Pipeline product catalogue

Consumables for pipeline welding

STRENGTH THROUGH **COOPERATION**

ESAB®

Understanding the **challenges**

The ESAB range of welding consumables for pipeline welding has evolved over the years and has earned a reputation in countless projects globally. With many recent addtions, it is a modern range of products dedicated to pipeline welding.

Quality, the environment and safety are three key areas of focus. ESAB is the one single welding company to have achieved ISO 14001 and OHSAS 18001 standards in Environmental, Health & Safety Management Systems across all our global manufacturing facilities.

With ESAB, you are assured of a partner who understands the challenges of pipeline welding and responds with innovative solutions for both onshore and offshore applications.

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STRENGTH THROUGH **COOPERATION**

Contents

World leader in welding and cutting technology systems

ESAB operates at the forefront of welding and cutting technology. Over one hundred years of continuous improvement in products and processes enables us to meet the challenges of technological advances in every sector in which ESAB operates.

Quality and environment standards
Quality, the environment and safety are three key areas of focus. ESAB is one of a few international companies to have achieved the ISO 14001 and OHSAS 18001 standards in Environmental, Health & Safety Management Systems across all our global manufacturing facilities.

At ESAB, quality is an ongoing process that is at the heart of all our production processes and facilities worldwide.

Multinational manufacturing, local representation and an international network of independent distributors bring the benefits of ESAB quality and unrivalled expertise in materials and processes within reach of all our customers, wherever they are located.

Welding consumables

- Globally available, vast range of high productivity welding consumables covering all applications.
- Consistent high quality.
- Productive, environmentally-friendly packaging solutions.
- A wide range of pipe welding tested low-hydrogen consumables.
- Most of the range produced in house: own development, metallurgy skills, QA.
- Production standards rigorously proved and tested to meet customer requirements.

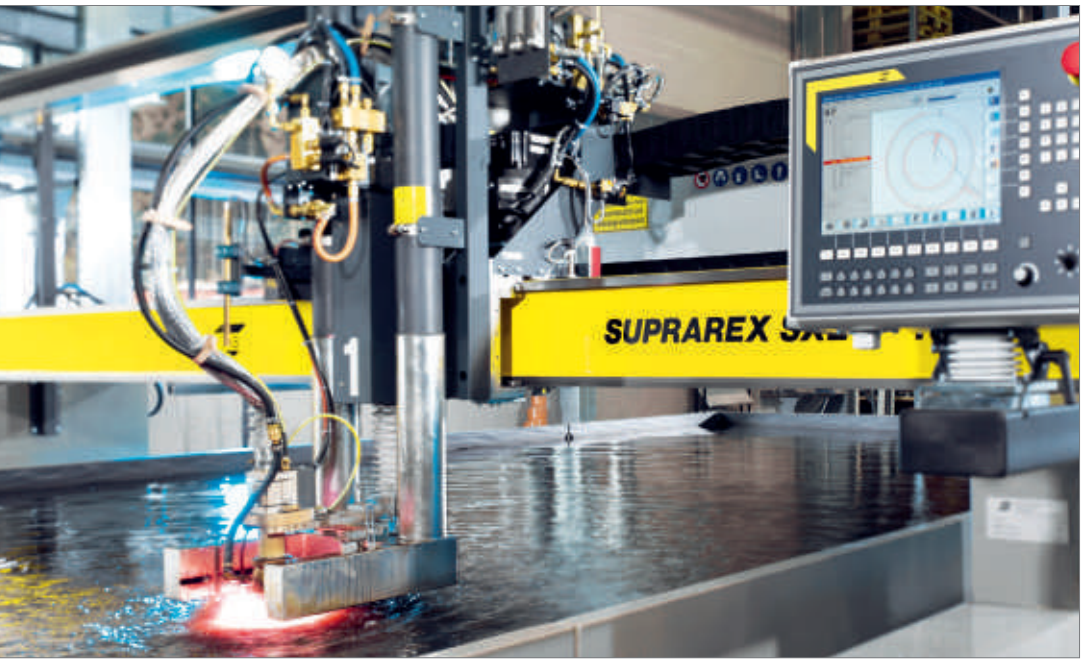
Equipment

- Large variety of equipment designed for demanding applications.
- Designed for semi-automation and automation. High- and low-end mechanised semi-automation.
- Various degrees of freedom to adjust optimum process.
- User-friendly controls.
- Reduced energy consumption.
- Smart welding processes such as SuperPulse™.
- Smart technology for consistent quality, long product life (durability).

Automation & robotics integration

- Complete welding solutions for different customer needs.
- Full range of processes from MIG/ MAG to SAW.
- Customised heavy duty submerged arc solutions.
- Reduced downtime in production due to smart designs.
- Full range of positioners, manipulators and column & booms.

World leader in welding and cutting technology systems



Cutting

- Cutting machines from 2 to 36m machine width.
- Filter systems.
- Cutting tables.
- Plasma system solutions from 1 to 120mm cutting thickness.
- Specialised cutting software and easy to operate CNC controls.
- High-duty oxyfuel cutting equipment.
- Tools for automated weld-edge preparation.

Personal protection equipment

- Full range of personal protection equipment.
- Complying to and exceeding the relevant standards.
- Specifications of welding glasses fulfil advanced optical requirements.
- UV and IR filtering.

ESAB & the pipeline industry

For over 100 years, ESAB has been powered by innovation and uncompromising standards – and by the will to continuously seek new and improved ways of serving our customers. This has made ESAB a world leader in welding products.

Every day countless kilometres of steel pipelines are installed worldwide for the most varied civil and industrial uses. They form real networks comparable to a system of road networks, which, although not so obvious, are definitely much more intricate and carry fluids and gases that have become essential for us.

To comply with technical specifications and fulfil the necessary safety requisites, special materials and welding processes which have evolved with the sector have been developed in recent years.
The main welding process used to install the pipelines is manual welding with coated electrode, which, thanks to its ease and versatility, is still the most popular.
However, to limit costs and increase welding productivity, particularly on long routes, various constructors have adopted the semi-automatic or completely automatic welding process with solid and flux cored wires.

However, still today, when more sophisticated materials and more productive and less expensive techniques are at the users' disposal, MMA welding remains a favoured process to weld pipes.
Its easy use, capacity to reach positions of difficult accessibility, the simplicity of the welding machines or the fact of being able to use motor generators as network power is not always available on installation sites, the fact that protective gases can be difficult to find in certain countries, necessary in welding with solid or cored wires, are not required, all these and others are the reasons for this choice.

ESAB's history in stick electrode welding can be traced back to 1903 and in fact the founder of ESAB was the pioneer of the modern day stick electrode.

The Pipeweld range of cellulosic and basic electrodes have been specially designed to meet the requirements of the applicable grade of steel used to manufacture pipelines and the safety specifications laid down by standards, but also to equip the user i.e. welders with versatile products created for this specific purpose.

The global shortage of skilled welders and the requirement to achieve welds of the highest quality has encouraged the development and use of welding "bugs". Although these machines still require a welder to operate them, they have in turn substantially decreased pipeline construction times and in many cases enabled the welds to be deposited to a higher standard than manual welding. ESAB has a complete range of solid and flux cored wire products that have been developed to supply this segment of the pipeline industry.
The creation of the Pipeweld range has created an identifiable, complete range of consumables, tried and tested to meet all the requirements of even the most stringent pipeline mechanical testing criteria.
The products come from a manufacturer with a proven track record in innovative welding solutions and a history of producing user friendly products.

Over the years ESAB has supplied consumables to all the pipeline sectors, cross country pipelines, offshore Reel-lay, J-lay, S-lay and double jointing.
We have contributed to the welding of thousands of miles of pipelines globally and will continue to develop our products to match the advancing requirements of the pipeline industry.

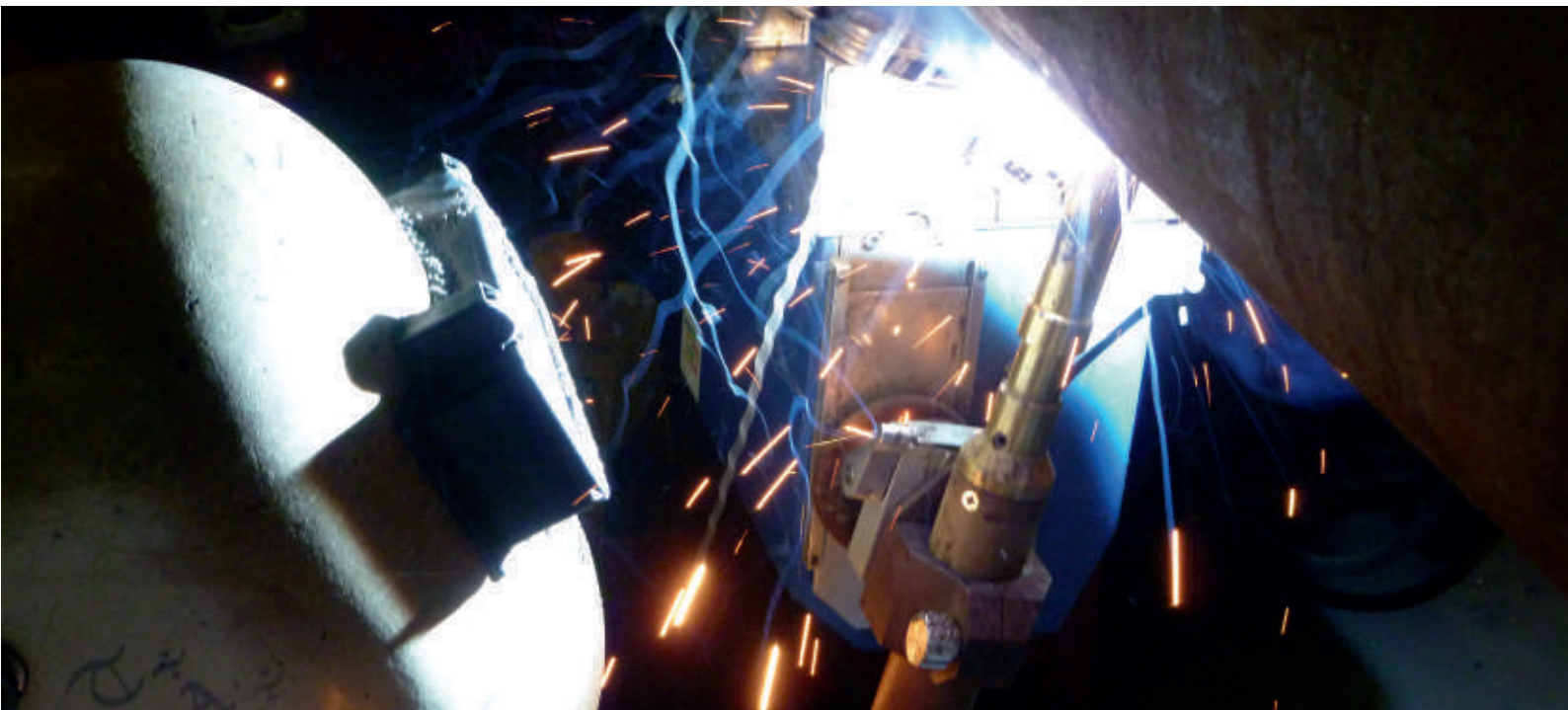
Overview ESAB consumables for pipeline welding

API 5L pipe steel grade	Minimum yield strength	Minimum tensile strength	Cellulosic electrodes	Basic electrodes
X52	360 MPa (52200 psi)	460 MPa (66700 psi)		
Root			Pipeweld 6010P/PLUS	Pipeweld 7016
Hot pass			Pipeweld 6010P/PLUS	Pipeweld 7016
Fill & cap			Pipeweld 6010P/PLUS	Pipeweld 7016
X60	415 MPa (60200psi)	520 MPa (75400 psi)		
Root			Pipeweld 6010P/PLUS	Pipeweld 7016
Hot pass			Pipeweld 7010 PLUS	Pipeweld 7016
Fill & cap			Pipeweld 7010 PLUS	Pipeweld 7016
X65	450 MPa (65300psi)	535 MPa (77600 psi)		
Root			Pipeweld 6010P/PLUS	Pipeweld 7016
Hot pass			Pipeweld 8010 PLUS	Pipeweld 8016
Fill & cap			Pipeweld 8010 PLUS	Pipeweld 8016
X70	485 MPa (70300 psi)	570 MPa (82700 psi)		
Root			Pipeweld 6010P/PLUS	Pipeweld 7016
Hot pass			Pipeweld 8010 PLUS	Pipeweld 8016
Fill & cap			Pipeweld 9010 PLUS	Pipeweld 8016
X80	555 MPa (80500psi)	625 MPa (90600 psi)		
Root			Pipeweld 6010P/PLUS	Pipeweld 7016
Hot pass			Pipeweld 9010 PLUS	Pipeweld 10018
Fill & cap			N.a.	Pipeweld 10018

N.a. : not applicable

NOTE:
Under certain circumstances it may be needed to select a higher strength consumable than recommended in this catalogue e.g. with high input applications, strain based design or when high strength overmatching is required.
All flux wire combinations for the SAW welding of pipeline grades are available, see page 24. Actual consumables selection depends on requirements and welding procedure.

Basic electrodes vertical down	Flux cored wires gas-shielded	Flux cored wires self-shielded	Solid wires
N.a	N.a.	N.a.	Pipeweld 70S-6/Plus
Pipeweld 80 DH	Pipeweld 71T-1	Pipeweld 8Ni1-H5	Pipeweld 70S-6/Plus
Pipeweld 80 DH	Pipeweld 71T-1	Pipeweld 8Ni1-H5	Pipeweld 70S-6/Plus
N.a	N.a.	N.a.	Pipeweld 70S-6/Plus
Pipeweld 80 DH	Pipeweld 91T-1	Pipeweld 8Ni1-H5	Pipeweld 70S-6/Plus
Pipeweld 80 DH	Pipeweld 91T-1	Pipeweld 8Ni1-H5	Pipeweld 70S-6/Plus
N.a	N.a.	N.a.	Pipeweld 70S-6/Plus
Pipeweld 80 DH	Pipeweld 91T-1	Pipeweld 8Ni1-H5	Pipeweld 70S-6/Plus
Pipeweld 80 DH	Pipeweld 91T-1	Pipeweld 8Ni1-H5	Pipeweld 70S-6/Plus
N.a.	N.a.	N.a.	Pipeweld 70S-6/Plus
Pipeweld 90 DH	Pipeweld 101T-1	N.a.	Pipeweld 70S-6/Plus
Pipeweld 90 DH	Pipeweld 101T-1	N.a.	Pipeweld 70S-6/Plus
N.a	N.a.	N.a.	Pipeweld 70S-6/Plus
Pipeweld 100 DH	Pipeweld 111T-1	N.a.	Pipeweld 100S
Pipeweld 100 DH	Pipeweld 111T-1	N.a.	Pipeweld 100S



The Pipeweld range of cellulosic electrodes

API 5L pipe steel grade	Cellulosic electrodes
X52	
Root	Pipeweld 6010P/PLUS
Hot pass	Pipeweld 6010P/PLUS
Fill & cap	Pipeweld 6010P/PLUS
X60	
Root	Pipeweld 6010P/PLUS
Hot pass	Pipeweld 7010 PLUS
Fill & cap	Pipeweld 7010 PLUS
X65	
Root	Pipeweld 6010P/PLUS
Hot pass	Pipeweld 8010 PLUS
Fill & cap	Pipeweld 8010 PLUS
X70	
Root	Pipeweld 6010P/PLUS
Hot pass	Pipeweld 8010 PLUS
Fill & cap	Pipeweld 9010 PLUS
X80	
Root	Pipeweld 6010P/PLUS
Hot pass	Pipeweld 9010 PLUS
Fill & cap	N.a.

ESAB cellulosic electrodes for pipeline welding
Cellulosic electrodes have been used for many years for welding pipelines worldwide. This is due to both easy application of the root run and the speed of weld metal deposition. The ESAB range of cellulosic electrodes deposits high quality weld metal for pipeline steels up to X70 for filling and for root pass welding for all grades.

It is standard practice that the root run is done with E6010 electrodes because of the excellent arc force control that these electrodes give, resulting in fewer fusion defects and good reinforcement.

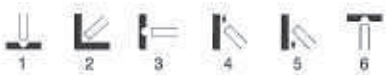
The Pipeweld 6010 PLUS is best suited for welding on negative polarity (DCEN) in order to optimise the reinforcement on the inside of the root. Using DCEN also reduces the risk of internal undercut, cracking as well as hollow beads. Pipeweld 6010 PLUS has excellent welding properties both in vertical up and vertical down progression.

If it is necessary to use DCEP for the root, it is advisable to use another electrode, the Pipeweld 6010P.

For the hot pass, fill and cap with E7010, E8010 and E9010, ESAB has a complete range of cellulosic electrodes for welding up to X70 pipe. These electrodes give excellent performance in both the vertical up and down position on DCEP.

Although ESAB cellulosic electrodes are designed to produce high integrity welds and excellent mechanical properties, care must be taken when selecting electrodes of this type on thicker pipe sections.

Due to the high hydrogen content of cellulosic electrode deposited weld metal, there may be an increased risk of hydrogen induced cracking and limitations may be achieved with regards to mechanical testing results.



Pipeweld 6010P	Typical all weld metal composition %			Typical all weld metal mechanical properties AW		Ø x l (mm)	Current (A)	Welding positions
AWS E6010	**C**	**Si**	**Mn**	**Re/Rp0.2 (MPa)**	**Rm (MPa)**	2.5 (3/32")	50-70	1 2 3 4 5 6
Cellulosic coated	0.01	0.15	0.35	410 (59,450 psi)	495 (71,775 psi)	3.2 (1/8")	65-120	1 2 3 4 5 6
Polarity				**CVN -20˚C (J)**	**A5 (%)**	4.0 (5/32")	90-180	1 2 3 4 5 6
DC+, AC				60 (-4˚F, 44 ft-lb)	22	5.0 (3/16")	150-240	1 2 3 4 5 6

A cellolosic electrode designed for DC+ and AC welding only. This electrode performs particularly well in uphill welding.

Pipeweld 6010 PLUS	Typical all weld metal composition %			Typical all weld metal mechanical properties AW		Ø x l (mm)	Current (A)	Welding positions
AWS E6010	**C**	**Si**	**Mn**	**Re/Rp0.2 (MPa)**	**Rm (MPa)**	2.5 (3/32")	60-80	1 2 3 4 5 6
Cellulosic coated	0.1	0.2	0.45	430 (62,350 psi)	525 (76,125 psi)	3.2 (1/8")	75-130	1 2 3 4 5 6
Polarity				**CVN -30˚C (J)**	**A5 (%)**	4.0 (5/32")	100-190	1 2 3 4 5 6
DC+(-)				50 (-22˚F, 37 ft-lb)	23	5.0 (3/16")	160-240	1 2 3 4 5 6

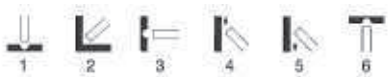
Pipeweld 6010 PLUS has been developed for rootpass welding on electrode negative. This product offers superior penetration and excellent root profiles, it can be used either vertical down or in an upwards progression.

Pipeweld 7010 PLUS	Typical all weld metal composition %				Typical all weld metal mechanical properties AW		Ø x l (mm)	Current (A)	Welding positions
AWS E7010-P1	**C**	**Si**	**Mn**	**Ni**	**Re/Rp0.2 (MPa)**	**Rm (MPa)**	3.2 (1/8")	65-120	1 2 3 4 5 6
Cellulosic coated	0.8	0.13	0.45	0.38	465 (67,425 psi)	560 (81,200 psi)	4.0 (5/32")	90-180	1 2 3 4 5 6
Polarity					**CVN -30˚C (J)**	**A5 (%)**	5.0 (3/16")	150-240	1 2 3 4 5 6
DC+					50 (-22˚F, 37 ft-lb)	23			

A cellulosic electrode designed for DC+ welding only. This electrode performs well for filling and capping on X52- X60 pipe materials in a downward progression.

Actual mechanical properties in X60	
Re/Rp0.2 (MPa)	**Rm (MPa)**
421 (62,495 psi)	552 (80,040 psi)
CVN -30˚C (J)	**A5 (%)**
53 (-22˚F, 39 ft-lb)	23

The Pipeweld range of cellulosic electrodes



Pipeweld 8010 PLUS	Typical all weld metal composition %				Typical all weld metal mechanical properties AW		Ø x l (mm)	Current (A)	Welding positions
AWS E8010-P1	**C**	**Si**	**Mn**	**Ni**	**Re/Rp0.2 (MPa)**	**Rm (MPa)**	3.2 (1/8")	65-120	1 2 3 4 5 6
Cellulosic coated	0.07	0.13	0.65	0.75	530 (76,850 psi)	625 (90,625 psi)	4.0 (5/32")	90-180	1 2 3 4 5 6
Polarity					**CVN -30˚C (J)**	**A5 (%)**	5.0 (3/16")	150-240	1 2 3 4 5 6
DC+					70 (-22˚F, 52 ft-lb)	22			
					Actual mechanical properties in X65				
	A cellolosic electrode designed for DC+ welding only. This electrode performs well for filling and capping on X60- X70 pipe materials in a downward progression.				**Re/Rp0.2 (MPa)**	**Rm (MPa)**			
					569 (82,505 psi)	632 (91,640 psi)			
					CVN -40˚C (J)	**A5 (%)**			
					41 (-40˚F, 30 ft-lb)	22			

Pipeweld 9010 PLUS	Typical all weld metal composition %				Typical all weld metal mechanical properties AW		Ø x l (mm)	Current (A)	Welding positions
AWS E9010-P1	**C**	**Si**	**Mn**	**Ni**	**Re/Rp0.2 (MPa)**	**Rm (MPa)**	3.2 (1/8")	65-120	1 2 3 4 5 6
Cellulosic coated	0.1	0.2	1	0.9	620 (89,900 psi)	700 (101,500 psi)	4.0 (5/32")	90-180	1 2 3 4 5 6
Polarity					**CVN -30˚C (J)**	**A5 (%)**	5.0 (3/16")	150-240	1 2 3 4 5 6
DC+					35 (-22˚F, 26 ft-lb)	22			
					Actual mechanical properties in X70				
	A cellolosic electrode designed for DC+ welding only. This electrode performs well for filling and capping on X70 and X80 hot passing and light wall applications (>9.5mm)				**Re/Rp0.2 (MPa)**	**Rm (MPa)**			
					556 (80,620 psi)	634 (91,930 psi)			
					CVN -30˚C (J)	**A5 (%)**			
					40 (-22˚F, 30 ft-lb)	21			

Basic low-hydrogen electrodes for up- and downhill welding

ESAB basic electrodes for pipeline welding
With the introduction of modern pipeline steels with elevated strength levels, the development of suitable cellulosic downhill electrodes appears to be stretched beyond it possibilities. Very often, the high weld metal hydrogen content and limited low-temperature toughness are found to offer insufficient guarantees for sound welds.

Low-hydrogen basic electrodes provide a technologically and economically sound alternative, providing the required combination of high weld metal strength and good low-temperature toughness and, morover, a sharply reduced risk of hydrogen induced cracking. Depending on the steel quality, preheat temperatures can be reduced or even be omitted in the case of many thermo-mechanically treated steel grades, bringing savings through better efficiency. Basic electrodes are used for pipe steel grades as from X70, especially with higher wall thickness and low-temperature weld metal toughness requirements.

The ESAB range of basic electrodes for pipeline welding features LMA (Low Moisture Absorption) types for uphill and downhill welding; named Pipeweld and Pipeweld DH respectively.

Uphill types can be used for the root pass and for filling and capping and weaving is generally applied. This gives a good weld penetration, but care must be taken to control the heat input to avoid loss of mechanical properties in the HAZ and weld metal. A disadvantage is that the uphill technique is relatively slow compared with downhill welding.

Downhill types are used exclusively for filling and capping in combination with cellulosic types for root & hot pass or basic uphill types for the root. The front-end laying speed, a decisive factor in pipeline construction, can be retained at economically attractive levels. In addition, stringer bead welding at high travel speed results in a relatively low heat input and consequently in good mechanical properties of HAZ and weld metal, including good low-temperature toughness.

API 5L pipe steel grade	Basic electrodes uphill	Basic electrodes downhill
X52		
Root	Pipeweld 7016	N.a
Hot pass	Pipeweld 7016	Pipeweld 80 DH
Fill & cap	Pipeweld 7016	Pipeweld 80 DH
X60		
Root	Pipeweld 7016	N.a
Hot pass	Pipeweld 7016	Pipeweld 80 DH
Fill & cap	Pipeweld 7016	Pipeweld 80 DH
X65		
Root	Pipeweld 7016	N.a
Hot pass	Pipeweld 8016	Pipeweld 80 DH
Fill & cap	Pipeweld 8016	Pipeweld 80 DH
X70		
Root	Pipeweld 7016	N.a.
Hot pass	Pipeweld 8016	Pipeweld 90 DH
Fill & cap	Pipeweld 8016	Pipeweld 90 DH
X80		
Root	Pipeweld 7016	N.a
Hot pass	Pipeweld 10018	Pipeweld 100 DH
Fill & cap	Pipeweld 10018	Pipeweld 100 DH

N.a. : not applicable

A generally recognised disadvantage of basic downhill electrodes is start porosity, which is not removed by subsequent passes, because of the low heat input. ESAB has solved this problem with its patented innovative solution, causing a higher current density and greater weld penetration when starting. This effectively counteracts start porosity. An advantage of our onnovation over types with a conical start end is that the coating does not so easily chip off at the start end.

ESAB basic electrodes for pipeline welding are supplied exclusively in VacPac vacuum packaging preserving the low-moisture condition until the moment of opening the VacPac. Thereafter, the LMA properties of the electrodes guarantee safe exposure for 12 hours when the foil is left in place.

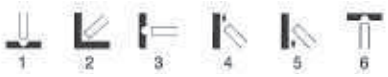
Basic low-hydrogen electrodes for uphill welding

Pipeweld 7016	Typical all weld metal composition %			Typical all weld metal mechanical properties AW		Ø x l (mm)	Current (A)	Welding positions
	C	Si	Mn	Re/Rp0.2 (MPa)	Rm (MPa)	3.2 (1/8")	80-140	1 2 3 4 6
AWS E7016-1	0.06	0.5	1.3	482 (69.890 psi)	575 (83,375 psi)	4.0 (5/32")	110-180	1 2 3 4 6
Basic coated				**CVN -40˚C (J)**	**A5 (%)**			1 2 3 4 6
Polarity				221 (-40˚F,163 ft-lb)	22			
AC/DC +/-								
Recovery				**Actual mechanical properties in X60**				
100%				**Re/Rp0.2 (MPa)**	**Rm (MPa)**			
HDM	Basic thin coated AC/DC electrode Providing excellent mechanical properties. This electrode ensures fully penetrated root passes, even in adverse conditions.			524 (75,980 psi)	610 (88,450 psi)			
<5.0ml/100g				**CVN -20˚C (J)**	**A5 (%)**			
				77 (-4˚F, 57 ft-lb)	25			

Pipeweld 8016	Typical all weld metal composition %				Typical all weld metal mechanical properties AW		Ø x l (mm)	Current (A)	Welding positions
AWS E8016-G	**C**	**Si**	**Mn**	**Ni**	**Re/Rp0.2 (MPa)**	**Rm (MPa)**	3.2 (1/8")	80-140	1 2 3 4 6
Basic coated	0.06	0.3	1.8	0.9	660 (95,700 psi)	740 (107,300 psi)	4.0 (5/32")	110-170	1 2 3 4 6
Polarity					**CVN -60˚C (J)**	**A5 (%)**			
AC/DC+/-					102 (-40˚F, 52 ft-lb)	30			
Recovery									
100%					**Actual mechanical properties in X70**				
HDM	All positional basic electrode that offers good CVN toughness at low temperatures. Can be used up to X80.				**Re/Rp0.2 (MPa)**	**Rm (MPa)**			
<5.0ml/100g					624 (90,480 psi)	692 (100,340 psi)			
					CVN -25˚C (J)	**A5 (%)**			
					140 (-13˚F, 103 ft-lb)	26			

Pipeweld 10018	Typical all weld metal composition %					Typical all weld metal mechanical properties AW		Ø x l (mm)	Current (A)	Welding positions
AWS E10018-D2	**C**	**Si**	**Mn**	**Mo**	**Ni**	**Re/Rp0.2 (MPa)**	**Rm (MPa)**	2.5 (3/32")	65-105	1 2 3 4 6
Basic coated	0.07	0.6	1.8	0.4	0.7	670 (97,150 psi)	740 (107.300 psi)	3.2 (1/8")	80-140	1 2 3 4 6
Polarity						**CVN -40˚C (J)**	**A5 (%)**	4.0 (5/32")	95-200	1 2 3 4 6
AC/DC+/-						40 (-40˚F, 29 ft-lb)	26			
Recovery										
120%						**Actual mechanical properties in X80**				
HDM	Pipeweld 10018 is a high strength all positional electrode for pipe applications. This electrode can be used on X80 (strain based) and X100.					**Re/Rp0.2 (MPa)**	**Rm (MPa)**			
<5.0ml/100g						764 (110,780 psi)	820 (118,900 psi)			
						CVN -20˚C (J)	**A5 (%)**			
						65 (-40˚F, 50 ft-lb)	24			

Basic low-hydrogen electrodes for downhill welding



Pipeweld 80DH	Typical all weld metal composition %				Typical all weld metal mechanical properties AW		Ø x l (mm)	Current (A)	Welding positions
AWS E8045-P2 H4R	**C**	**Si**	**Mn**	**Ni**	**Re/Rp0.2 (MPa)**	**Rm (MPa)**	2.5 (3/32")	60-90	1 2 3 4 5 6
Basic coated	0.07	0.5	1.2	0.1	530 (76,850 psi)	615 (89,175 psi)	3.2 (1/8")	110-150	1 2 3 4 5 6
Polarity					**CVN -30˚C (J)**	**A5 (%)**	4.0 (5/32")	180-220	1 2 3 4 5 6
DC+					80 (-22˚F, 59 ft-lb)	27	4.5 (3/16")	180-280	1 2 3 4 5 6
HDM									
<4.0ml/100g	A low hydrogen electrode for downhill welding of circumferential joints. This electrode has been specially designed to provide exellent striking properties. Production is much higher than conventional vertical up electrodes. Can be used on applications up to X70.				**Actual mechanical properties in X60**				
					Re/Rp0.2 (MPa)	**Rm (MPa)**			
					512 (74,240 psi)	612 (88,740 psi)			
					CVN -30˚C (J)	**A5 (%)**			
					69 (-22˚F, 51 ft-lb)	23			

Pipeweld 90DH	Typical all weld metal composition %				Typical all weld metal mechanical properties AW		Ø x l (mm)	Current (A)	Welding positions
AWS E9045-P2 H4R	**C**	**Si**	**Mn**	**Ni**	**Re/Rp0.2 (MPa)**	**Rm (MPa)**	3.2 (1/8")	110-150	1 2 3 4 5 6
Basic coated	0.06	0.55	1.6	0.9	610 (88,450 psi)	695 (100,775 psi)	4.0 (5/32")	180-220	1 2 3 4 5 6
Polarity					**CVN -30˚C (J)**	**A5 (%)**	4.5 (3/16")	210-270	1 2 3 4 5 6
DC+					80 (-22˚F, 59 ft-lb)	24			
HDM									
<4.0ml/100g	A low hydrogen electrode for downhill welding of circumferential joints. This electrode has been specially designed to provide exellent striking properties. Production is much higher than conventional vertical up electrodes. Can be used on applications X70 and X80.				**Actual mechanical properties in X70**				
					Re/Rp0.2 (MPa)	**Rm (MPa)**			
					570 (82,650 psi)	668 (96,860 psi)			
					CVN -30˚C (J)	**A5 (%)**			
					86 (-22˚F, 64 ft-lb)	20			

Pipeweld 100DH	Typical all weld metal composition %				Typical all weld metal mechanical properties AW		Ø x l (mm)	Current (A)	Welding positions
AWS E10018-G H4R	**C**	**Si**	**Mn**	**Ni**	**Re/Rp0.2 (MPa)**	**Rm (MPa)**	3.2 (1/8")	110-150	1 2 3 4 5 6
	0.6	0.45	1.85	1.75	690 (100,050 psi)	760 (110,200 psi)	4.0 (5/32")	180-220	1 2 3 4 5 6
Basic coated					**CVN -30˚C (J)**	**A5 (%)**	4.5 (3/16")	230-270	1 2 3 4 5 6
Polarity					110 (-22˚F, 81 ft-lb)	27			
DC+									
HDM									
<4.0ml/100g	A low hydrogen electrode for downhill welding of circumferential joints. This electrode has been specially designed to provide exellent striking properties. Production is much higher than conventional vertical up electrodes. Can be used on X80.				**Actual mechanical properties in X80**				
					Re/Rp0.2 (MPa)	**Rm (MPa)**			
					652 (94,540 psi)	732 (106,140 psi)			
					CVN -40˚C (J)	**A5 (%)**			
					57 (-40˚F, 42 ft-lb)	22			

Low-hydrogen electrodes always guaranteed with VacPac

No re-baking, no holding ovens, no quivers.

MMA electrodes from VacPac can be used straight from the package without the need to re-bake them and store them temporarily in holding ovens and quivers. Upon opening, fresh and dry electrodes are guaranteed when the vacuum is maintained. Electrodes of low moisture absorption type (LMA, classified as H4 or H5), re-absorb moisture slowly from the air. The safe exposure time for this type of electrode is 12 hours* after opening the VacPac with the foil left in place.

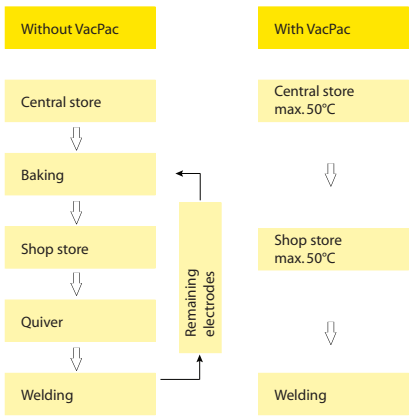
* Valid at standard AWS test conditions of 26.7°C and 80% RH.

How to handle VacPac

To protect the vacuum foil, avoid using a knife or any other sharp object when opening the outer package. Keep the electrodes inside the package and do not take out more than one electrode at a time. Low moisture absorption type electrodes (LMA) that have been exposed to the atmosphere in an opened VacPac for more than 12 hours (26.7°C and 80% RH) should be discarded or re-dried.

VacPac is available in various packaging sizes to suit fabricators' individual consumption of MMA electrodes.

Greatly simplified storage and handling for major savings



Flux cored wires for pipeline welding

API 5L pipe steel grade	Flux cored wires gas-shielded	Flux cored wires self-shielded
X52		
Root	N.a.	N.a.
Hot pass	Pipeweld 71T-1	Pipeweld 8Ni1-H5
Fill & cap	Pipeweld 71T-1	Pipeweld 8Ni1-H5
X60		
Root	N.a.	N.a.
Hot pass	Pipeweld 91T-1	Pipeweld 8Ni1-H5
Fill & cap	Pipeweld 91T-1	Pipeweld 8Ni1-H5
X65		
Root	N.a.	N.a.
Hot pass	Pipeweld 91T-1	Pipeweld 8Ni1-H5
Fill & cap	Pipeweld 91T-1	Pipeweld 8Ni1-H5
X70		
Root	N.a.	N.a.
Hot pass	Pipeweld 101T-1	N.a.
Fill & cap	Pipeweld 101T-1	N.a.
X80		
Root	N.a.	N.a.
Hot pass	Pipeweld 111T-1	N.a.
Fill & cap	Pipeweld 111T-1	N.a.

N.a. : not applicable

The **Pipeweld family** consists of all positional rutile, low-hydrogen flux-cored wires for applications involving the welding of pipe and pipe components with impact toughness requirements down to –60°C.

The wires are extremely “welder friendly” wire with a soft, spatter-free arc that always operates in the spray arc mode. It is easy to obtain flat welds with a good penetration and smooth wetting onto the pipe edges. The brittle slag is easily removed leaving behind a smooth rutile weld appearance. Typical positional welding defects such as lack of fusion and slag inclusions are avoided, due to the spray arc operation. The wires have a good tolerance to poor joint preparation.
The wire formulation provides a fast freezing slag that supports the weld pool well in positional welding, enabling deposition rates which cannot be equalled by stick electrodes or solid wires. Deposition rates in vertical up welding can reach up to 4 kg/h (100% duty cycle), making it the most productive consumable available for manual welding in this position. Diffusible hydrogen satisfies the AWS H4 class.

Pipeweld 8Ni1 H5

This self-shielded flux-cored wire is a product especially developed for the offshore industry. It is unique in the sense that it features a diffusible hydrogen content below 5ml/100g deposited weld metal making it ideal for critical steel applications where cold-cracking resistance is required. It is welder-friendly and has excellent all-positional welding operability, including downhill welding to suit for a wider range of WPS requirements. Pipeweld 8Ni1 H5 provides good low-temperature CVN toughness down to -40°C.

Gas shielded flux-cored wires

Pipeweld 71 T1	Typical all weld metal composition %			Typical all weld metal mechanical properties		Ø x l (mm)	Current (A)	Voltage (V)	Welding positions
AWS E71T-1M H8	**C**	**Si**	**Mn**	**Re/Rp0.2 (MPa)**	**Rm (MPa)**	1.2 (.047")	150-350	35 max	1 2 3 4 6
Gas shielded	0.06	0.6	1.33	535 (77,575 psi)	601 (87,145 psi)				
Rutile flux cored				**CVN -20˚C (J)**	**A5 (%)**				
DC+				54 (-4˚F, 41 ft-lb)	22				

Pipeweld 71T1 is an all positionable rutile flux cored wire that can be used with either Ar CO_2 or CO_2 shielding gases. This product is suitable for up to X52 pipe.

Actual mechanical properties in X60

Re/Rp0.2 (MPa)	Rm (MPa)
545 (79,025 psi)	639 (92,655 psi)
CVN -30˚C (J)	**A5 (%)**
42 (-22˚F, 31 ft-lb)	21

Pipeweld 91 T1	Typical all weld metal composition %			Typical all weld metal mechanical properties		Ø x l (mm)	Current (A)	Voltage (V)	Welding positions
AWS E91T1-G	**C**	**Si**	**Mn**	**Re/Rp0.2 (MPa)**	**Rm (MPa)**	1.2 (.047")	100-300	32 max	1 2 3 4 6
Gas shielded	0.05	0.37	1.25	604 (87,580 psi)	670 (97,150 psi)				
Rutile flux cored				**CVN -40˚C (J)**	**A5 (%)**				
DC+				92 (-40˚F, 68 ft-lb)	27				

Flux cored wire that is used with Ar-CO_2 shielding gas.This wire offers excellent weldability This product is suitable for up to X65 pipe.

Actual mechanical properties in X65

Re/Rp0.2 (MPa)	Rm (MPa)
569 (82,505 psi)	632 (91,640 psi)
CVN -40˚C (J)	**A5 (%)**
43 (-40˚F, 32 ft-lb)	22

Pipeweld 101 T1	Typical all weld metal composition %			Typical all weld metal mechanical properties		Ø x l (mm)	Current (A)	Voltage (V)	Welding positions
AWS E101T-G	**C**	**Si**	**Mn**	**Re/Rp0.2 (MPa)**	**Rm (MPa)**	1.2 (.047")	100-300	32 max	1 2 3 4 6
Gas shielded	0.06	0.4	1.54	654 (94,830 psi)	709 (102,805 psi)				
Rutile flux cored				**CVN -40˚C (J)**	**A5 (%)**				
DC+				70 (-40˚F, 52 ft-lb)	26				

Pipeweld 101T1 is an all positionable rutile flux cored wire that is used with Ar-CO_2 shielding gas.This wire offers excellent weldability This product is suitable for up to X70 pipe.

Actual mechanical properties in X70

Re/Rp0.2 (MPa)	Rm (MPa)
580 (84,100 psi)	691 (100,195 psi)
CVN -30˚C (J)	**A5 (%)**
42 (-22˚F, 31 ft-lb)	21

Pipeweld 111 T1	Typical all weld metal composition %				Typical all weld metal mechanical properties		Ø x l (mm)	Current (A)	Voltage (V)	Welding positions
AWS E111 T1 K3MJ-H4	**C**	**Si**	**Mn**	**Ni**	**Re/Rp0.2 (MPa)**	**Rm (MPa)**	1.2 (.047")	100-300	32 max	1 2 3 4 6
Gas shielded	0.06	0.39	1.2	2.8	761 (110, 345 psi)	840 (121,800 psi)				
Rutile flux cored					**CVN -40˚C (J)**	**A5 (%)**				
DC+					72 (-40˚F, 53 ft-lb)	18				

Pipeweld 111T1 is an all positionable rutile flux cored wire that is used with Ar-CO_2 shielding gas.This wire offers excellent weldability This product is suitable for up to X100 pipe.

Actual mechanical properties in X80	
Re/Rp0.2 (MPa)	**Rm (MPa)**
670 (97,150 psi)	721 (104,545 psi)
CVN -20˚C (J)	**A5 (%)**
83 (-4˚F, 61 ft-lb)	21

Self shielded flux-cored wires

Pipeweld 8 Ni1H5	Typical all weld metal composition %				Typical all weld metal mechanical properties		Ø x l (mm)	Current (A)	Voltage (V)	Welding positions
AWS E71T-8Ni1J	**C**	**Si**	**Mn**	**Ni**	**Re/Rp0.2 (MPa)**	**Rm (MPa)**	1.6 (1/16")	120-245	17-22	1 2 3 4 6
Self shielded	0.03	0.3	1.4	1.0	447 (59,450 psi)	536 (77,720 psi)	2.0 (5/64")	120-280	18-23	1 2 3 4 6
DC-					**CVN -29˚C (J)**	**A5 (%)**				
HDM					150 (-20˚F,110 ft-lb)	30				
<5.0ml/100g										

Pipeweld 8Ni1H5 is a self-shielded flux-cored wire designed to produce welds with low diffusible hydrogen and robust mechanical properties.It is welder friendly and has excellent all positionable weldingoperability. It operates on electrode negative (DC-ve) and produces sound welds either vertical up or down.

Actual mechanical properties in X60	
Re/Rp0.2 (MPa)	**Rm (MPa)**
493 (71,485 psi)	580 (84,100 psi)
CVN -20˚C (J)	**A5 (%)**
117 (-4˚F, 86 ft-lb)	22.5

Solid MAG wires

Pipeweld MAG wires - premium quality copper-coated wire
ESAB's Pipeweld premium quality copper-coated MAG welding wire feature a carefully controlled wire surface condition and cleanliness, in combination with a continuous copper-layer with optimum thickness. They bring reduced contamination of the feeding system with copper flakes and guarantee longer periods of problem-free feeding, arc stability, low spatter and excellent weld quality.The chemistry of the wire is carefully controlled for consistently high mechanical properties of the weld. They are successfully applied for manual and mechanised welding in the pipeline construction industry. They can be welded with Ar/CO_2 mixed shielding gas or with pure CO_2.

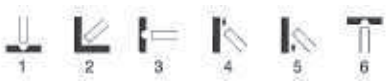
Pipeweld Plus MAG wires – non copper-coated wires with ASC
The Pipeweld Plus wires are non copper coated wires with ASC (Advanced Surface Characteristics). These wires do not contaminate wire feeders, liners, torches and contact tips with copper particles. This results in trouble-free feeding, a high process stability, reduced consumption of wear parts and superior welding properties.
With Pipeweld Plus you gain a higher productivity, improved weld quality, a cleaner work environment and reduced overall welding costs. They are successfully applied for manual and mechanised welding in the pipeline construction industry. They can be welded with Ar/CO_2 mixed shielding gas or with pure CO_2.

Pipeweld Plus features summarised are:
- Consistent welding performance
- Stable arc with low feeding force
- Excellent arc ignition
- High current operability
- Extremely low overall spatter
- Trouble-free feedability, even at high wire feed speeds and lengthy feed distances
- Low fume emission
- Improved resistance against corrosion of the wire

Pipeweld and Pipeweld Plus wires are always layer-wound on all spools to ensure wire pay-off without entanglement. Spools are sealed in foil with moisture absorbing paper included, for a long shelf life without the formation of rust.

API 5L pipe steel grade	Solid wires
X52	
Root	Pipeweld 70S-6/Plus
Hot pass	Pipeweld 70S-6/Plus
Fill & cap	Pipeweld 70S-6/Plus
X60	
Root	Pipeweld 70S-6/Plus
Hot pass	Pipeweld 70S-6/Plus
Fill & cap	Pipeweld 70S-6/Plus
X65	
Root	Pipeweld 70S-6/Plus
Hot pass	Pipeweld 70S-6/Plus
Fill & cap	Pipeweld 70S-6/Plus
X70	
Root	Pipeweld 70S-6/Plus
Hot pass	Pipeweld 70S-6/Plus
Fill & cap	Pipeweld 70S-6/Plus
X80	
Root	Pipeweld 70S-6/Plus
Hot pass	Pipeweld 100 S
Fill & cap	Pipeweld 100 S

N.a. : not applicable



Pipeweld 70S-6	Typical chemical composition wire (%)			Typical all weld metal mechanical properties		Ø x l (mm)	Current (A)	Voltage (V)	Welding positions
AWS A5.18	C	Si	Mn	**Re/Rp0.2 (MPa)**	**Rm (MPa)**	0.9mm (.035")	60-250	33 max	1 2 3 4 5 6
ER 70S-6	0.09	1.0	1.7	535 (77,575 psi)	600 (87,000 psi)	1.0mm (.040")	80-300	33 max	1 2 3 4 5 6
Polarity				**CVN -20˚C (J)**	**A5 (%)**	1.2mm (.047")	100-360	33 max	1 2 3 4 5 6
DC+				100 (-4˚F, 74 ft-lb)	26				

A copper coated wire electrode especialy designed for downhill welding of pipe. The chemistry of this product is carefully controlled to give outstanding mechanical properties. This product can be used up to X70 or X80 on narrow gap applications.

Actual mechanical properties in X80*	
Re/Rp0.2 (MPa)	**Rm (MPa)**
661 (95,845 psi)	728 (105,560 psi)
CVN -20˚C (J)	**A5 (%)**
147 (-4˚F, 108 ft-lb)	25

Pipeweld ER70S 6 Plus	Typical chemical composition wire (%)			Typical all weld metal mechanical properties		Ø x l (mm)	Current (A)	Voltage (V)	Welding positions
AWS A5.18	**C**	**Si**	**Mn**	**Re/Rp0.2 (MPa)**	**Rm (MPa)**	0.9mm (.035")	60-250	33 max	1 2 3 4 5 6
ER 70S-6	0.09	1.0	1.7	535 (77,575 psi)	600 (87,000 psi)	1.0mm (.040")	80-300	33 max	1 2 3 4 5 6
Polarity				**CVN -20˚C (J)**	**A5 (%)**	1.2mm (.047")	100-360	33 max	1 2 3 4 5 6
DC+				100 (-4˚F, 74 ft-lb)	26				

A copper free wire electrode especialy designed for superior feeding qualities and low surface deposits to reduce cleaning.The chemistry of this product is carefully controlled to give outstanding mechanical properties. This product can be used up to X70 or X80 on narrow gap applications.

Actual mechanical properties in X70*	
Re/Rp0.2 (MPa)	**Rm (MPa)**
619 (89,755 psi)	682 (98,890 psi)
CVN -40˚C (J)	**A5 (%)**
56 (-40˚F, 41 ft-lb)	23

Pipeweld 100S	Typical chemical composition wire (%)				Typical all weld metal mechanical properties		Ø x l (mm)	Current (A)	Voltage (V)	Welding positions
AWS A5.28	**C**	**Si**	**Mn**	**Ni**	**Re/Rp0.2 (MPa)**	**Rm (MPa)**	0.9mm (.035")	60-250	33 max	1 2 3 4 5 6
ER 100S-G	0.08	0.6	1.8	1.0	620 (89,900 psi)	700 (101,500 psi)	1.0mm (.040")	80-300	33 max	1 2 3 4 5 6
Polarity					**CVN -20˚C (J)**	**A5 (%)**	1.2mm (.047")	100-360	33 max	1 2 3 4 5 6
DC+					130 (-4˚F, 96 ft-lb)	20				
Shielding gas										

A copper coated wire electrode especialy designed for downhill welding of pipe. This high strength wire can be used on applications up to X100.

Actual mechanical properties in X80*	
Re/Rp0.2 (MPa)	**Rm (MPa)**
721 (104,545 psi)	835 (121,075 psi)
CVN -40˚C (J)	**A5 (%)**
208 (-40˚F, 153 ft-lb)	20

* Denotes a narrow gap joint

Submerged arc welding for double jointing

Submerged arc welding of pipelines
When a pipeline is laid using sections of pipe 12 m in length, it advances by 1 km for every 83 joints made on the line. Some pipe mills can make pipe in 18 m lengths, so for the same welding productivity, the speed of advance increases by 50%. In pursuit of even greater speeds of advance, and where access permits, it has become common practice to join pairs of pipe sections off line. This practice is known as double jointing. In offshore applications, groups of up to four pipe sections may be welded together at a time.

Generally for cross country pipelines the pipes being joined can be rotated so that welding is carried out in the down hand position, allowing for the use of high deposition rate processes such as submerged arc welding.

For offshore pipeline construction, double jointing has become very common, and it will have an important part to play where large distances have to be crossed.

For pipe grades up to X70, double jointing presents few problems. The pipe itself is likely to have been manufactured using the submerged arc process for its seam weld, and consumables to do this are readily available.

Tubular wires can offer a productivity improvement of about 25% compared with solid wires, and have been used where double jointing had to keep up with a fast-moving lay barge.

However the mechanical properties required for example on strain based designed X80 materials can present problems.

The submerged arc welding process is, by default a high heat input process resulting in high dilution levels. Consumables and welding techniques have to be carefully selected and controlled to meet the applicable acceptance criteria.

ESAB offers a full range of submerged arc welding consumables and equipment to meet these demands.

OK Flux 10.62 - high impact flux for critical applications

OK Flux 10.62 is an agglomerated, high-basic flux for submerged arc welding. It is used for multi-run welding of thick section materials. When high demands on impact toughness values are required, OK Flux 10.62 is the flux to use. The flux is neutral on Si and Mn alloying.

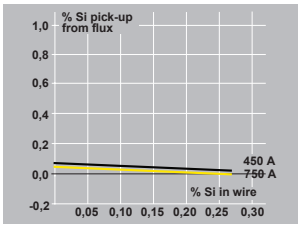
It can be used for single and multi-wire procedures, for butt and fillet welds and works equally well on DC and AC current. Since no alloying takes place, it is perfect for multi-layer welding of unlimited plate thickness. OK Flux 10.62 is especially suited for narrow gap welding due to good slag detachability and smooth sidewall blending. It operates optimally at the lower end of the voltage range. The weld metal produced has a low-oxygen content; approx. 300ppm and hydrogen levels lower than 5ml/100g.

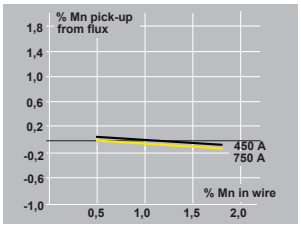
Classification flux	Basicity index	Density	Grain size
EN 760: SA FB 1 55 AC H5	3.2	~ 1.1 kg/ dm^3	0.2 - 1.6 mm

Slag type	Polarity	Alloy transfer	Hydrogen
Fluoride-basic	DC+ / AC	No Si or Mn alloying	≤ 5 HDM

Flux consumption
kg flux / kg wire

Voltage	DC+	AC
26	0.7	0.6
30	1.0	0.9
34	1.3	1.2
38	1.6	1.4





Single wire, ø 4.0 mm, DC+, 30 V, 60 cm/ min

Classification

	Wire	Weld metal		
OK Autrod	EN / AWS	EN / AW	AWS / AW	AWS / PWHT
12.22	S2Si / EM12K	S 38 5 FB S2Si	A5.17: F7A8-EM12K	A5.17: F6P8-EM12K
12.24	S2Mo; S Mo / EA2	S 46 4 FB S2Mo	A5.23: F8A6-EA2-A2	A5.23: F7P6-EA2-A2
12.32	S3Si / EH12K	S 46 6 FB S3Si	A5.17: F7A8-EH12K	A5.17: F7P8-EH12K
12.34	S3Mo; S MnMo / EA4	S 50 4 FB S3Mo	A5.23: F8A6-EA4-A4	A5.23: F8P6-EA4-A4
12.44	S4Mo / EA3	S 50 5 FB S4Mo	A5.23: F9A8-EA3-A3	A5.23: F9P8-EA3-A3
13.24	S3Ni1Mo0.2 / EG	S 50 6 FB S3Ni1Mo0.2	A5.23: F8A10-EG-G	A5.23: F8P8-EG-G
13.27	S2Ni2 / ENi2	S 46 7 FB S2Ni2	A5.23: F8A10-ENi2-Ni2	A5.23: F8P10-ENi2-Ni2
13.40	S3Ni1Mo / EG	S 62 6 FB S3Ni1Mo	A5.23: F10A8-EG-F3	A5.23: F9P6-EG-F3
13.43	S3Ni2,5CrMo / EG	S 69 6 FB S3Ni2,5CrMo	A5.23: F11A8-EG-G	A5.23: F11P8-EG-G
13.44	S3Ni1.5CrMo / EG	S 62 5 FB S3Ni1.5CrMo	A5.23: F9A8-EG-G	
OK Tubrod				
15.24S			A5.23: F8A6-EC-G	
15.25S			A5.23: F7A8-EC-Ni2	
15.27S			A5.23: F11A8-EC-G	
Spoolarc				
100	EF5		A5.23: F12A6-EF5-G	
120	EM4		A5.23: F11A6-EM4-M4	

OK Flux 10.62 - high impact flux for critical applications

Typical weld metal chemical composition (%), DC+

	C	Si	Mn	Cr	Ni	Mo	Other
With OK Autrod							
12.22	0.07	0.3	1.0				
12.24	0.07	0.2	1.0			0.5	
12.32	0.10	0.3	1.6				
12.34	0.10	0.2	1.4			0.5	
12.44	0.08	0.2	1.9			0.5	
13.24	0.08	0.3	1.4		0.9	0.2	
13.27	0.06	0.2	1.0		2.1		
13.40	0.07	0.2	1.5		0.9	0.5	
13.43	0.11	0.2	1.5	0.6	2.2	0.5	
13.44	0.08	0.2	1.4	0.2	1.6	0.4	
13.49	0.06	0.2	1.0		3.1		
With OK Tubrod							
15.00S	0.05	0.4	1.4				
15.24S	0.06	0.3	1.6		0.8		
15.25S	0.05	0.4	1.3		2.3		
15.27S	0.06	0.3	1.6		2.3	0.2	
With Spoolarc							
100	0.09	0.3	1.7	0.3	2.4	0.5	Cu: 0.3
120	0.07	0.3	1.5	0.3	2.3	0.5	

Typical weld metal mechanical properties, DC+

	ReL / Rp0.2 (MPa)	Rm (MPa)	A4 / A5 (%)	CVN (J at °C)				AW/ SR	Remarks
With OK Autrod				-40	-50	-60	-73		
12.22	410	500	33	90	70	40		AW	
12.24	500	580	25	60	45			AW	
12.32	475	560	28	110		75		AW	
12.34	540	620	24	115	45			AW	
12.40	530	620	26	50	40			AW	
12.44	600	700	27	80	65	55		AW	
13.21	470	560	28	70	60			AW	
13.24	530	620	25	120	110	70	50	AW	
13.27	490	570	27	110		80	50	AW	CVN at -70°C: 60 J
13.40	650	730	23	70	60			AW	CVN at -62°C: 50 J
13.43	700	800	21	75	65	55		AW	CVN at -62°C: 50 J
13.44	610	700	22	55				AW	CVN at -62°C: 40 J
With OK Tubrod									
15.24S	540	630	29	150	130			AW	
15.25S	490	580	29			100		AW	
15.27S	>690	>770	17					AW	CVN at -60°C: 69J
With Spoolarc									
100	855	925	20					AW	CVN at -51°C: 70J
120	760	825	20					AW	CVN at -51°C: 89J
With OK Autrod									
12.22	360	480	34	130	75	40		SR	
12.24	470	530	26	55	40			SR	
12.32	410	510	28	110		65		SR	
12.34	540	620	25	70	40			SR	
12.40	460	560	26	45	35			SR	
12.44	590	690	26	75	55	45		SR	
13.24	500	590	27	120	100	70		SR	
13.27	490	580	29	100		90	40	SR	
13.40	610	690	24	60	45			SR	
13.43	695	790	21	60	50			SR	CVN at – 62°C: 40 J
13.49	510	570	29				85	SR	CVN at – 101°C: 50 J

OK Flux 10.62 is used when high demands on low-temperature toughness, strength and CTOD-values are required. Many offshore constructions, drilling rigs, platforms, etc. are welded with OK Flux 10.62. It is used for all kinds of pressure vessel productions, including those for nuclear applications. In power generation it can be welded with applicable wires on creep resistant steels. Other applications include shipbuilding steels up to EH69 with various wires and approvals. It is also used on multi-run welded pipes, e.g. for special applications at low temperatures, or on high strength steels, structural steels, and fine-grained steels, including in civil construction and transport industries.

OK Flux 10.62 has passed CTOD tests with the following wires:
OK Autrod 12.32 at -10°C and -15°C,
OK Autrod 13.24 at -10°C and -15°C,
OK Autrod 13.27 at -10°C,
OK Autrod 13.40 at -10°C.

Easy and efficient storage and handling of fluxes

ESAB fluxes, agglomerated and fused, have a guaranteed as-manufactured moisture content from production. This moisture content is controlled by internal ESAB specifications. Before transport, each pallet is shrink wrapped in plastic foil. This precautionary action is done in order to maintain the as-manufactured moisture content for as long as possible. Flux should never be exposed to wet conditions, such as rain or snow.

Storage

- Unopened flux bags must be stored in maintained storage conditions as follows:
  Temperature: 20 +/- 10°C
  Relative humidity: As low as possible - not exceeding 60%.
- Fluxes shall not be stored longer than 3 years.
- The content of unprotected flux hoppers must, after an 8 hours shift, be placed in a drying cabinet or heated flux hopper at a temperature of 150 +/- 25°C.
- Remaining flux from opened bags must be placed at a temperature of 150 +/- 25°C.

Re-cycling

- Moisture and oil must be removed from the compressed air used in the re-cycling system.
- Addition of new flux must be done with the proportion of at least one part new flux to three parts re-cycled flux.
- Foreign material, such as millscale and slag, must be removed by a suitable system, such as sieving.

Re-drying

- When handled and stored as above, the ESAB fluxes can normally be used straight away.
- In severe applications, stipulated by the applicable material specification, re-drying of the flux is recommended.
- Furthermore, if the flux has somehow picked up moisture, re-drying can return the flux to its original moisture content.
- Re-drying shall be performed as follows:
  Agglomerated fluxes: 300 +/- 25°C for about 2-4 hours.
  Fused fluxes: 200 +/- 50°C for about 2-4 hours.
- Redrying must be done either in equipment that turns the flux so that the moisture can evaporate easily or in an oven on shallow plates with a flux height not exceeding 5 cm.
- Re-dried flux, not immediately used, must be kept at 150 +/- 25°C before use.

Disposal

- Discard any product, residue, disposable container or liner in an environmentally acceptable manner, in full compliance with federal and local regulations.
- Please address your local disposal company for prescribed disposal.
- Information on product and residues are given in the Safety Data Sheets available through www.esab.com.

Equipment for storage and re-drying

JS 200 Flux storage silo

- **Keeps flux dry and clean**
- **Adjustable temperature between 100 and 300°C**
- **Capacity: 200 l**
- **Supply voltage: 220V, 1 phase; output: 2 kW**

JK 50 Powder Dryer

- **Redries flux at max. 500°C for about 3 hours**
- **Then automatically drops temperature to pre-set value (max. 200°C) and stores flux**
- **Capacity: 50 l**
- **Supply voltage: 400V, 3 phase; output: 3.7 kW**

Storage and handling recommodations for consumables

Pipeweld MMA electrodes
ESAB Pipeweld basic stick electrodes are always packed in VacPac - ESAB's easy to use vacuum packaging. For recommendations on storage and handling see page 16 of this catalogue.

Pipeweld & Pipeweld Plus MAG wires and cored wires, should be stored in dry conditions in original sealed undamaged packaging as supplied. Contact with water or moisture should be avoided. This could take the form of rain or the condensation of moisture on a cold wire. To avoid condensation, keep the wire in the original packaging and, if necessary, leave the wire to warm up to at least the ambient temperature before opening the package. Other hydrogen-containing substances, like oil, grease and corrosion or substances that could absorb moisture must also be avoided on the surface of the wires. Wires should not be left on welding machines or out of the store for prolonged periods, especially overnight, since condensation of moisture from the air may lead to rapid surface deterioration. Partly used spools should be replaced in the original packaging for storage to prevent surface contamination. Wire should be stored at ambient conditions of temperature and humidity, and dusty areas should be avoided when wire is not enclosed in some type of dust-protecting packaging or equipment.

Cored wires that are rusty, have suffered from serious water and moisture contamination, or have been exposed to the atmosphere over long periods of time cannot be restored in their original condition and should be discarded.

Recommended conditions of storage
for all solid wires are minimum temperature of 15°C and humidity of maximum 60% RH.

ESAB submerged arc fluxes have a guaranteed as-manufactured moisture content from production. This moisture content is controlled by internal ESAB specifications. Before transport, each pallet is shrink wrapped in plastic foil. This precautionary action is done in order to maintain the as-manufactured moisture content for as long as possible. Flux should never be exposed to wet conditions, such as rain or snow.

Storage
- Unopened flux bags must be stored in maintained storage conditions as follows:
  Temperature: 20 +/- 10°C Relative humidity: as low as possible – not exceeding 60%.
- Fluxes delivered in aluminium lined BigBags can be stored under more severe climatic conditions, because the packaging protects the flux reliably from moisture pick-up, as long as it is unopened and undamaged.
- The content of unprotected flux hoppers must, after an 8 hours shift, be placed in a drying cabinet or heated flux hopper at a temperature of 150 +/- 25°C.
- Remaining flux from opened bags must be placed at a temperature of 150 +/- 25°C.

Re-cycling
- Moisture and oil must be removed from the compressed air used in the re-cycling system.
- Addition of new flux must be done with the proportion of at least one part new flux to three
parts re-cycled flux.
- Foreign material, such as millscale and slag, must be removed by a suitable system,
such as sieving.

Re-drying
- When handled and stored as above, the ESAB fluxes can normally be used straight away.

SAW welding automation
Welding heads

A2 S Mini Master

The A2 S Mini Master represents an automatic welding system designed with the emphasis on low weight, compactness and flexible use. The system is built around basic units. The degree of automation and process orientation of the basic unit you choose can be expanded or modified as required, depending on the application. Appropriate welding heads can be combined with suitable manipulators, which results in a total solution to a specific welding problem.

A6 S Compact

The A6 S Compact 300/ 500/ 700 are three reliable members of the A6 family for the efficient, high-productivity SAW method. These welding heads make it possible to build highly efficient stations for the internal welding of butt joints inside tubes in different versions for tubes down to diameter 300 mm. TV-monitoring equipment can be integrated into the system, thereby enabling the operator to supervise and adjust the head position from the outside via the TV screen.

	Single SAW	Twin SAW	Single GMAW
Max load at 100% duty cycle, A	800	800	600
Wire feed, m/ min	0.2-9	0.2-9	0.2-16

	A6 S Compact
Max load at 100% duty cycle, A	800
Wire diameter, mm	2.5, 3.0, 4.0
Wire feed, m/ min	0.4-8.0

SAW welding automation
Handling equipment

Roller beds
Roller beds are designed to enable large round items to be welded and handled during rotation welding for example. ESAB offers a large range of roller beds of different models and load possibilities. The range partly consists of conventional roller beds, where the operator manually and mechanically sets the distance between the rollers to different diameters – and partly self-adjusting roller beds, where the rollers automatically adjust themselves to the diameter of the workpiece. All roller beds are designed to be easily combined with ESAB A2/ A6 programme and can be controlled via a remote control unit or from the process controller PEK.

CD 5-120 and CI 5-120, conventional roller beds with rail bogie. Max. loading capacity from 2.5 – 60 tons/ section.

CD-30/ 60/ 100/ 120-DB and CI-30&0/ 100/ 120-IB, conventional roller beds with rail bogie. Max. loading capacity from 15 – 60 tons/ section.

FIR 35, 75 and 100, these units are part of a growing line and used especially in wind tower production. Max. loading capacity 35, 75 or 100 tons.

FIT 30, 60 and 100, conventional idler roller beds with built-in hydraulic height adjustment. These units are part of a growing line and used especially in wind tower production. Max. loading capacity 15, 30 or 50 tons.

FUB 30, complete unit for fit-up of section. One set of FUB consist of one power and one idler roller bed 30T. Four independently adjusted rollers to align the two sections with each other. Max. loading capacity 30 tons.

SD 5-100 and SI 5-100, self-aligning roller beds. Motorised and idler rail bogie versions. Max. loading capacity 2.5 – 50 tons/ section.

SD 5-100 DB and SI 5-100 IB, self-aligning roller beds. Motorised and idler rail bogie versions. Max. loading capacity 2.5 – 50 tons/ section.

Suitable application areas: wind tower fabrication, offshore, shipyards, pressure vessels and pipelines.

Versatile accessories: a wide range of accessories is available for ESAB's roller beds, which additionally improve workpiece handling during welding.

AC/DC inverter power source for efficient submerged arc welding

Power source Aristo® 1000 AC/DC SAW

- Based on unique and patent pending technologies to deliver the best welding performance with the lowest power consumption.
- Designed for use with the digital PEK controller and the robust A2/ A6 feeder units.
- A global inverter - connect to a three phase mains supply from 380 to 575 V, 50 or 60 Hz.
- Change between DC and AC ”on the fly”. Minimize downtime and weld defects by the push of a button with the patent pending ”on the fly” function.
- Long welding cables. The patent pending Cable Boost™ technology stores energy and instantly delivers up to 450% additional energy when required. Cable Boost extends the maximum usable weld cable length with more than a factor two, without compromising the weld result.
- Cable Boost™ is also an energy saver. The inductive energy generated in the welding cables is re-used in the welding process instead of being wasted as heat and power losses.
- Designed for uninterrupted welding production. There are no connectors or cables at any exposed positions. All cables are connected behind a door in the front of the machine. Easily accessible for service and well protected against damage.

The Aristo 1000 AC/DC power source, used in combination with ESAB’s new three wire ICE SAW process, is the most productive process available today for welding thick joints. Please contact your local ESAB office for more details.

	Aristo® 1000 AC/DC SAW
Mains supply, 3 ph, V, Hz	3380-575, 50/ 60
Mains current (DC load), A / V	86 / 380
	82 / 400
	79 / 415
	74 / 440
	71 / 460
	66 / 500
	59 / 550
	57 / 575
Mains fuse (slow), A / V	100 / 380
	100 / 400
	80 / 415
	80 / 440
	80 / 460
	80 / 500
	63 / 550
	63 / 575
Maximum load at 100% duty cycle, A / V	1000 / 44
Open circuit voltage, V	130
Open circuit power, W	240
Efficiency at max rating	0.88
Power factor	0.93
Dimensions, LxWxH, mm (in.)	865x610x1320 (34x24x52)
Weight, kg (lbs)	330 (727.5
Enclosure class	IP23
Certification	CE-certified
Third party approvals	ETL, CCC, Ghost-R

R&D and Central Laboratories

ESAB Central Laboratories
The ESAB Central laboratories in Gothenburg, Sweden, together with the Process Centre, form the technical heart of ESAB worldwide. Equipped with modern facilities, they provide research services to the development departments, to production sites and to end customers.

The several laboratories are:
- Metallographic laboratory
- Mechanical testing
- Chemical laboratory
- Welding laboratory
- Heat treatment laboratory

Principal activities are:
- Customer support:
  Defects, properties, welding procedures, failure analysis.
- Development support:
  Microstructure and properties for development and improvement of products.
- Research:
  Internal and external (universities, institutes) research projects.
- Production support:
  Verification of product quality and production processes.

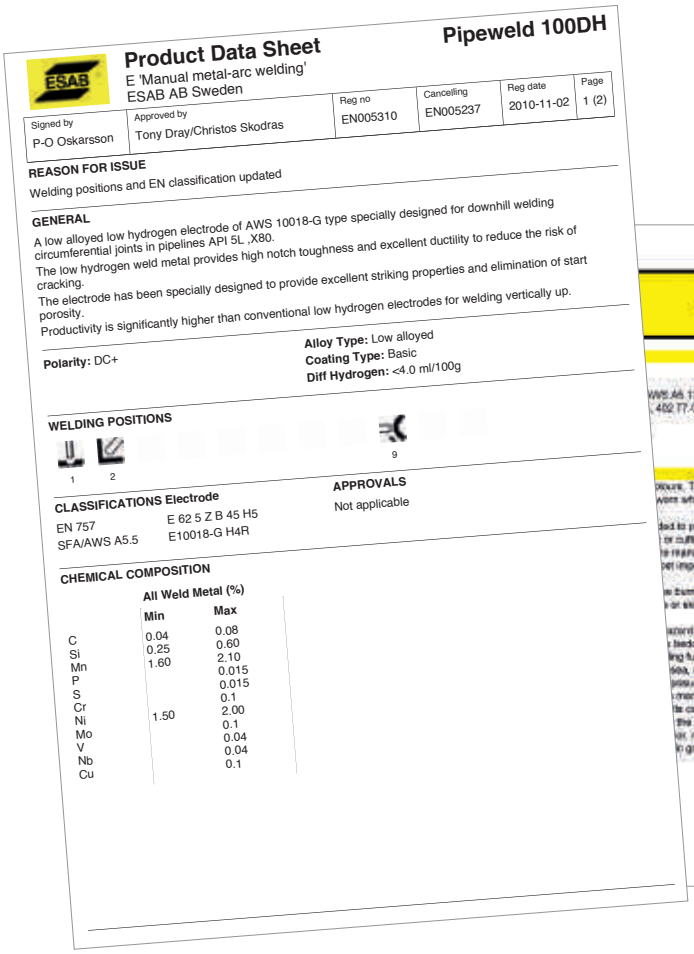
Welding Process Centre

The Process Centres are innovative environments were ESAB and its customers can work in partnership to develop total solutions for welding and cutting challenges, pushing the technological boundaries to exciting new levels.

The facilities are state of the art in equipment and apply best practice in EHS. There are also showrooms, with comprehensive demonstration facilities. A global network of ESAB Process Centres has been established to help our customers to improve their business performance and daily operations. This support network embraces the full spectrum of welding requirements, from customer support to process development; training to operational services. The global network uses the globally spread know-how within ESAB to maintain the same service levels around the globe ensuring that a consistent, high technology solution service is delivered.

Production facility certificates

Product documents



Product Data Sheet
E 'Manual metal-arc welding'
ESAB AB Sweden

Pipeweld 100DH

Signed by	Approved by	Reg no	Cancelling	Reg date	Page
P-O Oskarsson	Tony Dray/Christos Skodras	EN005310	EN005237	2010-11-02	1 (2)

REASON FOR ISSUE
Welding positions and EN classification updated

GENERAL
A low alloyed low hydrogen electrode of AWS 10018-G type specially designed for downhill welding circumferential joints in pipelines API 5L ,X80.
The low hydrogen weld metal provides high notch toughness and excellent ductility to reduce the risk of cracking.
The electrode has been specially designed to provide excellent striking properties and elimination of start porosity.
Productivity is significantly higher than conventional low hydrogen electrodes for welding vertically up.

Polarity: DC+
Alloy Type: Low alloyed
Coating Type: Basic
Diff Hydrogen: <4.0 ml/100g

WELDING POSITIONS
1 2 9

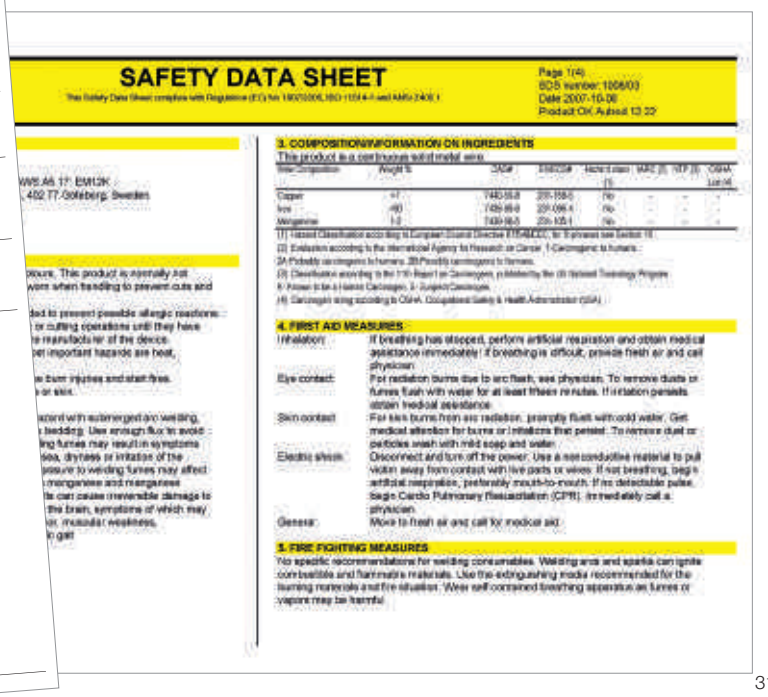
CLASSIFICATIONS Electrode
EN 757 E 62 5 Z B 45 H5
SFA/AWS A5.5 E10018-G H4R

APPROVALS
Not applicable

CHEMICAL COMPOSITION

	All Weld Metal (%) Min	Max
C	0.04	0.08
Si	0.25	0.60
Mn	1.60	2.10
P		0.015
S		0.015
Cr		0.1
Ni	1.50	2.00
Mo		0.1
V		0.04
Nb		0.04
Cu		0.1

All Pipeweld products are supported by core documentation such as product data sheets (PDS) and safety data sheets (SDS)



SAFETY DATA SHEET

Page 1(4)
SDS number: 1006/03
Date 2007-10-08
Product OK Autrod 13 22

3. COMPOSITION/INFORMATION ON INGREDIENTS
This product is a cast bronze solid metal wire.

Wire Composition	Weight %	CAS#	EINECS#	Hazard class [1]	MAC [2]	TLV [3]	OSHA Limit
Copper	>7	7440-50-8	231-159-6	No	-	-	-
Iron	<80	7439-89-6	231-096-4	No	-	-	-
Manganese	1-3	7439-96-5	231-105-1	No	-	-	-

4. FIRST AID MEASURES
Inhalation: If breathing has stopped, perform artificial respiration and obtain medical assistance immediately! If breathing is difficult, provide fresh air and call physician.
Eye contact: For radiation burns due to arc flash, see physician. To remove dusts or fumes flush with water for at least fifteen minutes. If irritation persists obtain medical assistance.
Skin contact: For skin burns from arc radiation, promptly flush with cold water. Get medical attention for burns or irritations that persist. To remove dust or particles wash with mild soap and water.
Electric shock: Disconnect and turn off the power. Use a non-conductive material to pull victim away from contact with live parts or wires. If not breathing, begin artificial respiration, preferably mouth-to-mouth. If no detectable pulse, begin Cardio Pulmonary Resuscitation (CPR). Immediately call a physician.
General: Move to fresh air and call for medical aid.

5. FIRE FIGHTING MEASURES
No specific recommendations for welding consumables. Welding arcs and sparks can ignite combustible and flammable materials. Use fire-extinguishing media recommended for the burning materials and fire situation. Wear self-contained breathing apparatus as fumes or vapors may be harmful.

World leader in welding and cutting technology and systems

XA00155920 2014/07

ESAB operates at the forefront of welding and cutting technology. Over one hundred years of continuous improvement in products and processes enables us to meet the challenges of technological advance in every sector in which ESAB operates.

Quality and environment standards

Quality, the environment and safety are three key areas of focus. ESAB is one of few international companies to have obtained the ISO 14001 and OHSAS 18001 standards in Environmental, Health & Safety Management Systems across all our global manufacturing facilities.

At ESAB, quality is an ongoing process that is at the heart of all our production processes and facilities worldwide. Multinational manufacturing, local representation and an international network of independent distributors brings the benefits of ESAB quality and unrivalled expertise in materials and processes within reach of all our customers, wherever they are located.

ESAB Sales and Support offices worldwide

** Includes manufacturing facilities of ESAB North America. A wholly owned subsidiary of Anderson Group Inc.*