



iSAM AG



SAW solutions for large diameter pipes
and wind tower production

Böhler Schweisstechnik Deutschland GmbH & iSAM AG -

Böhler Welding and iSAM have joint forces to offer the industry combined total submerged arc welding (SAW) solutions for the production of large diameter pipes and wind towers. The “triangle” for successful industrial projects consists of welding consumables, welding power sources & controls and the integrated welding & handling system.

Böhler Welding Group is one of the world's largest manufacturers and supplier of welding consumables for the main arc welding processes SAW, SMAW, GTAW, GMAW and FCAW. The product range includes wires, covered electrodes, cored wires and submerged arc welding fluxes and covers most materials that can be welded from unalloyed mild steels, low alloyed steels and stainless steels up to nickel base alloys.

In addition to joining applications, the product program also includes welding consumables for Maintenance & Repair as well as for cladding applications for all industries. Further more and to complete the scope of product, a wide range of filler metals for brazing and soldering is available and produced within the Böhler Welding Group.

With 10 production sites and 19 sales offices spread out over the world, the Böhler Welding Group is a true global player in the field of welding consumables for demanding industries. Technical support and expertise is provided through a global network of experienced metallurgists and professional welding engineers.

The biggest production company within the Böhler Welding Group is Böhler Schweisstechnik Deutschland GmbH, in Hamm, Germany. Here, amongst other product, most solid wires are produced for GMAW and GTAW as well as wires for submerged arc welding. Together with the production of welding fluxes for joining applications, a vast range of wire/flux combinations for submerged arc welding are available to suit most industrial applications. A selection of these wire/flux combinations for the welding of large diameter pipes and wind towers is covered in this brochure.

iSAM AG is a German company specialised in the development and production of advanced industrial process & control systems as used in steel making, aerospace, bulk material handling in ports as well as in pipe production & welding technology. With over 25 years of experience and a global support network, iSAM can provide the service and support the welding industry requires and demands.

The business unit Welding Technology & Automation offers hardware-engineering & planning, assembly of control cabinets, computer software & networking systems as well as programming & commissioning.

For welding, the typical iSAM products are high performance electronic power sources for SAW and GMAW, digital arc controllers and laser seam tracking systems as part of project based solutions.

To complete the “triangle”, **HAANE welding systems GmbH** in Germany offers integrated welding & handling system such as column & booms, turn tables, manipulators, positioners, rotators, portal systems, flux recovery systems, welding heads, wire feeding systems etc. to suit any industrial application from single units to complete production facilities as well as for upgrading of existing production equipment.

HAANE is a iSAM Group company with many years of experience in this field and there for the ideal partner to engage in demanding industrial projects. Throughout this brochure product references will be exemplified.



Roller Stands – Haane Production Series RBZ

SAW Fluxes for Submerged Arc Welding

Welding flux	Type	Classification EN 760	Application
UV 400	Aluminate basic	SA AB 1 67 AC H5	S 1 – S 2 Mo; moderate Si, Mn pickup
UV 400 WP	Aluminate basic	SA AB 1 67 AC H5	Economic grade for windtower fabrication
UV 418 TT	Fluoride basic	SA FB 1 55 AC H5	Neutral flux; excellent toughness
UV 310 P	Aluminate basic	SA AB 1 55 AC H5	Two run technique for line pipe welding
UV 420 TTR-(W)	Fluoride basic	SA FB 1 65 DC (AC)	Creep resisting; CrMo steels; CrMo hydrobreating reactors



- Welding Technology & Automation

SAW characteristics

Flux	AB	AB	FB	AB	FB
Suitability to AC	+++	+++	++	+++	++ (++++)
Current carrying capacity	+++	+++	+++	++++	+++
Resistance to pore formation	+++	+++	+++	+++	+++
Travel speed	+++	+++	++	++++	+++
Bead appearance	+++	++	+++	++	+++
Slag removal	++++	+++	+++	++++	+++
Multi wire	++++	+++	+++	++++	++
Two run	+++	+++	+++	++++	-
Crack resistance	+++	+++	+++	+++	+++
Creep resistance	++	++	++	-	++++
Toughness	+++	++	++++	+++	-

++++ excellent +++ very good ++ good + normal



Large diameter pipes, welded with high-performance welding equipment

Multi Wire Submerged Arc Welding

Basically, the SAW process is popular for its high deposition rates when welding thick material with the multi-pass technique. Due to the high welding current that can be applied, the penetration is profound which makes the process also very suitable for two-run technique in smaller material thicknesses at a reasonable welding speed. The deposition rate can be increased by using multiple wires (up to 6), either using large diameter wires (up to 4.0 – 5.0 mm) with high currents (up to 1200 – 1400 A) and multiple power sources. When only 2 wires with each a separate power source is used, the process is referred to as tandem welding. Alternatively, smaller wires (1.6 – 2.4 mm) can be used in the twin-wire welding mode using 2 wires and one power source with a current up to 800 A. In this case, the higher current density in the individual wires will increase the deposition rate. This process can achieve higher welding speeds and an even higher deposition rates when 2 twin-wire welding heads are used in line. This process is known as tandem-twin welding. As usual there is no single solution for all applications and the most suitable solution will be a combination of some as described above.

Typical wire chemistry in %

Typ: Union	C	Si	Mn	P	S	Mo	others	Application
S 2	0.1	0.1	1.0	≤ 0.01	≤ 0.01	-	-	bis S355N, 355N
S 2 Si	0.1	0.3	1.2	≤ 0.01	≤ 0.01	-	-	S420, ASTM A 516-65
S 3 Si	0.1	0.3	1.6	≤ 0.01	≤ 0.01	-	-	up to S460N, P460N ASTM A 516-70
S 2 Mo	0.1	0.1	1.0	≤ 0.01	≤ 0.01	0.5	-	S460N, P460N, 15Mo3
S 3 TiB	0.08	0.3	1.6	≤ 0.01	≤ 0.005	-	Ti, B	up to X 80
S 3 Mo TiB	0.08	0.3	1.2	≤ 0.01	≤ 0.005	0.5	Ti, B	up to X 80



Classification of wire-flux combination

Application	Windtower two run *	Multilayer	Line pipes two run *
Wire	Flux		
	UV 400 / UV 400 WP EN 756 / AWS	UV 418 TT EN 756 / AWS	UV 310 P API5L / AWS
EN 760	SA AB 1 67 AC H5	SA FB 1 55 AC H5	SA AB 1 55 AC H5
Union S 2	F7 EM12 S 38 4 AB S2	A 5.17 F7A5-EM12 S 35 4 FB S2	
Union S 2 Si	A 5.17 F7A4-EM12K S 42 5 AB S2Si	A 5.17 F7A6-EM12K S 42 5 FB S2Si	
Union S 3 Si		A 5.17 F7A8-EH12K S 46 6 FB S3Si	X70: (A 5.17 F8A4-EH12K-G)
Union S 2 Mo			X80: A 5.23 F9TA4-EA2-G
Union S 3 TiB			X70: A 5.17 (F8A6-EH12KTiB-G)
Union S 3 Mo TiB			X80: A 5.23 F9TA6-EA2Ti

* properties depend on pipe steel properties strongly

A popular set up for longitudinal welds in pipe is 3-wire welding with a single lead wire on DC+ for penetration, combined with two trail wires on AC for increased deposition (filling). The use of two different current types, DC+ and AC, prevents interferences between the two welding arcs. This set up would be used for welding in the two-run technique, one run inside and one outside. The weld preparation is almost a square butt. Thickness limitation in this case would be about 25 mm (one inch)

From here, all varieties are possible and also applied in practice, more wires, higher current, special power sources, cored wires etc. Most companies have gathered experience over many years to find and define the best set up for their application.

SAW wire/flux combinations

In order to achieve the desired mechanical properties of a welded joint the choice of the welding consumables, in this case the wire/flux combination is crucial. Bearing in mind that the dilution with the parent metal can be over 70 %, the weld metal is of eminent importance to the overall joint properties.

The wire/flux combinations listed in this brochure have been designed by Böhler to exactly govern the requested mechanical properties in specific base materials. It is no coincidence that they are referred to as wire/flux combinations while all wires and fluxes listed meet individual internal specifications as to achieve the welding, chemical and mechanical properties laid out in the development design criteria.

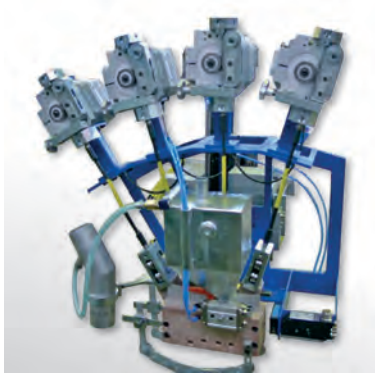
Although the wires and fluxes meet all the listed specifications, certain unique properties have been designed into the products, based on the welding engineering and metallurgical know-how that is available within Böhler.



Inside welding column – Flux handling system
Wind tower production (Offshore)

This brochure provides an overview and the basic information about the Böhler wire/flux combinations for application in the production of line pipe and structures for wind towers. More and specific information such as sizes and packaging options can be obtained from the individual data sheets, available on the brand websites.

iSAM Group welding technologie & automation



Outside Welding Head



Inside Welding Head



Outside Welding Column

Typical parameters for two run technique

single wire						
Thickness mm	Preparation	Wire Ø mm	Run	Current A	Voltage V	Speed cm/min
6		3.0	1	400	34	80
			2	500	34	85
8		4.0	1	500	34	80
			2	600	34	85

multi wire welding*, wire diameter 4 mm, tandem welding							
Thickness mm	Preparation	Run	Head 1 A	V	Head 2 A	V	Speed cm/min
10		1	600	28	500	30	100
		2	650	29	550	32	110
15		1	750	29	650	32	120
		2	850	30	700	34	130
20		1	850	30	700	34	90
		2	950	32	750	36	110

multi wire welding*, wire diameter 4 mm, 3 wire welding									
Thickness mm	Preparation	Run	Head 1 A	V	Head 2 A	V	Head 3 A	V	Speed cm/min
10		1	650	32	600	34	550	36	180
		2	750	32	650	34	550	36	200
15		1	1000	34	900	36	600	38	170
		2	1100	34	1000	36	600	38	180
20		1	1100	34	1000	36	650	38	130
		2	1200	35	1100	38	650	40	150

* parameters using 4/5 welding heads on request



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