-A FOX CN 20/25M		CN 20/25M-IG	CN 20/25M-IG (Si)		15 15
Type 6 Mo	S31254 N08926 N08367	FOX NIBAS 625	NIBAS 625-FD	NIBAS 625-IG	NIBAS 625-IG		16
Duplex 22Cr	S31803 S32205	FOX CN 22/9 N FOX CN 22/9 N-B	CN 22/9 PW-FD CN 22/9 N-FD	CN 22/9N-IG	CN 22/9N-IG	CN 22/9N-UP + BB 202	17 17
Superduplex 25Cr	S32550 S32750 S32760	FOX CN 25/9 CuT		CN 25/9 CuT-IG	CN 25/9 CuT-IG		18
Dissimilar joints		FOX CN 23/12-A FOX CN 23/12Mo-A FOX NIBAS 625 FOX NIBAS C 24	CN 23/12 PW-FD CN 23/12Mo PW-FD NIBAS 625 FD	CN 23/12-IG NIBAS 625-IG NIBAS C 24-IG	CN 23/12-IG CN 23/12-MC NIBAS 625-IG NIBAS C 24-IG	CN 23/12-UP + BB 202	19 19 20 20
<b>Nickel base alloys</b> Alloy 625 Alloy 59 Alloy C 276 Alloy 400 Alloy 600 Alloy 800/800HT	N06625 N06059 N10276 N04400 N06600 N08810	FOX NIBAS 625 FOX NIBAS C 24 FOX NIBAS C 276 FOX NIBAS 400 FOX NIBAS 70/20 FOX CN 21/33 Mn	NIBAS 625-FD    NIBAS 70/20-FD	NIBAS 625-IG NIBAS C 24-IG NIBAS C 276-IG NIBAS 400-IG NIBAS 70/20-IG CN 21/33 Mn-IG	NIBAS 625-IG NIBAS C 24-IG NIBAS C 276-IG NIBAS 400-IG NIBAS 70/20-IG CN 21/33 Mn-IG		21 21 22 21 22 22
<b>Non ferrous alloys</b> Copper base alloys Cu-Ni 90-10 Cu-Ni 70-30	C70600 C71500	FOX CuNi30 Fe		CuNi30 Fe-IG			23
Titanium Ti grade 2	R50400			ER Ti 2			23

# Mild steels

<b>BÖHLER</b> Standard AWS EN	<b>Welding process</b>	<b>Typical analysis</b>  %	<b>Typical mechanical properties</b>	<b>Sizes</b>  mm	<b>Characteristics and applications</b>
<b>FOX EV 50</b> E7018-1H4R E 42 5 B 4 2 H5	SMAW	C 0.07 Si 0.5 Mn 1.1	Re 490 N/mm <sup>2</sup> Rm 560 N/mm <sup>2</sup> A5 27 % Av 190 J 100 J...-50 °C	2.0 2.5 3.2 4.0 5.0 6.0	Basic electrode engineered for high quality welds in all positions except vertical down. Excellent impact strength at low temperature. Low hydrogen content (acc. AWS condition HD ≤ 4 ml/100 g weld metal). The electrode coating is resistant to moisture absorption.
<b>EML 5</b> ER70S-3 W 46 5 W2Si	GTAW	C 0.1 Si 0.6 Mn 1.2	Re 500 N/mm <sup>2</sup> Rm 600 N/mm <sup>2</sup> A5 26 % Av 220 J ≥47 J...-50 °C	1.6 2.0 2.4 3.0	GTAW welding rod for high requirements of weld metal impact strength down to -50 °C. Also for components subjected to galvanising after welding. Very popular rod for high integrity welds.
<b>Ti 52-FD</b> E71T-1H4 E71T-1MH8 T 46 2 P M 1 H10 T 42 2 P C 1 H5	FCAW	C 0.06 Si 0.5 Mn 1.2 Ti +	Re 490 N/mm <sup>2</sup> Rm 580 N/mm <sup>2</sup> A5 26 % Av 180 J 70 J...-46 °C	1.2 1.6	Rutile flux cored welding wire with fast freezing slag system. User friendly welding characteristics in all positions with one wire dia. 1.2 mm and same parameter setting. Excellent mechanical properties, easy slag removal, low spatter loss, smooth, finely rippled bead surface, high X-ray safety. The product performs to the highest productivity with significant savings in time and economical aspects when used for positional welding.
<b>HL 51-FD</b> E70C-6MH4 T 46 4 M M 2 H5	FCAW	C 0.07 Si 0.7 Mn 1.5	Re 490 N/mm <sup>2</sup> Rp 610 N/mm <sup>2</sup> A5 27 % Av 130 J 70 J...-46 °C (80% Ar/20% CO <sub>2</sub> )	1.2 1.6	Metal cored wire, high efficiency welding for automatic and semi-automatic joint welding of mild and fine-grained constructional steels. Induces steady spray arc droplet transfer with minimum spatter formation. Very little oxide formation permits the welding of several layers without the need for interlayer cleaning (HD ≤ 5 ml/100 g). Ideal for fillet welds. Provides 20% better productivity than MAG solid wire welding.
<b>EMS 2 + BB 400</b> F7A4-EM12K S 42 4 AB S2Si	SAW	C 0.07 Si 0.35 Mn 1.5	Re 420 N/mm <sup>2</sup> Rm 500 N/mm <sup>2</sup> A5 22 % Av 100 J ≥47 J...-46 °C	2.0 2.5 3.0 3.2 4.0	Wire/flux combination for welding of general purpose structural, fine grained and pipe steels. BB 400 is an agglomerated, aluminate basic type. It is characterized by its low Si and moderate Mn pickup. It is suitable on DC and AC.



# API Pipe steels

<b>BÖHLER</b> Standard AWS EN	<b>Welding process</b>	<b>Typical analysis</b> %	<b>Typical mechanical properties</b>	<b>Sizes</b> mm	<b>Characteristics and applications</b>
<b>FOX EV PIPE</b> E7016-1H4R E 42 4 B 1 2 H5	SMAW	C 0.06 Si 0.6 Mn 0.9 Ni 0.17	Re 470 N/mm <sup>2</sup> Rm 560 N/mm <sup>2</sup> A5 29% Av 170 J 55 J...-46 °C	2.0 2.5 3.2 4.0	Basic electrode excellent suited for vertical up welding of root passes using D.C. negative polarity as well as for filler and cover passes for pipes, tubes and plates on D.C. positive polarity, or even A.C. Good impact properties down to -46 °C. Low hydrogen content (HD ≤ 5 ml/100g).
<b>FOX EV 60 PIPE</b> E8016-GH4R E 50 4 1Ni B 1 2 H5	SMAW	C 0.07 Si 0.6 Mn 1.2 Ni 0.9	Re 550 N/mm <sup>2</sup> Rm 590 N/mm <sup>2</sup> A5 29% Av 170 J 60 J...-46 °C	2.5 3.2 4.0	Basic electrode excellent suited for vertical up welding of root passes using D.C. negative polarity as well as for filler and cover passes for pipes, tubes and plates on D.C. positive polarity, or even A.C. Good impact properties down to -46 °C. Low hydrogen content (acc. AWS condition HD ≤ 4 ml/100 g weld metal).
<b>FOX EV 70 PIPE</b> E9016-GH4R E 55 4 Z (Mn 2Ni Mo) B 1 2 H5	SMAW	C 0.06 Si 0.5 Mn 1.7 Ni 2.2 Mo 0.3	Re 620 N/mm <sup>2</sup> Rm 680 N/mm <sup>2</sup> A5 20% Av 140 J 55 J...-46 °C	2.5 3.2 4.0	Basic electrode excellent suited for vertical up welding of root passes using D.C. negative polarity as well as for filler and cover passes for pipes, tubes and plates on D.C. positive polarity, or even A.C. Good impact properties down to -46 °C. Low hydrogen content (acc. AWS condition HD ≤ 4 ml/100 g weld metal).
<b>FOX BVD 85</b> E8018-G E 46 5 1Ni B 4 5	SMAW	C 0.04 Si 0.4 Mn 0.9 Ni 0.9	Re 510 N/mm <sup>2</sup> Rm 560 N/mm <sup>2</sup> A5 27% Av 170 J 65 J...-50 °C	3.2 4.0 4.5	Basic electrode for vertical down welding of filler and cover passes. The weld deposit shows an ideal combination of high strength and cryogenic toughness down to -50 °C. Special design has enabled this electrode to provide exceptional striking characteristics and the avoidance of start porosity. Low hydrogen content.
<b>FOX BVD 90</b> E9018-G E 55 5 Z2Ni B 4 5	SMAW	C 0.04 Si 0.3 Mn 1.2 Ni 2.2	Re 600 N/mm <sup>2</sup> Rm 650 N/mm <sup>2</sup> A5 27% Av 170 J 80 J...-50 °C	3.2 4.0 4.5	Basic electrode for vertical down welding of filler and cover passes. The weld deposit shows an ideal combination of high strength and cryogenic toughness down to -50 °C. Special design has enabled this electrode to provide exceptional striking characteristics and the avoidance of start porosity. Low hydrogen content.
<b>FOX BVD 90 M</b> E9018-G E 50 4 1Ni B 4 5	SMAW	C 0.04 Si 0.25 Mn 0.9 Cr 0.3 Mo 0.13 Ni 0.9	Re >550 N/mm <sup>2</sup> Rp >630 N/mm <sup>2</sup> A5 >18% Av >120 J	4.0	Basic electrode for vertical down designed for the overmatching welding of pipe steel grades up to X65 according to API 5L. Special design has enabled this electrode to provide exceptional striking characteristics and the avoidance of start porosity. Low hydrogen content.
<b>EML 5</b> ER70S-3 W 46 5 W2Si	GTAW	C 0.1 Si 0.6 Mn 1.2	Re 500 N/mm <sup>2</sup> Rm 600 N/mm <sup>2</sup> A5 26% Av 220 J ≥47 J...-50 °C	1.6 2.0 2.4 3.0	GTAW welding rod for high requirements of weld metal impact strength down to -50 °C. Also for components subjected to galvanising after welding. Very popular rod for high integrity welds.
<b>I 52 Ni</b> ER80S-Ni1 (mod.) W3Ni1	GTAW	C 0.07 Si 0.7 Mn 1.4 Ni 0.9	Re 500 N/mm <sup>2</sup> Rm 600 N/mm <sup>2</sup> A5 25% Av 150 J 90 J...-50 °C	1.6 2.0 2.4	GTAW rod Ni-alloyed for welding of offshore pipe work and similar high integrity applications. High impact properties down to -50 °C.
<b>SG 3-P</b> ER70S-G G 46 5 M G0 G4 Si1 G 42 4 C G0 G4 Si1	GMAW	C 0.05 Si 0.75 Mn 1.5 Ti +	Re 510 N/mm <sup>2</sup> Rp 640 N/mm <sup>2</sup> A5 25% Av 120 J 55 J...-50 °C (80% Ar/20% CO <sub>2</sub> ) Re 470 N/mm <sup>2</sup> Rp 610 N/mm <sup>2</sup> A5 26% Av 100 J 60 J...-40 °C (100%CO <sub>2</sub> )	0.9	GMAW wire micro alloyed designed for high quality automatic welding of pipelines. An optimum balanced alloying concept ensures good weld metal properties to fulfil the high requirements in the on-offshore pipeline industry. The deposit is extremely crack resistant and the weld metal offers high impact values down to -50 °C.

# API Pipe steels

<b>BÖHLER</b> Standard AWS EN	<b>Welding process</b>	<b>Typical analysis</b>  %	<b>Typical mechanical properties</b>	<b>Sizes</b>  mm	<b>Characteristics and applications</b>
<b>K-Nova Ni</b>  ER80S-G G3Ni1	GMAW	C 0.06 Si 0.7 Mn 1.5 Ni 0.9 Ti +	Re 500 N/mm <sup>2</sup> Rp 590 N/mm <sup>2</sup> A5 24% Av 150J 80J...-50 °C (80% Ar/20% CO <sub>2</sub> )  Re 470 N/mm <sup>2</sup> Rp 560 N/mm <sup>2</sup> A5 25% Av 110J 45J...-50 °C (100% CO <sub>2</sub> )	0.9 1.0 1.14	GMAW wire micro alloyed designed for high quality automatic welding of pipelines. An optimum balanced alloying concept ensures good weld metal properties to fulfil the high requirements in the on-offshore pipeline industry. The deposit is extremely crack resistant and the weld metal offers high impact values down to -50 °C.
<b>Ti 60-FD</b>  E81T1-Ni1MH8 T 50 6 1Ni P M 1 H5	FCAW	C 0.06 Si 0.45 Mn 1.2 Ni 0.85	Re >500 N/mm <sup>2</sup> Rp >560 N/mm <sup>2</sup> A5 >19% Av >120J > 47J...-60 °C (80%Ar/20%CO <sub>2</sub> )	1.2 1.6	Rutile flux cored welding wire with fast freezing slag system which allows currents up to 250 A in positional welding. It operates in the spray arc transfer without any spatter formation. It provides an easy slag removal, smooth beads with good side wall wetting. Excellent impact properties down to -60 °C.
<b>EMS 2 + BB 400</b>  F7A4-EM12K S 42 4 AB S2Si	SAW	C 0.07 Si 0.35 Mn 1.5	Re 420 N/mm <sup>2</sup> Rm 500 N/mm <sup>2</sup> A5 22% Av 100J ≥47J...-46 °C	2.0 2.5 3.0 3.2 4.0	Wire/flux combination for welding of general purpose structural, fine grained and pipe steels. BB 400 is an agglomerated, aluminate basic type. It is characterized by its low Si and moderate Mn pickup. It is suitable on DC and AC.



# High strength steels

BÖHLER Standard AWS EN	Welding process	Typical analysis  %	Typical mechanical properties	Sizes  mm	Characteristics and applications
<b>FOX EV 60</b> E8018-C3H4R E 46 6 1Ni B 4 2 H5	SMAW	C 0.07 Si 0.4 Mn 1.15 Ni 0.9	Re 510 N/mm <sup>2</sup> Rm 610 N/mm <sup>2</sup> A5 27% Av 180 J 110 J...-60 °C	2.5 3.2 4.0 5.0	Basic electrode, Ni-alloyed low hydrogen (acc. AWS condition HD ≤ 4 ml/100 g weld metal). Excellent operating characteristics in all positions except vertical down. Particularly high toughness properties down to -60 °C. Metal recovery about 115%.
<b>FOX EV 65</b> E8018-GH4R E 55 6 1NiMo B 4 2 H5	SMAW	C 0.06 Si 0.3 Mn 1.2 Ni 0.8 Mo 0.35	Re 600 N/mm <sup>2</sup> Rm 650 N/mm <sup>2</sup> A5 25% Av 180 J 80 J...-60 °C	2.5 3.2 4.0	Basic electrode, NiMo-alloyed low hydrogen (acc. AWS condition HD ≤ 4 ml/100 g weld metal) for welding of high tensile strength steels. Excellent operating characteristics in all positions except vertical down. Particularly high toughness properties down to -60 °C
<b>FOX EV 75</b> E10018-GH4R E 62 6 Mn 2NiCrMo B 4 2 H5	SMAW	C 0.05 Si 0.4 Mn 1.6 Ni 2.0 Mo 0.4	Re 700 N/mm <sup>2</sup> Rm 750 N/mm <sup>2</sup> A5 23% Av 140 J ≥47 J...-60 °C	3.2 4.0 5.0	Basic electrode, MnNiMo alloyed low hydrogen (acc. AWS condition HD ≤ 4 ml/100 g weld metal). High resistance to cracking. Good impact properties down to -60 °C.
<b>FOX EV 85</b> E11018-GH4R E 69 6 Mn 2NiCrMo B 4 2 H5	SMAW	C 0.05 Si 0.4 Mn 1.7 Cr 0.4 Ni 2.1 Mo 0.5	Re 780 N/mm <sup>2</sup> Rp 840 N/mm <sup>2</sup> A5 20% Av 110 J 60 J...-60 °C	2.5 3.2 4.0 5.0	Basic electrode, low hydrogen (acc. AWS condition HD ≤ 4 ml/100 g weld metal) for positional welding of high strength steels with minimum yield strength of 690 N/mm <sup>2</sup> and reliable toughness down to -60 °C.
<b>EML 5</b> ER70S-3 W 46 5 W2Si	GTAW	C 0.1 Si 0.6 Mn 1.2	Re 500 N/mm <sup>2</sup> Rm 600 N/mm <sup>2</sup> A5 26% Av 220 J ≥47 J...-50 °C	1.6 2.0 2.4 3.0	GTAW rod for high requirements of weld metal impact strength down to -50 °C. Also for components subjected to galvanising after welding. Very popular rod for high integrity welds.
<b>I 52 Ni</b> ER80S-Ni1 (mod.) W3Ni1	GTAW	C 0.07 Si 0.7 Mn 1.4 Ni 0.9	Re 500 N/mm <sup>2</sup> Rm 600 N/mm <sup>2</sup> A5 25% Av 150 J 90 J...-50 °C	1.6 2.0 2.4	GTAW rod, Ni-alloyed for welding of offshore pipe work and similar high integrity applications. High impact properties down to -50 °C. Root pass only on S690Q base metal.
<b>K-Nova Ni</b> ER80S-G G3Ni1	GMAW	C 0.06 Si 0.7 Mn 1.5 Ni 0.9 Ti +	Re 500 N/mm <sup>2</sup> Rp 590 N/mm <sup>2</sup> A5 24% Av 150J 80J...-50 °C (80% Ar/20% CO <sub>2</sub> )  Re 470 N/mm <sup>2</sup> Rp 560 N/mm <sup>2</sup> A5 25% Av 110J 45J...-50 °C (100% CO <sub>2</sub> )	0.9 1.0 1.2	GMAW wire, micro alloyed designed for high quality automatic welding of pipelines. An optimum balanced alloying concept ensures good weld metal properties to fulfil the high requirements in the on-offshore pipeline industry. The deposit is extremely crack resistant and the weld metal offers high impact values down to -50 °C.
<b>NiMo 1-IG</b> ER90S-G G 55 6 M Mn3Ni1Mo G 55 4 C Mn3Ni1Mo	GMAW	C 0.08 Si 0.6 Mn 1.8 Ni 0.9 Mo 0.3	Re 620 N/mm <sup>2</sup> Rp 700 N/mm <sup>2</sup> A5 23% Av 140J ≥ 47J...-60 °C (80% Ar/20% CO <sub>2</sub> )  Re 590 N/mm <sup>2</sup> Rp 680 N/mm <sup>2</sup> A5 22% Av 120J ≥ 47J...-40 °C (100% CO <sub>2</sub> )	1.0 1.2	GMAW wire, NiMo-alloyed for welding of quenched and tempered, thermo mechanically treated fine grained structural steels. High impact properties down to -60 °C under Argon/CO <sub>2</sub> mixtures.

# High strength steels

<b>BÖHLER</b> Standard AWS EN	<b>Welding process</b>	<b>Typical analysis</b>  %	<b>Typical mechanical properties</b>	<b>Sizes</b>  mm	<b>Characteristics and applications</b>
<b>NiCrMo2.5-IG</b>  ER110S-G G 69 6 M Mn3Ni2.5CrMo	GMAW	C 0.08 Si 0.6 Mn 1.4 Cr 0.3 Mo 0.4 Ni 2.5	Re 810 N/mm <sup>2</sup> Rp 910 N/mm <sup>2</sup> A5 18% Av 120J ≥47J...-60 °C (80% Ar/20% CO <sub>2</sub> )	1.0 1.2	GMAW wire, CrNiMo-alloyed designed for welding of high-strength fine grained constructional steels with stringent requirement on low temperature toughness down to -60 °C under Ar/CO <sub>2</sub> mixtures.
<b>Ti 60-FD</b>  E81T1-Ni1MH8 T 50 6 1Ni P M 1 H5	FCAW	C 0.06 Si 0.45 Mn 1.2 Ni 0.85	Re >500 N/mm <sup>2</sup> Rp >560 N/mm <sup>2</sup> A5 >19% Av >120J > 47J...-60 °C (80%Ar/20%CO <sub>2</sub> )	1.2 1.6	Rutile flux cored welding wire with fast freezing slag system which allows currents up to 250 A in positional welding. It operates in the spray arc transfer without any spatter formation. It provides an easy slag removal, smooth beads with good side wall wetting. Excellent impact properties down to -60 °C.
<b>3NiMo1-UP+ BB 420TTR</b>  F9A8-EG-F3-N S 50 4 FB S3Ni1Mo	SAW	C 0.08 Si 0.25 Mn 1.55 Mo 0.55 Ni 0.9	Re 560 N/mm <sup>2</sup> Rp 680 N/mm <sup>2</sup> A5 22% Av 140J 27J...-60 °C	4.0	Wire/flux combination for welding of high strength and low temperature steels. The flux displays neutral metallurgical behaviour and is characterised by a high degree of purity. Basicity acc. to Boniszewski 3,4 Mol. %
<b>3 NiCrMo2,5-UP+ BB 420TTR, BB 420TTRC</b>  F12A5-EG-F6 (mod.) Flux: SA FB 1 65 DC H5	SAW	C 0.1 Si 0.25 Mn 1.6 Cr 0.35 Mo 0.55 Ni 2.2	Re 760 N/mm <sup>2</sup> Rp 880 N/mm <sup>2</sup> A5 17% Av 110J 45J...-50 °C	3.0 4.0	Wire/flux combination for welding of high strength and low temperature steels. The flux is agglomerated of fluorid basic type. It is suitable for single wire with DC+ and tandem (DC+ and AC) welding.



# Stainless steels – Martensitic

<b>BÖHLER</b> Standard AWS EN	<b>Welding process</b>	<b>Typical analysis</b>  %	<b>Typical mechanical properties</b>	<b>Sizes</b>  mm	<b>Characteristics and applications</b>
<b>FOX CN 13/4</b>  E410NiMo-25 E 13 4 B 62	SMAW	C 0.035 Si 0.3 Mn 0.5 Cr 12.2 Mo 0.5 Ni 4.5	Re 680 N/mm <sup>2</sup> Rm 910 N/mm <sup>2</sup> A5 17% Av 66 J 50 J...-60°C PWHT 600 °C/2 h	2.5 3.2 4.0 5.0	Basic electrode for welding of similar alloyed soft martensitic steels. The weld deposit yields very good ductility & toughness as well as low hydrogen contents (< 5 ml/100 g)
<b>FOX CN 13/4 SUPRA</b>  E410NiMo-15 E 13 4 B 42	SMAW	C 0.03 Si 0.3 Mn 0.6 Cr 12.5 Mo 0.5 Ni 4.5	Re 680 N/mm <sup>2</sup> Rm 930 N/mm <sup>2</sup> A5 18% Av 70 J 55 J...-60°C PWHT 600 °C/2 h	3.2 4.0 5.0	Basic electrode, core wire alloyed for welding of similar alloyed soft martensitic steels. Due to an optimum balanced alloying concept the weld deposit offers very good ductility and cracking resistance despite of its high strength. Out of position weldable except vertical down.
<b>CN 13/4-IG</b>  ER410NiMo (mod.) W 13 4 G 13 4	GTAW GMAW	C 0.02 Si 0.7 Mn 0.7 Cr 12.3 Mo 0.5 Ni 4.7	GTAW Re 750 N/mm <sup>2</sup> Rm 830 N/mm <sup>2</sup> A5 21% Av 150 J >32 J...-60°C PWHT 600 °C/8 h  GMAW Re 760 N/mm <sup>2</sup> Rm 890 N/mm <sup>2</sup> A5 17% Av 80 J PWHT 580 °C/8 h	2.0 2.4          1.2	GTAW rod and GMAW wire with precisely tuned alloying composition for ductile weld metal with best CVN toughness and crack resistance. The preferred gas for MAG welding is 92% Argon + 8% CO <sub>2</sub> .
<b>CN 13/4-MC</b>  EC410NiMo (mod.) T 13 4 MM2	FCAW	C ≤ 0.025 Si 0.7 Mn 0.9 Cr 12.0 Mo 0.6 Ni 4.6	Re 760 N/mm <sup>2</sup> Rm 900 N/mm <sup>2</sup> A5 16% Av 65 J ≥ 47 J...-20 °C PWHT 580 °C/8h  Shielding gas: Ar + 2.5% CO <sub>2</sub>	1.2 1.6	Metal cored wire for welding of similar alloyed soft martensitic steels and cast steels.  CN 13/4-MC offers favourable spray or puls arc characteristics, minimum spatter formation, flat and smooth bead profiles, an excellent wetting behaviour and safe penetration as well as best productivity. Best impact values and extra low hydrogen contents (acc. AWS condition HD ≤ 4 ml/100 g weld metal).

# Stainless steels – Austenitic

<b>BÖHLER</b> Standard AWS EN	<b>Welding process</b>	<b>Typical analysis</b>  %	<b>Typical mechanical properties</b>	<b>Sizes</b>  mm	<b>Characteristics and applications</b>
<b>FOX EAS 4 M</b>  E316L-15 E 19 12 3 LB 22	SMAW	C 0.03 Si 0.4 Mn 1.2 Cr 18.8 Mo 2.7 Ni 11.5	Re 460 N/mm <sup>2</sup> Rm 600 N/mm <sup>2</sup> A5 38% Av 90 J ≥32 J...-120°C >27 J...-196°C	2.5 3.2 4.0	Basic electrode stainless steel. Designed to produce first class weld deposits. Provides 100% X-ray safety together with very good root pass and positional welding characteristics. Good gap bridging ability, easy weld pool and slag control. An excellent product for welding on site! Fully alloyed core wire and packed into hermetically sealed tins.
<b>FOX EAS 4 M-A</b>  E316L-17 E 19 12 3 LR 32	SMAW	C 0.03 Si 0.8 Mn 0.8 Cr 18.8 Mo 2.7 Ni 11.7	Re 460 N/mm <sup>2</sup> Rm 600 N/mm <sup>2</sup> A5 36% Av 70 J ≥32 J...-120°C	1.5 2.0 2.5 3.2 4.0 5.0	Rutile electrode stainless steel. An acknowledged world leader, noted for its superior welding characteristics. Fully alloyed core wire ensures the most reliable corrosion resistance. Other advantages include high current carrying capacity, minimum spatter formation, self releasing slag, smooth and clean weld profile, safety against formation of porosity due to moisture resistant coating and packaging into hermetically sealed tins and VAC-packs.
<b>EAS 4M-IG</b>  ER316 L W 19 12 3 L	GTAW	C 0.02 Si 0.5 Mn 1.7 Cr 18.5 Mo 2.6 Ni 12.3	Re 470 N/mm <sup>2</sup> Rm 650 N/mm <sup>2</sup> A5 38% Av 140 J ≥32 J...-196 °C	1.6 2.0 2.4 3.0	GTAW rod of type AWS ER 316L designed to a very precise analysis to create a weld deposit of high purity, superior hot cracking and corrosion resistance. CVN toughness down to -196 °C. Resistant to intergranular corrosion up to +400 °C.
<b>EAS 4M-IG (Si)</b>  ER316LSi G 19 12 3 L Si	GMAW	C 0.02 Si 0.8 Mn 1.7 Cr 18.4 Mo 2.8 Ni 12.4	Re 450 N/mm <sup>2</sup> Rm 630 N/mm <sup>2</sup> A5 38% Av 120 J ≥32 J...-196 °C	0.8 1.0 1.2	GMAW wire of type ER 316L (Si). Designed for first class welding, wetting and feeding characteristics as well as reliable corrosion resistance up to +400 °C and low temperature service down to -196 °C.
<b>EAS 4 PW-FD</b>  E316LT1-4(1) T 19 12 3 LP M (C) 1	FCAW	C 0.03 Si 0.7 Mn 1.5 Cr 19.0 Mo 2.7 Ni 12.0	Re 400 N/mm <sup>2</sup> Rm 560 N/mm <sup>2</sup> A5 38% Av 65 J ≥32 J...-120 °C	1.2 1.6	EAS 4 PW-FD is a rutile flux cored welding wire with fast freezing slag providing excellent positional welding characteristics.  EAS 4M-FD is a rutile flux cored welding wire for downhand welding.
<b>EAS 4M-FD</b>  E316LT0-4(1) T 19 12 3 L R M(C) 3  ø 0.9 mm E316LT1-4(1) T 19 12 3 L P M (C) 1	FCAW	C 0.03 Si 0.7 Mn 1.5 Cr 19.0 Mo 2.7 Ni 12.0	Re 400 N/mm <sup>2</sup> Rm 560 N/mm <sup>2</sup> A5 38% Av 55 J ≥32 J...-120 °C	0.9 1.2 1.6	Both products achieve high productivity and are easy to operate. Self releasing slag, almost no spatter formation and temper discoloration. Smooth weld finish and safe penetration.  Suitable for service temperatures from -120 °C to +400 °C.  Please also note our special brochure „Flux cored welding wires for stainless steels“.
<b>EAS 4M-UP+BB 202</b>  ER316L S 19 12 3 L  SA FB 2 DC (Flux)	SAW	C 0.02 Si 0.6 Mn 1.3 Cr 18.3 Mo 2.7 Ni 12.2	Re ≥350 N/mm <sup>2</sup> Rm ≥560 N/mm <sup>2</sup> A5 ≥35% Av ≥80 J ≥32 J...-120°C	3.0	SAW-wire/flux combination of type 316L for multi-pass welding.  Smooth beads, easy slag removal without any slag residues and good welding characteristics are very much appreciated by users.  BB 202 is a fluoride basic, agglomerated flux, providing a low flux consumption.  Basicity 2.3 acc. to Boniczewski



# Stainless steels – Austenitic

BÖHLER Standard AWS EN	Welding process	Typical analysis  %	Typical mechanical properties	Sizes  mm	Characteristics and applications
<b>FOX FFB</b> E310-15 (mod.) E 25 20 B 22	SMAW	C 0.11 Si 0.6 Mn 3.5 Cr 26.0 Ni 20.5	Re 420 N/mm <sup>2</sup> Rm 600 N/mm <sup>2</sup> A5 36% Av 100 J ≥32 J...-196 °C	2.5 3.2 4.0 5.0	Basic electrode, low hydrogen, recommended particularly for heavy components. For similar heat resisting steels. Scale resistant up to +1200 °C. The high Mn content provides especially good resistance to hot cracking.
<b>FOX FFB-A</b> E310-16 E 25 20 R 32	SMAW	C 0.12 Si 0.5 Mn 2.2 Cr 26.0 Ni 20.5	Re 430 N/mm <sup>2</sup> Rm 620 N/mm <sup>2</sup> A5 35% Av 75 J	2.0 2.5 3.2 4.0	Rutile electrode, for similar heat resistant steels, AC weldability is recommended for thinner plates and tubes. Scale resistant up to +1200 °C.
<b>FFB-IG</b> ER310 (mod.) W 25 20 Mn G 25 20 Mn	GTAW GMAW	C 0.12 Si 0.9 Mn 3.2 Cr 25.0 Ni 20.5	GTAW Re 420 N/mm <sup>2</sup> Rm 630 N/mm <sup>2</sup> A5 33% Av 85 J ≥32 J...-196 °C  GMAW Re 400 N/mm <sup>2</sup> Rm 620 N/mm <sup>2</sup> A5 38% Av 95 J ≥32 J...-196 °C	1.6 2.0 2.4  0.8 1.0 1.2	GTAW rod and GMAW wire of type AWS ER310. Scaling resistant up to +1200 °C.  The Mn-content is above the maximum limit of AWS ER310 to provide much better hot cracking resistance of the fully austenitic weld metal than a similar AWS corresponding type Mn < 2.5% can provide.
<b>FOX CN 20/25M</b> E385-15 (mod.) E 20 25 5 Cu NL B 22	SMAW	C ≤ 0.04 Si 0.4 Mn 4.0 Cr 20.0 Mo 6.5 Ni 25.0 Cu 1.4 N 0.14  PREN ≥ 45	Re 440 N/mm <sup>2</sup> Rm 650 N/mm <sup>2</sup> A5 35% Av 75 J ≥32 J...-269 °C	2.5 3.2 4.0	Basic electrode, best suitable for heavy wall thicknesses. Both electrodes are for welding of CrNiMo steels with 4 - 5% Mo e.g. UNS N08904 where high resistance against pitting and crevice corrosion is required. The average Mo content of the weld metal is 6.2% thus compensating the segregation in high Mo-alloyed weld metals.
<b>FOX CN 20/25M-A</b> E385-17 (mod.) E 20 25 5 Cu N L R 32	SMAW	C 0.03 Si 0.7 Mn 2.0 Cr 20.5 Mo 6.2 Ni 25.0 Cu 1.6 N 0.17  PREN ≥ 45	Re 410 N/mm <sup>2</sup> Rm 640 N/mm <sup>2</sup> A5 34% Av 70 J ≥32 J...-196 °C	2.5 3.2 4.0	Rutile electrode, should be preferably used up to wall thicknesses of 14 mm. It is designed for excellent operating characteristics on DC/AC.
<b>CN 20/25M-IG</b> ER385 (mod.) W Z20 25 5 Cu NL	GTAW	C ≤ 0.02 Si 0.7 Mn 4.7 Cr 20.0 Mo 6.2 Ni 25.4 Cu 1.5 N 0.12  PREN ≥ 45	GTAW Re 440 N/mm <sup>2</sup> Rm 670 N/mm <sup>2</sup> A5 42% Av 115 J ≥32 J...-269 °C	1.6 2.0 2.4	GTAW rod and GMAW wire for 4 - 5% Mo alloyed CrNi-steels like N08904. The weld metal shows a stable austenitic micro structure with excellent pitting resistance (PREN >45) and crevice corrosion resistance as well as resistance to stress corrosion cracking. Both rod and wire have an increased Mo content (6.2%) to compensate for segregation in high Mo alloyed weld metals, thus producing equivalent corrosion resistance to the relevant base metals offering 4 - 5% Mo.
<b>CN 20/25M-IG (Si)</b> ER385 (mod.) W Z20 25 5 Cu NL	GMAW	PREN ≥ 45	GMAW Re 410 N/mm <sup>2</sup> Rm 650 N/mm <sup>2</sup> A5 39% Av 100 J ≥32 J...-196 °C	0.8 1.0 1.2	Shielding gases for GMAW Ar + 20-30% He + max. 2% CO <sub>2</sub> or Ar + 20% He + 0.5% CO <sub>2</sub> .

# Stainless steels – Type 6 Mo

<b>BÖHLER</b> Standard AWS EN	<b>Welding process</b>	<b>Typical analysis</b> %	<b>Typical mechanical properties</b>	<b>Sizes</b> mm	<b>Characteristics and applications</b>
<b>FOX NIBAS 625</b> ENiCrMo3 E Ni6625(NiCr22Mo9Nb)	SMAW	C 0.025 Si 0.4 Mn 0.7 Cr 22.0 Mo 9.0 Ni > 60.0 Nb 3.3 Fe 0.5 Co ≤ 0.05 Al ≤ 0.4 PREN > 52	Re 530 N/mm <sup>2</sup> Rm 800 N/mm <sup>2</sup> A5 40% Av 80 J 45 J...-196 °C	2.5 3.2 4.0	Basic electrode suitable for welding of 6% Mo superaustenitic grades S 31254, N 08926, N 08367 and the matching alloy 625. Electrode and weld metal meet highest quality and corrosion requirements. Extremely resistant to stress corrosion cracking and pitting. The pitting resistance equivalent is >52. Highly resistant to hot cracking.
<b>NIBAS 625-IG</b> ERNiCrMo-3 S Ni6625(NiCr22Mo9Nb)	GTAW GMAW	C ≤ 0.02 Si 0.1 Mn 0.3 Cr 22.0 Mo 9.0 Ni ≥ 60.0 Nb 3.6 Fe 0.5 PREN > 52	GTAW Re 540 N/mm <sup>2</sup> Rm 800 N/mm <sup>2</sup> A5 38% Av 160 J 130 J...-196 °C GMAW Re 510 N/mm <sup>2</sup> Rm 780 N/mm <sup>2</sup> A5 40% Av 130 J 80 J...-196 °C	1.6 2.0 2.4 1.0 1.2	GTAW rod and GMAW wire of type AWS ER NiCrMo-3 suitable for welding of the 6% Mo superaustenitic grades S31254, N 08926, N 08367 and the matching alloy 625. Rod, wire and weld metal meet highest quality and corrosion requirements. Extremely resistant to stress corrosion cracking and pitting. The pitting resistance equivalent is >52. Highly resistant to hot cracking. For GMAW shielding gas to EN 439 I1 Argon or I3 Ar + He is recommended.
<b>NIBAS 625 FD</b> ENiCrMo-3T0-4 Typ Ni6625(NiCr22Mo9Nb)	FCAW	C 0.05 Si 0.4 Mn 0.4 Cr 22.0 Mo 8.5 Ni ≥ 60.0 Nb 3.3 Fe ≤ 5.0	Re 490 N/mm <sup>2</sup> Rm 750 N/mm <sup>2</sup> A5 30% Av 60 J 47 J...-196 °C	1.2	Rutil flux cored welding wire of type E NiCrMo-3 suitable for welding of the 6% Mo superaustenitic grades S31254, N08926, N08367 and the matching alloy 625. The wire can be used in all positions except vertical down. Extremely resistant to stress corrosion cracking and pitting. Shielding gases Ar +15-25% CO <sub>2</sub> .



# Stainless steels – Duplex 22Cr

<b>BÖHLER</b> Standard AWS EN	<b>Welding process</b>	<b>Typical analysis</b>  %	<b>Typical mechanical properties</b>	<b>Sizes</b>  mm	<b>Characteristics and applications</b>
<b>FOX CN 22/9 N</b>  E2209-17 E 22 9 3 N L R 3 2	SMAW	C 0.03 Si 0.9 Mn 0.8 Cr 23.0 Mo 3.2 Ni 9.0 N 0.17  PREN ≥35	Re 650 N/mm <sup>2</sup> Rm 820 N/mm <sup>2</sup> A5 25% Av 55 J ≥32 J...-20 °C	2.5 3.2 4.0 5.0	Rutile electrode which offers excellent positional weldability and thus is perfectly suited for pipe welding of grade UNS S31803. Good wetting characteristics and slag removability. Resistant to porosity, reliable CVN toughness down to -20°C. It is designed with a fully alloyed core wire providing best corrosion resistance and a very homogeneous micro structure with specified ferrite content of 30 - 60 FN (WRC) PREN >35.
<b>FOX CN 22/9 N-B</b>  E2209-15 E 22 9 3 N L B 2 2	SMAW	C 0.03 Si 0.3 Mn 1.1 Cr 23.0 Mo 3.2 Ni 8.8 N 0.16  PREN ≥35	Re 630 N/mm <sup>2</sup> Rm 830 N/mm <sup>2</sup> A5 27% Av 105 J ≥65 J...-46 °C	2.5 3.2 4.0 5.0	For wall thicknesses > 25 mm or impact requirements down to -50 °C, the basic electrode FOX CN 22/9 N-B is recommended.
<b>CN 22/9 N-IG</b>  ER2209 W 22 9 3 N L G 22 9 3 NL	GTAW GMAW	C 0.015 Si 0.4 Mn 1.7 Cr 22.5 Mo 3.2 Ni 8.8 N 0.15  PREN ≥35	GTAW Re 600 N/mm <sup>2</sup> Rm 800 N/mm <sup>2</sup> A5 33% Av 150 J ≥32 J...-60 °C  GMAW Re 660 N/mm <sup>2</sup> Rm 830 N/mm <sup>2</sup> A5 28% Av 85 J ≥32 J...-46 °C	1.6 2.0 2.4 3.2    1.0 1.2	GTAW rod and GMAW wire of type ER2209 for standard duplex stainless steels. Designed for first class welding, wetting and feeding characteristics as well as reliable resistance to stress corrosion cracking and pitting. Ferrite content 30-60 FN (WRC).  Shielding gas for GMAW: Argon +20-30% He + max. 2% CO <sub>2</sub> or Argon +20-30% He + max. 1% O <sub>2</sub>
<b>CN 22/9 PW-FD</b>  E2209T1-4(1) T 22 9 3 NL P M (C) 1	FCAW	C ≥0.03 Si 0.8 Mn 0.9 Cr 22.7 Mo 3.2 Ni 9.0 N 0.13  PREN ≥35	Re 600 N/mm <sup>2</sup> Rm 800 N/mm <sup>2</sup> A5 27% Av 80 J 45 J...-46 °C  Ar +18% CO <sub>2</sub>	1.2	Rutile flux cored welding wire with fast freezing slag providing excellent positional welding characteristics. It is designed to satisfy the highest demands of offshore fabricators when welding standard duplex stainless steels like UNS S31803 or S32205, Ferrite 30-50FN, CPT 22 °C acc. to ASTM G48/A or A 923 method C are being used.  Please also note our special brochure „Flux cored welding wires for stainless steels“.
<b>CN 22/9 N-FD</b>  E2209T0-4(1) T 22 9 3 NL R M (C) 3	FCAW	C ≥0.03 Si 0.8 Mn 0.9 Cr 22.7 Mo 3.2 Ni 9.0 N 0.13  PREN ≥35	Re 600 N/mm <sup>2</sup> Rm 800 N/mm <sup>2</sup> A5 27% Av 60 J ≥32 J...-46 °C  Ar +18% CO <sub>2</sub>	1.2	Rutile flux cored welding wire for downhand welding. Self releasing slag, almost no spatter formation and temper discoloration, smooth weld finish and safe penetration.  Ferrite 30-50FN, CPT 22 °C acc. to ASTM G48/A or A 923 method C.  Please also note our special brochure „Flux cored welding wires for stainless steels“.
<b>CN 22/9 N-UP+BB 202</b>  ER2209 S 22 9 3 NL  SA FB 2 DC (Flux)	SAW	C 0.015 Si 0.55 Mn 1.3 Cr 22.5 Mo 3.1 Ni 8.9 N 0.14  PREN ≥35	Re ≥550 N/mm <sup>2</sup> Rm ≥750 N/mm <sup>2</sup> A5 ≥27% Av ≥100 J ≥32 J...-46 °C	3.0	SAW-wire/flux combination of type 2209 duplex stainless steel for multi-pass welding. Smooth beads, easy slag removal without any slag residues and good welding characteristics are very much appreciated by the users.  BB 202 is a fluoride basic, agglomerated flux, providing a low flux consumption.  Basicity 2.3 acc. to Boniczewski.

# Stainless steels – Superduplex 25Cr

<b>BÖHLER</b> Standard AWS EN	<b>Welding process</b>	<b>Typical analysis</b>  %	<b>Typical mechanical properties</b>	<b>Sizes</b>  mm	<b>Characteristics and applications</b>
<b>FOX CN 25/9 CuT</b>  E2553-15 (mod.) E 25 9 4 N L B 2 2	SMAW	C 0.03 Si 0.5 Mn 1.1 Cr 25.0 Ni 9.3 Mo 3.7 N 0.22 Cu 0.7 W 0.7  PREN ≥40	Re >600 N/mm <sup>2</sup> Rm >750 N/mm <sup>2</sup> A5 >22% Av >70 J 50 J...-50 °C	2.5 3.2 4.0	Basic electrode for welding of superduplex stainless steels acc. to UNS S32550, S32750, S32760. Excellent resistance to stress corrosion cracking and pitting corrosion.  PREN is ≥40.  The operating temperature is -50 °C up to +250 °C. Well suited for the conditions in the offshore field application.
<b>CN 25/9 CuT-IG</b>  ER2553 (mod.) W 25 9 4 NL G 25 9 4 NL	GTAW GMAW	C 0.02 Si 0.3 Mn 0.8 Cr 25.5 Ni 9.5 Mo 3.7 N 0.22 Cu 0.6 W 0.6  PREN ≥40	GTAW Re >700 N/mm <sup>2</sup> Rm >850 N/mm <sup>2</sup> A5 >25% Av >120 J 50 J...-50 °C  GMAW Re >650 N/mm <sup>2</sup> Rm >750 N/mm <sup>2</sup> A5 >25% Av >80 J 50 J...-46 °C	2.0 2.4           1.0 1.2	GTAW rod and GMAW wire for welding of superduplex stainless steels acc. to UNS S32550, S32750, S32760. Excellent resistance to stress corrosion cracking and pitting corrosion.  PREN is ≥40.  The operating temperature is -50 °C up to +250 °C. Well suited for the conditions in the offshore field application.  Shielding gases for GMAW Ar + 20-30% He + max. 2% CO <sub>2</sub> or Ar +20-30% He + max. 1% O <sub>2</sub> .  For applications requiring low Hydrogen, we offer the product BÖHLER CN 25/9 CuT-IG-LH with Hydrogen Content guaranteed less than 3 ppm.

# Stainless steels – Dissimilar joints

<b>BÖHLER</b> Standard AWS EN	<b>Welding process</b>	<b>Typical analysis</b> %	<b>Typical mechanical properties</b>	<b>Sizes</b> mm	<b>Characteristics and applications</b>
<b>FOX CN 23/12-A</b>  E309L-17 E 23 12 L R 3 2	SMAW	C 0.02 Si 0.7 Mn 0.7 Cr 23.0 Ni 12.5	Re 440 N/mm <sup>2</sup> Rm 570 N/mm <sup>2</sup> A5 40% Av 60 J ≥32 J...-60 °C	2.5 3.2 4.0 5.0	Rutile electrode stainless steel of type 309L and 309MoL.  Superior welding characteristics.  Can be used on AC or DC. Other advantages include high current carrying capacity, minimum spatter formation, self releasing slag, smooth and clean weld profile, safety against formation of porosity due to the moisture resistant coating and its packaging into hermetically sealed tins or VAC-packs.
<b>FOX CN 23/12Mo-A</b>  E309MoL-17 (mod.) E 23 12 2 L R 3 2	SMAW	C 0.02 Si 0.7 Mn 0.8 Cr 23.0 Mo 2.7 Ni 12.5	Re 580 N/mm <sup>2</sup> Rm 720 N/mm <sup>2</sup> A5 27% Av 55 J 45 J...-20 °C	2.0 2.5 3.2 4.0 5.0	
<b>CN 23/12-IG</b>  ER309L W 23 12 L G 23 12 L	GTAW GMAW	C 0.02 Si 0.5 Mn 1.7 Cr 24.0 Ni 13.2	GTAW Re 440 N/mm <sup>2</sup> Rm 590 N/mm <sup>2</sup> A5 34% Av 150 J ≥32 J...-120 °C  GMAW Re 420 N/mm <sup>2</sup> Rm 570 N/mm <sup>2</sup> A5 32% Av 130 J ≥32 J...-80 °C	1.6 2.0 2.4    0.8 1.0 1.2	GTAW rod and GMAW wire of type AWS ER309L. Designed for good welding, wetting and feeding characteristics as well as good safety after dilution when welding dissimilar joints.  Suitable for service temperatures between -120 °C (GTAW) and -80 °C, (GMAW) to +300 °C.  For GMAW shielding gas acc. to EN 439 M12 Ar + max. 2,5% CO <sub>2</sub> or M13 Ar + max. 1% O <sub>2</sub> is recommended
<b>CN 23/12 PW-FD</b>  E309LT1-4(1) T 23 12 L P M (C) 1	FCAW	C ≤0.03 Si 0.7 Mn 1.4 Cr 22.8 Ni 12.5	Re 400 N/mm <sup>2</sup> Rm 540 N/mm <sup>2</sup> A5 35% Av 65 J 50 J...-60 °C  Ar + 18% CO <sub>2</sub>	1.2 1.6	Rutile flux cored welding wires of type 309L and 309MoL with fast freezing slag providing excellent positional welding characteristics and fast travel speeds.  Self releasing slag, almost no spatter formation and temper discolouration, smooth weld finish and safe penetration. Suitable for service temperatures from -60 °C to +300 °C.
<b>CN 23/12 Mo PW-FD</b>  E309LMoT1-4(1) T 23 12 2 L P M (C) 1	FCAW	C ≤0.03 Si 0.7 Mn 1.4 Cr 22.7 Mo 2.7 Ni 12.3	Re 530 N/mm <sup>2</sup> Rm 720 N/mm <sup>2</sup> A5 32% Av 65 J 50 J...-60 °C  Ar + 18% CO <sub>2</sub>	1.2	Please also note our special brochure „Flux cored welding wires for stainless steels“.
<b>CN 23/12-UP+BB 202</b>  ER309L S 23 12 L  SA FB 2 DC (Flux)	SAW	C 0.015 Si 0.65 Mn 1.3 Cr 23.4 Ni 13.1	Re >320 N/mm <sup>2</sup> Rm >520 N/mm <sup>2</sup> A5 >30% Av >70 J	3.0	SAW wire/flux combination of type ER309L for multi-pass welding. Smooth beads, easy slag release without any slag residues and good welding characteristics. The average ferrite content is 16 FN. Suitable up to service temperatures of +300 °C.  BB 202 is a fluoride basic, agglomerated flux, providing a low flux consumption.  Basicity 2.3 acc. to Boniczewski.
<b>CN 23/12-MC</b>  EC309L T 23 12 L M M 1	GMAW	C ≤0.03 Si 0.6 Mn 1.4 Cr 22.7 Ni 12.2	Re 400 N/mm <sup>2</sup> Rm 540 N/mm <sup>2</sup> A5 32% Av 70 J ≥32 J...-120 °C  Shielding gas: Ar + 2.5 % CO <sub>2</sub>	1.2	Metal cored wire of type T 23 12 L / ER309L for welding dissimilar joints between high alloyed Cr- and CrNi(Mo)-steels and mild- or low alloyed steels. BÖHLER CN 23/12-MC is designed for very good welding, wetting and feeding characteristics as well as good safety after dilution when welding dissimilar joints. Suitable for service temperatures between -120 °C and +300 °C.  The wider arc, in comparison to solid wire, will reduce the risk of lack of fusion and is less sensitive against misalignment of edges and different gap widths. Preheat and interpass temperature as required by the base metal. Welding with conventional or pulsed power sources (preferably slightly leading torch position, angle appr. 80 °). Recommended stick out 15-20 mm and length of arc 3-5 mm.



# Stainless steels – Dissimilar joints

<b>BÖHLER</b> Standard AWS EN	<b>Welding process</b>	<b>Typical analysis</b>  %	<b>Typical mechanical properties</b>	<b>Sizes</b>  mm	<b>Characteristics and applications</b>
<b>FOX NIBAS 625</b>  ENiCrMo3 E Ni6625(NiCr22Mo9Nb)	SMAW	C 0.025 Si 0.4 Mn 0.7 Cr 22.0 Mo 9.0 Ni > 60.0 Nb 3.3 Fe 0.5 Co ≤ 0.05 Al ≤ 0.4  PREN > 52	Re 530 N/mm <sup>2</sup> Rm 800 N/mm <sup>2</sup> A5 40% Av 80 J 45 J...-196 °C	2.5 3.2 4.0	Basic electrode suitable for welding of 6% Mo superaustenitic grades S31254, N08926, N08367 and the matching alloy 625.  Electrode and weld metal meet highest quality and corrosion requirements. Extremely resistant to stress corrosion cracking and pitting.  The pitting resistance equivalent is >52. Highly resistant to hot cracking.
<b>NIBAS 625-IG</b>  ERNiCrMo-3 S Ni6625(NiCr22Mo9Nb)	GTAW GMAW	C ≤ 0.02 Si 0.1 Mn 0.1 Cr 22.0 Mo 9.0 Ni ≥ 60.0 Nb 3.6 Fe 0.5  PREN > 52	GTAW Re 540 N/mm <sup>2</sup> Rm 800 N/mm <sup>2</sup> A5 38% Av 160 J 130 J...-196 °C  GMAW Re 510 N/mm <sup>2</sup> Rm 780 N/mm <sup>2</sup> A5 40% Av 130 J 80 J...-196 °C	1.6 2.0 2.4          1.0 1.2	GTAW rod and GMAW wire of type AWS ERNiCrMo-3 suitable for welding of the 6% Mo superaustenitic grades S31254, N08926, N08367 and the matching alloy 625. Rod, wire and weld metal meet highest quality and corrosion requirements. Extremely resistant to stress corrosion cracking and pitting.  The pitting resistance equivalent is >52. Highly resistant to hot cracking.  For GMAW shielding gas to EN 439 I1 Argon or I3 Ar + He is recommended.
<b>NIBAS 625 FD</b>  ENiCrMo-3T0-4 Typ Ni6625(NiCr22Mo9Nb)	FCAW	C 0.05 Si 0.4 Mn 0.4 Cr 22.0 Mo 8.5 Ni ≥ 60.0 Nb 3.3 Fe < 5.0	Re 490 N/mm <sup>2</sup> Rm 750 N/mm <sup>2</sup> A5 30% Av 60 J	1.2	Rutil flux cored welding wire of type ENiCrMo-3 suitable for welding of the 6% Mo superaustenitic grades S31254, N08926, N08367 and the matching alloy 625.  The wire can be used in all positions except vertical down.  Extremely resistant to stress corrosion cracking and pitting. Shielding gases Ar + 15-25% CO <sub>2</sub> .
<b>FOX NIBAS C 24</b>  ENiCrMo-13 EL-NiCr22Mo16	SMAW	C < 0.02 Si < 0.2 Mn 0.5 Cr 22.5 Mo 15.5 Ni balance Fe 1	Re > 450 N/mm <sup>2</sup> Rm > 720 N/mm <sup>2</sup> A5 > 30% Av > 75 J	2.5 x 250 3.2 x 300 4.0 x 350	Basic electrode, for highest corrosion requirements and welding of the Ni base steel grades, e.g. UNS N06059, N06022, 2.4605, 2.4602 as well as for joining these grades with low alloyed and stainless steels. Excellent resistance against pitting and crevice corrosion and chloride-induced stress corrosion cracking. The special composition of the coating prevents the precipitation of intermetallic phases.
<b>NIBAS C 24-IG</b>  ERNiCrMo-13 SG-NiCr23Mo16	GTAW GMAW	C < 0.01 Si 0.1 Mn < 0.5 Cr 23.0 Mo 16.0 Ni balance Fe < 1	GTAW Re > 450 N/mm <sup>2</sup> Rm > 700 N/mm <sup>2</sup> A5 > 35% Av > 120 J  GMAW Re > 420 N/mm <sup>2</sup> Rm > 700 N/mm <sup>2</sup> A5 > 35% Av > 100 J	1.6 2.0 2.4          1.0 1.2	GTAW rod and GMAW wire of type AWS ERNiCrMo-13 are also best suited to meet all before mentioned characteristics.  For GMAW shielding gas acc. to EN 439 I1 Argon or M11 + 28% He is recommended.

# Nickel base alloys

<b>BÖHLER</b> Standard AWS EN	<b>Welding process</b>	<b>Typical analysis</b>  %	<b>Typical mechanical properties</b>	<b>Sizes</b>  mm	<b>Characteristics and applications</b>
<b>FOX NIBAS 625</b>  ENiCrMo3 E Ni6625(NiCr22Mo9Nb)	SMAW	C 0.025 Si 0.4 Mn 0.7 Cr 22.0 Mo 9.0 Ni > 60.0 Nb 3.3 Fe 0.5 Co ≤ 0.05 Al ≤ 0.4  PREN > 52	Re 530 N/mm <sup>2</sup> Rm 800 N/mm <sup>2</sup> A5 40% Av 80 J 45 J...-196 °C	2.5 3.2 4.0	Basic electrode suitable for welding of 6% Mo superaustenitic grades S31254, N08926, N08367 and the matching alloy 625.  Electrode and weld metal meet highest quality and corrosion requirements. Extremely resistant to stress corrosion cracking and pitting.  The pitting resistance equivalent is >52. Highly resistant to hot cracking.
<b>NIBAS 625-IG</b>  ERNiCrMo-3 S Ni6625(NiCr22Mo9Nb)	GTAW GMAW	C ≤ 0.02 Si 0.1 Mn 0.1 Cr 22.0 Mo 9.0 Ni ≥ 60.0 Nb 3.6 Fe 0.5  PREN > 52	GTAW Re 540 N/mm <sup>2</sup> Rm 800 N/mm <sup>2</sup> A5 38% Av 160 J 130 J...-196 °C  GMAW Re 510 N/mm <sup>2</sup> Rm 780 N/mm <sup>2</sup> A5 40% Av 130 J 80 J...-196 °C	1.6 2.0 2.4          1.0 1.2	GTAW rod and GMAW wire of type AWS ERNiCrMo-3 suitable for welding of the 6% Mo superaustenitic grades S31254, N08926, N08367 and the matching alloy 625. Rod, wire and weld metal meet highest quality and corrosion requirements. Extremely resistant to stress corrosion cracking and pitting. The pitting resistance equivalent is >52. Highly resistant to hot cracking.  For GMAW shielding gas to EN 439 I1 Argon or I3 Ar + He is recommended.
<b>NIBAS 625 FD</b>  ENiCrMo-3T0-4 Typ Ni6625(NiCr22Mo9Nb)	FCAW	C 0.05 Si 0.4 Mn 0.4 Cr 22.0 Mo 8.5 Ni ≥ 60.0 Nb 3.3 Fe < 5.0	Re 490 N/mm <sup>2</sup> Rm 750 N/mm <sup>2</sup> A5 30% Av 60 J	1.2	Rutil flux cored welding wire of type ENiCrMo-3 suitable for welding of the 6% Mo superaustenitic grades S31254, N08926, N08367 and the matching alloy 625.  The wire can be used in all positions except vertical down.  Extremely resistant to stress corrosion cracking and pitting. Shielding gases Ar +15-25% CO <sub>2</sub> .
<b>FOX NIBAS C 24</b>  ENiCrMo-13 E Ni6059(NiCr23Mo16)	SMAW	C < 0.02 Si < 0.2 Mn 0.5 Cr 22.5 Mo 15.5 Ni balance Fe 1	Re > 450 N/mm <sup>2</sup> Rm > 720 N/mm <sup>2</sup> A5 > 30% Av > 75 J	2.5 3.2 4.0	Basic electrode for highest corrosion requirements and welding of the Ni base steel grades, e.g. UNS N06059, N06022, 2.4605, 2.4602 as well as for joining these grades with low alloyed and stainless steels. Excellent resistance against pitting and crevice corrosion and chloride-induced stress corrosion cracking. The special composition of the coating prevents the precipitation of intermetallic phases.
<b>NIBAS C 24-IG</b>  ERNiCrMo-13 S Ni6059(NiCr23Mo16)	GTAW GMAW	C < 0.01 Si 0.1 Mn 0.5 Cr 23.0 Mo 16.0 Ni balance Fe < 1	GTAW Re > 450 N/mm <sup>2</sup> Rm > 700 N/mm <sup>2</sup> A5 > 35% Av > 120 J  GMAW Re > 420 N/mm <sup>2</sup> Rm > 700 N/mm <sup>2</sup> A5 > 35% Av > 100 J	1.6 2.0 2.4          1.0 1.2	GTAW rod and GMAW wire of type AWS ERNiCrMo-13 are also best suited to meet all before mentioned characteristics.  For GMAW shielding gas acc. to EN 439 I1 Argon or M11 +28% He is recommended.
<b>FOX NIBAS 400</b>  NiCu-7 E Ni4060(NiCu30Mn3Ti)	SMAW	C < 0.05 Si 0.7 Mn 3.0 Ni balance Cu 29.0 Fe 1.0 Ti 0.7 Al 0.3	Re > 300 N/mm <sup>2</sup> Rm > 450 N/mm <sup>2</sup> A5 > 30% Av > 80 J	2.5 3.2 4.0 5.0	Basic electrode for joining and surfacing of nickel copper alloys, e.g. alloy 400, N04400, 2.4360, 2.4375 as well as for clad nickel copper steels and joining dissimilar materials such as steel to copper and copper alloys. Excellent corrosion resistance to chloride induced stress corrosion cracking and a wide range of marine and chemical requirements.
<b>NIBAS 400-IG</b>  ERNiCu-7 S Ni4060(NiCu30Mn3Ti)	GTAW GMAW	C < 0.02 Si 0.3 Mn 3.2 Ni balance Cu 29.0 Fe 1.0 Ti 2.4 Al < 1.0	GTAW Re > 300 N/mm <sup>2</sup> Rm > 500 N/mm <sup>2</sup> A5 > 35% Av > 150 J  GMAW Re > 300 N/mm <sup>2</sup> Rm > 500 N/mm <sup>2</sup> A5 > 35% Av > 150 J	1.6 2.0 2.4          1.0 1.2	GTAW rod and GMAW wire of type AWS ERNiCu-7 are also best suited to meet all before mentioned characteristics.  For GMAW shielding gas acc. to EN 439 I1 Argon or M11 +28% He is recommended.

# Nickel base alloys

<b>BÖHLER</b> Standard AWS EN	<b>Welding process</b>	<b>Typical analysis</b>  %	<b>Typical mechanical properties</b>	<b>Sizes</b>  mm	<b>Characteristics and applications</b>
<b>FOX NIBAS 70/20</b>  ENiCrFe-3 (mod.) E Ni6082(NiCr20Mn3Nb)	SMAW	C 0.025 Si 0.4 Mn 5.0 Cr 19.0 Mo ≤1.2 Ni ≥67.0 Nb 2.2 Fe 3.0 Co ≤0.08 Ti +	Re 420 N/mm <sup>2</sup> Rm 680 N/mm <sup>2</sup> A5 40% Av 120 J 80 J...-196 °C	2.5 3.2 4.0 5.0	Basic electrode for joining Nickel and Nickel alloys e.g. UNS N06600, N06601, for dissimilar joints and for many other applications.  The weld metal is universal applicable, has an outstanding crack resistance, even resistant to stress corrosion cracking and shows good mechanical properties at sub zero, room and elevated temperatures.
<b>NIBAS 70/20-IG</b>  ERNiCr-3 S Ni6082(NiCr20Mn3Nb)	GTAW GMAW	C ≤0.03 Si ≤0.3 Mn 3.0 Cr 20.0 Ni ≥67.0 Nb 2.5 Fe ≤1.7 Ti +	GTAW Re 440 N/mm <sup>2</sup> Rm 680 N/mm <sup>2</sup> A5 42% Av 190 J 100 J...-196 °C  GMAW Re 420 N/mm <sup>2</sup> Rm 680 N/mm <sup>2</sup> A5 40% Av 160 J 80 J...-196 °C	1.6 2.0 2.4    0.8 1.0 1.2	GTAW rod and GMAW wire of type AWS ERNiCr-3 are also best suited to meet all before mentioned characteristics.  For GMAW shielding gas acc. to EN 439 I1 Argon or I3 Ar + He is recommended.
<b>NIBAS 70/20-FD</b>  ENiCr-3T0-4 Typ Ni6082(NiCr20Mn3Nb)	FCAW	C 0.03 Si 0.4 Mn 3.2 Cr 20.0 Ni ≥67.0 Nb 2.5 Fe <2.0	Re 400 N/mm <sup>2</sup> Rm 650 N/mm <sup>2</sup> A5 39% Av 135 J 110 J...-196 °C	1.2 1.6	Rutile flux cored welding wire for downhand and horizontal welding positions. It provides very good operating characteristics, good side wall wetting, safe penetration and a smooth weld finish. The shielding gas should be Argon +15-25% CO <sub>2</sub> .  Please also note our special brochure „Flux cored welding wires for stainless steels“.
<b>FOX NIBAS C 276</b>  ENiCrMo-4 E Ni6276(NiCr15Mo15Fe6W4)	SMAW	C <0.02 Si <0.2 Mn 0.6 Cr 16.5 Mo 16.5 Ni balance Fe 5.0 W 4.0	Re >450 N/mm <sup>2</sup> Rm >720 N/mm <sup>2</sup> A5 >30% Av 70 J	2.5 3.2 4.0	Basic electrode for welding of similar alloyed Ni base steel grades, e.g. N10276, 2.4819 as well as for joining these grades with low alloyed and stainless steels.  Excellent resistance to chlorine contaminated and chloride containing medias. Resistant against strong oxidisers such as ferric and cupric chlorides.
<b>NIBAS C 276-IG</b>  ERNiCrMo-4 S Ni6276(NiCr15Mo15Fe6W4)	GTAW GMAW	C <0.012 Si 0.1 Cr 16.0 Mo 16.0 Ni balance Fe 6.0 V 0.2 W 3.5	GTAW Re >450 N/mm <sup>2</sup> Rm >750 N/mm <sup>2</sup> A5 >30% Av >90 J  GMAW Re >450 N/mm <sup>2</sup> Rm >750 N/mm <sup>2</sup> A5 >30% Av >90 J	1.6 2.0 2.4    1.0 1.2	GTAW rod and GMAW wire of type AWS ERNiCrMo-4 are also best suited to meet all before mentioned characteristics.  For GMAW shielding gas acc. to EN 439 I1 Argon or M11 +28% He is recommended.
<b>FOX CN 21/33 Mn</b>  E Z21 33 B 4 2	SMAW	C 0.14 Si 0.3 Mn 4.5 Cr 21.0 Ni 33.0 Nb 1.3 Fe balance	Re >410 N/mm <sup>2</sup> Rm >600 N/mm <sup>2</sup> A5 >25% Av 70 J	2.5 3.2 4.0	Basic electrode for joining and surfacing of heat resistant steels and cast steels of the same or similar chemical composition e.g. alloy 800/800HT, UNS N08800, N08810, or 1.4876, 1.4958.  Suitable for operating temperatures up to 1050 °C dependence of the atmosphere.
<b>CN 21/33 Mn-IG</b>  W Z21 33MnNb G Z21 33 MnNb	GTAW GMAW	C 0.12 Si 0.2 Mn 4.8 Cr 21.8 Ni 32.5 Nb 1.2 Fe balance	GTAW Re ≥400 N/mm <sup>2</sup> Rm ≥600 N/mm <sup>2</sup> A5 ≥17% Av ≥50 J  GMAW Re ≥400 N/mm <sup>2</sup> Rm ≥600 N/mm <sup>2</sup> A5 ≥17% Av ≥50 J	2.0 2.4    1.0 1.2	GTAW rod and GMAW wire are also best suited to meet all before mentioned characteristics.  For GMAW shielding gas acc. to EN 439 M13 is recommended.

# Non ferrous alloys – Copper base and Titanium

<b>BÖHLER</b> Standard AWS EN	<b>Welding process</b>	<b>Typical analysis</b>  %	<b>Typical mechanical properties</b>	<b>Sizes</b>  mm	<b>Characteristics and applications</b>
<b>FOX CuNi30 Fe</b>  ECuNi EL-CuNi30Mn	SMAW	C 0.03 Si 0.3 Mn 1.2 Ni 30.0 Fe 0.6 Cu balance	Re >240 N/mm <sup>2</sup> Rm >390 N/mm <sup>2</sup> A5 >30% Av >80 J	2.5 3.2 4.0	CuNi base electrode for joining and surfacing of similar alloyed base metals with up to 30% Nickel, as well as for non ferrous alloys and steels of different nature. Due to the excellent resistance to sea water the electrode is best suitable for offshore applications. The electrode can be operated in all positions except vertical down.
<b>CuNi30 Fe-IG</b>  ERCuNi S Cu7158(CuNi30)	GTAW	C <0.05 Mn 0.8 Ni 30.0 Fe 0.6 Ti <0.5 Cu balance	Re >200 N/mm <sup>2</sup> Rm >360 N/mm <sup>2</sup> A5 >30% HB 120	1.6 2.0 2.4	GTAW rod for joining and surfacing of similar alloyed base metals with up to 30% Nickel, as well as for non ferrous alloys and steels of different nature. Due to the excellent resistance to sea water, the wire is best suitable for offshore applications.
<b>ER Ti 2-IG</b>  ERTi2 –	GTAW	C ≤0.03 Fe ≤0.2 O <0.1 H <0.008 N ≤0.02 Ti balance	GTAW Re 295 N/mm <sup>2</sup> Rm 500N/mm <sup>2</sup> A5 42% Z 76%	1.6 2.0 2.4	GTAW rod for welding of pure Titan and Titan alloys with similar chemical composition. Titanium can be tungsten arc welded employing techniques similar to those used for welding of stainless steel. However, Titanium requires a greater cleanliness and the use of auxiliary gas shielding to protect the molten puddle and cooling weld zone from atmospheric contamination.



Published by BÖHLER WELDING

**Böhler Schweißtechnik Austria GmbH**

Böhler-Welding-St. 1

8605 Kapfenberg / AUSTRIA

☎ +43 (0) 3862-301-0

☎ +43 (0) 3862-301-95193

✉ [postmaster.bsga@bsga.at](mailto:postmaster.bsga@bsga.at)

[www.boehler-welding.com](http://www.boehler-welding.com)

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