



Product Catalogue

ESAB India Limited

Welding Consumables - Equipment - Automation - Cutting Systems





It's all here

A complete range of welding and cutting equipment, filler materials and accessories for any type of industry? We've got it.

The expertise and application experience to share with you? Absolutely. A worldwide network of sales offices and distributors to give you service and support wherever you are? Positive.

It's all here to help you boost your welding productivity. All from a single dependable source. From ESAB.

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YOUR PARTNER IN WELDING & CUTTING

Publisher's Note



ESAB Product Catalogue of Welding & Cutting Products is an updated version of an extensive product range for today's conceivable welding application. ESAB pursues a policy of continuous development and hence product specifications are subject to change. The information given in this book is correct and accurate to the best of our knowledge, however, ESAB India Limited is not responsible and liable for any damages resulting from using this information/products. Further, we reserve the right to change the specifications without notice.

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In 1904, Oscar Kjellberg, a Swedish engineer, was working on ships and boilers in Gothenburg, Sweden. He was not satisfied with the quality of repair jobs. His quest for a better technology led to the invention of the world's first covered electrode. And thus, Elektriska Svetsnings Aktie Bolaget (ESAB) was born. Today, ESAB leads the world in providing welding and cutting solutions.

At ESAB, every problem is an opportunity, every sale start of an enduring relationship. From supplying welding equipment to consumables,

cutting machines to working environment products, ESAB, today has established itself as one of the leading suppliers of welding, cutting and working environment solutions in the country.

ESAB products are now an integral part of industries like Shipbuilding, Petrochemical, Construction, Transport, Offshore, Energy and Repair and Maintenance.

The ESAB group belongs to the world renowned Charter Plc. Group, UK, and employs around 9300 people of which more than 600 are engaged in research and development at centres in Sweden, Holland, UK, Germany, USA, Brazil and India.

In India, ESAB was formally incorporated on 10th November 1987, and it has expanded through a number of acquisitions. The organisation operates five manufacturing facilities backed by world-class R&D.

All the manufacturing units of Esab India Limited, are ISO 9001 and 14000 certified - the only company in India, in the welding field to receive such an honour. The entire ESAB group including ESAB India has achieved ISO 14001 and OHSAS 18001 certification for Environmental and Occupational Health and Safety Management system. This is believed to be the most comprehensive certification achieved by any global company till date

A CENTURY OF ESAB INNOVATIONS

1904 The Coated Electrode (MMA Welding)

1937 Unionmelt (Submerged-Arc Welding)

1938 Gravity Welding

1944 Heliarc (TIG Welding)

1947 MIG / MAG (Welding)

1955 Plasma Cutting

1960 Flux-Cored Wire

1979 Narrow-Gap Welding

1982 LMA Electrodes (Low-Moisture Absorption)

1989 Adaptive-Butt Welding

1989 VacPac[®] (Vacuum-Packed) Electrodes

1995 High-Speed Cored Wire

1996 Friction-Stir Welding

1997 Laser-Bevel Cutting

2001 First Modular Platform for Welding Equipments

2002 Copper Fee Wire - Aristorod[®]

2005 The Q Set Function

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Welding Consumables





ESAB FERROSPEED

A rutile coated general-purpose electrode for SMAW

Classification AWS A5.1: E6012
IS 814: ER4124

DESCRIPTION

ESAB FERROSPEED is a rutile-coated general-purpose electrode for welding structures that are not subjected to heavy dynamic loading and is specially designed for higher tolerance to less cleaned plates and poor joint fit-ups. The electrode has high current carrying capacity and produces quality weld metal.

APPROVALS: ABS, BV, DNV, IBR, IRS, LRS & MMD

WELDING CURRENT: DC_±, AC 70V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.08	YS (N/mm ²)	430
Si	0.20	UTS (N/mm ²)	520
Mn	0.35	Elongation (%)	25
		Impact (CVN) @ +20°C (Joules)	70

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	No. of Electrodes in a	
			Carton	Cardboard box
3.15	450	95-150	150	600
4.00	450	140-190	100	400
5.00	450	180-260	65	260

PACKING: Electrodes are packed in cartons and four of these cartons are shrink wrapped in a cardboard box.

ESAB FERROARC

A rutile coated general-purpose electrode for SMAW

Classification AWS A5.1: E6013
IS 814: ER4211X

DESCRIPTION

ESAB FERROARC is a medium coated general purpose mild steel electrode, which operates on low OCV (50V) AC in all positions. ESAB FERROARC delivers smooth and stable welding arc with low spatter, excellent slag detachability and smooth weld bead appearance. The weld deposit is of radiographic quality.

APPROVALS: ABS, BV, DNV, IBR, IRS, LRS, MMD, MN Dastur & TOYO

WELDING CURRENT: DC_±, AC 50V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.08	YS (N/mm ²)	430
Si	0.20	UTS (N/mm ²)	500
Mn	0.35	Elongation (%)	26
		Impact (CVN) @ 0°C (Joules)	80

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	No. of Electrodes in a	
			Carton	Cardboard box
2.50	350	50-80	300	900
3.15	350	60-120	190	570
3.15	450	60-110	185	555
4.00	450	90-170	125	375
5.00	450	130-280	85	255

PACKING: Electrodes are packed in cartons and three of these cartons are shrink wrapped in a cardboard box.



ESAB FERROSPEED PLUS

A rutile coated all-round electrode for SMAW

Classification AWS A5.1: E6013
IS 814: ER4211X

DESCRIPTION

ESAB FERROSPEED PLUS is a medium-heavy coated mild steel welding electrode for all positions, having good mechanical properties and arc characteristics. ESAB FERROSPEED PLUS operates on low open circuit voltage and its good running characteristics results in excellent weld finish of radiographic quality. ESAB FERROSPEED PLUS is also known for its superior V-down welding capabilities.

APPROVALS: ABS, BV, DNV, IBR, IRS, LRS, MMD, MN Dastur, PDIL & TOYO

WELDING CURRENT: DC \pm , AC 50V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.08	YS (N/mm ²)	400
Si	0.18	UTS (N/mm ²)	500
Mn	0.30	Elongation (%)	27
		Impact (CVN) @ 0°C (Joules)	80

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	No. of Electrodes in a	
			Carton	Cardboard Box
2.5	350	50-85	190/265	760/795
3.15	350	60-120	140/195	560/585
3.15	450	60-110	140/190	560/570
4.00	450	80-180	85/115	340/345
5.00	450	100-235	55/75	220/225

PACKING: Electrodes are packed in cartons and three-four of these cartons are shrink wrapped in a cardboard box.

ESAB VORTIC

A rutile coated general-purpose electrode for SMAW

Classification AWS A5.1: E6013
IS 814: ER4224X

DESCRIPTION

ESAB VORTIC is a medium coated general purpose mild steel electrode, especially designed for use in vertical and over head positions. This is a rutile coated electrode, with fast freezing slag and excellent slag detachability even in deep grooves.

APPROVALS: IBR, IRS, LRS & MMD

WELDING CURRENT: DC \pm , AC 70V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.07	YS (N/mm ²)	430
Si	0.18	UTS (N/mm ²)	470
Mn	0.40	Elongation (%)	25
		Impact (CVN) @ 0°C (Joules)	70

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	No. of Electrodes in a	
			Carton	Cardboard box
2.50	350	40-100	185	740
3.15	450	100-125	125	500
4.00	450	135-175	90	360
5.00	450	150-260	60	240

PACKING: Electrodes are packed in cartons and four of these cartons are shrink wrapped in a cardboard box.

ESAB 28

A rutile coated all-round electrode for SMAW

Classification AWS A5.1: E6013
IS 814: ER4212X

DESCRIPTION

ESAB 28 is a medium heavy rutile coated mild steel electrode designed for welding of unalloyed structural steels in all positions. The electrode gives smooth radiographic quality weld with low spatter and smoke. Slag is self detachable and the bead shape is uniform and finely rippled.

APPROVALS: ABS, BV, DNV, IBR, IRS, LRS, MMD, NPC, PDIL & TOYO

WELDING CURRENT: DC_±, AC 50V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.08	YS (N/mm ²)	420
Si	0.25	UTS (N/mm ²)	510
Mn	0.35	Elongation (%)	28
		Impact (CVN) @ 0°C (Joules)	90

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	No. of Electrodes in a	
			Carton	Cardboard box
2.50	350	50-80	190	760
3.15	350	60-130	120	480
3.15	450	60-120	120	480
4.00	450	90-170	75	300
5.00	450	130-260	50	200

PACKING: Electrodes are packed in cartons and four of these cartons are shrink wrapped in a cardboard box.

ESAB VORDIAN

A rutile coated high productivity electrode for SMAW

Classification AWS A5.1: E6013
IS 814: ERR4221X

DESCRIPTION

ESAB VORDIAN is an all position medium heavy rutile coated mild steel welding electrode of outstanding quality permitting the use of low open circuit voltages. ESAB VORDIAN is extremely suitable for flat and horizontal-vertical positions, as well as for vertical and overhead welding.

APPROVALS: ABS, BV, DNV, IBR, IRS, LRS, MMD & TOYO

WELDING CURRENT: DC_±, AC 50V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.07	YS (N/mm ²)	430
Si	0.20	UTS (N/mm ²)	490
Mn	0.35	Elongation (%)	29
		Impact (CVN) @ 0°C (Joules)	90

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	No. of Electrodes in a	
			Carton	Cardboard box
2.50	350	50-80	160	640
3.15	350	60-130	110	440
3.15	450	60-110	110	440
4.00	450	90-170	75	300
5.00	450	130-240	50	200

PACKING: Electrodes are packed in cartons and four of these cartons are shrink wrapped in a cardboard box.



ESAB FERROWELD 1

A basic coated low hydrogen electrode for SMAW

Classification AWS A5.1: E7016
IS 814: EB5424H₃X

DESCRIPTION

ESAB FERROWELD 1 is a basic coated, hydrogen controlled electrode for welding mild, medium tensile, low alloy, free cutting and difficult to weld steels and grey cast iron (non-machinable deposits) in all positions, using AC or DC. The composition of coating ensures complete absence of porosity and cracking.

WELDING CURRENT : DC_±, AC 70V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.06	YS (N/mm ²)	450
Si	0.70	UTS (N/mm ²)	540
Mn	1.00	Elongation (%)	32
		Impact (CVN) @ -30°C (Joules)	60

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	No. of Electrodes in a	
			Carton	Cardboard box
2.50	350	75-105	170	680
3.15	450	95-150	100	400
4.00	450	140-190	65	260
5.00	450	190-260	45	180

PACKING: Electrodes are packed in cartons and four of these cartons are shrink wrapped in a cardboard box.

ESAB 36H

A basic coated low hydrogen electrode for SMAW

Classification AWS A5.1: E7018
IS 814: EB5426H₃JX

DESCRIPTION

ESAB 36H is a heavy basic coated, hydrogen controlled iron powder electrode designed for welding in all positions. It gives tough, crack resistant weld on mild and low alloy steels. ESAB 36H deposits good radiographic quality welds and is ideal for welding restraint structures where stresses can not be avoided.

APPROVALS: ABS, BV, DNV, IBR, IRS, LRS, MMD, NPC, PDIL & TOYO

WELDING CURRENT: DC₊, AC 70V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.07	YS (N/mm ²)	470
Si	0.35	UTS (N/mm ²)	540
Mn	1.25	Elongation (%)	28
		Impact (CVN) @ -30°C (Joules)	100

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	No. of Electrodes in a	
			Carton	Cardboard box
2.50	350	60-100	130	520
3.15	450	70-130	90	360
4.00	450	90-200	60	240
5.00	450	110-280	40	160

PACKING: Electrodes are packed in cartons and four of these cartons are shrink wrapped in a cardboard box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.

OK 48.20 (SPL)

A basic coated low-hydrogen MMAW electrode for NACE requirements

Classification AWS A5.1: E7018

DESCRIPTION

OK 48.20 (SPL) is a heavy basic coated, low hydrogen all positional electrode for welding medium tensile & fine grained carbon steels. The electrode meets NACE requirements.

WELDING CURRENT: DC+, AC 70V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.07	YS (N/mm ²)	450
Si	0.30	UTS (N/mm ²)	540
Mn	1.10	Elongation (%)	30
		Impact (CVN) @ -30°C (Joules)	100

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	No. of Electrodes in a	
			Carton	Cardboard box
2.50	350	75-105	130	520
3.15	450	95-150	90	360
4.00	450	140-190	60	240
5.00	450	180-260	40	160

PACKING: Electrodes are packed in cartons and four of these cartons are shrink wrapped in a cardboard box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.

ESAB 36H (SPL)

A basic coated low-hydrogen MMAW electrode for low temperature applications

Classification AWS A5.1: E7018-1
IS 814: EB5626H₃JX

DESCRIPTION

ESAB 36H (SPL) is a basic coated low hydrogen iron powder electrode for low temperature applications. It is an all positional electrode for welding medium tensile and fine grained carbon steels.

APPROVALS: ABS, IBR, LRS, NPC, PDIL & TOYO

WELDING CURRENT: DC+, AC 70V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.07	YS (N/mm ²)	460
Si	0.30	UTS (N/mm ²)	550
Mn	1.30	Elongation (%)	30
		Impact (CVN) @ -46°C (Joules)	80

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	No. of Electrodes in a	
			Carton	Cardboard box
2.50	350	55-100	140	560
3.15	450	70-130	90	360
4.00	450	90-200	60	240
5.00	450	110-280	40	160

PACKING: Electrodes are packed in cartons and four of these cartons are shrink wrapped in a cardboard box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.



ESAB 36H (SPL) M

A basic coated low-hydrogen MMAW electrode for low temperature & NACE requirements

Classification AWS A5.1: E7018-1

DESCRIPTION

ESAB 36H (SPL) M is a heavy basic coated extra low hydrogen, iron powder, moisture resistant electrode designed for welding in all positions. The electrode meets NACE requirements.

WELDING CURRENT: DC+, AC 70V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.07	YS (N/mm ²)	440
Si	0.30	UTS (N/mm ²)	540
Mn	1.10	Elongation (%)	31
		Impact (CVN) @ -46°C (Joules)	80

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	No. of Electrodes in a	
			Carton	Cardboard box
2.50	350	75-105	140	560
3.15	450	95-150	90	360
4.00	450	140-190	60	240
5.00	450	180-260	40	160

PACKING: Electrodes are packed in cartons and four of these cartons are shrink wrapped in a cardboard box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.

ESAB C23S

A high recovery rutile-iron powder electrode for SMAW

Classification AWS A5.1: E7024
IS 814: ERR5234KX

DESCRIPTION

ESAB C23S is a heavy coated rutile-iron powder electrode having a metal recovery of 130-140%. It is specially designed for very fast welding of unalloyed steels in downhand position and for standing fillets by contact welding.

APPROVALS: BV & IRS

WELDING CURRENT: DC_±, AC 70V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.08	YS (N/mm ²)	460
Si	0.40	UTS (N/mm ²)	550
Mn	0.80	Elongation (%)	22
		Impact (CVN) @ 0°C (Joules)	60

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	No. of Electrodes in a	
			Carton	Cardboard box
3.15	450	70-120	75	300
4.00	450	70-130	55	220
5.00	450	120-250	30	120

PACKING: Electrodes are packed in cartons and four of these cartons are shrink wrapped in a cardboard box.



Gas Welding Fluxes

DESCRIPTION

ESAB welding and brazing fluxes are well known and are designed to obtain consistent and sound joints between steel, copper, brass, bronze and aluminium. Some of the common applications are found in manufacturing and repair of automobiles, refrigeration and air conditioning, tool manufacturing and other industries.

ESAB WELDING AND BRAZING FLUXES

Flux	Application
ESAB Castox	Cast Iron Welding Cast Irons by fusion welding technique.
ESAB Brazotectic	Fusion welding of brass, brazing copper to steel sheets and tubes with Silicon Bronze rods. Welding copper alloys with Nickel Bronze and other Bronze rods. However not suitable for braze - welding cast iron or brazing stellite for tipping of tools.
ESAB Bronzotectic	Braze welding cast or malleable iron and building up worn bearing surfaces with Manganese Bronze rods and Nickel Bronze rods.
ESAB Alotectic AWS A5.31 FBI-A	Welding Aluminium and Aluminium alloys
ESAB Rumatam A AWS A5.31 FB3-F	For Silver Brazing
ESAB Albratectic AWS A5.31 FBI -A	Brazing Aluminium and Aluminium alloys containing 2% Magnesium

REMOVAL OF FLUX RESIDUE:

Aluminium and Aluminium alloys: Immediately after welding wash the joints in warm water and brush vigorously. When conditions allow, follow up by a rapid dip in a 5% solution of nitric acid; wash again, using hot water to assist drying.

Copper and Brass:- Wash in boiling water followed by brushing. Where possible a 2% solution of nitric or sulphuric acid is preferred to help in lifting the glassy deposit, followed by a hot water wash.

Cast Iron:- Residues may be removed easily by a chipping hammer or wire brush.

Rumatam A:- Can be easily removed by soaking brazed components in hot water followed by wire brushing. In difficult situations, the work piece should be immersed in 5% to 10% sulphuric acid solution for a period of 2 to 5 minutes, followed by hot water rinsing and wire brushing.

PACKING: ESAB Welding and Brazing Fluxes are packed in plastic containers and then in cardboard box totalling 25 Kg Net of 500g each.

Pipe Welding Electrodes

PIPEWELD 6010R

Cellulose coated electrode for SMAW of pipes

Classification AWS A5.1: E6010
IS 814: EC4410 X

DESCRIPTION

PIPEWELD 6010R is high cellulose coated electrode for welding of pipes. The electrode is designed to provide deep and complete penetration. The weld bead obtained is smooth with a thin, fast freezing, easily removable slag, giving radiographic quality weld metal.

APPROVALS: NPC, PDIL & TOYO

WELDING CURRENT: DC+

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.10	YS (N/mm ²)	440
Si	0.35	UTS (N/mm ²)	520
Mn	0.65	Elongation (%)	26
		Impact (CVN) @ -30°C (Joules)	60

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	No. of Electrodes in a	
			Carton	Cardboard box
2.50	350	50-80	200	800
3.15	350	90-130	130	520
4.00	350	110-160	80	320

PACKING: Electrodes are packed in cartons and four of these cartons are shrink wrapped in a cardboard box. Also available in 10 kg hermetically sealed tins.



OK 73.08

A Ni-Cu alloyed low hydrogen electrode for SMAW

Classification AWS A5.5: E8018-G
IS 1395: E55BG129Fe

DESCRIPTION

OK 73.08 is a Ni-Cu alloyed low hydrogen electrode, which deposits a weld metal with good corrosion resistance to sea water and flue gases. The weld metal has excellent mechanical properties. It is used for the welding of weather proof steel and ship's hull structural steel and shell plating of ice-breakers.

WELDING CURRENT: DC+, AC 90V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.07	YS (N/mm ²)	460
Si	0.40	UTS (N/mm ²)	550
Mn	1.10	Elongation (%)	30
Ni	0.45	Impact (CVN)	
Cu	0.40	@ -20°C (Joules)	130

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	No. of Electrodes in a	
			Carton	Cardboard box
2.50	350	50-90	140	560
3.15	450	90-140	90	360
4.00	450	140-190	55	220
5.00	450	190-240	35	140

PACKING: Electrodes are packed in cartons and four of these cartons are shrink wrapped in a cardboard box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.

OK 73.68

A 2.5Ni alloyed hydrogen controlled electrode for SMAW

Classification AWS A5.5: E8018-C1
IS 1395: E55BC126Fe

DESCRIPTION

OK 73.68 is a 2.5Ni alloyed hydrogen controlled electrode, specially designed for welding low alloy steels used for high ductility, toughness and resistance to the embrittlement effects at sub-zero temperatures. The weld metal is suitable for impact requirements down to -60°C. The composition of the weld metal is designed in such a way that, good low temperature impact properties are obtained, even when welding vertically up. The alloy is also noted for its good corrosion resistance to sea water and sulphuric acid fumes.

APPROVALS: ABS

WELDING CURRENT: DC+, AC 70V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.08	YS (N/mm ²)	490
Si	0.35	UTS (N/mm ²)	570
Mn	0.90	Elongation (%)	30
Ni	2.30	Impact (CVN)	
		@ -60°C (Joules)	95

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	No. of Electrodes in a	
			Carton	Cardboard box
2.50	350	50-90	79	474
3.15	450	90-140	39	312
4.00	450	140-190	26	208
5.00	450	190-240	18	144

PACKING: Electrodes are packed in moisture resistant vacuum packed cartons, which can be used without redrying.



OK 74.46

A 0.5Mo alloyed low hydrogen electrode for SMAW

Classification AWS A5.5: E7018-A1
IS 1395: E49BA126Fe

DESCRIPTION

OK 74.46 is a 0.5Mo alloyed low hydrogen electrode for welding of creep resistant steels. The specially designed running characteristics make it suitable for welding joints in the inclined positions. OK 74.46 deposits a weld metal with good crack resistance and creep resistance up to a temperature of 525°C.

APPROVALS: IBR, NPC, PDIL & TOYO

WELDING CURRENT: DC+, AC 70V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.06	YS (N/mm ²)	500
Si	0.30	UTS (N/mm ²)	590
Mn	0.70	Elongation (%)	26
Mo	0.55	Impact (CVN) @ -20°C (Joules)	70

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	No. of Electrodes in a	
			Carton	Cardboard box
2.50	350	50-95	135	540
3.15	450	75-130	95	380
4.00	450	90-175	60	240
5.00	450	110-290	35	140

PACKING: Electrodes are packed in cartons and four of these cartons are shrink wrapped in a cardboard box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.

OK 76.18

A 1.25Cr-0.5Mo alloyed low hydrogen electrode for SMAW of creep resistant steels

Classification AWS A5.5: E8018-B2
IS 1395: E55BB226Fe

DESCRIPTION

OK 76.18 is a basic coated, hydrogen controlled iron powder type electrode, for welding creep resistant steels of 1.25Cr-0.5Mo or similar type, used in high temperature components of power plants, boilers, oil-refineries, petrochemical plants etc. The slag system is designed in such a way that the electrode welds with a stable arc and minimum spatter. OK 76.18 welds without short-circuiting and deposits a weld metal resistant to both cracking and porosity. The weld metal is resistant to scaling up to 575°C.

APPROVALS: IBR, NPC, PDIL & TOYO

WELDING CURRENT: DC+, AC 70V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.06	YS (N/mm ²)	530
Si	0.60	UTS (N/mm ²)	620
Mn	0.70	Elongation (%)	26
Cr	1.25		
Mo	0.60		

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	No. of Electrodes in a	
			Carton	Cardboard box
2.50	350	70-100	130	520
3.15	450	90-150	95	380
4.00	450	140-180	60	240
5.00	450	180-240	35	140

PACKING: Electrodes are packed in cartons and four of these cartons are shrink wrapped in a cardboard box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.

OK 76.18M

A low carbon 1.25Cr-0.5Mo alloyed electrode for SMAW of creep resistant steels

Classification AWS A5.5: E7018-B2L
IS 1395: E49BB2L26Fe

DESCRIPTION

OK 76.18M is a low carbon, basic coated hydrogen controlled iron powder type electrode, used for welding creep resistant steels of 1.25Cr-0.5Mo or similar type, used in high temperature components of power plants, boilers, oil-refineries, petrochemical plants etc. The electrode welds with a stable arc, minimum amount of spatter and smooth & even weld bead. OK 76.18M deposits a weld metal resistant to both cracking and porosity. The weld metal is resistant to scaling up to 575°C.

WELDING CURRENT: DC+, AC 70V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.03	YS (N/mm ²)	450
Si	0.40	UTS (N/mm ²)	540
Mn	0.60	Elongation (%)	24
Cr	1.25		
Mo	0.55		

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	No. of Electrodes in a	
			Carton	Cardboard box
2.50	350	70-110	130	520
3.15	450	90-150	95	380
4.00	450	130-190	60	240
5.00	450	150-260	35	140

PACKING: Electrodes are packed in cartons and four of these cartons are shrink wrapped in a cardboard box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.

OK 76.28

A 2.25Cr-1Mo alloyed low hydrogen electrode for SMAW of creep resistant steels

Classification AWS A5.5: E9018-B3
IS 1395: 63BB326Fe

DESCRIPTION

OK 76.28 is a basic coated hydrogen controlled iron powder type electrode, depositing a weld metal of the type 2.25Cr-1Mo, suitable for welding of similar Cr-Mo steels, used in high temperature components of power plants, boilers, oil-refineries, petrochemical plants etc. The slag system is designed in such a way that the electrode welds with a stable arc and minimum spatter. The weld metal provides scaling resistance up to 600°C.

APPROVALS: IBR, NPC, PDIL & TOYO

WELDING CURRENT: DC+, AC 70V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.07	YS (N/mm ²)	620
Si	0.50	UTS (N/mm ²)	710
Mn	0.80	Elongation (%)	21
Cr	2.30		
Mo	1.00		

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	No. of Electrodes in a	
			Carton	Cardboard box
2.50	350	60-90	130	520
3.15	450	80-140	95	380
4.00	450	95-180	60	240
5.00	450	140-270	35	140

PACKING: Electrodes are packed in cartons and four of these cartons are shrink wrapped in a cardboard box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.



OK 76.28M

A low carbon 2.25Cr-1Mo alloyed electrode for SMAW of creep resistant steels

Classification AWS A5.5: E8018-B3L

DESCRIPTION

OK 76.28M is a low carbon basic coated hydrogen controlled iron powder type electrode, depositing a weld metal of the type 2.25Cr-1Mo, suitable for welding of similar Cr-Mo steels, used in high temperature components of power plants, boilers, oil-refineries, petrochemical plants etc. The electrode welds with a stable arc, minimum amount of spatter and smooth & even weld bead. The weld metal provides scaling resistance up to 600°C.

WELDING CURRENT: DC+, AC 70V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.05	YS (N/mm ²)	610
Si	0.50	UTS (N/mm ²)	700
Mn	0.85	Elongation (%)	23
Cr	2.15		
Mo	1.10		

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	No. of Electrodes in a	
			Carton	Cardboard box
2.50	350	60-90	130	520
3.15	450	80-140	95	380
4.00	450	100-180	60	240

PACKING: Electrodes are packed in cartons and four of these cartons are shrink wrapped in a cardboard box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.

ESAB KV4

A 5Cr-0.5Mo alloyed low hydrogen electrode for SMAW of creep resistant steels

Classification AWS A5.5: E8018-B6
IS 1395: E55B-B620

DESCRIPTION

ESAB KV4 is a 5Cr-0.5Mo alloyed basic coated low hydrogen electrode, used for welding creep resistant, Cr-Mo bearing steels. It deposits a weld metal that is highly resistant to heat and corrosion. The electrode is designed to provide a stable arc, minimum spatter and superior weld bead. ESAB KV4 finds extensive use in the oil refineries, chemical and petrochemical Industries where it has to resist corrosion and hydrogen attack at high temperatures.

WELDING CURRENT: DC+

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.06	YS (N/mm ²)	480
Si	0.45	UTS (N/mm ²)	570
Mn	0.70	Elongation (%)	19
Cr	5.00		
Mo	0.50		

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	No. of Electrodes in a	
			Carton	Cardboard box
2.50	350	50-90	135	540
3.15	350	90-140	95	380
4.00	350	140-190	60	240
5.00	450	190-240	45	180

PACKING: Electrodes are packed in cartons and four of these cartons are shrink wrapped in a cardboard box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.

ESAB KV7

A 9Cr-1Mo alloyed low hydrogen electrode for SMAW of creep resistant steels

Classification AWS A5.5: E8018-B8
IS 1395: E55BB820

DESCRIPTION

ESAB KV7 is basic coated low hydrogen electrode, for welding creep resistant steels of 9Cr-1Mo type. The weld metal is highly resistant to corrosion and hydrogen attack at high temperatures. The electrode runs with a quiet, stable arc and gives a minimum amount of spatter and superior weld appearance. It finds extensive use in the power plants, oil refineries, chemical and petrochemical industries.

WELDING CURRENT: DC+

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.06	YS (N/mm ²)	630
Si	0.35	UTS (N/mm ²)	780
Mn	0.90	Elongation (%)	21
Cr	10.40		
Ni	0.15		
Mo	1.10		

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	No. of Electrodes in a	
			Carton	Cardboard box
2.50	350	70-100	135	540
3.15	350	90-125	95	380
4.00	350	140-190	60	240
5.00	450	180-240	45	180

PACKING: Electrodes are packed in cartons and four of these cartons are shrink wrapped in a cardboard box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.

ESAB KV7M

A 9Cr-1Mo-V-N alloyed low hydrogen electrode for SMAW of creep resistant steels

Classification AWS A5.5: E9018-B9 (Nearest)

DESCRIPTION

ESAB KV7M is a basic coated low hydrogen electrode for welding of modified 9Cr-1Mo steels like P91/T91. The electrode is suitable for all positional welding in plates and tubes. ESAB KV7M finds extensive use in the power plants, oil refineries, chemical and petrochemical industries where it has to resist corrosion and hydrogen attack at high temperatures.

WELDING CURRENT: DC+

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.10	YS (N/mm ²)	620
Si	0.20	UTS (N/mm ²)	710
Mn	1.00	Elongation (%)	20
Cr	9.00		
Ni	0.10		
Mo	1.10		
Nb	0.04		
N	0.04		
V	0.20		

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	No. of Electrodes in a	
			Carton	Cardboard box
2.50	350	60-80	135	540
3.15	350	90-130	95	380
4.00	350	95-195	60	240
5.00	450	140-270	35	140

PACKING: Electrodes are packed in cartons and four of these cartons are shrink wrapped in a cardboard box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.



ESAB 98

A Ni-Mo alloyed low hydrogen electrode for SMAW of high tensile strength steels

Classification AWS A5.5: E9018M

DESCRIPTION

ESAB 98 is a Ni-Mo alloyed hydrogen controlled iron powder type electrode, for welding high tensile strength steels. The electrode deposits, tough and crack resistant welds. The optimum addition of iron powder permits the use of higher currents and results in improved arc characteristics coupled with higher metal recovery. The operational characteristics are excellent in all positions. ESAB 98 finds extensive use in pressure vessels, piping, penstock, earth moving equipment, machinery parts, automobile parts, chemical plants etc.

APPROVAL: ABS

WELDING CURRENT: DC+, AC 70V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.05	YS (N/mm ²)	570
Si	0.40	UTS (N/mm ²)	640
Mn	1.00	Elongation (%)	28
Cr	0.10	Impact (CVN)	
Ni	1.60	@ -51°C (Joules)	110
Mo	0.25		

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	No. of Electrodes in a	
			Carton	Cardboard box
2.50	350	50-90	130	520
3.15	450	90-140	90	360
4.00	450	140-190	60	240
5.00	450	190-240	40	160

PACKING: Electrodes are packed in cartons and four of these cartons are shrink wrapped in a cardboard box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.

ESAB 118

A Cr-Ni-Mo alloyed low hydrogen electrode for SMAW of HSLA steels

Classification AWS A5.5: E11018M

DESCRIPTION

ESAB 118 is a Cr-Ni-Mo alloyed low hydrogen electrode, for welding high strength low alloy steels including quenched and tempered steels. The electrode gives a tough weld metal without the risk of temper brittleness. The all position electrode has excellent arc and current carrying characteristics, with an easily removable slag and excellent bead finish contributing to its immense welder appeal. Used for components of penstock, earth moving equipment and other heavy steel fabrications made of high tensile strength steels.

APPROVALS: ABS

WELDING CURRENT: DC+, AC 70V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.05	YS (N/mm ²)	690
Si	0.40	UTS (N/mm ²)	780
Mn	1.40	Elongation (%)	25
Cr	0.15	Impact (CVN)	
Ni	2.20	@ -51°C (Joules)	50
Mo	0.40		

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	No. of Electrodes in a	
			Carton	Cardboard box
2.50	350	75-110	130	520
3.15	450	90-140	90	360
4.00	450	140-185	60	240
5.00	450	160-240	40	160

PACKING: Electrodes are packed in cartons and four of these cartons are shrink wrapped in a cardboard box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.

ESAB 120

A Cr-Ni-Mo alloyed low hydrogen electrode for SMAW of HSLA steels

Classification AWS A5.5: E12018M

DESCRIPTION

ESAB 120 is a Cr-Ni-Mo alloyed low hydrogen electrode, for welding ultra high strength low alloy steels. The electrode is designed to give a tough weld metal avoiding risk of temper brittleness. The operational characteristics are excellent in all positions.

APPROVALS: ABS

WELDING CURRENT: DC+, AC 70V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.06	YS (N/mm ²)	790
Si	0.25	UTS (N/mm ²)	860
Mn	1.60	Elongation (%)	20
Cr	0.90	Impact (CVN)	
Ni	2.35	@ -51°C (Joules)	70
Mo	0.40		

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	No. of Electrodes in a	
			Carton	Cardboard box
3.15	450	90-140	90	360
4.00	450	140-190	60	240
5.00	450	190-240	40	160

PACKING: Electrodes are packed in cartons and four of these cartons are shrink wrapped in a cardboard box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.

ESAB FERROWELD W2

A Cr-Ni-Cu alloyed low hydrogen electrode for SMAW of weathering steels

Classification AWS A5.5: E8018-W2

DESCRIPTION

ESAB FERROWELD W2 is a Cr-Ni-Cu alloyed basic coated hydrogen controlled electrode, suitable for welding of weathering steels, steels having greater resistance to atmospheric corrosion as compared to normal steels and high tensile strength steels. The electrode is designed to provide excellent striking and re-striking properties, stable arc, easily detachable slag and smooth & even weld bead. ESAB FERROWELD W2 is specially recommended for weathering steels like COR-TEN A & B and their equivalents.

WELDING CURRENT: DC+

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.06	YS (N/mm ²)	560
Si	0.50	UTS (N/mm ²)	650
Mn	0.90	Elongation (%)	27
Cr	0.60	Impact (CVN)	
Ni	0.60	@ -20°C (Joules)	80
Cu	0.40		

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	No. of Electrodes in a	
			Carton	Cardboard box
2.50	350	50-90	140	560
3.15	450	90-140	90	360
4.00	450	140-190	60	240
5.00	450	190-240	40	160

PACKING: Electrodes are packed in cartons and four of these cartons are shrink wrapped in a cardboard box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.

Stainless Steel Electrodes

OK 61.50

A rutile based stainless steel electrode for SMAW of 18Cr-8Ni type steels

Classification AWS A5.4: E308-16

DESCRIPTION

OK 61.50 is an AC/DC rutile coated 20Cr-10Ni stainless steel electrode. The unique flux coating allows easy striking and restriking and is completely free from short-circuiting during welding.

APPROVALS: NPC, PDIL & TOYO

WELDING CURRENT: DC+, AC 70V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.05	YS (N/mm ²)	470
Si	0.80	UTS (N/mm ²)	630
Mn	0.75	Elongation (%)	42
Cr	20.50		
Ni	9.10		

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	Packing
2.50	350	60-100	Weight Per Box: 10 Kg
3.15	350	80-120	Weight Per Carton
4.00	350	120-170	(Packet): 2 Kg
5.00	350	160-210	No. of Cartons (Packets) in a box: 5

PACKING: Electrodes are packed in heat sealed plastic cartons and five of these cartons are shrink wrapped in a card board box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying

OK 61.30

A rutile based extra low carbon stainless steel electrode for SMAW of 18Cr-8Ni type steels

Classification AWS A5.4: E308L-16

DESCRIPTION

OK 61.30 is a rutile based extra low carbon 20Cr-10-Ni type stainless steel electrode with a controlled ferrite that provides excellent resistance to corrosion, cracking and high temperature scaling resistance up to 800°C.

APPROVALS: PDIL & TOYO

WELDING CURRENT: DC+, AC 70V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.03	YS (N/mm ²)	540
Si	0.90	UTS (N/mm ²)	620
Mn	0.65	Elongation (%)	42
Cr	20.00		
Ni	10.00		

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	Packing
2.50	350	60-90	Weight Per Box: 10 Kg
3.15	350	80-120	Weight Per Carton
4.00	350	120-170	(Packet): 2 Kg
5.00	350	160-210	No. of Cartons (Packets) in a Box: 5

PACKING: Electrodes are packed in heat sealed plastic cartons and five of these cartons are shrink wrapped in a card board box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.

ESAB 304B

A basic coated extra low carbon stainless steel electrode for SMAW of 18Cr-8Ni type steels

Classification AWS A5.4: E308L-15

DESCRIPTION

ESAB 304B is an extra low carbon, basic coated 19Cr-10Ni stainless steel electrode with outstanding welding properties in the vertical and overhead position. The weld metal is highly resistant to cracking and porosity and has good impact toughness at very low temperatures.

APPROVAL: NPC

WELDING CURRENT: DC+

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.03	YS (N/mm ²)	450
Si	0.40	UTS (N/mm ²)	570
Mn	1.50	Elongation (%)	40
Cr	19.00	Impact (CVN)	
Ni	10.50	@ -196°C (Joules)	30

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	Packing
2.50	350	60-100	Weight Per Box: 10 Kg
3.15	350	80-120	Weight Per Carton
4.00	350	120-170	(Packet): 2 Kg
5.00	350	180-210	No. of Cartons (Packets) in a Box: 5

PACKING: Electrodes are packed in heat sealed plastic cartons and five of these cartons are shrink wrapped in a card board box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.

OK 61.80

A Nb stabilised stainless steel electrode for SMAW of 18Cr-8Ni & stabilized stainless steels

Classification AWS A5.4: E347-16

DESCRIPTION

OK 61.80 is a rutile type low carbon 19Cr-10Ni stabilized stainless steel electrode. Niobium minimizes the chromium carbide precipitation and thereby improves the intergranular corrosion resistance.

APPROVALS: NPC & TOYO

WELDING CURRENT: DC+, AC 70V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.03	YS (N/mm ²)	550
Si	0.90	UTS (N/mm ²)	630
Mn	0.65	Elongation (%)	35
Cr	19.80		
Ni	9.80		
Nb	0.65		

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	Packing
2.50	350	60-100	Weight Per Box: 10 Kg
3.15	350	80-120	Weight Per Carton
4.00	350	120-170	(Packet): 2 Kg
5.00	350	160-210	No. of Cartons (Packets) in a Box: 5

PACKING: Electrodes are packed in heat sealed plastic cartons and five of these cartons are shrink wrapped in a card board box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.



OK 63.50

A rutile based stainless steel electrode for SMAW of 18Cr-12Ni-2.5Mo type steels

Classification AWS A5.4: E316-16

DESCRIPTION

OK 63.50 is a rutile coated stainless steel electrode with a unique low moisture absorption coating depositing a weld metal of the type 18Cr-12Ni-2.5Mo.

APPROVALS: NPC, PDIL & TOYO

WELDING CURRENT: DC+, AC 70V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.05	YS (N/mm ²)	480
Si	0.70	UTS (N/mm ²)	650
Mn	0.75	Elongation (%)	42
Cr	19.50		
Ni	12.00		
Mo	2.10		

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	Packing
2.50	350	60-100	Weight Per Box: 10 Kg
3.15	350	80-120	Weight Per Carton
4.00	350	120-170	(Packet): 2 Kg
5.00	350	160-210	No. of Cartons (Packets) in a Box: 5

PACKING: Electrodes are packed in heat sealed plastic cartons and five of these cartons are shrink wrapped in a card board box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.

OK 63.30

A rutile based extra low carbon stainless steel electrode for SMAW of 18Cr-12Ni-2.5Mo type steels

Classification AWS A5.4: E316L-16

DESCRIPTION

OK 63.30 is an extra low carbon, rutile based electrode depositing a weld metal of the type 18Cr-12Ni-2.5Mo. It is completely free from short-circuiting during welding coupled with excellent striking and restriking properties. It provides a self releasing slag and a weld bead that is extremely smooth and shiny.

APPROVALS : PDIL & TOYO

WELDING CURRENT: DC+, AC 70V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.03	YS (N/mm ²)	500
Si	0.85	UTS (N/mm ²)	590
Mn	0.60	Elongation (%)	40
Cr	18.30		
Ni	12.00		
Mo	2.30		

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	Packing
2.50	350	60-100	Weight Per Box: 10 Kg
3.15	350	80-120	Weight Per Carton
4.00	350	120-170	(Packet): 2 Kg
5.00	350	160-210	No. of Cartons (Packets) in a Box: 5

PACKING: Electrodes are packed in heat sealed plastic cartons and five of these cartons are shrink wrapped in a card board box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.

ESAB 316KCR

An extra low carbon stainless steel electrode depositing ferrite free weld metal

Classification AWS A 5.4: E316L-16 (Nearest)

DESCRIPTION

ESAB 316KCR is a specially designed extra low carbon stainless steel electrode to deposit a ferrite free, fully austenitic weld metal with better corrosion resistance to hydrochloric, nitric and sulphuric acids.

APPROVALS: PDIL, SNAMPROGETTI (CR.UR.510 rev 03) & TOYO

WELDING CURRENT: DC+, AC 70V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.04	YS (N/mm ²)	450
Si	0.40	UTS (N/mm ²)	570
Mn	1.20	Elongation (%)	38
Cr	18.00		
Ni	14.20		
Mo	2.20		

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	Packing
2.50	350	60-90	Weight Per Box: 10 Kgs
3.15	350	80-120	Weight Per Carton
4.00	350	120-170	(Packet): 2 Kg
5.00	350	160-210	No. of Cartons (Packets) in a Box: 5

PACKING: Electrodes are packed in heat sealed plastic cartons and five of these cartons are shrink wrapped in a card board box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.

OK 67.67

A rutile based stainless steel electrode for SMAW of similar composition steels & dissimilar steels

Classification AWS A 5.4: E309-16

DESCRIPTION

OK 67.67 is a rutile based, all positional electrode depositing a weld metal of the type 23Cr-13Ni. The weld deposit provides excellent resistance to corrosion and oxidation at very high temperatures, up to 1100°C.

APPROVALS: NPC, PDIL & TOYO

WELDING CURRENT: DC+, AC 70V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.04	YS (N/mm ²)	480
Si	0.75	UTS (N/mm ²)	590
Mn	0.70	Elongation (%)	36
Cr	23.20		
Ni	13.20		

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	Packing
2.50	350	60-100	Weight Per Box: 10 Kg
3.15	350	80-120	Weight Per Carton
4.00	350	120-170	(Packet): 2 Kg
5.00	350	160-210	No. of Cartons (Packets) in a Box: 5

PACKING: Electrodes are packed in heat sealed plastic cartons and five of these cartons are shrink wrapped in a card board box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.



ESAB 309

A basic coated stainless steel electrode for SMAW of similar composition steels & dissimilar steels

Classification AWS A 5.4: E309-15

DESCRIPTION

ESAB 309 is a basic coated, all positional electrode depositing a weld metal of the type 23Cr-13Ni. The weld deposit is extremely tough, resistant to corrosion and oxidation at elevated temperatures, up to 1100°C.

WELDING CURRENT: DC+

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.05	YS (N/mm ²)	490
Si	0.70	UTS (N/mm ²)	620
Mn	0.80	Elongation (%)	40
Cr	23.80		
Ni	13.20		

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	Packing
2.50	350	60-100	Weight Per Box: 10 Kg
3.15	350	80-120	Weight Per Carton
4.00	350	120-170	(Packet): 2 Kg
5.00	350	160-210	No. of Cartons (Packets) in a Box: 5

PACKING: Electrodes are packed in heat sealed plastic cartons and five of these cartons are shrink wrapped in a card board box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.

OK 67.60

A rutile based extra low carbon 23Cr-13Ni stainless steel electrode for SMAW

Classification AWS A 5.4: E309L-16

DESCRIPTION

OK 67.60 is a rutile based, extra low carbon, all positional electrode of 23Cr-13Ni type for joining of stainless steels to unalloyed or low alloyed steels and for surfacing of unalloyed steels.

APPROVALS : NPC, PDIL & TOYO

WELDING CURRENT: DC+, AC 70V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.03	YS (N/mm ²)	490
Si	0.75	UTS (N/mm ²)	600
Mn	0.85	Elongation (%)	42
Cr	23.00		
Ni	13.60		

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	Packing
2.50	350	60-100	Weight Per Box: 10 Kg
3.15	350	80-120	Weight Per Carton
4.00	350	120-170	(Packet): 2 Kg
5.00	350	160-210	No. of Cartons (Packets) in a Box: 5

PACKING: Electrodes are packed in heat sealed plastic cartons and five of these cartons are shrink wrapped in a card board box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.

ESAB 309LC

A basic coated extra low carbon 23Cr-13Ni stainless steel electrode for SMAW

Classification AWS A 5.4: E309L-15

DESCRIPTION

ESAB 309LC is an extra low carbon all positional basic coated electrode giving austenitic weld deposit of 23Cr-13Ni type. It is suitable for welding heat resistant Cr-Ni alloyed steels and stainless steels to unalloyed or low alloyed steels, where better toughness is required.

WELDING CURRENT: DC+

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.03	YS (N/mm ²)	470
Si	0.75	UTS (N/mm ²)	590
Mn	1.00	Elongation (%)	40
Cr	23.50		
Ni	13.70		

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	Packing
2.50	350	60-100	Weight Per Box: 10 Kg
3.15	350	80-120	Weight Per Carton
4.00	350	120-170	(Packet): 2 Kg
5.00	350	160-210	No. of Cartons (Packets) in a Box: 5

PACKING: Electrodes are packed in heat sealed plastic cartons and five of these cartons are shrink wrapped in a card board box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.

OK 67.70

A rutile based 23Cr-13Ni-2.5Mo stainless steel electrode for SMAW

Classification AWS A 5.4: E309Mo-16

DESCRIPTION

OK 67.70 is a rutile based, over alloyed stainless steel electrode giving a weld deposit of 23Cr-13Ni-2.5Mo type, for welding stainless steels to other types of steels and for use as a buffer layer in welding acid resisting clad steels.

APPROVALS: NPC & PDIL

WELDING CURRENT: DC+, AC 70V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.06	YS (N/mm ²)	530
Si	0.80	UTS (N/mm ²)	630
Mn	0.60	Elongation (%)	32
Cr	24.00		
Ni	13.50		
Mo	2.60		

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	Packing
2.50	350	60-100	Weight Per Box: 10 Kg
3.15	350	80-120	Weight Per Carton
4.00	350	120-170	(Packet): 2 Kg
5.00	350	160-210	No. of Cartons (Packets) in a Box: 5

PACKING: Electrodes are packed in heat sealed plastic cartons and five of these cartons are shrink wrapped in a card board box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.



ESAB 309Mo

A basic coated 23Cr-13Ni-2.5Mo stainless steel electrode for SMAW

Classification AWS A 5.4: E309Mo-15

DESCRIPTION

ESAB 309Mo is a basic coated, over-alloyed stainless steel electrode giving a weld deposit of 23Cr-13Ni-2.5Mo type, for welding stainless steels to other types of steels, where better toughness is required.

WELDING CURRENT: DC+

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.06	YS (N/mm ²)	520
Si	0.80	UTS (N/mm ²)	620
Mn	0.80	Elongation (%)	30
Cr	24.00		
Ni	13.00		
Mo	2.50		

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	Packing
2.50	350	60-100	Weight Per Box: 10 Kg
3.15	350	80-120	Weight Per Carton
4.00	350	120-170	(Packet): 2 Kg
5.00	350	160-210	No. of Cartons (Packets) in a Box: 5

PACKING: Electrodes are packed in heat sealed plastic cartons and five of these cartons are shrink wrapped in a card board box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.

ESAB 309LMo

A basic coated extra low carbon stainless steel electrode for SMAW of similar composition steels & dissimilar steels

Classification AWS A 5.4: E309LMo-15

DESCRIPTION

ESAB 309LMo is an extra low carbon, basic coated all positional stainless steel electrode, giving an austenitic weld deposit of 23Cr-13Ni-2.5Mo type. The weld metal has excellent resistance to corrosion and oxidation at elevated temperatures up to 1100°C in continuous service, coupled with good strength and toughness.

WELDING CURRENT: DC+

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.03	YS (N/mm ²)	500
Si	0.70	UTS (N/mm ²)	600
Mn	0.70	Elongation (%)	34
Cr	23.50		
Ni	13.50		
Mo	2.50		

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	Packing
2.50	350	60-100	Weight Per Box: 10 Kg
3.15	350	80-120	Weight Per Carton
4.00	350	120-170	(Packet): 2 Kg
5.00	350	160-210	No. of Cartons (Packets) in a Box: 5

PACKING: Electrodes are packed in heat sealed plastic cartons and five of these cartons are shrink wrapped in a card board box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.

ESAB 309Cb

A Nb stabilised stainless steel electrode for SMAW of similar composition steels & dissimilar steels

Classification AWS A 5.4: E309Nb-15

DESCRIPTION

ESAB 309Cb is a basic coated stainless steel electrode giving austenitic weld deposit of 23Cr-13Ni type. Columbium provides immunity against weld decay. The C-Nb ratio is carefully controlled to provide stabilization against intergranular corrosion.

WELDING CURRENT: DC+

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.04	YS (N/mm ²)	510
Si	0.80	UTS (N/mm ²)	630
Mn	1.00	Elongation (%)	30
Cr	23.50		
Ni	13.50		
Nb	0.70		

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	Packing
2.50	350	60-100	Weight Per Box: 10 Kg
3.15	350	80-120	Weight Per Carton
4.00	350	120-170	(Packet): 2 Kg
5.00	350	160-210	No. of Cartons (Packets) in a Box: 5

PACKING: Electrodes are packed in heat sealed plastic cartons and five of these cartons are shrink wrapped in a card board box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.

OK 67.13

A stainless steel electrode depositing fully austenitic weld metal for SMAW of 25Cr-20Ni type steels

Classification AWS A 5.4: E310-16

DESCRIPTION

OK 67.13 is a semi basic type austenitic stainless steel electrode depositing a 25Cr-20Ni type weld deposit, which has excellent stability and oxidation resistance in continuous service up to 1100°C.

APPROVALS: NPC

WELDING CURRENT: DC+, AC 70V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.10	YS (N/mm ²)	430
Si	0.60	UTS (N/mm ²)	600
Mn	1.70	Elongation (%)	34
Cr	26.50		
Ni	21.00		
Mo	0.10		

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	Packing
2.50	350	60-100	Weight Per Box: 10 Kg
3.15	350	80-120	Weight Per Carton
4.00	350	120-170	(Packet): 2 Kg
5.00	350	160-210	No. of Cartons (Packets) in a Box: 5

PACKING: Electrodes are packed in cartons and four of these cartons are shrink wrapped in a cardboard box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.



ESAB RSW

A rutile based high alloyed universal electrode for joining steels of unknown composition

Classification AWS A 5.4: E312-16

DESCRIPTION

ESAB RSW is a rutile coated all positional electrode, for welding of complex dissimilar alloys and high strength steels with low heat input, giving sound joints free from any cracks and fissures. It is a specially designed high alloy electrode for joining steels of unknown composition. The weld metal has high strength combined with excellent resistance against impact, heat (excellent scaling resistance up to 1150°C) and corrosion.

APPROVALS: CQA (Met), Ichapore & DGQA

WELDING CURRENT: DC+, AC 70 V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.09	YS (N/mm ²)	600
Si	0.50	UTS (N/mm ²)	770
Mn	1.80	Elongation (%)	23
Cr	30.00		
Ni	10.00		
Mo	0.20		

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	Packing
2.50	350	60-100	Weight Per Box: 10 Kg
3.15	350	80-120	Weight Per Carton
4.00	350	120-170	(Packet): 2 Kg
5.00	350	160-210	No. of Cartons (Packets) in a Box: 5

PACKING: Electrodes are packed in cartons and four of these cartons are shrink wrapped in a cardboard box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.

OK 67.45

A 20Cr-10Ni-5Mn stainless steel electrode for SMAW

Classification AWS A 5.4: E307-16 (Nearest)

DESCRIPTION

OK 67.45 is an austenitic stainless steel electrode giving a weld metal of the 20Cr-10Ni-5Mn type. The tough weld metal imparts excellent crack resistance, when welding steels of even poor weldability.

APPROVALS: CQA (Met), Ichapore & DGQA

WELDING CURRENT: DC+, AC 70V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.04	YS (N/mm ²)	450
Si	0.60	UTS (N/mm ²)	610
Mn	5.10	Elongation (%)	45
Cr	20.50		
Ni	10.50		
Mo	0.60		

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	Packing
2.50	350	60-100	Weight Per Box: 10 Kg
3.15	350	80-120	Weight Per Carton
4.00	350	120-170	(Packet): 2 Kg
5.00	350	160-210	No. of Cartons (Packets) in a Box: 5

PACKING: Electrodes are packed in cartons and four of these cartons are shrink wrapped in a cardboard box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.

ESAB CHROMWELD G

A rutile coated 18Cr-8Ni-4Mn stainless steel electrode for SMAW

DESCRIPTION

ESAB CHROMWELD G is a rutile coated stainless steel electrode depositing an 18Cr-8Ni-5Mn work hardening type weld metal. The electrode is specially designed for applications involving good work hardening properties and for joining of high tensile steels.

WELDING CURRENT: DC+, AC 70V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.06	YS (N/mm ²)	470
Si	0.80	UTS (N/mm ²)	630
Mn	4.50	Elongation (%)	38
Cr	18.40		
Ni	8.20		
Mo	0.30		

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	Packing
2.50	350	60-100	Weight Per Box: 10 Kg
3.15	350	80-120	Weight Per Carton
4.00	350	120-170	(Packet): 2 Kg
5.00	350	160-210	No. of Cartons (Packets) in a Box: 5

PACKING: Electrodes are packed in cartons and four of these cartons are shrink wrapped in a cardboard box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.

ESAB ARMOID 1

A special stainless steel electrode for SMAW of armour plates and crack sensitive steels

DESCRIPTION

ESAB ARMOID 1 is a stainless steel electrode designed for joining of high strength and dissimilar alloys, armour plates and other crack sensitive steels. It deposits an austenitic weld metal with sufficient residual ferrite to impart extreme crack resistivity.

APPROVALS: CQA (Met), Ichapore & DGQA

WELDING CURRENT: DC+, AC 70V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.08	UTS (N/mm ²)	730
Si	0.50	Elongation (%)	35
Mn	1.40		
Cr	19.50		
Ni	8.50		
Mo	2.80		

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	Packing
2.50	350	60-100	Weight Per Box: 10 Kg
3.15	350	80-120	Weight Per Carton
4.00	350	120-170	(Packet): 2 Kg
5.00	350	160-210	No. of Cartons (Packets) in a Box: 5

PACKING: Electrodes are packed in cartons and four of these cartons are shrink wrapped in a cardboard box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.



OK 68.10

A basic coated stainless steel electrode depositing a ferritic 13Cr weld metal for SMAW

Classification AWS A5.4: E410-15

DESCRIPTION

OK 68.10 is a basic coated stainless steel electrode giving ferritic weld metal of 13Cr type for welding steels of similar composition.

WELDING CURRENT: DC+

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.03	UTS (N/mm ²)	520
Si	0.40	Elongation (%)	25
Mn	0.70		
Cr	12.00		
Ni	0.40		

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	Packing
2.50	350	70-100	Weight Per Box: 10 Kg
3.15	350	90-120	Weight Per Carton
4.00	350	120-170	(Packet): 2 Kg
5.00	350	160-210	No. of Cartons (Packets) in a Box: 5

PACKING: Electrodes are packed in cartons and four of these cartons are shrink wrapped in a cardboard box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.

OK 68.00

A rutile based stainless steel electrode for SMAW of 13Cr-4Ni-Mo type stainless steel castings

Classification AWS A 5.4: E410NiMo-16

DESCRIPTION

OK 68.00 is a specially designed rutile coated stainless steel electrode depositing 12Cr-4.5Ni-0.5 Mo weld metal. It has excellent welding characteristics in flat, H-V position and V-up positions.

WELDING CURRENT: DC+, AC 70V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.03	UTS (N/mm ²)	800
Si	0.35	Elongation (%)	15
Mn	0.90		
Cr	12.00		
Ni	4.70		
Mo	0.60		

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	Packing
2.50	350	70-100	Weight Per Box: 10 Kg
3.15	350	90-120	Weight Per Carton
4.00	350	120-170	(Packet): 2 Kg
5.00	350	160-210	No. of Cartons (Packets) in a Box: 5

PACKING: Electrodes are packed in cartons and four of these cartons are shrink wrapped in a cardboard box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.

ESAB 430

A basic coated stainless steel electrode depositing a ferritic 17Cr weld metal for SMAW

Classification AWS A 5.4: E430-15

DESCRIPTION

ESAB 430 is a basic coated stainless steel electrode giving ferritic weld metal of 17Cr type for welding steels of similar composition.

WELDING CURRENT: DC+

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.03	UTS (N/mm ²)	520
Si	0.60	Elongation (%)	22
Mn	0.35		
Cr	16.50		
Ni	0.35		

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amps)	Packing
2.50	350	70-100	Weight Per Box: 10 Kg
3.15	350	90-120	Weight Per Carton
4.00	350	120-170	(Packet): 2 Kg
5.00	350	160-210	No. of Cartons (Packets) in a Box: 5

PACKING: Electrodes are packed in cartons and four of these cartons are shrink wrapped in a cardboard box. This electrode can also be made available in moisture resistant vacuum packed cartons, which can be used without redrying.

OK 67.50

A rutile based stainless steel electrode for SMAW of duplex stainless steels

Classification AWS A5.4: E2209-17

DESCRIPTION

OK 67.50 is an acid rutile electrode specially designed for welding of ferritic-austenitic stainless steels of the type UNS S31803 (popularly known as "Duplex stainless steels").

APPROVALS: ABS, BV, CE, CWB, DNV, Seproz & VdTÜV

WELDING CURRENT: DC+, AC 60V

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.03	YS (N/mm ²)	690
Si	0.75	UTS (N/mm ²)	850
Mn	0.90	Elongation (%)	25
Cr	22.50	Impact (CVN)	
Ni	9.50	@ +20°C (Joules)	50
Mo	3.00	@ -30°C (Joules)	40
Cu	0.10		
N	0.15		

CURRENT RANGE

Size (mm)	Length (mm)	Current Range (Amps)
2.50	300	50-90
3.20	350	80-120
4.00	350	90-160
5.00	350	150-220

PACKING: Electrodes are packed in moisture resistant vacuum packed cartons, which can be used without redrying.



OK 68.55

A basic coated stainless steel electrode for SMAW of super duplex stainless steels

Classification AWS A5.4: E2594-15

DESCRIPTION

OK 68.55 is a basic coated electrode for welding austenitic-ferritic steels of the super duplex type. OK 68.55 deposits a weld metal with high ductility that has very high resistance to pitting, crevice and stress corrosion cracking.

APPROVALS: DNV

WELDING CURRENT: DC+

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.04	YS (N/mm ²)	700
Si	0.45	UTS (N/mm ²)	900
Mn	0.80	Elongation (%)	28
Cr	25.20	Impact (CVN)	
Ni	9.70	@ -20°C (Joules)	70
Mo	4.00	@ -40°C (Joules)	55
N	0.25	@ -60°C (Joules)	45

CURRENT RANGE

Size (mm)	Length (mm)	Current Range (Amps)
2.50	300	50-80
3.20	350	60-100
4.00	350	100-140

PACKING: Electrodes are packed in moisture resistant vacuum packed cartons, which can be used without redrying.



OK TIGROD S2

A Cu coated solid rod for GTAW

Classification AWS A5.18: ER70S-2
EN ISO 636-A: W 38 3 W2Ti

DESCRIPTION

OK TIGROD S2 is a copper coated Mn-Si alloyed solid rod for GTAW of non-alloyed steels, used in general construction, pressure vessel fabrication and shipbuilding. It is especially suitable for welding of light gauge non-alloyed steels in all positions and for a variety of applications, including root run for pipes & tubes.

APPROVALS: NPC & PDIL

WELDING CURRENT: DC-

SHIELDING GAS: Ar

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
C	0.06	YS (N/mm ²)	420
Si	0.55	UTS (N/mm ²)	520
Mn	1.10	Elongation (%)	28
		Impact (CVN) @ -30°C (Joules)	150

PACKING DATA

Size (mm)	Length (mm)	Packing (5 Kg.)
1.6	1000	✓
2.0	1000	✓
2.5	1000	✓
3.15	1000	✓

PACKING: The rods are packed in tubes weighing 5 kg and four of them in a cardboard box.

OK TIGROD S2 (SPL)

A Cu coated solid rod for GTAW

Classification AWS A5.18: ER70S-2
EN ISO 636-A: W 38 3 W2Ti

DESCRIPTION

OK TIGROD S2 (SPL) is a copper coated Mn-Si alloyed solid rod for the GTAW of non-alloyed and micro alloyed steels, used in general construction, pressure vessel fabrication and shipbuilding. OK TIGROD S2 (SPL) contains optimized manganese and silicon to provide good strength and impact toughness at sub-zero temperatures. The alloy meets NACE requirements.

WELDING CURRENT: DC-

SHIELDING GAS: Ar

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
C	0.05	YS (N/mm ²)	420
Si	0.55	UTS (N/mm ²)	520
Mn	1.20	Elongation (%)	28
Al	0.13	Impact (CVN) @ -46°C (Joules)	60
Ti	0.08		
Zr	0.07		

PACKING DATA

Size (mm)	Length (mm)	Packing (5 Kg.)
1.6	1000	✓
2.0	1000	✓
2.5	1000	✓
3.15	1000	✓

PACKING: The rods are packed in tubes weighing 5 kg and four of them in a cardboard box.



OK TIGROD 13.09

A Cu coated 0.5Mo alloyed solid rod for GTAW

Classification AWS A5.28: ER80S-G

DESCRIPTION

OK TIGROD 13.09 is copper coated 0.5Mo alloyed solid rod for the GTAW of creep-resistant steels of the same type, such as pipes in pressure vessels and boilers with a working temperature of up to about 500°C. The rod can also be used for high strength low alloy steels.

APPROVALS: CE, DB, DNV & VdTÜV

WELDING CURRENT: DC-

SHIELDING GAS: Ar

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
C	0.10	YS (N/mm ²)	540
Si	0.60	UTS (N/mm ²)	630
Mn	1.10	Elongation (%)	25
Mo	0.50	Impact (CVN)	
Cu	0.15	@ -40°C (Joules)	90

PACKING DATA

Size (mm)	Length (mm)	Packing (5 Kg.)
1.6	1000	✓
2.0	1000	✓
2.4	1000	✓
3.2	1000	✓

PACKING: The rods are packed in tubes weighing 5 kg.

OK TIGROD 13.16

A Cu coated 1.3Cr-0.5Mo alloyed solid rod for GTAW of creep resistant steels

Classification AWS A5.28: ER80S-B2

DESCRIPTION

OK TIGROD 13.16 is a copper coated chromium-molybdenum alloyed (1.3Cr-0.5Mo), solid rod for GTAW of creep resistant steels like SA387 Grade 11, A335 Grade P11 or similar materials. OK TIGROD 13.16 is a high purity wire with a guaranteed Bruscato factor X<15.

APPROVALS: CE

WELDING CURRENT: DC-

SHIELDING GAS: Ar

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
C	0.08	YS (N/mm ²)	640
Si	0.50	UTS (N/mm ²)	730
Mn	0.60	Elongation (%)	24
Cr	1.30	Impact (CVN)	
Mo	0.50	@ -40°C (Joules)	50
Cu	0.15		

PACKING DATA

Size (mm)	Length (mm)	Packing (5 Kg.)
1.6	1000	✓
2.0	1000	✓
2.4	1000	✓
3.2	1000	✓

PACKING: The rods are packed in tubes weighing 5 kg.

OK TIGROD B2L

A Cu coated low carbon 1.3Cr-0.5Mo alloyed solid rod for GTAW of creep resistant steels

Classification AWS A5.28: ER70S-B2L

DESCRIPTION

OK TIGROD B2L is a low carbon GTAW solid rod suitable for welding creep resistant steels of the type 1.25Cr-0.5Mo. It provides excellent mechanical properties as well as high creep resistance.

WELDING CURRENT: DC-

SHIELDING GAS : Ar

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
C	0.03	YS (N/mm ²)	540
Si	0.60	UTS (N/mm ²)	630
Mn	0.60	Elongation (%)	25
Cr	1.30	Impact (CVN)	
Mo	0.50	@ -20°C (Joules)	150
Cu	0.15		

PACKING DATA

Size (mm)	Length (mm)	Packing (5 Kg.)
1.6	1000	✓
2.0	1000	✓
2.4	1000	✓

PACKING: The rods are packed in tubes weighing 5 kg.

OK TIGROD 13.17

A Cu coated 2.5Cr-1Mo alloyed solid rod for GTAW of creep resistant steels

Classification AWS A5.28: ER90S-B3

DESCRIPTION

OK TIGROD 13.17 is a copper coated chromium-molybdenum alloyed (2.5Cr-1Mo), solid rod for GTAW of creep resistant steels like SA387 Grade 22, A335 Grade P22 or similar materials. The wire has high purity chemistry with a guaranteed Bruscato factor X < 15.

APPROVALS: CE

WELDING CURRENT: DC-

SHIELDING GAS: Ar

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
C	0.09	YS (N/mm ²)	620
Si	0.50	UTS (N/mm ²)	730
Mn	0.60	Elongation (%)	22
Cr	2.40	Impact (CVN)	
Mo	1.00	@ -40°C (Joules)	50
Cu	0.15		

PACKING DATA

Size (mm)	Length (mm)	Packing (5 Kg.)
2.0	1000	✓
2.4	1000	✓
3.2	1000	✓

PACKING: The rods are packed in tubes weighing 5 kg.



OK TIGROD B3L

A Cu coated low carbon 2.4Cr-1Mo alloyed solid rod for GTAW of creep resistant steels

Classification AWS A5.28: ER80S-B3L

DESCRIPTION

OK TIGROD B3L is a low carbon GTAW solid rod suitable for welding creep resistant steels of the type 2.25Cr-1Mo. It provides excellent mechanical properties as well as high creep resistance.

WELDING CURRENT: DC-

SHIELDING GAS: Ar

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
C	0.03	YS (N/mm ²)	530
Si	0.60	UTS (N/mm ²)	630
Mn	0.60	Elongation (%)	24
Cr	2.40		
Mo	1.00		
Cu	0.15		

PACKING DATA

Size (mm)	Length (mm)	Packing (5 Kg.)
1.6	1000	✓
2.0	1000	✓
2.4	1000	✓

PACKING: The rods are packed in tubes weighing 5 kg.

OK TIGROD 13.23

A Cu coated 0.9Ni alloyed solid rod for GTAW

Classification AWS A5.28: ER80S-Ni1

DESCRIPTION

OK TIGROD 13.23 is a copper coated 0.9Ni alloyed, solid rod for GTAW of low temperature and fine-grained steels. The wire provides good impact toughness down to -50°C and is especially suitable for use in the offshore industry.

APPROVALS: DNV

WELDING CURRENT: DC-

SHIELDING GAS: Ar

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
C	0.08	YS (N/mm ²)	500
Si	0.70	UTS (N/mm ²)	600
Mn	1.00	Elongation (%)	25
Ni	0.90	Impact (CVN)	
Mo	0.25	@ 0°C (Joules)	230
Cu	0.15	@ -20°C (Joules)	200
		@ -46°C (Joules)	140
		@ -60°C (Joules)	90

PACKING DATA

Size (mm)	Length (mm)	Packing (5 Kg.)
1.6	1000	✓
2.0	1000	✓
2.4	1000	✓
3.2	1000	✓

PACKING: The rods are packed in tubes weighing 5 kg.

OK TIGROD 13.28

A Cu coated 2.4Ni alloyed solid rod for GTAW

Classification AWS A5.28: ER80S-Ni2

DESCRIPTION

OK TIGROD 13.28 is a copper coated 2.4Ni alloyed, solid rod for GTAW of low-alloyed and low temperature steels in applications such as vessels, pipes and offshore industry with a minimum yield strength less than 470 MPa. The wire provides good impact toughness down to -60°C.

APPROVALS: VdTÜV

WELDING CURRENT: DC-

SHIELDING GAS: Ar

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
C	0.10	YS (N/mm ²)	540
Si	0.60	UTS (N/mm ²)	630
Mn	1.10	Elongation (%)	30
Ni	2.40	Impact (CVN)	
Cu	0.15	@ -20°C (Joules)	200
		@ -40°C (Joules)	180
		@ -60°C (Joules)	150

PACKING DATA

Size (mm)	Length (mm)	Packing (5 Kg.)
1.6	1000	✓
2.0	1000	✓
2.4	1000	✓
3.0	1000	✓

PACKING: The rods are packed in tubes weighing 5 kg.

OK TIGROD 13.32

A Cu coated 5Cr-0.5Mo alloyed solid rod for GTAW of creep resistant steels

Classification AWS A5.28: ER80S-B6

DESCRIPTION

OK TIGROD 13.32 is a copper coated 5Cr-0.5Mo alloyed, solid rod for the GTAW of creep resistant steels of similar composition. The rod is also suitable for welding of high strength steels with minimum yield strength less than 730 MPa.

WELDING CURRENT: DC-

SHIELDING GAS: Ar

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
C	0.07	YS (N/mm ²)	580
Si	0.40	UTS (N/mm ²)	680
Mn	0.60	Elongation (%)	22
Cr	5.70	Impact (CVN)	
Mo	0.60	@ +20°C (Joules)	100
Cu	0.15	@ -20°C (Joules)	80
		@ -30°C (Joules)	50

PACKING DATA

Size (mm)	Length (mm)	Packing (5 Kg.)
1.6	1000	✓
2.0	1000	✓
2.4	1000	✓

PACKING: The rods are packed in tubes weighing 5 kg.



OK TIGROD 13.37

A Cu coated 9Cr-1Mo alloyed solid rod for GTAW of high temperature steels

Classification AWS A5.28: ER80S-B8

DESCRIPTION

OK TIGROD 13.37 is a copper coated 9Cr-1Mo alloyed, solid rod for the GTAW of high temperature steels and steels for hot hydrogen service, especially in oil refineries.

WELDING CURRENT: DC-

SHIELDING GAS: Ar

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
C	0.08	YS (N/mm ²)	540
Si	0.40	UTS (N/mm ²)	660
Mn	0.60	Elongation (%)	26
Cr	9.00	Impact (CVN)	
Mo	1.00	@ -20°C (Joules)	140
		@ -40°C (Joules)	120
		@ -60°C (Joules)	90

PACKING DATA

Size (mm)	Length (mm)	Packing (5 Kg.)
1.6	1000	✓
2.0	1000	✓
2.4	1000	✓

PACKING: The rods are packed in tubes weighing 5 kg.

OK TIGROD 13.38

A Cu coated 9Cr-1Mo-V-N alloyed solid rod for GTAW of high temperature steels

Classification AWS A5.28: ER90S-B9

DESCRIPTION

OK TIGROD 13.38 is a copper coated 9Cr-1Mo-V-N alloyed solid rod for the GTAW of high temperature steels and steels for hot hydrogen service, especially in oil refineries. It is preferably be used for 9Cr steels, such as P91/T91. The wire has extremely high purity chemistry and produces improved strength levels both at room temperature and higher temperatures.

APPROVALS: VdTUV,

WELDING CURRENT: DC-

SHIELDING GAS: Ar

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
C	0.10	YS (N/mm ²)	690
Si	0.30	UTS (N/mm ²)	790
Mn	0.50	Elongation (%)	20
Cr	8.90	Impact (CVN)	
Ni	0.80	@ 0°C (Joules)	180
Mo	1.00	@ -20°C (Joules)	150
Nb	0.06	@ -40°C (Joules)	90
N	0.04	@ -60 C (Joules)	70
V	0.20		

PACKING DATA

Size (mm)	Length (mm)	Packing (5 Kg.)
2.0	1000	✓
2.4	1000	✓

PACKING: The rods are packed in tubes weighing 5 kg.

OK TIGROD 16.10

An extra low carbon stainless steel solid rod for GTAW of 18Cr-8Ni type steels

Classification AWS A5.9: ER308L

DESCRIPTION

OK TIGROD 16.10 is a corrosion resistant, chromium-nickel alloyed solid rod for welding austenitic chromium-nickel alloys of 18Cr-8Ni type. OK TIGROD 16.10 has good general corrosion resistance. The alloy has a low carbon content which makes it particularly suitable to the applications, where there is a risk of intergranular corrosion. The alloy is widely used in the chemical and food-processing industries, as well as for pipes, tubes and boilers.

APPROVALS: NPC, PDIL & TOYO

WELDING CURRENT: DC-

SHIELDING GAS: Ar

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
C	0.03	YS (N/mm ²)	400
Si	0.40	UTS (N/mm ²)	580
Mn	1.75	Elongation (%)	45
Cr	19.80	Impact (CVN)	
Ni	9.50	@ -196°C (Joules)	60

PACKING DATA

Size (mm)	Length (mm)	Packing (5 Kg.)
1.6	1000	✓
2.0	1000	✓
2.5	1000	✓
3.15	1000	✓

PACKING: The rods are packed in tubes weighing 5 kg.

OK TIGROD 16.11

A Nb stabilized 20Cr-10Ni stainless steel solid rod for GTAW

Classification AWS A5.9: ER347

DESCRIPTION

OK TIGROD 16.11 is a corrosion-resistant, chromium-nickel alloyed solid rod for welding stabilized austenitic chromium-nickel alloys of 18Cr-8Ni type. OK TIGROD 16.11 has good general corrosion resistance. The alloy is stabilized with niobium to improve resistance to the intergranular corrosion of the weld metal. Due to the niobium content, this alloy is recommended for use at higher temperatures

APPROVALS: NPC & TOYO

WELDING CURRENT: DC-

SHIELDING GAS: Ar

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
C	0.04	YS (N/mm ²)	430
Si	0.40	UTS (N/mm ²)	620
Mn	1.50	Elongation (%)	35
Cr	19.50	Impact (CVN)	
Ni	9.50	@ +20°C (Joules)	100
Nb	0.50		

PACKING DATA

Size (mm)	Length (mm)	Packing (5 Kg.)
1.6	1000	✓
2.0	1000	✓
2.5	1000	✓
3.15	1000	✓

PACKING: The rods are packed in tubes weighing 5 kg.



OK TIGROD 16.13

An austenitic stainless steel solid rod for GTAW of 25Cr-20Ni type steels

Classification AWS A5.9: ER310

DESCRIPTION

OK TIGROD 16.13 is a corrosion-resistant, chromium-nickel alloyed solid rod for welding heat-resistant austenitic stainless steels of 25Cr-20Ni type. OK TIGROD 16.13 has good general oxidation resistance, especially at high temperatures, due to its high Cr content. Common applications include industrial furnaces, boiler parts and heat exchangers.

WELDING CURRENT: DC-

SHIELDING GAS: Ar or He or Ar/He

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
C	0.09	YS (N/mm ²)	350
Si	0.45	UTS (N/mm ²)	550
Mn	1.75	Elongation (%)	32
Cr	26.70	Impact (CVN)	
Ni	20.60	@ +20°C (Joules)	120

PACKING DATA

Size (mm)	Length (mm)	Packing (5 Kg.)
1.6	1000	✓
2.0	1000	✓
2.5	1000	✓
3.15	1000	✓

PACKING: The rods are packed in tubes weighing 5 kg.

OK TIGROD 16.30

An extra low carbon stainless steel solid rod for GTAW of 18Cr-12Ni-2.5Mo type steels

Classification AWS A5.9: ER316L

DESCRIPTION

OK TIGROD 16.30 is a corrosion resistant, chromium-nickel-molybdenum alloyed solid rod for welding austenitic stainless alloys of the 18Cr-8Ni and 18Cr-12Ni-2.5Mo types. The alloy has very good resistance to corrosion in acid and chlorinated environments. The alloy has a low carbon content which makes it particularly suitable to the applications, where there is a risk of intergranular corrosion. The alloy is widely used in the chemical and food-processing industries, as well as in shipbuilding and various types of architectural structures.

APPROVALS: NPC, PDIL & TOYO

WELDING CURRENT: DC-

SHIELDING GAS: Ar

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
C	0.03	YS (N/mm ²)	450
Si	0.40	UTS (N/mm ²)	630
Mn	1.60	Elongation (%)	32
Cr	19.00	Impact (CVN)	
Ni	11.80	@ -196°C (Joules)	50
Mo	2.10		

PACKING DATA

Size (mm)	Length (mm)	Packing (5 Kg.)
1.6	1000	✓
2.0	1000	✓
2.5	1000	✓
3.15	1000	✓

PACKING: The rods are packed in tubes weighing 5 kg.

OK TIGROD 16.53

An extra low carbon 24Cr-13Ni stainless steel solid rod for GTAW

Classification AWS A5.9: ER309L

DESCRIPTION

OK TIGROD 16.53 is a corrosion resistant, chromium-nickel alloyed solid rod for joining stainless steels to non-alloy or low-alloy steels and for welding austenitic stainless alloys of the 24Cr-13Ni types. The alloy is also used for welding buffer layers on C-Mn steels.

APPROVALS: NPC, PDIL & TOYO

WELDING CURRENT: DC-

SHIELDING GAS: Ar

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
C	0.03	YS (N/mm ²)	410
Si	0.45	UTS (N/mm ²)	580
Mn	1.75	Elongation (%)	35
Cr	23.50	Impact (CVN)	
Ni	12.20	@ -60°C (Joules)	100

PACKING DATA

Size (mm)	Length (mm)	Packing (5 Kg.)
1.6	1000	✓
2.0	1000	✓
2.5	1000	✓
3.15	1000	✓

PACKING: The rods are packed in tubes weighing 5 kg.

OK TIGROD 16.54

An extra low carbon corrosion resistant solid rod of the 309LMo type for GTAW

Classification AWS A5.9: ER309LMo (Nearest)

DESCRIPTION

OK TIGROD 16.54 is a corrosion resistant, chromium-nickel-molybdenum alloyed solid rod for welding dissimilar steels, such as 316L to unalloyed and low-alloyed steels and for overlay welding of unalloyed and low-alloyed steels when Mo is essential.

WELDING CURRENT: DC-

SHIELDING GAS: Ar

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
C	0.03	YS (N/mm ²)	400
Si	0.50	UTS (N/mm ²)	600
Mn	1.50	Elongation (%)	34
Cr	22.00	Impact (CVN)	
Ni	14.00	@ +20°C (Joules)	100
Mo	2.50		

PACKING DATA

Size (mm)	Length (mm)	Packing (5 Kg.)
1.6	1000	✓
2.0	1000	✓
2.5	1000	✓

PACKING: The rods are packed in tubes weighing 5 kg.

OK TIGROD 1100

A soft aluminium solid rod for GTAW

Classification AWS A5.10: R1100

DESCRIPTION

OK TIGROD 1100 is highly resistant to chemical attack and weathering. It is a relatively soft alloy, easily formable and it is used extensively in thin - gauge and foil products. It has good welding characteristics. A desirable characteristic of the alloy is bright finish obtained by anodising. Non-heat treatable.

APPROVALS: CWB

WELDING CURRENT: AC

SHIELDING GAS: Ar or Ar/He

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
Mn	<0.05	YS (N/mm ²)	30
Cu	0.13	UTS (N/mm ²)	75
Al	>99.00	Elongation (%)	35
Zn	<0.10		
Si+Fe	<0.95		

PACKING DATA

Size (mm)	Length (mm)	Packing (5 Kg.)
2.0	1000	✓

PACKING: The rods are packed in tubes weighing 5 kg.



OK TIGROD 4043

A Si alloyed general purpose aluminium solid rod for GTAW

Classification AWS A5.10: R4043

DESCRIPTION

OK TIGROD 4043 is one of the most widely used welding alloys. It is used for welding AlMgSi types and AlSi alloys (up to 7% silicon). Not recommended for anodising. Non-heat treatable.

APPROVALS: CE, CWB, DB

WELDING CURRENT: AC

SHIELDING GAS: Ar or Ar/He

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
Si	5.00	YS (N/mm ²)	55
Mn	<0.05	UTS (N/mm ²)	165
Cu	<0.10	Elongation (%)	18
Ti	<0.15		
Zn	<0.10		
Fe	<0.60		

PACKING DATA

Size (mm)	Length (mm)	Packing (5 Kg.)
2.0	1000	✓
2.4	1000	✓
3.2	1000	✓

PACKING: The rods are packed in tubes weighing 5 kg.

OK TIGROD 5183

A Mg-Mn alloyed aluminium solid rod for GTAW

Classification AWS A5.10: R5183

DESCRIPTION

OK TIGROD 5183 is designed to provide the highest possible strength in the as welded condition of alloy AA 5083 and similar high magnesium alloys. The alloy is typically used in marine and structural applications where high strength, high impact fracture toughness and exposure to corrosive elements are important. The alloy is not recommended for elevated temperature applications due to its susceptibility to stress corrosion cracking. The alloy is non-heat treatable.

APPROVALS: CE, CWB, DB & VdTÜV

WELDING CURRENT: AC

SHIELDING GAS: Ar or Ar/He

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
Si	<0.40	YS (N/mm ²)	140
Mn	0.80	UTS (N/mm ²)	290
Cr	0.15	Elongation (%)	25
Cu	<0.10	Impact (CVN)	
Ti	<0.15	@ +20°C (Joules)	30
Zn	<0.25		
Fe	<0.40		
Mg	4.80		

PACKING DATA

Size (mm)	Length (mm)	Packing (2.5 Kg.)
1.6	1000	✓
2.0	1000	✓
2.4	1000	✓
3.2	1000	✓

PACKING: The rods are packed in 2.5 kg cartons and four of them in a Cardboard box.

OK TIGROD 5356

A Mg alloyed aluminium solid rod for GTAW

Classification AWS A5.10: R5356

DESCRIPTION

OK TIGROD 5356 is the most widely used welding alloy and can be classified as a general-purpose type filler alloy. OK TIGROD 5356 is typically chosen because of its relatively high shear strength. The 5XXX alloy base material, welded with OK TIGROD 5356, with weld pool chemistry greater than 3% Mg and service temperatures in excess of 65°C, is susceptible to stress corrosion cracking. The alloy is non-heat treatable.

APPROVALS: CE, CWB, DB & VdTÜV

WELDING CURRENT: AC

SHIELDING GAS: Ar or Ar/He

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
Si	<0.25	YS (N/mm ²)	120
Mn	0.15	UTS (N/mm ²)	265
Cr	0.13	Elongation (%)	26
Cu	<0.10		
Ti	0.11		
Zn	<0.10		
Fe	<0.40		
Mg	5.00		

PACKING DATA

Size (mm)	Length (mm)	Packing (5 Kg.)
1.6	1000	✓
2.0	1000	✓
2.4	1000	✓
3.2	1000	✓

PACKING: The rods are packed in tubes weighing 5 kg.

OK TIGROD 5556A

A Mg-Mn alloyed aluminium solid rod for GTAW

Classification AWS A5.10: R5556

DESCRIPTION

OK TIGROD 5556A is a solid rod suitable for welding of aluminium alloys (approx. up to 5% Mg) that are not age hardenable and alloys where a high tensile strength is required. The corrosion resistance in a marine atmosphere is very good.

APPROVALS: VdTÜV

WELDING CURRENT: AC

SHIELDING GAS: Ar or He or Ar/He

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
Si	<0.25	YS (N/mm ²)	145
Mn	0.80	UTS (N/mm ²)	295
Cr	0.13	Elongation (%)	25
Cu	<0.10	Impact (CVN)	
Ti	0.13	@ +20°C (Joules)	25
Zn	<0.20		
Fe	<0.40		
Mg	5.30		

PACKING DATA

Size (mm)	Length (mm)	Packing (5 Kg.)
1.6	1000	✓
2.0	1000	✓
2.4	1000	✓
3.2	1000	✓

PACKING: The rods are packed in tubes weighing 5 kg.



OK TIGROD 19.30

A Si-Mn alloyed copper solid rod for GTAW

Classification AWS A5.7: ERCuSi-A

DESCRIPTION

OK TIGROD 19.30 is a silicon-manganese alloyed copper solid rod, for welding of copper-silicon, copper-zinc and low alloyed copper alloys. OK TIGROD 19.30 has good flow properties. The alloy is widely used in the joining of zinc-coated steel sheets.

WELDING CURRENT: DC-

SHIELDING GAS: Ar or He or Ar/He

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
Si	3.40	YS (N/mm ²)	150
Mn	1.10	UTS (N/mm ²)	350
Cu	>94	Elongation (%)	40
Sn	<0.20		
Zn	<0.20		
Fe	<0.30		

PACKING DATA

Size (mm)	Length (mm)	Packing (5 Kg.)
2.0	1000	✓
3.2	1000	✓

PACKING: The rods are packed in tubes weighing 5 kg.

OK TIGROD 19.40

An Al alloyed copper solid rod for GTAW of aluminium bronzes

Classification AWS A5.7: ERCuAl-A1

DESCRIPTION

An aluminium-bronze (CuAl8) rod for the GTAW of rolled and cast aluminium-bronze alloys. The alloy is noted for its high strength, good wear resistance and very good corrosion resistance, particularly in salt water.

WELDING CURRENT: DC-

SHIELDING GAS: Ar or He or Ar/He

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
Si	<0.10	YS (N/mm ²)	175
Mn	<0.50	UTS (N/mm ²)	420
Cu	bal.	Elongation (%)	40
Al	7.80		
Zn	<0.10		
Fe	<0.50		

PACKING DATA

Size (mm)	Length (mm)	Packing (5 Kg.)
2.4	1000	✓
3.2	1000	✓

PACKING: The rods are packed in tubes weighing 5 kg.



ESAB MW1

A Cu coated solid wire for GMAW

Classification AWS A5.18: ER70S-6
EN ISO 14341-A: G 3Si1

DESCRIPTION

ESAB MW1 is a copper coated, Mn-Si alloyed solid wire for GMAW of non alloyed steels, used in general construction, automotives, ship building and pressure vessel fabrication. The wire has a carefully controlled wire chemistry and a unique surface technology providing superior weld metal quality at high wire feed speeds and at high welding currents.

WELDING CURRENT: DC+

APPROVALS: ABS, DNV, IBR, IRS, LRS, MMD, MN Dastur & NPC

SHIELDING GAS: 100%CO₂ or 80%Ar/20%CO₂

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
C	0.08	YS (N/mm ²)	450
Si	0.85	UTS (N/mm ²)	560
Mn	1.45	Elongation (%)	24
Cu	0.25	Impact (CVN) @ -30°C (Joules)	50

CURRENT RANGE & PACKING DATA

Size (mm)	Current (Amp)	Voltage (V)	Packing in Kg.				
			12.5	15.0	17.5	100	250
0.8	60-220	17-25	✓	✓	×	✓	×
1.2	90-330	18-30	×	✓	✓	✓	✓
1.6	120-440	20-36	✓	×	×	×	✓
2.0	150-550	21-41	✓	×	×	×	×

PACKING: The wire can be supplied in plastic or wire basket spool packed in a cardboard box weighing 12.5/15.0/17.5 kg or Marathon Pac weighing 100/250 kg or Bobbins weighing 200 kg.

OK ARISTOROD 12.50

A non Cu coated solid wire for GMAW

Classification AWS A5.18: ER70S-6
EN ISO 14341-A: G 3Si1

DESCRIPTION

OK ARISTOROD 12.50 is a non copper coated Mn-Si alloyed solid wire for the GMAW of unalloyed steels, used in general construction, automotive components, pressure vessel fabrication and shipbuilding. OK ARISTOROD 12.50 is treated with ESAB's unique Advanced Surface Characteristics (ASC) technology, taking MAG welding operations to new levels of performance and all-round efficiency, especially in robotic and mechanised welding. Characteristic features include excellent start properties; trouble-free feeding at high wire speeds and lengthy feed distances; a very stable arc at high welding currents; extremely low levels of spatter; low fume emission; reduced contact tip wear and improved protection against corrosion of the wire. OK ARISTOROD 12.50 is available in the unique ESAB octagonal Marathon Pac, which is excellent for mechanised welding applications.

APPROVALS: ABS, BV, CE, DB, DNV, LR, PRS, RS & VdTUV

WELDING CURRENT: DC+

SHIELDING GAS: 100%CO₂ or 80%Ar/20%CO₂

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
C	0.10	YS (N/mm ²)	470
Si	0.90	UTS (N/mm ²)	560
Mn	1.50	Elongation (%)	26
		Impact (CVN) @ -30°C (Joules)	70

CURRENT RANGE

Size (mm)	Current (Amp)	Voltage (V)
0.8	60-200	18-24
0.9	70-250	18-26
1.0	80-300	18-32
1.2	120-380	18-35
1.4	150-420	22-36
1.6	225-550	28-38

PACKING: The wire can be supplied in plastic or wire basket spool packed in a cardboard box weighing 15/18 kg or Marathon Pac weighing 250/475 kg.



OK ARISTOROD 13.09

A non Cu coated 0.5Mo alloyed solid wire for GMAW

Classification AWS A5.28: ER80S-G

DESCRIPTION

OK ARISTOROD 13.09 is a non copper coated 0.5Mo alloyed solid wire for the GMAW of creep-resistant steels of the same type, such as pipes in pressure vessels and boilers with a working temperature of up to 500°C. The wire is suitable for operating at high currents with maintained disturbance free wire feeding giving a stable arc with a low amount of spatter. OK ARISTOROD 13.09 is available in the unique ESAB octagonal Marathon Pac, which is excellent for mechanised welding applications.

APPROVALS: CE, DB, DNV & VdTÜV

WELDING CURRENT: DC+

SHIELDING GAS: 100%CO₂ or 80%Ar/20%CO₂

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
C	0.10	YS (N/mm ²)	430
Si	0.60	UTS (N/mm ²)	550
Mn	1.10	Elongation (%)	26
Mo	0.50	Impact (CVN)	
		@ +20°C (Joules)	150
		@ -20°C (Joules)	90
		@ -40°C (Joules)	70

CURRENT RANGE

Size (mm)	Current (Amp)	Voltage (V)
0.8	40-170	16-22
1.0	80-280	18-28
1.2	120-350	20-33
1.6	225-480	26-38

PACKING: The wire can be supplied in plastic or wire basket spool packed in a cardboard box weighing 15/18 kg or select sizes in Marathon Pac weighing 250 kg.

OK AUTROD 13.14

A Cu coated low alloyed solid wire for GMAW of HSLA steels

Classification AWS A5.28: ER90S-D2

DESCRIPTION

OKAUTROD 13.14 is a copper coated low alloyed wire for GMAW of HSLA steels. It is used for fabrication of tractor cylinder, automobile components and wagons. The wire is designed to produce excellent beads of radiographic quality in all positions. One of the significant applications of OK AUTROD 13.14 is of welding 'CONCOR' wagons of the Indian Railways

APPROVALS: RDSO

WELDING CURRENT: DC+

SHIELDING GAS: 100%CO₂ or 80%Ar/20%CO₂

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
C	0.10	YS (N/mm ²)	580
Si	0.60	UTS (N/mm ²)	690
Mn	2.00	Elongation (%)	24
Mo	0.45	Impact (CVN)	
Cu	0.25	@ -30°C (Joules)	45

CURRENT RANGE & PACKING DATA

Size (mm)	Current (Amp)	Voltage (V)	Packing in Kg.	
			12.5	15.0
1.2	80-280	18-28	✓	✓
1.6	120-360	20-34	✓	×

PACKING: The wire can be supplied in plastic spool packed in a cardboard box weighing 12.5/15.0 kg.

OK ARISTOROD 13.16

A non Cu coated 1.3Cr-0.5Mo alloyed solid wire for GMAW of creep resistant steels

Classification AWS A5.28: ER80S-B2

DESCRIPTION

OKARISTOROD 13.16 is a non copper coated chromium-molybdenum alloyed (1.3Cr-0.5Mo), solid wire for GMAW of creep resistant steels like SA387 Grade 11, A335 Grade P11 or similar materials. OK ARISTOROD 13.16 is a high purity wire with a guaranteed Bruscato factor $X < 15$. It is treated with ESAB's unique advanced surface characteristics (ASC) technology, taking MAG welding operations to new levels of performance and all-round efficiency, especially in robotic and mechanised welding. Characteristics features include excellent start properties; trouble free feeding at high wire speeds and lengthy feed distances; a very stable arc at high welding currents; extremely low levels of spatter; low fume emission; reduced contact tip wear and improved protection against corrosion of the wire.

WELDING CURRENT: DC+

SHIELDING GAS: 100%CO₂ or 80%Ar/20%CO₂

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
C	0.10	YS (N/mm ²)	490
Si	0.60	UTS (N/mm ²)	580
Mn	0.60	Elongation (%)	21
Cr	1.35		
Mo	0.50		

CURRENT RANGE

Size (mm)	Current (Amp)	Voltage (V)
1.2	120-350	20-33

PACKING: The wire can be supplied in plastic or wire basket spool packed in a cardboard box weighing 18 kg or Marathon Pac weighing 250 kg.

OK AUTROD 13.17

A Cu coated 2.5Cr-1Mo alloyed solid wire for GMAW of creep resistant steels

Classification AWS A5.28: ER90S-B3

DESCRIPTION

OK AUTROD 13.17 is a copper coated chromium-molybdenum alloyed (2.5Cr-1Mo), solid wire for GMAW of creep resistant steels like SA387 Grade 22, A335 Grade P22 or similar materials. The wire has high purity chemistry with a guaranteed Bruscato factor $X < 15$.

WELDING CURRENT: DC+

SHIELDING GAS: 100%CO₂ or 80%Ar/20%CO₂ or Ar/1-5O₂

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
C	0.09	YS (N/mm ²)	590
Si	0.60	UTS (N/mm ²)	720
Mn	0.60	Elongation (%)	22
Cr	2.50	Impact (CVN)	
Mo	1.00	@ -40°C (Joules)	50
Cu	0.25		

CURRENT RANGE

Size (mm)	Current (Amp)	Voltage (V)
1.0	80-280	18-28
1.2	120-350	20-33

PACKING: The wire can be supplied in plastic or wire basket spool packed in a cardboard box weighing 15 kg.



OK AUTROD 13.28

A Cu coated 2.4Ni alloyed solid wire for GMAW of low alloyed and low temperature steels

Classification AWS A5.28: ER80S-Ni2

DESCRIPTION

OK AUTROD 13.28 is a copper coated 2.4Ni alloyed, solid wire for GMAW of low-alloyed and low temperature steels in applications such as vessels, pipes and offshore industry with a minimum yield strength less than 470 MPa. The wire provides good impact toughness down to -60°C.

APPROVALS: CE, DNV, NAKS & VdTÜV

WELDING CURRENT: DC+

SHIELDING GAS: 100%CO₂ or 80%Ar/20%CO₂ or Ar/1-5O₂

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
C	0.10	YS (N/mm ²)	540
Si	0.60	UTS (N/mm ²)	630
Mn	1.10	Elongation (%)	29
Ni	2.40	Impact (CVN)	
Mo	0.15	@ -60°C (Joules)	50
Cu	0.25		

CURRENT RANGE

Size (mm)	Current (Amp)	Voltage (V)
0.8	80-170	16-22
1.0	80-280	18-28
1.2	120-350	20-33

PACKING: The wire can be supplied in plastic or wire basket spool packed in a cardboard box weighing 15 kg.

OK ARISTOROD 69

A non Cu coated Cr-Ni-Mo alloyed solid wire for GMAW of high tensile strength steels

Classification AWS A5.28: ER110S-G
EN ISO 16834-A: G Mn3Ni1CrMo

DESCRIPTION

OK ARISTOROD 69 is a non copper coated 0.3Cr-1.4Ni-0.25Mo alloyed, solid wire for the GMAW of high strength steels with low-temperature impact toughness requirements. OK ARISTOROD 69 is treated with ESAB's unique Ad-vanced Surface Characteristics (ASC) technology, taking MAG welding operations to new levels of performance and all-round efficiency, especially in robotic and mechanised welding. Characteristic features include excellent start properties; trouble-free feeding at high wire speeds and lengthy feed distances; a very stable arc at high welding currents; extremely low levels of spatter; low fume emission; reduced contact tip wear and improved protection against corrosion of the wire. OK ARISTOROD 69 is available in the unique ESAB octagonal Marathon Pac, which is excellent for mechanised welding applications.

APPROVALS: CE, DB & VdTÜV

WELDING CURRENT: DC+

SHIELDING GAS: 80%Ar/20%CO₂

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
C	0.08	YS (N/mm ²)	730
Si	0.60	UTS (N/mm ²)	800
Mn	1.70	Elongation (%)	19
Cr	0.30	Impact (CVN)	
Ni	1.40	@ -20°C (Joules)	70
Mo	0.25	@ -40°C (Joules)	55

CURRENT RANGE

Size (mm)	Current (Amp)	Voltage (V)
0.8	80-280	18-28
1.0	80-280	18-28
1.2	120-350	20-33

PACKING: The wire can be supplied in plastic or wire basket spool packed in a cardboard box weighing 15/18 kg or select sizes in Marathon Pac weighing 250 kg.

OK AUTROD 16.10

An extra low carbon stainless steel solid wire for GMAW of 18Cr-8Ni type steels

Classification AWS A5.9: ER308L

DESCRIPTION

A corrosion resistant, chromium-nickel alloyed solid wire for welding austenitic stainless alloys of 18Cr-8Ni type. OK AUTROD 16.10 has good general corrosion resistance. The alloy has a low carbon content which makes it particularly suitable to the applications, where there is a risk of intergranular corrosion. The alloy is widely used in the chemical and food-processing industries, as well as for pipes, tubes and boilers.

APPROVALS: NPC

WELDING CURRENT: DC+

SHIELDING GAS: Ar/O₂ or Ar/CO₂

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
C	0.03	YS (N/mm ²)	420
Si	0.45	UTS (N/mm ²)	590
Mn	1.70	Elongation (%)	36
Cr	20.00	Impact (CVN)	
Ni	9.80	@ -196°C (Joules)	50

CURRENT RANGE

Size (mm)	Current (Amp)	Voltage (V)
0.8	50-180	16-22
1.2	80-280	19-28
1.6	100-380	19-33

PACKING: The wire can be supplied in plastic spool packed in a cardboard box weighing 12.5/15.0 kg.

OK AUTROD 16.11

A Nb stabilized 20Cr-10Ni stainless steel solid wire for GMAW

Classification AWS A5.9: ER347

DESCRIPTION

A corrosion-resistant, chromium-nickel alloyed solid wire for welding stabilized austenitic chromium-nickel alloys of 18Cr-8Ni type. OK AUTROD 16.11 has good general corrosion resistance. The alloy is stabilized with niobium to improve resistance to the intergranular corrosion of the weld metal. Due to the niobium content, this alloy is recommended for use at higher temperatures.

WELDING CURRENT: DC+

SHIELDING GAS: Ar/O₂ or Ar/CO₂

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
C	0.03	YS (N/mm ²)	400
Si	0.40	UTS (N/mm ²)	600
Mn	1.50	Elongation (%)	35
Cr	19.50	Impact (CVN)	
Ni	9.50	@ +20°C (Joules)	100
Nb	0.40		

CURRENT RANGE

Size (mm)	Current (Amp)	Voltage (V)
0.8	50-180	16-22
1.2	80-280	19-28

PACKING: The wire can be supplied in plastic spool packed in a cardboard box weighing 12.5/15.0 kg.



OK AUTROD 16.13

An austenitic stainless steel solid wire for GMAW of 25Cr-20Ni type steels

Classification AWS A5.9: ER310

DESCRIPTION

A corrosion-resistant, chromium-nickel alloyed solid wire for welding heat-resistant austenitic stainless steels of 25Cr-20Ni type. OK AUTROD 16.13 has good general oxidation resistance, especially at high temperatures, due to its high Cr content. The alloy is fully austenitic and is therefore sensitive to hot cracking. Common applications include industrial furnaces, boiler parts and heat exchangers.

WELDING CURRENT: DC+

SHIELDING GAS: Ar/O₂ or Ar/CO₂

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
C	0.09	YS (N/mm ²)	310
Si	0.40	UTS (N/mm ²)	510
Mn	1.60	Elongation (%)	32
Cr	26.00	Impact (CVN)	
Ni	20.50	@ +20°C (Joules)	120

CURRENT RANGE

Size (mm)	Current (Amp)	Voltage (V)
1.2	80-280	19-28

PACKING: The wire can be supplied in plastic spool packed in a cardboard box weighing 12.5/15.0 kg.

OK AUTROD 16.30

An extra low carbon stainless steel solid wire for GMAW of 18Cr-12Ni-2.5Mo type steels

Classification AWS A5.9: ER316L

DESCRIPTION

A corrosion resistant, chromium-nickel-molybdenum alloyed solid wire for welding austenitic stainless alloys of the 18Cr-8Ni and 18Cr-12Ni-2.5Mo types. The alloy has very good resistance to corrosion in acid and chlorinated environments. The alloy has a low carbon content which makes it particularly suitable to the applications, where there is a risk of intergranular corrosion. The alloy is widely used in the chemical and food-processing industries, as well as in shipbuilding and various types of architectural structures.

WELDING CURRENT: DC+

SHIELDING GAS: Ar/O₂ or Ar/CO₂

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
C	0.03	YS (N/mm ²)	430
Si	0.40	UTS (N/mm ²)	620
Mn	1.70	Elongation (%)	35
Cr	18.50	Impact (CVN)	
Ni	11.80	@ -196°C (Joules)	50
Mo	2.70		

CURRENT RANGE

Size (mm)	Current (Amp)	Voltage (V)
0.8	50-180	16-22
1.2	80-280	19-28
1.6	100-380	19-33

PACKING: The wire can be supplied in plastic spool packed in a cardboard box weighing 12.5/15.0 kg.

OK AUTROD 16.53

An extra low carbon 24Cr-13Ni stainless steel solid wire for GMAW

Classification AWS A5.9: ER309L

DESCRIPTION

A corrosion resistant, chromium-nickel alloyed solid wire for joining stainless steels to non-alloy or low-alloy steels and for welding austenitic stainless alloys of the 24Cr-13Ni types. The alloy is also used for welding buffer layers on C-Mn steels.

WELDING CURRENT: DC+

SHIELDING GAS: Ar/O₂ or Ar/CO₂

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
C	0.03	YS (N/mm ²)	420
Si	0.40	UTS (N/mm ²)	600
Mn	1.70	Elongation (%)	37
Cr	23.50	Impact (CVN)	
Ni	12.50	@ -60°C (Joules)	80

CURRENT RANGE

Size (mm)	Current (Amp)	Voltage (V)
0.8	50-180	16-22
1.2	80-280	19-28
1.6	100-380	19-33

PACKING: The wire can be supplied in plastic spool packed in a cardboard box weighing 12.5/15.0 kg.

OK AUTROD 1100

A soft aluminium solid wire for GMAW

Classification AWS A5.10: ER1100

DESCRIPTION

OK AUTROD 1100 is highly resistant to chemical attack and weathering. It is a relatively soft alloy that is very formable and is used extensively in thin gauge and foil products. It has good welding characteristics. A desirable characteristic of the alloy is bright finish obtained by anodising. Non-heat treatable.

APPROVALS: CWB

WELDING CURRENT: DC+

SHIELDING GAS: Ar or Ar/He

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
Mn	<0.05	YS (N/mm ²)	30
Cu	0.13	UTS (N/mm ²)	75
Al	>99.00	Elongation (%)	35
Zn	<0.10		
Si+Fe	<0.95		

CURRENT RANGE

Size (mm)	Current (Amp)	Voltage (V)
1.0	140-260	20-29
1.2	140-260	20-29
1.6	190-350	25-30

PACKING: The wire can be supplied in plastic spool packed in a cardboard box weighing 7/9 kg.



OK AUTROD 4043

A Si alloyed general purpose aluminium solid wire for GMAW

Classification AWS A5.10: ER4043

DESCRIPTION

OK AUTROD 4043 is one of the most widely used welding and brazing alloys and can be classified as a general purpose filler alloy. The silicon additions result in improved fluidity (wetting action) to make the alloy a preferred choice of welders. The alloy is not sensitive to weld cracking and produces bright and almost smut free welds. Not recommended for anodizing. Non-heat treatable.

APPROVALS: CE, CWB, DB & VdTÜV

WELDING CURRENT: DC+

SHIELDING GAS: Ar or Ar/He

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
Si	5.00	YS (N/mm ²)	55
Mn	<0.05	UTS (N/mm ²)	165
Cu	<0.10	Elongation (%)	18
Ti	<0.15		
Zn	<0.10		
Fe	<0.60		

CURRENT RANGE

Size (mm)	Current (Amp)	Voltage (V)
0.8	60-170	13-24
0.9	60-170	13-24
1.0	90-210	15-26
1.2	140-260	20-29
1.6	190-350	25-30
2.0	280-400	26-31
2.4	280-400	26-31

PACKING: The wire can be supplied in plastic spool packed in a cardboard box weighing 7/9 kg or select sizes in Marathon Pac weighing 25/80/141 kg.

OK AUTROD 5183

A Mg-Mn alloyed aluminium solid wire for GMAW

Classification AWS A5.10: ER5183

DESCRIPTION

OK AUTROD 5183 is designed to provide the highest possible strength in the as welded condition of alloy AA 5083 and similar high magnesium alloys. The alloy is typically used in marine and structural applications where high strength, high fracture toughness for impact resistance and exposure to corrosive elements are important. The alloy is not recommended for elevated temperature applications due to its susceptibility to stress corrosion cracking. The alloy is non-heat treatable.

APPROVALS: ABS, BV, CE, Class NK, CWB, DB, DNV, GL, LR & VdTÜV

WELDING CURRENT: DC+

SHIELDING GAS: Ar or Ar/He

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
Si	<0.40	YS (N/mm ²)	140
Mn	0.80	UTS (N/mm ²)	290
Cr	0.15	Elongation (%)	25
Cu	<0.10	Impact (CVN)	
Ti	<0.15	@ +200C (Joules)	30
Zn	<0.25		
Fe	<0.40		
Mg	4.80		

CURRENT RANGE

Size (mm)	Current (Amp)	Voltage (V)
1.0	90-210	15-26
1.2	140-260	20-29
1.6	190-350	25-30
2.4	280-400	26-31

PACKING: The wire can be supplied in plastic spool packed in a cardboard box weighing 7/9 kg or select sizes in Marathon Pac weighing 25/80/141 kg.

OK AUTROD 5356

A Mg alloyed aluminium solid wire for GMAW

Classification AWS A5.10: ER5356

DESCRIPTION

OK AUTROD 5356 is the most widely used welding alloy and can be classified as a general purpose type filler alloy. OK AUTROD 5356 is typically chosen because of its relatively high shear strength. The 5XXX alloy base material, welded with OK AUTROD 5356, with weld pool chemistry greater than 3% Mg and service temperatures in excess of 65°C is susceptible to stress corrosion cracking. The alloy is non-heat treatable.

APPROVALS: ABS, BV, CE, CWB, DB, DNV, GL, LR, RINA & VdTÜV

WELDING CURRENT: DC+

SHIELDING GAS: Ar or Ar/He

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
Si	<0.25	YS (N/mm ²)	120
Mn	0.15	UTS (N/mm ²)	265
Cr	0.13	Elongation (%)	26
Cu	<0.10		
Ti	0.11		
Zn	<0.10		
Fe	<0.40		
Mg	5.00		

CURRENT RANGE

Size (mm)	Current (Amp)	Voltage (V)
0.8	60-170	13-24
0.9	60-170	13-24
1.0	90-210	15-26
1.2	140-260	20-29
1.6	190-350	25-30
2.4	280-400	26-31

PACKING: The wire can be supplied in plastic spool packed in a cardboard box weighing 7/9 kg or select sizes in Marathon Pac weighing 25/80/141 kg.

OK AUTROD 5556A

A Mg-Mn alloyed aluminium solid wire for GMAW

Classification AWS A5.10: ER5556

DESCRIPTION

OK AUTROD 5556A is a continuous solid wire suitable for welding of aluminium alloys (approx. up to 5 % Mg) that are not age-hardenable and alloys where a higher tensile strength is required. The corrosion resistance in marine atmosphere is high.

APPROVALS: CE & VdTÜV

WELDING CURRENT: DC+

SHIELDING GAS: Ar or He or Ar/He

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
Si	<0.25	YS (N/mm ²)	145
Mn	0.80	UTS (N/mm ²)	295
Cr	0.13	Elongation (%)	25
Cu	<0.10	Impact (CVN)	
Ti	0.13	@ +200C (Joules)	25
Zn	<0.20		
Fe	<0.40		
Mg	5.30		

CURRENT RANGE

Size (mm)	Current (Amp)	Voltage (V)
1.0	90-210	15-26
1.2	140-260	20-29
1.6	190-350	25-30
2.4	280-400	26-31

PACKING: The wire can be supplied in plastic spool packed in a cardboard box weighing 7/9 kg or select sizes in Marathon Pac weighing 25/80/141 kg.



OK AUTROD 19.30

A Si-Mn alloyed copper solid wire for GMA welding and GMA brazing

Classification AWS A5.7: ERCuSi-A

DESCRIPTION

OK AUTROD 19.30 is a silicon-manganese alloyed copper solid wire, for welding of copper-zinc alloys & low alloyed copper and for GMA brazing of zinc coated steel sheets. OK AUTROD 19.30 has good flow properties. The alloy is widely used in the automotive industry for GMA brazing of galvanised steel in car body production. The wire is also suitable for overlay welding of unalloyed and low alloyed steels.

APPROVALS: VdTÜV

WELDING CURRENT: DC+

SHIELDING GAS: Ar or He or Ar/He or Ar/O₂

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
Si	3.40	YS (N/mm ²)	130
Mn	1.10	UTS (N/mm ²)	350
Cu	>94	Elongation (%)	40
Sn	<0.20		
Zn	<0.20		
Fe	<0.30		

CURRENT RANGE

Size (mm)	Current (Amp)	Voltage (V)
0.8	60-165	13-17.5
1.0	80-210	12.5-18
1.2	150-320	16-29
1.6	170-350	18 - 31

PACKING: The wire can be supplied in plastic spool packed in a cardboard box weighing 15 kg or select sizes in Marathon Pac weighing 200 kg.

OK AUTROD 19.40

An Al alloyed copper solid wire for GMAW of aluminium bronzes

Classification AWS A5.7: ERCuAl-A1

DESCRIPTION

OK AUTROD 19.40 is aluminium alloyed copper solid wire for welding of aluminium bronzes of the same type and over lay welding of un-alloyed and low alloyed steels. The alloy is recognized for high strength, good wear resistance and very good corrosion resistance particularly against sea water. The alloy is widely used for joining corrosion-resistant pipes made of aluminium bronze or other special brass alloys. Other common applications include the overlay welding of bearings, ship's propellers and rails.

WELDING CURRENT: DC+

SHIELDING GAS: Ar or He or Ar/He or Ar/O₂

TYPICAL PROPERTIES

Wire Composition (Wt.%)		All Weld Mechanical Properties	
Si	<0.10	YS (N/mm ²)	175
Mn	<0.50	UTS (N/mm ²)	420
Cu	bal.	Elongation (%)	40
Al	7.80		
Zn	<0.10		
Fe	<0.50		

CURRENT RANGE

Size (mm)	Current (Amp)	Voltage (V)
0.8	60-165	13-17.5
1.0	80-210	12.5-18
1.2	150-320	16-29
1.6	170-350	18 - 31

PACKING: The wire can be supplied in plastic spool packed in a cardboard box weighing 15 kg or select sizes in Marathon Pac weighing 200 kg.



DUAL SHIELD 7100 LH

All position rutile, low-hydrogen flux cored wire for mild and medium tensile steels

Classification AWS A5.20: E71T-1C/E71T-1M

DESCRIPTION

DUAL SHIELD 7100 LH is a multi-purpose all positional rutile, low hydrogen cored wire for use with CO₂ or Ar/CO₂ shielding gas. The wire is suitable for all mild and medium tensile steels. The running characteristics are exceptional with a stable arc, low spatter and flat welds.

APPROVALS: ABS, BV, DNV, IRS & LRS

WELDING CURRENT: DC+

SHIELDING GAS: 100%CO₂ or 80%Ar/20%CO₂

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.06	YS (N/mm ²)	480
Si	0.50	UTS (N/mm ²)	610
Mn	1.25	Elongation (%)	24
		Impact (CVN) @ -20°C (Joules)	60

CURRENT RANGE

Size (mm)	Current (Amp)	Voltage (V)
1.2	150-350	23-35
1.6	150-450	22-36

PACKING: The wire can be supplied in plastic spool packed in a cardboard box weighing 12.5/15.0 kg.

DUAL SHIELD 7100

FCAW wire for mild steel and 490N/mm² class high tensile strength steel

Classification AWS A5.20: E71T-1C

DESCRIPTION

DUAL SHIELD 7100 is a multi purpose all position flux cored wire for use with CO₂ gas. The smooth metal transfer facilitates easy deposition in vertical-up welding. The slag coverage is complete and designed for easy removal. Weld metal is consistently free of inclusions and porosity.

APPROVALS: ABS, BV, CCS, DNV, KR, LR & NK

WELDING CURRENT: DC+

SHIELDING GAS: 100%CO₂

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.04	YS (N/mm ²)	490
Si	0.55	UTS (N/mm ²)	560
Mn	1.25	Elongation (%)	30
		Impact (CVN) @ 0°C (Joules)	90
		@ -20°C (Joules)	50

CURRENT RANGE

Size (mm)	Current (Amp)	Voltage (V)
1.2	140-330	22-34
1.4	150-390	22-35
1.6	160-460	23-36

PACKING: The wire can be supplied in plastic spool packed in a cardboard box weighing 12.5/15.0 kg or select sizes in Marathon Pac weighing 100/200/300 kg.



OK TUBROD 15.14A

FCAW wire for mild steel and 490N/mm² class high tensile strength steel

Classification AWS A5.20: E71T-1C/E71T-1M
E71T-9C/E71T-9M

DESCRIPTION

OK TUBROD 15.14A is a multipurpose all position flux cored wire for use with CO₂ or Ar/CO₂ shielding gas. The wire is suitable for all mild and medium tensile steels. The smooth metal transfer facilitates easy deposition even in positional welding. Weldmetal is radiographically sound and provides good impact toughness down to -30°C.

APPROVALS: ABS, BV, CCS, DNV, KR, LR, NK & TUV

WELDING CURRENT: DC+

SHIELDING GAS: 100%CO₂ or 75%Ar/25%CO₂

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.04	YS (N/mm ²)	500
Si	0.50	UTS (N/mm ²)	580
Mn	1.30	Elongation (%)	28
		Impact (CVN)	
		@ -18°C (Joules)	80
		@ -30°C (Joules)	50

CURRENT RANGE

Size (mm)	Current (Amp)	Voltage (V)
1.2	140-300	21-30
1.4	150-360	21-32
1.6	160-410	22-34

PACKING: The wire can be supplied in plastic spool packed in a cardboard box weighing 12.5/15.0 kg or select sizes in Marathon Pac weighing 100/200/300 kg.

OK TUBROD 15.00A

Basic slag type flux cored wire for mild steel and 490N/mm² class high tensile strength steel

Classification AWS A5.20: E71T-5C-J/E71T-5M-J

DESCRIPTION

OK TUBROD 15.00A is a basic flux cored wire which produces a low hydrogen weld deposits. It is especially suitable for fabrication of unalloyed steels where superior toughness and crack resistance are required.

APPROVALS: ABS, BV, DNV, GL & LR

WELDING CURRENT: DC+

SHIELDING GAS: 100%CO₂ or 75%Ar/25%CO₂

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.06	YS (N/mm ²)	440
Si	0.60	UTS (N/mm ²)	540
Mn	1.35	Elongation (%)	30
		Impact (CVN)	
		@ -30°C (Joules)	110
		@ -51°C (Joules)	80

CURRENT RANGE

Size (mm)	Current (Amp)	Voltage (V)
1.2	140-280	22-31
1.4	150-300	22-33
1.6	170-320	24-35

PACKING: The wire can be supplied in plastic spool packed in a cardboard box weighing 12.5/15.0 kg.

COREWELD 70

Metal cored wire for mild steel and 490N/mm² class high tensile strength steel

Classification AWS A5.18: E70C-6M

DESCRIPTION

COREWELD 70 is a metal cored wire that combines the high deposition rates of a flux cored wire with the high efficiencies of solid wire. The wire exhibits low levels of spatter, slag and fumes.

APPROVALS: ABS, BV, DNV, GL & LR

WELDING CURRENT: DC+

SHIELDING GAS: 100%CO₂ or 75%Ar/25%CO₂

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.05	YS (N/mm ²)	450
Si	0.60	UTS (N/mm ²)	550
Mn	1.35	Elongation (%)	30
		Impact (CVN)	
		@ -18°C (Joules)	60
		@ -30°C (Joules)	40

CURRENT RANGE

Size (mm)	Current (Amp)	Voltage (V)
1.2	140-350	20-33
1.4	150-430	21-34
1.6	300-500	27-35

PACKING: The wire can be supplied in plastic spool packed in a cardboard box weighing 12.5/15.0 kg or select sizes in Marathon Pac weighing 100/200/300 kg.

DUAL SHIELD 7000-A1

FCAW wire for 0.5Mo heat resistant steel

Classification AWS A5.29: E81T1-A1C

DESCRIPTION

DUAL SHIELD 7000-A1 is an all-position flux cored wire recommended for welding 0.5Mo steels. It is used in the fabrication and erection of boilers, pressure piping & tubing and other pressure vessel applications. 75%Ar / 25%CO₂ shielding gas mixture may be used to improve arc characteristics, increase wetting action, decrease penetration and provide easier arc control for out-of-position welding.

WELDING CURRENT: DC+

SHIELDING GAS: 100%CO₂ or 75%Ar/25%CO₂

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.05	YS (N/mm ²)	480
Si	0.45	UTS (N/mm ²)	560
Mn	0.80	Elongation (%)	30
Mo	0.50		

CURRENT RANGE

Size (mm)	Current (Amp)	Voltage (V)
1.2	140-330	22-34
1.4	150-390	22-34
1.6	160-430	24-36

PACKING: The wire can be supplied in plastic spool packed in a cardboard box weighing 12.5/15.0 kg.



DUAL SHIELD 8000-B2

FCAW wire for 0.5-1.25Cr-0.5Mo heat resistant steel

Classification AWS A5.29: E81T1-B2C

DESCRIPTION

DUAL SHIELD 8000-B2 is an all-position 1.25Cr-0.5Mo flux cored wire for welding creep resistant steels of type 0.5Cr-0.5Mo, 1Cr-0.5Mo and 1.25Cr-0.5Mo.

WELDING CURRENT: DC+

SHIELDING GAS: 100%CO₂ or 75%Ar/25%CO₂

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.05	YS (N/mm ²)	520
Si	0.50	UTS (N/mm ²)	610
Mn	0.60	Elongation (%)	24
Cr	1.30		
Mo	0.55		

CURRENT RANGE

Size (mm)	Current (Amp)	Voltage (V)
1.2	140-330	22-34
1.4	150-390	22-34
1.6	160-430	24-36

PACKING: The wire can be supplied in plastic spool packed in a cardboard box weighing 12.5/15.0 kg.

DUAL SHIELD 9000-B3

FCAW wire for 2.25Cr-1.0Mo heat resistant steel

Classification AWS A5.29: E91T1-B3C

DESCRIPTION

DUAL SHIELD 9000-B3 is an all-position 2.25Cr-1Mo flux cored wire for welding creep resistant steels of similar composition.

WELDING CURRENT: DC+

SHIELDING GAS: 100%CO₂ or 75%Ar/25%CO₂

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.05	YS (N/mm ²)	600
Si	0.50	UTS (N/mm ²)	690
Mn	0.55	Elongation (%)	22
Cr	2.25		
Mo	1.05		

CURRENT RANGE

Size (mm)	Current (Amp)	Voltage (V)
1.2	140-330	22-34
1.4	150-390	22-34
1.6	160-430	24-36

PACKING: The wire can be supplied in plastic spool packed in a cardboard box weighing 12.5/15.0 kg.

OK TUBROD 15.24

A 1Ni alloyed basic flux cored wire

Classification AWS A5.29: E80T5-G

DESCRIPTION

OK TUBROD 15.24 is a basic low hydrogen flux cored wire depositing a 1Ni weld metal. It combines high strength combined with low temperature toughness for service down to -50°C and has good CTOD-performance. This applies to both the as welded and stress relieved condition. It provides good operability and slag release.

WELDING CURRENT: DC-

SHIELDING GAS: 80%Ar/20%CO₂

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.06	YS (N/mm ²)	540
Si	0.50	UTS (N/mm ²)	600
Mn	1.50	Elongation (%)	28
Ni	0.80	Impact (CVN) @ -51°C (Joules)	70

CURRENT RANGE

Size (mm)	Current (Amp)	Voltage (V)
1.2	140-330	22-34
1.4	150-390	22-34
1.6	160-430	24-36

PACKING: The wire can be supplied in plastic spool packed in a cardboard box weighing 12.5/15.0 kg.

DUAL SHIELD T-115

Basic slag type flux cored wire for 760N/mm² class high tensile strength steel

Classification AWS A5.29: E110T5-K4M

DESCRIPTION

DUAL SHIELD T-115 is a basic slag flux cored wire designed for applications requiring a high strength weld deposit of excellent quality. The weld deposit is resistant to cracking in heavy sections or under high restraint.

WELDING CURRENT: DC+

SHIELDING GAS: 75%Ar/25%CO₂

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.06	YS (N/mm ²)	730
Si	0.60	UTS (N/mm ²)	810
Mn	1.35	Elongation (%)	21
Cr	0.25	Impact (CVN) @ -30°C (Joules)	50
Ni	2.20	@ -51°C (Joules)	35
Mo	0.45		

CURRENT RANGE

Size (mm)	Current (Amp)	Voltage (V)
1.2	140-330	22-34
1.4	150-390	22-34
1.6	160-460	24-36

PACKING: The wire can be supplied in plastic spool packed in a cardboard box weighing 12.5/15.0 kg.



SHIELD-BRIGHT 308L

FCAW wire for 18Cr-8Ni stainless steels

Classification AWS A5.22: E308LT1-1(4)

DESCRIPTION

SHIELD-BRIGHT 308L is a flux cored wire for welding type 301, 302, 304 and 304L stainless steels. Low carbon content helps to minimize chromium carbide precipitation and thereby improve the intergranular corrosion resistance. It may also be used for welding types 321 and 347 if the service conditions do not exceed an approximate temperature of 260°C.

APPROVALS: ABS, BV, CCS, DNV, KR, LR & NK

WELDING CURRENT: DC+

SHIELDING GAS: 100%CO₂ or 75%Ar/25%CO₂

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.03	YS (N/mm ²)	400
Si	0.75	UTS (N/mm ²)	570
Mn	1.10	Elongation (%)	45
Cr	19.20		
Ni	10.00		

CURRENT RANGE

Size (mm)	Current (Amp)	Voltage (V)
1.0	100-170	21-27
1.2	130-250	23-31
1.6	160-320	24-33

PACKING: The wire can be supplied in plastic spool packed in a cardboard box weighing 12.5 kg.

SHIELD-BRIGHT 308H

FCAW wire for 18Cr-8Ni type stainless steels

Classification AWS A5.22: E308HT1-1(4)

DESCRIPTION

SHIELD-BRIGHT 308H is a flux cored wire for welding type 304H stainless steel. It can also be used for welding type 301, 302, and 304 stainless steels. It contains a higher carbon level than 308L wire to give greater high temperature strength.

WELDING CURRENT: DC+

SHIELDING GAS: 100%CO₂ or 75%Ar/25%CO₂

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.05	YS (N/mm ²)	410
Si	0.80	UTS (N/mm ²)	590
Mn	1.10	Elongation (%)	43
Cr	18.60		
Ni	10.00		

CURRENT RANGE

Size (mm)	Current (Amp)	Voltage (V)
1.0	100-170	21-27
1.2	130-250	23-31
1.6	160-320	24-33

PACKING: The wire can be supplied in plastic spool packed in a cardboard box weighing 12.5 kg.

SHIELD-BRIGHT 309L

Flux cored wire for welding dissimilar steels

Classification AWS A5.22: E309LT1-1(4)

DESCRIPTION

SHIELD-BRIGHT 309L is a flux cored wire for welding steels of similar composition, stainless steel to carbon or low alloy steels and for the first layer cladding of carbon and low alloy steels.

APPROVALS: ABS, BV, CCS, DNV, KR, LR & NK

WELDING CURRENT: DC+

SHIELDING GAS: 100%CO₂ or 75%Ar/25%CO₂

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.03	YS (N/mm ²)	420
Si	0.80	UTS (N/mm ²)	580
Mn	1.10	Elongation (%)	40
Cr	22.70		
Ni	12.30		

CURRENT RANGE

Size (mm)	Current (Amp)	Voltage (V)
1.0	100-170	21-27
1.2	130-250	23-31
1.6	160-320	24-33

PACKING: The wire can be supplied in plastic spool packed in a cardboard box weighing 12.5 kg.

SHIELD-BRIGHT 309MoL

Flux cored wire for welding dissimilar steels

Classification AWS A5.22: E309LMoT1-1(4)

DESCRIPTION

SHIELD-BRIGHT 309MoL is a flux cored wire for welding dissimilar metals such as molybdenum containing austenitic stainless steels to non alloyed or low alloyed steels. Applications of this kind include the welding of buffer layers for acid-resistant clad steels and surfacing. It is used in paper mills and in power plants to give greater corrosion resistance.

APPROVALS: DNV & KR

WELDING CURRENT: DC+

SHIELDING GAS: 100%CO₂ or 75%Ar/25%CO₂

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.03	YS (N/mm ²)	550
Si	0.65	UTS (N/mm ²)	700
Mn	0.95	Elongation (%)	33
Cr	23.00		
Ni	12.50		
Mo	2.50		

CURRENT RANGE

Size (mm)	Current (Amp)	Voltage (V)
0.9	100-200	21-30
1.2	130-270	23-31
1.6	160-350	24-33

PACKING: The wire can be supplied in plastic spool packed in a cardboard box weighing 12.5 kg.



SHIELD-BRIGHT 316L

FCAW wire for low carbon 18Cr-12Ni-2.5Mo type stainless steels

Classification AWS A5.22: E316LT1-1(4)

DESCRIPTION

SHIELD-BRIGHT 316L is a flux cored wire for welding type 316 & 316L stainless steels. It contains molybdenum, which resists pitting corrosion induced by sulphuric and sulphurous acids, chlorides and cellulose solutions. It is used widely in the rayon, dye and paper making industries.

APPROVALS: ABS, BV, DNV, KR, LR & NK

WELDING CURRENT: DC+

SHIELDING GAS: 100%CO₂ or 75%Ar/25%CO₂

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.03	YS (N/mm ²)	400
Si	0.80	UTS (N/mm ²)	570
Mn	1.10	Elongation (%)	38
Cr	18.40		
Ni	11.80		
Mo	2.40		

CURRENT RANGE

Size (mm)	Current (Amp)	Voltage (V)
1.0	100-170	21-27
1.2	130-250	23-31
1.6	160-320	24-33

PACKING: The wire can be supplied in plastic spool packed in a cardboard box weighing 12.5 kg.

SHIELD-BRIGHT 347

FCAW wire for 18Cr-8Ni and Stabilized stainless steels

Classification AWS A5.22: E347T1-1(4)

DESCRIPTION

SHIELD-BRIGHT 347 is a flux cored wire for welding 304, 304L, 321 and 347 type stainless steels. The addition of niobium helps to minimize chromium carbide precipitation and thereby improve the intergranular corrosion resistance.

WELDING CURRENT: DC+

SHIELDING GAS: 100%CO₂ or 75%Ar/25%CO₂

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.03	YS (N/mm ²)	420
Si	0.90	UTS (N/mm ²)	590
Mn	1.10	Elongation (%)	40
Cr	19.00		
Ni	9.60		
Nb	0.45		

CURRENT RANGE

Size (mm)	Current (Amp)	Voltage (V)
1.0	100-170	21-27
1.2	130-250	23-31
1.6	160-320	24-33

PACKING: The wire can be supplied in plastic spool packed in a cardboard box weighing 12.5 kg.

ARCALOY T-409Ti

Metal type FCAW wire for 12Cr stainless steels

Classification AWS A5.22: E409T0-G

DESCRIPTION

ARCALOY T-409Ti is a metal cored wire designed to match the corrosion resistance and mechanical properties of type 409Ti stainless steel. This material is widely used in automotive exhaust systems.

WELDING CURRENT: DC+

SHIELDING GAS: 98%Ar/2%O₂

TYPICAL PROPERTIES

Weld Metal Composition (Wt.%)		All Weld Mechanical Properties	
C	0.03	YS (N/mm ²)	370
Si	0.50	UTS (N/mm ²)	500
Mn	0.45	Elongation (%)	20
Cr	11.70		
Ti	0.80		

CURRENT RANGE

Size (mm)	Current (Amp)	Voltage (V)
1.2	160-250	19-24

PACKING: The wire can be supplied in plastic spool packed in a cardboard box weighing 12.5/15.0 kg or Marathon Pac weighing 100/200 kg.

OK AUTROD 12.08L

A copper coated mild steel wire for SAW

Classification AWS A5.17: EL8/EL12

DESCRIPTION

OK AUTROD 12.08L is a copper coated, mild steel solid wire for submerged arc welding of mild and medium tensile steels. It can be used in combination OK Flux 10.71L or OK Flux 10.81L or OK Flux 10.81LS, depending on the application and mechanical property requirements.

TYPICAL PROPERTIES

Wire Composition (Wt.%)	
C	0.06
Si	0.02
Mn	0.50

PACKING DATA

Size (mm)	Packing 25 Kg
2.00	✓
2.50	✓
3.15	✓
4.00	✓
5.00	✓

PACKING: The wire can be supplied in corrugated cardboard box weighing 25 Kg.

OK AUTROD 12.22L

A copper coated medium Mn alloyed solid wire for SAW

Classification AWS A5.17: EM12K

DESCRIPTION

OK AUTROD 12.22L is a copper coated, medium manganese alloyed killed solid wire for submerged arc welding medium and high strength steels. It can be used in combination with OK Flux 10.62 or OK Flux 10.71L or OK Flux 10.81LS, depending on the application and mechanical property requirements.

TYPICAL PROPERTIES

Wire Composition (Wt.%)	
C	0.10
Si	0.20
Mn	1.00

PACKING DATA

Size (mm)	Packing 25 Kg	Packing 250 Kg	Packing 375/450 Kg
1.20	×	✓	×
1.60	×	✓	×
2.00	✓	✓	✓
2.50	✓	✓	✓
3.15	✓	✓	✓
4.00	✓	✓	✓
5.00	✓	×	×

PACKING: The wire can be supplied in corrugated cardboard box weighing 25 Kg or Marathon Pac/Steel Bobbins weighing 250 Kg or Drums weighing 375/450 Kg.

ESAB SA13K

A copper coated medium Mn alloyed solid wire for SAW

Classification AWS A5.17: EM13K

DESCRIPTION

ESAB SA13K is a copper coated, medium manganese alloyed killed solid wire for submerged arc welding of medium and high tensile steels. It can be used in combination with OK Flux 10.62 or OK Flux 10.71L or OK Flux 10.81LS, depending on the application and mechanical property requirements.

TYPICAL PROPERTIES

Wire Composition (Wt.%)	
C	0.08
Si	0.50
Mn	1.10

PACKING DATA

Size (mm)	Packing 25 Kg	Packing 250 Kg
1.60	×	✓
3.15	✓	✓

PACKING: The wire can be supplied in corrugated cardboard box weighing 25 Kg or Marathon Pac/Steel Bobbins weighing 250 Kg.



ESAB SA10K

A copper coated high Mn alloyed solid wire for SAW

Classification AWS A5.17: EH10K

DESCRIPTION

ESAB SA10K is a copper coated, high manganese alloyed killed solid wire for submerged arc welding of medium and high strength steels. It can be used in combination with OK Flux 10.62L or OK Flux 10.71L, depending on the application and mechanical property requirements.

TYPICAL PROPERTIES

Wire Composition (Wt.%)	
C	0.10
Si	0.20
Mn	1.50

PACKING DATA

Size (mm)	Packing 25 Kg	Packing 450 Kg
2.50	✓	×
3.15	✓	×
4.00	✓	✓
5.00	✓	×

PACKING: The wire can be supplied in corrugated cardboard box weighing 25 Kg or Drums weighing 450 Kg.

OK AUTROD 12.40L

A copper coated high Mn alloyed semi killed solid wire for SAW

Classification AWS A5.17: EH14

DESCRIPTION

OK AUTROD 12.40L is a copper coated, high manganese alloyed semi-killed solid wire for submerged arc welding of medium and high tensile steels. It can be used in combination with OK Flux 10.62L or OK Flux 10.71L, depending on the application and mechanical property requirements.

TYPICAL PROPERTIES

Wire Composition (Wt.%)	
C	0.12
Si	0.05
Mn	1.85

PACKING DATA

Size (mm)	Packing 25 Kg	Packing 450 Kg
2.50	✓	×
3.15	✓	✓
4.00	✓	✓
5.00	✓	×

PACKING: The wire can be supplied in corrugated cardboard box weighing 25 Kg or Drums weighing 450 Kg.

OK AUTROD 12.24L

A copper coated Mo alloyed solid wire for SAW

Classification AWS A5.23: EA2

DESCRIPTION

OK AUTROD 12.24L is a copper coated, molybdenum alloyed solid wire for the submerged arc welding of non alloyed and low alloyed steels. It can be used in combination with OK Flux 10.62 or OK Flux 10.71L, depending on the application and mechanical property requirements.

TYPICAL PROPERTIES

Wire Composition (Wt.%)	
C	0.10
Si	0.15
Mn	1.10
Mo	0.50

PACKING DATA

Size (mm)	Packing 25 Kg
2.00	✓
3.15	✓
4.00	✓

PACKING: The wire can be supplied in corrugated cardboard box weighing 25 Kg.

OK AUTROD 12.33L

A copper coated Mo alloyed solid wire for SAW

Classification AWS A5.23: EA3K

DESCRIPTION

OK AUTROD 12.33L is a copper coated, molybdenum alloyed solid wire for the submerged arc welding of high tensile steels. It can be used in combination with OK Flux 10.62 or OK Flux 10.71L, depending on the application and mechanical property requirements.

TYPICAL PROPERTIES

Wire Composition (Wt.%)	
C	0.10
Si	0.60
Mn	1.75
Mo	0.45

PACKING DATA

Size (mm)	Packing 25 Kg
2.00	✓
3.15	✓
4.00	✓

PACKING: The wire can be supplied in corrugated cardboard box weighing 25 Kg.

OK AUTROD 13.10 SC

A low alloyed copper coated solid wire for SAW of 1.25Cr-0.5Mo type steels.

Classification AWS A5.23: EB2R

DESCRIPTION

OK AUTROD 13.10 SC is a low-alloyed, copper coated solid wire designed for the submerged arc welding of creep-resistant steels of the 1.25Cr-0.5Mo type. It is especially designed for step cooling applications. It can be used in combination with OK Flux 10.62.

TYPICAL PROPERTIES

Wire Composition (Wt.%)	
C	0.10
Si	0.15
Mn	0.70
Cr	1.20
Mo	0.50

PACKING DATA

Size (mm)	Packing 30 Kg	Packing 280/300 Kg	Packing 450/475 Kg
1.60	×	×	✓
2.00	✓	✓	✓
2.50	✓	×	×
3.20	✓	×	×
4.00	✓	✓	×

PACKING: The wire can be supplied in corrugated cardboard box weighing 30 Kg or bulk packs weighing 280/300/450/475 Kg.

OK AUTROD 13.20 SC

A low alloyed copper coated solid wire for SAW of 2.25Cr-1Mo type steels.

Classification AWS A5.23: EB3R

DESCRIPTION

OK AUTROD 13.20 SC is a low-alloyed, copper coated solid wire designed for the submerged arc welding of creep-resistant steels of the 2.25Cr-1Mo type. It is especially designed for step cooling applications. It can be used in combination with OK Flux 10.62.

TYPICAL PROPERTIES

Wire Composition (Wt.%)	
C	0.10
Si	0.15
Mn	0.60
Cr	2.30
Mo	1.00

PACKING DATA

Size (mm)	Packing 25 Kg
2.00	✓
2.50	✓
3.20	✓
4.00	✓

PACKING: The wire can be supplied in corrugated cardboard box weighing 30 Kg.



OK AUTROD 16.10

An extra low carbon stainless steel solid wire for SAW of 18Cr-8Ni type steels

Classification AWS A5.9: ER308L

DESCRIPTION

A corrosion resistant, chromium-nickel alloyed solid wire for welding austenitic stainless alloys of 18Cr-8Ni type. OK Autrod 16.10 has good general corrosion resistance. The alloy has a low carbon content which makes it particularly suitable to the applications, where there is a risk of intergranular corrosion. The alloy is widely used in the chemical and food-processing industries, as well as for pipes, tubes and boilers. OK AUTROD 16.10 can be used in combination with OK FLUX 10.92L.

TYPICAL PROPERTIES

Wire Composition (Wt.%)	
C	0.03
Si	0.45
Mn	1.80
Cr	20.70
Ni	9.80

PACKING DATA

Size (mm)	Packing 25 Kg
2.00	✓
2.50	✓
3.15	✓
4.00	✓

PACKING: The wire can be supplied in corrugated cardboard box weighing 25 Kg.

OK AUTROD 16.11

A Nb stabilized 20Cr-10Ni stainless steel solid wire for SAW

Classification AWS A5.9: ER347

DESCRIPTION

A corrosion-resistant, chromium-nickel alloyed solid wire for welding stabilized austenitic chromium-nickel alloys of 18Cr-8Ni type. OK AUTROD 16.11 has good general corrosion resistance. The alloy is stabilized with niobium to improve resistance to the intergranular corrosion of the weld metal. Due to the niobium content, this alloy is recommended for use at higher temperatures. OK AUTROD 16.11 can be used in combination with OK FLUX 10.92L.

TYPICAL PROPERTIES

Wire Composition (Wt.%)	
C	0.03
Si	0.40
Mn	1.30
Cr	19.50
Ni	9.50
Nb	0.40

PACKING DATA

Size (mm)	Packing 25 Kg
2.50	✓
3.15	✓
4.00	✓

PACKING: The wire can be supplied in corrugated cardboard box weighing 25 Kg.

OK AUTROD 16.13

An austenitic stainless steel solid wire for SAW of 25Cr-20Ni type steels

Classification AWS A5.9: ER310

DESCRIPTION

A corrosion-resistant, chromium-nickel alloyed solid wire for welding heat-resistant austenitic stainless steels of 25Cr-20Ni type. OK AUTROD 16.13 has good general oxidation resistance, especially at high temperatures, due to its high Cr content. The alloy is fully austenitic and is therefore sensitive to hot cracking. Common applications include industrial furnaces, boiler parts and heat exchangers. OK AUTROD 16.13 can be used in combination with OK FLUX 10.92L.

TYPICAL PROPERTIES

Wire Composition (Wt.%)	
C	0.10
Si	0.45
Mn	1.60
Cr	26.80
Ni	20.60

PACKING DATA

Size (mm)	Packing 25 Kg
2.50	✓
3.15	✓
4.00	✓

PACKING: The wire can be supplied in corrugated cardboard box weighing 25 Kg.

OK AUTROD 16.30

An extra low carbon stainless steel solid wire for SAW of 18Cr-12Ni-2.5Mo type steels

Classification AWS A5.9: ER316L

DESCRIPTION

A corrosion resistant, chromium-nickel-molybdenum alloyed solid wire for welding austenitic stainless alloys of the 18Cr-8Ni and 18Cr-12Ni-2.5Mo types. The alloy has very good resistance to corrosion in acid and chlorinated environments. The alloy has a low carbon content which makes it particularly suitable to the applications, where there is a risk of intergranular corrosion. The alloy is widely used in the chemical and food-processing industries, as well as in shipbuilding and various types of architectural structures. OK AUTROD 16.30 can be used in combination with OK FLUX 10.92L.

TYPICAL PROPERTIES

Wire Composition (Wt.%)	
C	0.03
Si	0.40
Mn	1.70
Cr	18.50
Ni	11.80
Mo	2.70

PACKING DATA

Size (mm)	Packing 25 Kg
2.50	✓
3.15	✓
4.00	✓

PACKING: The wire can be supplied in corrugated cardboard box weighing 25 Kg.

OK AUTROD 16.53

An extra low carbon 24Cr-13Ni stainless steel solid wire for SAW

Classification AWS A5.9: ER309L

DESCRIPTION

A corrosion resistant, chromium-nickel alloyed solid wire for joining stainless steels to non-alloy or low-alloy steels and for welding austenitic stainless alloys of the 24Cr-13Ni types. The alloy is also used for welding buffer layers on C-Mn steels. OK AUTROD 16.53 can be used in combination with OK FLUX 10.92L.

TYPICAL PROPERTIES

Wire Composition (Wt.%)	
C	0.03
Si	0.45
Mn	1.75
Cr	23.50
Ni	12.50

PACKING DATA

Size (mm)	Packing 25 Kg
2.50	✓
3.15	✓
4.00	✓

PACKING: The wire can be supplied in corrugated cardboard box weighing 25 Kg.

SAW FLUXES

OK FLUX 10.62

An agglomerated high basic non-alloying flux for SAW

Classification AWS A5.23: F8P2-EB2R-B2
F8P2-EB3R-B3

BASICITY INDEX: 3.2

DESCRIPTION

OK FLUX 10.62 is an agglomerated non-alloying, high-basic flux. It is especially suitable for the multi-run welding of thick materials using the single-wire and multiple-wire technique. It is designed for the multi-pass butt welding of mild, medium and high tensile steels, as well as low-alloyed steels, with impact toughness down to -40°/-60°C. As it is a flux of the high-basic type, it has a high current-carrying capacity on both AC and DC. To increase productivity with no loss of mechanical properties, OK FLUX 10.62 is best used together with iron powder addition. It is especially suitable for narrow gap welding, due to the good slag detachability and smooth side-wall blending. OK FLUX 10.62 can be successfully used in the applications, where good CTOD values are required. OK FLUX 10.62 yields low-oxygen weld metal (approx. 300 ppm) and produces low-hydrogen weld metal (lower than 5 ml/100 g).

TYPICAL WELD METAL PROPERTIES

OK FLUX 10.62/	C	Si	Mn	Cr	Mo	YS (N/mm ²)	UTS (N/mm ²)	Elongation (%)	CVN Impact (Joules)	Impact Temperature (°C)
OK AUTROD 13.10 SC	0.08	0.20	0.70	1.10	0.50	500	610	26	80	-30
OK AUTROD 13.20 SC	0.08	0.20	0.60	2.00	0.85	530	620	25	80	-30

PACKING: OK FLUX 10.62 is packed in paper bag containing 25 Kg.

OK FLUX 10.62L

An agglomerated high basic non-alloying flux for SAW

Classification AWS A5.17: F7A6/F7P8-EH10K
F7A6/F7P6-EH14

BASICITY INDEX: 3.2

DESCRIPTION

OK FLUX 10.62L is an agglomerated non-alloying, high-basic flux. It is especially suitable for the multi-run welding of thick materials using the single-wire and multiple-wire technique. It is designed for the multi-pass butt welding of mild, medium and high tensile steels, as well as low-alloyed steels, with impact toughness down to -40°/-60°C. As it is a flux of the high-basic type, it has a high current-carrying capacity on both AC and DC. It is especially suitable for narrow gap welding, due to the good slag detachability and smooth side-wall blending. OK FLUX 10.62 yields low-oxygen weld metal and produces low-hydrogen weld metal (lower than 5 ml/100 g).

TYPICAL WELD METAL PROPERTIES

OK FLUX 10.62L/	C	Si	Mn	YS (N/mm ²)	UTS (N/mm ²)	Elongation (%)	CVN Impact (Joules)	Impact Temperature (°C)
ESAB SA10K	0.08	0.20	1.25	470	540	27	45	-51
OK AUTROD 12.40L	0.09	0.10	1.45	490	550	30	40	-51

PACKING: OK FLUX 10.62L is packed in plastic lined paper bag containing 25 Kg.

OK FLUX 10.71L

An agglomerated slightly Si and Mn alloying basic flux for SAW

Classification AWS A5.17: F6A2-EL8/EL12
 F7A4/F6P5-EM12K
 F7A4/F7P6-EH10K
 F7A4/F7P5-EH14
 AWS A5.23: F8A2/F7P0-EA2-A4
 F9A0/F8P0-EA3K-A3

BASICITY INDEX: 1.5

TYPICAL WELD METAL PROPERTIES

OK FLUX 10.71L/	C	Si	Mn	Mo	YS (N/mm ²)	UTS (N/mm ²)	Elongation (%)	CVN Impact (Joules)	Impact Temperature (°C)
OK AUTROD 12.08L	0.06	0.20	0.90	-	390	450	25	70	-30
OK AUTROD 12.22L	0.08	0.40	1.35	-	450	540	30	35	-40
ESAB SA10K	0.07	0.50	1.65	-	490	580	26	30	-40
OK AUTROD 12.40L	0.07	0.40	1.80	-	500	590	27	40	-40
OK AUTROD 12.24L	0.08	0.40	1.25	0.50	550	610	24	50	-30
OK AUTROD 12.33L	0.07	0.75	2.00	0.40	630	700	25	35	-18

PACKING: OK FLUX 10.71L is packed in plastic lined paper bags containing 25 Kg.

OK FLUX 10.81L

An agglomerated Si and Mn alloying acidic flux for SAW

Classification AWS A5.17: F7AZ/F7PZ-EL8/EL12

BASICITY INDEX: 0.7

TYPICAL WELD METAL PROPERTIES

OK FLUX 10.81L/	C	Si	Mn	YS (N/mm ²)	UTS (N/mm ²)	Elongation (%)
OK AUTROD 12.08L	0.06	0.70	1.20	540	590	25

PACKING: OK FLUX 10.81L is packed in plastic lined paper bag containing 25 Kg.

DESCRIPTION

OK FLUX 10.71L is a basic agglomerated, slightly Si and Mn alloying flux for submerged arc welding. It is specially designed for fillet welding and single and multi pass butt welding of mild, medium and high tensile steels. The flux is of aluminate basic type and it has a very high current carrying capacity on both AC and DC with very good operating characteristics. OK FLUX 10.71L is also suited to narrow gap welding due to the excellent slag detachability and smooth side-wall blending.

DESCRIPTION

OK FLUX 10.81L is an acidic agglomerated Si and Mn alloying flux for submerged arc welding. It provides exceptional welding characteristics with a slag system that allows higher welding speeds. It is specially designed for use in combination with OK AUTROD 12.08L.



OK FLUX 10.81LS

An agglomerated Si and Mn alloying acidic flux for SAW

Classification AWS A5.17: F7AZ/F7PZ-EL8/EL12
F7AZ/F7PZ-EM12K

BASICITY INDEX: 0.8

DESCRIPTION

OK FLUX 10.81LS is an acidic agglomerated Si and Mn-alloying flux for submerged arc welding. Most suitable for applications where the dilution of base metal is high, e.g. in fillet welding and butt welding of thin and medium thick plates with a limited number of passes. The superior welding properties associated with the acid slag system of OK FLUX 10.81LS permit high travel speeds in butt and fillet welding. It offers superior bead shape, slag removal and surface finish. It can be easily used over rust and primer without running the risk of porosity.

TYPICAL WELD METAL PROPERTIES

OK FLUX 10.81LS/	C	Si	Mn	YS (N/mm ²)	UTS (N/mm ²)	Elongation (%)
OK AUTROD 12.08L	0.07	0.70	1.10	530	580	26
OK AUTROD 12.22L	0.09	0.80	1.50	550	620	24

PACKING: OK FLUX 10.81LS is packed in plastic lined paper bag containing 25 Kg.

OK FLUX 10.92L

An agglomerated non-alloying basic flux for SAW of stainless steels

BASICITY INDEX: 2.1

DESCRIPTION

OK FLUX 10.92L is a basic non-alloying agglomerated flux for the submerged arc welding of stainless steels and high-alloyed Cr-Ni-Mo steels.

TYPICAL WELD METAL PROPERTIES

OK FLUX 10.92L/	C	Si	Mn	Cr	Ni	Mo	Nb	UTS (N/mm ²)	Elongation (%)	CVN Impact (Joules)	Impact Temperature (°C)
OK AUTROD 16.10	0.03	0.45	1.40	18.20	8.80			560	35	35	-196
OK AUTROD 16.11	0.03	0.50	1.10	18.00	8.80		0.40	610	32	50	-60
OK AUTROD 16.30	0.03	0.50	1.40	17.00	10.00	2.10		570	32	60	-60
OK AUTROD 16.53	0.03	0.45	1.45	21.00	11.00			580	35	50	-60

PACKING: OK FLUX 10.92L is packed in plastic lined paper bag containing 25 Kg.



STRIP & FLUX COMBINATIONS FOR CLADDING

Stainless steel strips and Fluxes for Submerged Arc and Electroslag Cladding

DESCRIPTION

Nowadays, the two most productive systems for surfacing large components that are subject to corrosion or wear are submerged arc and electroslag cladding, using a strip electrode. Both processes are characterised by a high deposition rate and low dilution.

TYPICAL APPLICATIONS

They are suitable for surfacing flat and curved objects such as heat exchanger plates or pressure vessels of different kinds. Submerged Arc Strip Cladding (SASC) is the most frequently - used process, but if higher productivity and restricted dilution rates are

required, Electroslag Strip Cladding (ESSC) is used. These strips are finding increasing use in petroleum industry in hydrocracking, hydro-sulphurisation and catalytic refining processes and in the chemical and petrochemical industries.

Fluxes for SASC and ESSC

Process	Product	Basicity Index	Density Kg/dm ³
SASC	OK Flux 10.05	1.1	0.7
ESSC	OK Flux 10.10	4.0	1.0

Dimension & packing

Product	Type	Size	Weight
Strips	OK Band	60 x 0.5 mm	25 or 50 Kg coils
Fluxes	OK Flux	-	25 Kg bags

Other sizes available on request.

Stainless steel welding strips for SASC

Product	AWS A5.9	Typical strip composition						
		%C	%Si	%Mn	%Cr	%Ni	%Mo	Other
OK Band 308L	EQ308L	≤0.03	0.5	1.8	20.3	10.0	≤0.03	-
OK Band 347	EQ347	≤0.03	0.5	1.8	20.0	10.0	≤0.03	Nb≤1.0
OK Band 316L	EQ316L	≤0.03	0.5	1.8	19.0	12.5	2.8	-
OK Band 309 L	EQ309L	≤0.03	0.5	1.8	24.0	13.0	≤0.03	-

Stainless steel welding strips for ESSC

Product	Typical strip composition						
	%C	%Si	%Mn	%Cr	%Ni	%Mo	Other
OK Band 309L ESW	≤0.03	0.3	1.8	21.0	11.0	≤0.5	-
OK Band 309L Nb ESW	≤0.02	0.3	1.8	21.0	11.0	≤0.5	Nb≤0.8
OK Band 309LMo ESW	≤0.02	0.3	1.8	20.5	13.5	3.1	-

Other welding strips for SASC

To be used with	AWS A5.14	Typical strip composition						
		%C	%Si	%Mn	%Cr	%Ni	%Mo	Other
OK Band NiCrMo3	ERNiCrMo-3	≤0.10	≤0.2	≤0.5	21.5	Bal.	9.0	Fe≤2.0
OK Band NiCr3	ERNiCr-3	≤0.10	≤0.5	3.0	20.0	Bal.	1.8	Fe≤3.0

Notes:

- 1) Other types of strips also available on demand.
- 2) OK Flux 10.05 and OK Flux 10.10 have to be redried at 300-305°C for 2 hours before use.
- 3) Typical Weldmetal composition is available on demand.
- 4) OK Band 309L ESW together with OK Flux 10.10 produces 308L type weld deposit (single layer).
- 5) OK Band 309LNb ESW together with OK Flux 10.10 produces 347 type weld deposit (single layer).
- 6) OK Band 309LMo ESW together with OK Flux 10.10 produces 316L type weld deposit (single layer).

Hard Surfacing Consumables

WIRE & FLUX COMBINATIONS

Wires and Fluxes for overlaying by SAW

DESCRIPTION

ESAB hard surfacing consumables are ideal for surfacing components that are worn-out or to resist wear against abrasion and impact with work hardening properties.

WIRES

ESAB WRAS has the following composition. OK AUTOROD 12.08L and OK AUTOROD 12.40L could also be used.

FLUXES

ESAB AGGLOWELD HFG and ESAB AGGLOWELD HFS are agglomerated basic fluxes designed for hard surfacing applications by providing necessary alloying elements to the weld deposit. ESAB AGGLOWELD HFG Weldmetal is a tough machinable alloy resisting compressive load, without micro fissuring and also has resistance to fatigue and impact. ESAB AGGLOWELD HFS can produce deposits of higher hardness with suitable wire.

TYPICAL APPLICATIONS

Suitable for overlaying of scraper blades, cane cutting knives, bucket body, chutes, guides, plough shear, cam rollers, gate valve seats, road graders, roll reclamation, crane wheels, earth moving equipment, crusher equipment etc. Suitable for building of machine components such as cams, gears, splines, sprockets, railway equalizer beams, sugar mill pinions, rims, tractor sprockets, gear teeth, wobblers, pump shafts, crane wheel, pulley brakes, cable drums skid wheels pulley brakes, track rollers, Crane wheels, ditcher rolls etc.

TYPICAL PROPERTIES - WRAS

Wire Composition (Wt.%)	
C	0.35
Si	0.40
Mn	0.90
Cr	1.00

PACKING: The wire is available in 4.00 mm dia having net weight of 25 Kg. Flux is available in plastic lined paper bag containing 25 Kg.

TYPICAL WELDMETAL PROPERTIES (After 3rd layer)

FLUX /	ESAB WRAS		OK AUTROD 12.40L		OK AUTROD 12.08L	
	VHN	RC	VHN	RC	VHN	RC
ESAB AGGLOWELD HFG	400-440	38-42	320-370	31-35	260-300	24-28
ESAB AGGLOWELD HFS	480-550	46-56	400-450	48-43	-	-
OK FLUX 10.71L	220-250	21-26	-	-	-	-

9% Ni STEELS FOR LNG TANK FABRICATION

DESCRIPTION

LNG Storage tanks are usually fabricated from 9% Ni steels to provide a combination of properties at a reasonable price. Quenched & tempered 9% Ni Steels has excellent low temperature properties and is not susceptible to under bead cracking or excessive hardening in the HAZ on account of its low carbon. Esab offers a complete range of proven consumables, which have been used in over 30 global installations.

Nickel Based Consumables

The tensile strength of the high nickel alloy weld metal is close to that of 9% nickel steels and has high resistance to brittle fracture, good impact strength at -196°C, lateral expansion, side bend test and yield strength properties. Special stainless steel consumables are also available for LNG transport tanks and associated piping. Please refer section on stainless steel consumables elsewhere in this book.

APPLICATIONS

The SMAW electrodes are designed to weld on AC, largely to eliminate the magnetic arc blow problem of 9% nickel steels. SAW is preferred for circumferential welds and SMAW for the vertical welds. Smaller diameter wires (1.6mm) deliver better impact values. 9% nickel steels can be welded without pre and post weld treatment up to 60 mm, as per ASME code, OK 92.55 is Preferred, when higher impact values are specified.

TYPICAL WELDMETAL COMPOSITION (After 3rd Layer)

Material/ESAB Product	Chemical Composition (%)									
	C	Si	Mn	Cr	Ni	Mo	Nb	W	S&P	Fe
9% Ni Steels	0.13 Max	0.15 0.40	0.90 Max	-	8.5 9.5	-	-	-	0.005 Max	-
OK 92.45	≤0.05	0.5	≤0.5	21.5	64.0	9.0	3.3	-	-	≤5.0
OK 92.55	≤0.08	0.4	3.0	13.0	70.0	6.0	1.5	1.5	-	≤8.0
OK AUTROD 19.82/ OK FLUX 10.16	0.01	0.3	0.3	22.0	Bal	9.0	3.5*	-	-	1.5

*Including Tantalum

TYPICAL ALL WELDMETAL MECHANICAL PROPERTIES

Material / ESAB Product	Classification	Mechanical Properties			
		YS (N/mm ²)	UTS (N/mm ²)	EI (%)	CVN Impact Values (J at -196°C)
9% Ni Steels	A553-82	585	690-825	20	27
OK 92.45	ENiCrMo-3	500	780	35	50
OK 92.55	ENiCrMo-6	>430	>690	>35	>70
OK AUTROD 19.82/ OK FLUX 10.16	ERNiCrMo-3	420	700	40	80

Consumables for Ni Steels

SMAW

OK 92.26

Classification AWS A5.11 ENiCrFe-3

DESCRIPTION

A nickel - based electrode for welding nickel alloys such as inconel 600 and similar Inconel alloys, cryogenic steels, martensitic to austenitic steels, dissimilar steels, heat-resistant steels and castings with limited weldability.

APPROVALS: ABS, SEPROS, UDT.

WELDING CURRENT: DC+

TYPICAL WELDMETAL PROPERTIES

Weldmetal Composition (%)		Typical Mechanical properties of all Weldmetal	
C	≤0.10	YS	410 N/mm ²
Si	0.5	UTS	640 N/mm ²
Mn	7.0	EL	40%
Cr	15.0	Impact Values +20°C	100J
Ni	67.0	-196°C	80J
Nb	1.7		
Cu	<0.5		
Ti	<0.5		
Ta	<0.3		
Fe	7.0		

CURRENT DATA

Diameter (mm)	Length mm	Welding Current, A	Arc voltage, V
2.5	300	50-70	22
3.2	350	65-105	23
4.0	350	75-150	24
5.0	350	120-170	25

OK 92.86

Classification AWS A5.11 ENiCu-7

DESCRIPTION

A nickel-copper electrode for welding NiCu alloys to themselves and to steels and for corrosion resistant surfacing. The weld metal of OK 92.86 is crack resistant and ductile and meets rigorous requirements relating to corrosion resistance in sea water and in reducing and oxidising acids. OK 92.86 is used for welding corrosion - resistant monel alloys within the petroleum and ammonium sulphate industry and in power plants.

WELDING CURRENT: DC+

TYPICAL WELDMETAL PROPERTIES

Weldmetal Composition (%)		Typical Mechanical properties of all Weldmetal	
C	≤0.10	YS	410 N/mm ²
Si	0.5	UTS	640 N/mm ²
Mn	2.5	EL	40%
Ni	66.0	Impact Values +20°C	100J
Nb	<0.3	-196°C	80J
Cu	30.0		
Al	<0.5		
Ti	0.2		
Fe	1.5		

CURRENT DATA

Diameter (mm)	Length mm	Welding Current, A	Arc voltage, V
2.5	300	50-70	22
3.2	350	70-120	26
4.0	350	120-140	28



OK 92.59

Classification AWS A5.11 ENiCrMo-13

DESCRIPTION

OK 92.59 is designed for welding alloy 59, C-276 and 625 Ni-based materials. It is also suitable for welding superaustenitic steels like AISI/ASTM S31254 and S32654.

WELDING CURRENT: DC+

TYPICAL WELDMETAL PROPERTIES

Weldmetal Composition (%)		Typical Mechanical properties of all Weldmetal	
C	<0.02	YS	430 N/mm ²
Si	<0.2	UTS	770 N/mm ²
Mn	<0.2	EL	40%
Cr	23.0	Impact Values +20°C	70J
Ni	62.0	-196°C	60J
Mo	15.5		
Fe	<1.0		

CURRENT DATA

Diameter (mm)	Length mm	Welding Current, A	Arc voltage, V
2.5	300	50-70	20
3.2	350	60-90	21
4.0	350	80-120	22

Consumables for Ni Steels

GMAW

OK AUTROD 19.81

Classification AWS A5.14 ERNiCrMo-13

DESCRIPTION

A continuous, solid, Ni-Cr-Mo electrode for welding high-alloyed materials of the 20Cr-25Ni type with 4-6% Mo and Ni-based alloys of a similar type. It can also be welded in combination with carbon steels. The weld metal has very good corrosion resistance over a wide range of applications in oxidising and reducing media.

APPROVALS: VdTÜV

WELDING CURRENT: DC+

TYPICAL WELDMETAL PROPERTIES

Wire Composition (%)	Typical Mechanical properties of all Weldmetal	
C <0.01	YS	550 N/mm ²
Si <0.1	UTS	750 N/mm ²
Mn <0.5	EL	40%
Cr 23.0	Impact Values -110°C	120J
Ni >56.0		
Mo 15.5		
Fe <1.5		

CURRENT DATA

Diameter (mm)	Welding Current, A	Arc voltage, V
0.8	70-190	20-27
1.0	100-200	21-27
1.2	160-280	24-30
1.6	200-350	25-32

PACKING: The wire can be supplied in plastic or wire basket spool packed in a cardboard box weighing 15kg.

OK AUTROD 19.82

Classification AWS A5.14 ERNiCrMo-3

DESCRIPTION

A continuous, solid, corrosion and heat - resistant, Ni-Cr electrode for welding high-alloyed heat-resistant and corrosion - resistant materials, 9% Ni steels and similar steels with high notch toughness at low temperatures. It is also suitable for joining dissimilar metals of the types mentioned above. The weld metal has very good mechanical properties at high and low temperatures. Good resistance to pitting and stress corrosion.

APPROVALS: UDT, VdTÜV

WELDING CURRENT: DC+

TYPICAL WELDMETAL PROPERTIES

Wire Composition (%)	Typical Mechanical properties of all Weldmetal	
C <0.10	YS	500 N/mm ²
Si <0.5	UTS	780 N/mm ²
Mn <0.5	EL	45%
Cr 21.5	Impact Values +20°C	130J
Ni >60.0	-105°C	120J
Mo 9.0	-196°C	110J
Cu <0.5		
Al <0.4		
Ti <0.4		
Fe <2.0		

CURRENT DATA

Diameter (mm)	Welding Current, A	Arc voltage, V
1.0	100-200	21-27
1.2	160-280	24-30
1.6	200-350	25-32

PACKING: The wire can be supplied in plastic or wire basket spool packed in a cardboard box weighing 15kg.



OK TIGROD 19.81

Classification SFA/AWS A5.14 ERNiCrMo-13

DESCRIPTION

Bare Ni-Cr-Mo rod for welding high - alloyed materials of the 20Cr-25Ni typewith 4-6% Mo and Ni based alloys of a similar type. It can also be welded in combination with carbon steels. The weld metal has very good corrosion resistance over a wide range of applications in oxidising and reducing media.

APPROVALS: VdTÜV

WELDING CURRENT: DC-

TYPICAL WELDMETAL PROPERTIES

Wire Composition (%)		Typical Mechanical properties of all Weldmetal	
C	<0.01	YS	550 N/mm ²
Si	<0.1	UTS	800 N/mm ²
Mn	<0.5	EL	45%
Cr	23.0	Impact Values -110°C	120J
Ni	>56.0		
Mo	15.5		
Fe	<1.5		

PACKING DATA

Diameter (mm)	Length mm	Packing (5 Kg)
1.6	1000	✓
2.0	1000	✓
2.4	1000	✓

OK TIGROD 19.82

Classification AWS A5.14 ERNiCrMo-3

DESCRIPTION

A nickel-based, corrosion - and heat - resistant, 22% Cr, 9% Mo, 3.5% Nb rod for the GTAW of high - alloyed steel, heat - resistant steel, corrosion - resistant steel, 9% Ni steels and similar steel with high notch toughness at low temperatures. It is also suitable for joining dissimilar metals of the types mentioned above. OK TIGROD 19.82 is normally welded with pure Ar as the shielding gas.

APPROVALS: UDT, VdTÜV

WELDING CURRENT: DC-

TYPICAL WELDMETAL PROPERTIES

Wire Composition (%)		Typical Mechanical properties of all Weldmetal	
C	<0.1	YS	550 N/mm ²
Si	<0.5	UTS	780 N/mm ²
Mn	<0.5	EL	40%
Cr	21.5	Impact Values -196°C	130J
Ni	>60.0		
Mo	9.0		
Cu	<0.5		
Al	<0.4		
Ti	<0.4		
Fe	<2.0		

PACKING DATA

Diameter (mm)	Length mm	Packing (5 Kg)
1.6	1000	✓
2.0	1000	✓
2.4	1000	✓
3.2	1000	✓



OK TIGROD 19.85

Classification SFA/AWS A5.14 ERNiCr-3

DESCRIPTION

A nickel-based, corrosion - and heat - resistant, 20% Cr, 3% Mn, 2.5% Nb rod for the GTAW of high - alloyed steel, heat - resistant steel, corrosion - resistant steel, 9% Ni steels and similar steels with high notch toughness at low temperatures. It is also suitable for joining dissimilar metals of the types mentioned above. OK TIGROD 19.85 is usually welded with pure Ar as the shielding gas.

APPROVALS: UDT, VdTÜV

WELDING CURRENT: DC-

TYPICAL WELDMETAL PROPERTIES

Wire Composition (%)	Typical Mechanical properties of all Weldmetal	
C <0.1	YS	440 N/mm ²
Si <0.5	UTS	670 N/mm ²
Mn 3.0	EL	40%
Cr 20.0	Impact Values +20°C	150J
Ni >67.0	-196°C	100J
Cu <0.5		
Ti <0.7		
Fe <3.0		

PACKING DATA

Diameter (mm)	Length mm	Packing (5 Kg)
1.6	1000	✓
2.0	1000	✓
2.4	1000	✓

OK TIGROD 19.93

Classification AWS A5.14 ERNiCu-7

DESCRIPTION

A nickel-based, rod alloyed with about 30% Cu, 2% Ti and 1% Fe for the GTAW of base materials of the same type. It can also be used for joining these alloys to steels. OK TIGROD 19.93 is normally welded with pure Ar as the shielding gas.

APPROVALS: UDT, VdTÜV

WELDING CURRENT: DC-

TYPICAL WELDMETAL PROPERTIES

Wire Composition (%)	Typical Mechanical properties of all Weldmetal	
C <0.15	YS	300 N/mm ²
Si <1.0	UTS	530 N/mm ²
Mn 3.0	EL	45%
Ni 65.0	Impact Values +20°C	130J
Nb <0.5	0°C	140J
Cu 30.0	-20°C	150
Ti 2.3		
Fe 1.5		

PACKING DATA

Diameter (mm)	Length mm	Packing (5 Kg)
1.6	1000	✓
2.0	1000	✓
2.4	1000	✓



OK FLUX 10.16

BASICITY INDEX: 2.4

DESCRIPTION

OK FLUX 10.16 is an agglomerated, non-alloying flux for submerged arc welding. OK FLUX 10.16 is specially designed for butt welding with nickel based alloyed wire and cladding with nickel based alloy strips. The well -

balanced flux composition minimises silicon transfer from the flux to the welding metal, thereby minimising the risk of hot cracking when welding with nickel - based alloys. OK FLUX 10.16 can only be used on DC when butt welding with nickel-based alloy wires. Reverse polarity (DC-) should preferably be used in order to minimise the dilution for the base material and the risk of hot cracking in the weld metal.

TYPICAL WELDMETAL PROPERTIES

OK FLUX 10.16 / OK AUTROD	Chemical Composition (%)						Mechanical Properties			
	C	Si	Mn	Cr	Ni	Mo	YS N/mm ²	UTS N/mm ²	Impacts values Charpy V Notch	
									J	Temp (°C)
19.82	0.01	0.3	0.3	21.0	bal.	9.0	420	700	80	-196
19.85	0.01	0.3	3.2	19.0	bal.	<2.0	360	600	100	-196

PACKING: OK FLUX 10.16 is packed in paper bag containing 25 Kg.



STORAGE AND HANDLING

RECOMMENDATIONS FOR THE STORAGE, REDRYING AND HANDLING OF ESAB COVERED ELECTRODES.

General Information

All covered electrodes are sensitive to moisture re-absorption to a greater or lesser degree. Care must be taken during storage and handling to prevent moisture being re-absorbed.

Storage

Covered electrodes of any type will pick up moisture only very slowly if they are stored under the following climatic conditions:

At Temperatures

During winter, it is possible to have low relative humidity by keeping the temperature in the storeroom at least 10°C above the outdoor temperature. During certain periods in the summer and in a tropical climate, sufficiently low relative humidity can be maintained by air dehumidification.

Redrying

Low-hydrogen basic electrodes should be redried before use whenever there are application requirements relating to weldmetal hydrogen content and / or radiographic soundness (not needed for VacPac®).

Acid rutile stainless electrodes and all types of basic electrodes may produce pores in the weld if they have not been stored in sufficiently dry conditions. Redrying the electrode will restore their usability.

Mild steel rutile and acid electrodes normally need no redrying.

Cellulose electrodes must not be redried.

Electrodes which are seriously damaged by moisture can normally not be redried. These electrodes should be scrapped.

Redrying Conditions

Redrying temperatures and holding times are specified on the label and in the product specification.

The redrying temperature is the temperature in the bulk of the electrodes.

The redrying time is measured from the point at which the redrying temperature has been reached.

Do not stack more than four layers of electrodes in the redrying oven.

It is recommended not to redry covered electrodes more than three times.

Holding Oven

The holding oven is used for intermediate storage to avoid moisture pick-up in the coating of low - hydrogen electrodes and acid rutile stainless electrodes. The electrodes which should be stored in the holding oven are:

1. Electrodes that have been redried.
2. Electrodes that have been removed from their hermetically - sealed container.
3. Electrodes that are considered to be in good condition and are transferred directly from the store room after unpacking.

Holding over temperature : 120 - 150°C

Precautions on Site

Keep the electrodes in electrically - heated quivers at a minimum temperature of 70°C. After work return the remaining electrodes to the holding oven.

Damaged Coating

Mechanically damaged electrodes on which parts of the coating are missing will not perform correctly and should be scrapped.

VacPac®

Electrodes in VacPac® will not pick up any moisture during storage. They require no redrying before use, provided the package is undamaged. This is indicated by a vacuum in the package.

Handling VacPac® Electrodes

Protect VacPac® from damage at all times.

The outer board packaging offers extra protection from mechanical damage to the metal foil. Handle the single inner, metal foil, VacPac® with special care.

Do not use a knife or any other sharp object to open the outer board packaging.

Before using VacPac® Electrodes

Check if the protective foil still contains a vacuum. If the vacuum has been lost, redry the electrodes before use.

Cut open the protective foil at one end.

Do not take out more than one electrode at a time, thereby, ensuring that the remaining electrodes are still protected inside the package. Put the top back on the plastic capsule.

Discard or redry electrodes that have been exposed to the atmosphere in an opened VacPac® for more than 8 hours.

STORAGE AND HANDLING RECOMMENDATIONS FOR OK TUBROD / DUAL SHIELD / COREWELD / CORED WIRES.

Cored wire should be stored in conditions which prevent the accelerated deterioration of products or packaging. All cored wires should avoid direct contact with water or moisture. This could take the form of rain or the condensation of moisture on a cold wire.

Cored wires must be stored in dry conditions. The relative humidity and temperature should be monitored and the temperature should not fall below the dew point.

To avoid condensation, the wire should be kept in the original packaging and, if necessary, left to warm up to at least the ambient temperature before opening the package.

Other hydrogen-containing substances, such as oil, grease and corrosion, or substances that could absorb moisture must also be avoided on the wire surface.

Products must be stored in such a way as to avoid damage during storage.

STORAGE AND HANDLING RECOMMENDATIONS FOR OK FLUX

ESAB fluxes, have a guaranteed as-manufactured moisture content from the factories. This moisture content is well - controlled by internal ESAB specifications. Before transport, each pallet is shrink wrapped in plastic foil. This precaution action is done in order to maintain the as-manufactured moisture content as long as possible. Flux should never be exposed to direct wetness such as rain or snow.

Storage

- Unopened flux bags must be kept under properly maintained storage condition as follows:
- Temperature : 20 +/- 10°C
- Relative humidity : as low as possible - not exceeding 60%.
- The content of unprotected flux hoppers should 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 should be placed at a temperature of 150 +/- 25°C

Recycling

- Moisture and oil must in a suitable way be removed from the pressure air used in the recycling system.

- Addition of new flux must be done with the proportion of at least one part new flux to three parts recycled flux.

Foreign material such as millscale, dross etc. should be removed by a suitable system such as sieving.

Redrying

When handled and stored as above, the ESAB fluxes can normally be used as they are.

If, however, a severe application is considered, as given by the applicable material specification, redrying of the flux is recommended.

Furthermore, if the flux, due to unfavourable handling or storage, has picked up moisture, redrying can return the flux to its original state regarding moisture.

Redrying shall be performed as follows:

Agglomerated fluxes : 300 +/- 25°C for about 2-4 hours.

Redrying must be done on shallow plates with a flux height not exceeding 50 mm. Redried flux, not immediately used, must be kept at 150 +/- 25°C before use.



HANDWELDING ELECTRODES

Official approval

In addition to the official approval given in this catalogue, many electrodes are approved by shipping societies, Defence authorities, railway boards, private companies and so on. Information about the different types of approval is available on request.

Tensile properties

Unless otherwise stated, tensile properties refer to all weld metal test pieces prepared according to the rules of the classification societies using 4 and 5 mm diameter electrodes.

Welding current

Maximum and minimum values are given. The most suitable welding current depends largely on the size of the workpiece, the welding position and the type of joint.

Small workpieces require a lower current, larger workpieces a higher current, depending on the dissipation of heat from the joint.

Cold cracking

Cold cracking will only occur if the following three factors are present at the same time:

1. Hard phases in the weld, preferably martensite
2. Sufficient stress
3. Hydrogen dissolved in the weld metal

Hard phases form when the weld is cooled rapidly from melting temperature to room temperature. Alloying elements, mostly carbon, are forced to dissolve in the weld metal and make it brittle. The following formula describes this process in the case of standard carbon - manganese steel:-

$$E_c = \%C + \frac{\%Mn}{6} + \frac{\%(Cr+Mo+V)}{5} + \frac{\%(Ni+Cu)}{15}$$

Steels with $E_c=0.35$ and below are usually weldable without any problems at normal steel sizes. For the more highly alloyed steels and steels with thicker dimensions, an elevated working temperature is necessary in order to reduce the cooling rate.

The elevated temperature also allows the hydrogen to diffuse.

To determine elevated working temperatures, please consult BS 5135: 1984 or SS 064025. If the E_c dimension of the plates and heat input are known, these standards will state whether heating is necessary and the level at which it should take place.

Tension cannot be avoided when welding, as steel expands when heated, although correct planning and heat treatment can reduce tension considerably.

Hydrogen forms from water in the surroundings and from the electrode coating. The water is divided into oxygen and hydrogen in the arc and the hydrogen in particular has a strong tendency to dissolve in the weld metal and initiate cold cracking.

Conclusion : Dry basic electrodes when there is risk of cold cracking.

Labelling

The electrode type is clearly marked on the coating of each electrode near the grip end, e.g. ESAB 36H.

GENERAL INFORMATION

Choice of suitable electrode

The electrodes in this catalogue are placed into groups according to the type of alloy deposited. Within each group of electrodes for welding mild, low-alloy and stainless steels, there are several cases in which many different electrodes are designed for welding the same type of steel. So, for each steel grade, there are often a large number of electrode types to choose from, all of which produce similar weld metal compositions but have different coatings, welding properties, welding speeds and weld metal quality. This large choice makes it possible to choose the electrode which produces the right weld metal quality at the lowest cost.

When selecting an electrode, the first rule is to select one which produces a weld metal quality equal to or better than that of the base material and, when necessary, is approved for the material in question. Welding position and type of joint are other factors which influence the choice of electrode, as different welding positions and types of joint.

General information about the influence of coating type on welding properties, welding speed and weld metal quality

Rutile electrodes giving about 100% weld metal recovery are easy to strike and use and are particularly suitable for short welds in mild steel, for fillet welds, for welding sheet steels and for bridging large joint gaps. The welds have a fine finish and spatter losses are negligible. The welding speed is moderate.

Unalloyed electrodes

Unalloyed rutile electrodes are not normally recommended for welding steel with a nominal tensile strength exceeding 440 MPa (45 kg/mm²). Rutile electrodes are relatively insensitive to moisture.

High-efficiency rutile electrodes

High-efficiency rutile electrodes generally produce a higher welding speed, which increases as the weld metal recovery increases. Eg. ESAB C23S.

They are all easy to use, produce excellent slag detachability, fine bead appearance and are particularly suitable for welding horizontal/vertical fillets. The weld metal has tensile properties which are as high as, or somewhat higher than, those of the weld metal from unalloyed basic electrodes but have lower elongation and impact strength.

The evenness of the weld and the smooth transition of the base material make joints produced with rutile electrodes at least as good in terms of fatigue strength as unmachined joints. Unalloyed rutile electrodes, irrespective of their efficiency, can be recommended for welding mild steel with a nominal tensile strength of 440 MPa (45 kg/mm²). When it comes to the tensile strength of the deposit, rutile electrodes can also be used for welding steels with a nominal tensile strength of more than 440 MPa (45 kg/mm²), but, as a general rule, only electrodes producing a weld metal with a low hydrogen content, e.g. basic, rutile basic or zircon-basic electrodes, should be used to weld these steels.

Unalloyed basic electrodes

Unalloyed basic electrodes give moderate welding speed in the flat position but are faster than other types when welding vertically upwards. The reason for this is that basic electrodes can be deposited at a higher current in the vertical position than other types of electrode. In addition, the amount of weld metal deposited per electrode is greater than that of other electrodes which can be used in this position. This results in a smaller number of electrode changes. The normal result is therefore a higher fusion rate and higher arctime factor when welding vertically upwards with basic electrodes compared with other types.

The slag is normally not quite as easy to remove as the slag from acid or rutile electrodes, but, in spite of this, it can be classed as easily detachable. The slag from basic electrodes has a lower melting point than that from rutile or acid electrodes. The risk of slag inclusions during normal production welding is therefore unusually small when basic electrodes are used, even if the slag is not completely removed between beads during multi-run welding.

The weld metal from basic electrodes has a low hydrogen content and usually has good toughness even at low temperatures. Basic electrodes are less likely to produce either hot cracks or cold cracks compared with other types of electrode. The superiority of basic electrodes from this point of view appears when welding manganese alloyed structural steels, pressure-vessel steels and ship's plate with a nominal tensile strength of 490-530 MPa (50-54 kg/mm²). The higher the hardenability of the steel to be welded, the greater the necessity to use basic electrodes and the greater the need for low moisture content in the coating.



Cellulose electrodes

Cellulose electrodes are easy to use in all welding positions and are particularly good for vertical and overhead welding. Cellulose electrodes are recommended for all-positional welding where the mechanical properties of the deposit are of the greatest importance and radiographic requirements must be met. Vertical and overhead welding often require an electrode one size larger in comparison to electrodes with other types of coating. Cellulose electrodes are extremely good for vertical-down welding.

Higher tensile steel requires preheating and higher interpass temperatures than when the welding is done with low-hydrogen electrodes.

Approval in accordance with classification society rules

Welding materials are normally classified by ESAB in accordance with a standard, e.g. AWS and EN. To verify mechanical properties they are also approved in accordance with the rules of the classification societies.

Classification

The Classification of welding products refers to standards and, when a welding product is classified, its type, properties and field of application are given. The manufacturer verifies the correct classification of a product by internal testing and / or by witness of an outside organisation.

Approval

Ship owners and partners in offshore enterprises require welding consumables to be approved in accordance with the rules of the classification societies. Approval is also required by clients in accordance with national or international standards for boiler and pressure vessels as well as other standards to be verified by an authorized approval institute.

Approved welding products are entered on the "List of Approved Welding Consumables: distributed annually by the societies and other institutes.

This catalogue provides information about the welding position, current/polarity, low hydrogen and grading.

Non-alloyed and low-alloyed steels

Consumables are divided into three categories based on their tensile strength level:

Normal strength steel : Indicated by the numbers 1, 2 or 3 (e.g. 3.3M) that the electrode is to be used in steel with a minimum yield strength (ReH) of 305 and a tensile strength (Rm) of 400-560 MPa.

High strength Steel : Indicated by 2Y, 3Y, 4Y, 5Y (ReH min 375 and Rm 490-660 MPa) and 2Y40,3Y40, 4Y40 (ReH min 400 and Rm 510-690 MPa)

Extra high strength steel : Indicated by 3Y42, 4Y42, 5Y42 up to 5Y69 and so on for the different strength steel categories, where the numbers 42...69 symbolize a yield strength in MPa indicating that the electrodes can be used for extra high tensile steels.

Toughness level

Each steel category is divided into three to five toughness levels represented by the first digit in the grade (1, 2, 3, 4 or 5)

- 1 suitable for grade A steel (impact tested at 20°C)
- 2 suitable for grade A, B and C steels (impact tested at 0°C)
- 3 suitable for grade A, B, D and E steels (impact tested at -20°C)
- 4 suitable for grade A, B, D, E and F steels (impact tested at -40°C)
- 5 suitable for grades A, B, D, E and F steels (impact tested at -60°C)

Other frequently used abbreviations

T	two-run welding (submerged arc welded with one run from each side)
M	multi-run welding (submerged arc or automatic gas-shielded arc welding)
S	semi-automatic, gas-shielded and flux - flux - cored arc welding
H5, H10, H15	low - hydrogen welding consumables
DP	deep penetration

Stainless steel and other high-content alloyed steels

Grades of stainless steel for which the welding consumable is approved are indicated with respect to one or more of the types of stainless steels : 304L, 304LN, 316LN and so on.





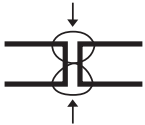
The abbreviation SS/CMn indicates approval for joining any of the austenitic types of stainless steel to any of the normal strength or higher tensile ship steels. Dup/CMn indicates approval for joining any of the duplex types of stainless steel to any of the normal strength or higher tensile ship steels.

The system described for grading the consumables in accordance with the rules of the classification societies changes as new steels appear on the market and sometimes there are changes to the approval ratings which might mean that the handbook may not be currently up-to date. To ensure that valid information is used, please request the latest issued Product Data Sheet for the consumables and / or the latest edition of the "List of Approved Consumables" and approval certificates from the most recent annual repeat test.

Calculation of electrode consumption

In the tables, joint cross section, theoretical joint volume and kg weld metal per metre length of welded joint are given. The electrode consumption per metre of welded joint is obtained by dividing the number of kg of weld metal by N, where N is the kg of weld metal per kg of electrode and is given for each electrode on their respective pages.

Square butt joints: Joint volumes and weld metal weights

Position	Plate thickness mm	Gap mm	Volume/length cm ³ /m	Weight/length weld metal kg/m
 Flat	1	0	2	0.02
	1.5	0.5	3	0.02
	2	1	4	0.03
	3	1.5	7	0.05
 Flat	4	2	17	0.13
	5	2	21	0.16
	6	2.5	27	0.21
	7	3	36	0.28
 Horizontal-Vertical	1	0	2.5	0.02
	1.5	0.5	4	0.03
	2	1	5	0.04
	3	1.5	9.5	0.07
 Horizontal-Vertical	4	2	22	0.17
	5	2.5	25	0.20
	6	3	32	0.25
	7	3	42	0.33
 Overhead	4	2	9	0.07
	5	2	10.5	0.08
	6	2.5	13	0.10
	7	3	16	0.13
	4	2	10.5	0.08
	5	2	16	0.13
	6	2.5	18	0.14
7	3	21	0.16	

Calculation of electrode consumption Single V-joints: volumes and weld metal weights

Plate thickness mm	Gap mm	50° Flat			60° Flat			70° Vertical			80° Overhead			60° Horizontal-Vertical		
		Flat			Flat			Vertical			Overhead			Horizontal-Vertical		
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
4	1	11.5	11	0.09	13	12.5	0.10	15	16.5	0.13	17.5	18	0.14	13	14.5	0.11
5	1	16.5	16	0.13	19.5	19	0.15	22.5	24.5	0.19	26	28	0.22	19.5	21	0.16
6	1	23	21.5	0.17	27	25.5	0.20	31	37	0.29	36	38.5	0.30	27	30	0.24
7	1.5	33.5	32.5	0.26	39	38	0.30	45	49	0.38	51.5	56	0.44	39	42	0.33
8	1.5	42	40	0.31	49	46.5	0.37	57	59.5	0.47	65.5	70	0.55	49	56	0.44
9	1.5	51	48	0.38	60.5	56	0.44	70	75.5	0.59	81.5	87.5	0.69	60.5	65	0.51
10	2	66.5	62	0.49	77.5	72	0.57	90	96.5	0.76	104	109	0.86	77.5	81	0.64
11	2	78.5	71.5	0.56	92	83.5	0.66	107	113	0.89	124	130	1.02	92	96.5	0.76
12	2	91	83	0.65	107	97.5	0.77	125	134	1.05	145	157	1.23	107	113	0.89
14	2	120	110	0.86	141	130	1.02	165	171	1.34	193	204	1.60	141	159	1.17
15	2	135	123	0.97	160	146	1.15	188	197	1.55	219	231	1.81	160	171	1.34
16	2	151	132	1.04	180	157	1.23	211	223	1.75	247	257	2.02	180	186	1.46
18	2	189	170	1.33	223	204	1.60	263	276	2.17	308	320	2.51	223	233	1.83
20	2	227	208	1.63	271	247	1.94	320	334	2.62	376	396	3.11	271	281	2.21
25	2	341	313	2.46	411	375	2.94	488	510	4.00	577	606	4.76	411	425	3.34

1 Theoretical volume cm³/m

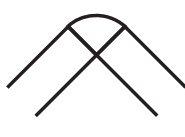
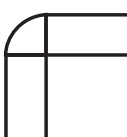


2 Actual joint volume cm³/m (taking account of transverse shrinkage)

3 Deposited weld metal kg/m


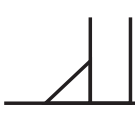


The first run and backing run V-joints: Weld metal weights

Position	Plate thickness mm	Weight/length kg/m	Electrode diam mm
Flat	6-12	0.10	3.25
Flat	> 12	0.15	4
Vertical	> 8	0.15	3.25
Horizontal-Vertical	> 8	0.15	3.25
Overhead	> 10	0.10	3.25

Calculation of electrode consumption
Corner welds: Actual joint volumes and weld metal weights

Plate thickness	Section size								
		mm	mm ²	cm ³ /m	kg/m	cm ³ /m	kg/m	cm ³ /m	kg/m
2	2	3.5	0.03	3	0.02	3.5	0.03	3.5	0.03
3	4.5	7	0.05	7	0.05	7	0.05	7.5	0.06
4	8	9	0.07	9	0.07	9.5	0.07	10.5	0.08
5	12.5	13	0.10	13.5	0.11	14.5	0.11	16	0.13
6	18	18.5	0.15	19.5	0.15	21	0.16	22	0.17
7	24.5	25.5	0.20	26.5	0.21	27.5	0.22	31.5	0.25
8	32	33	0.26	34.5	0.27	36	0.28	40.5	0.32
9	40.5	41.5	0.33	43	0.34	45.5	0.36	51	0.40
10	50	51.5	0.40	53.5	0.42	56	0.44	64	0.50
11	60.5	63	0.49	67	0.53	72	0.57	78.5	0.62
12	72	74.5	0.58	79	0.62	84.5	0.66	93	0.73
15	113	116	0.91	123	0.97	132	1.04	141	1.11
18	162	167	0.31	174	1.37	190	1.49	204	1.60
20	200	206	1.62	206	1.62	227	1.78	252	1.98
22	242	248	1.95	255	2.00	275	2.16	204	2.39
25	323	329	2.58	331	2.60	370	2.90	405	3.18

Fillet welds: Actual joint volumes and weld metal weights

Throat thickness	Section size								
		mm	mm ²	cm ³ /m	kg/m	cm ³ /m	kg/m	cm ³ /m	kg/m
2	4	5	0.04	6	0.05	5.5	0.04	5.5	0.04
2.5	6.5	7.5	0.06	8.5	0.07	8	0.06	8.5	0.07
3	9	10.5	0.08	12.5	0.10	11	0.09	12	0.09
3.5	12.5	14	0.11	16	0.13	15	0.12	16.5	0.13
4	16	18	0.14	21	0.16	19.5	0.15	22	0.17
4.5	20.5	22.5	0.18	26	0.20	24.5	0.19	26.5	0.21
5	25	27.5	0.22	31.5	0.25	30.5	0.24	33	0.26
5.5	30.5	33.5	0.26	37	0.29	36	0.28	40.5	0.32
6	36	40	0.31	42	0.33	43	0.34	47.5	0.37
6.5	42.5	46.5	0.37	49.5	0.39	51	0.40	56	0.44
7	49	54.5	0.43	57	0.45	56	0.44	65	0.51
7.5	56.5	60.5	0.47	65	0.51	64	0.50	73.5	0.58
8	64	70	0.55	73.5	0.58	76.5	0.60	82.5	0.65
9	81	88	0.69	94	0.74	95	0.75	109	0.86
10	100	108	0.85	114	0.89	116	0.91	130	1.02
11	121	131	1.03	138	1.08	143	1.12	157	1.23
12	144	155	1.22	162	1.27	169	1.33	188	1.48
13	169	179	1.41	190	1.49	195	1.53	220	1.73
14	196	207	1.62	224	1.76	227	1.78	257	2.02
15	225	237	1.86	248	1.95	264	2.07	294	2.31

The weight of welding electrodes or welding wire necessary to complete a given weld joint may be calculated by the formula:

$$P = \frac{WL}{E}$$

P = Weight of electrode or wire required

W = Weight per unit length of weldmetal

L = Length of weld (meter)

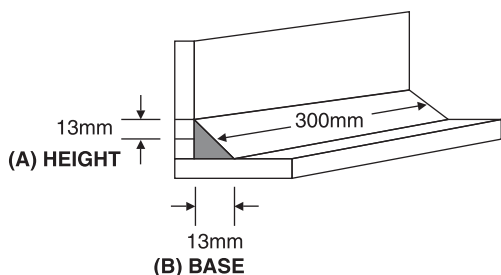
E = Deposition efficiency

WEIGHT PER UNIT LENGTH OF WELDMETAL

For calculating the weight of weldmetal requires, we consider the following items.

1. Area of cross-section of the weld
2. Length of the weld
3. Volume of the weld in cubic centimetre
4. Weight of the weldmetal per cubic centimetre

The area of the cross-section (the triangle) in the fillet weld shown below is equal to one half the base times the height. The volume of the weld is equal to the area times the length, and the weight of the weld then, is the volume times the weight of the material (steel) per cubic centimetre.



This example is for a fillet weld with no reinforcement. Similar calculations can be made for butt or lap joint. The table on following pages lists the weight per metre of fillet and the more common butt joints.

DEPOSITION EFFICIENCY

The deposition efficiency of an electrode or welding wire indicates the portion of that product you can expect to be deposited as weldmetal. Losses due to slag, spatter, fume and in the case of semi automatic or automatic welding processes, the ends cut before each weld and the wire left in the feed cable make no process 100% efficient.

For estimates of electrode or wire consumption, the following average values of deposition efficiency may be used.

PROCESS	DEPOSITION EFFICIENCY
Submerged Arc	99%
Gas Metal Arc (98% Ar, 2% O ₂)	98%
Gas Metal Arc (75%Ar, 25% CO ₂)	96%
Gas Metal Arc (CO ₂)	93%
Metal Cored Wires	93%
Gas Shielded Flux Cored Wires	85%
Self Shielded Flux Cored Wires	82%
* Shielded Metal Arc (Stick 300 mm long)	59%
* Shielded Metal Arc (Stick 350 mm long)	62%
* Shielded Metal Arc (Stick 450 mm long)	66%

* Includes 2" stub loss.

It must be remembered that when deposition tests are performed in the laboratory, the deposition efficiency is calculated by the formula:

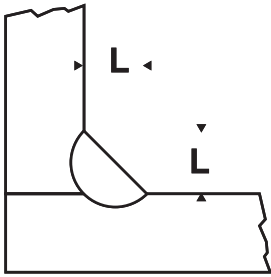
$$\text{Deposition Efficiency} = \frac{\text{Weight of metal deposited}}{\text{Weight of electrode consumed}}$$

This does not take stub loss into consideration. The chart below shows how the length of the stub effects the laboratory-established efficiency.

STUB LOSS CORRECTION TABLE FOR COATED ELECTRODES

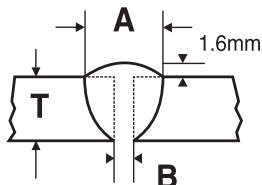
	Deposition Efficiency	50mm STUB	75mm STUB	100 mm STUB	125mm STUB
300 mm ELECTRODE	60%	50.00%	45.00%	40.00%	35.00%
	65%	54.20%	46.70%	43.30%	37.90%
	70%	58.30%	52.50%	46.60%	40.80%
	75%	62.50%	56.20%	50.00%	43.70%
350 mm ELECTRODE	60%	51.40%	47.10%	42.90%	38.30%
	65%	55.70%	51.1 0%	46.40%	41.00%
	70%	60.00%	55.00%	50.00%	45.00%
	75%	64.30%	56.90%	53.60%	46.20%
450 mm ELECTRODE	60%	53.30%	50.00%	46.60%	43.30%
	65%	57.70%	54.20%	50.50%	46.90%
	70%	62.20%	56.30%	54.40%	50.50%
	75%	66.60%	62.50%	56.30%	54.20%
	80%	71.10%	66.60%	62.20%	57.70%

The following tables show the estimated weight of consumables for some of the common weld joints.



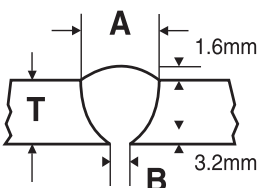
Horizontal Fillet Weld

Fillet Size L (mm)	Weldmetal Required Kg/m	Weight of electrode/Wire required per unit length of weld (Kg/m)			
		SMAW	GMAW	FCAW	Metal Cored
3	0.04	0.06	0.04	0.05	0.04
5	0.09	0.15	0.10	0.11	0.10
6	0.16	0.26	0.17	0.19	0.17
8	0.25	0.40	0.26	0.29	0.27
10	0.36	0.58	0.38	0.43	0.39
13	0.64	1.04	0.67	0.76	0.70
16	1.00	1.62	1.06	1.18	1.09
19	1.44	2.33	1.53	1.70	1.57
25	2.56	4.14	2.70	3.02	2.79



Square Butt Joint

Joint Dimensions (mm)			Weldmetal Required kg/m	Stick Electrode Required kg/m
T	B	A		
5	1.5	10	0.14	0.22
6	1.5	11	0.17	0.28
	2.5		0.21	0.34
8	1.5	13	0.20	0.33
	2.5		0.25	0.40



Single - V Butt Joint

Joint Dimensions (mm)			Weldmetal Required kg/m	Stick Electrode Required kg/m
T	B	A		
6	2.0	8	0.19	0.31
8	2.5	10	0.34	0.54
10	3	13	0.53	0.86
13	3	16	0.80	1.27
16	3	21	1.31	2.12
19	3	24	1.84	2.96
25	3.2	32	3.18	5.12

WEIGHT PER METER OF WELDMETAL FOR FILLET WELDS AND ELEMENTS OF COMMON BUTT JOINTS
INSTRUCTION

1. Make a drawing of the cross-section of the joint to exact scale.
2. Divide the cross-section into right triangles, rectangles and sketch in the desired reinforcement.
3. Dimension the thickness, angles, angle leg length, root opening and the length and height of the reinforcement.
4. Total the weight per meter of each of the elements from the chart for the weight per meter of the weld.

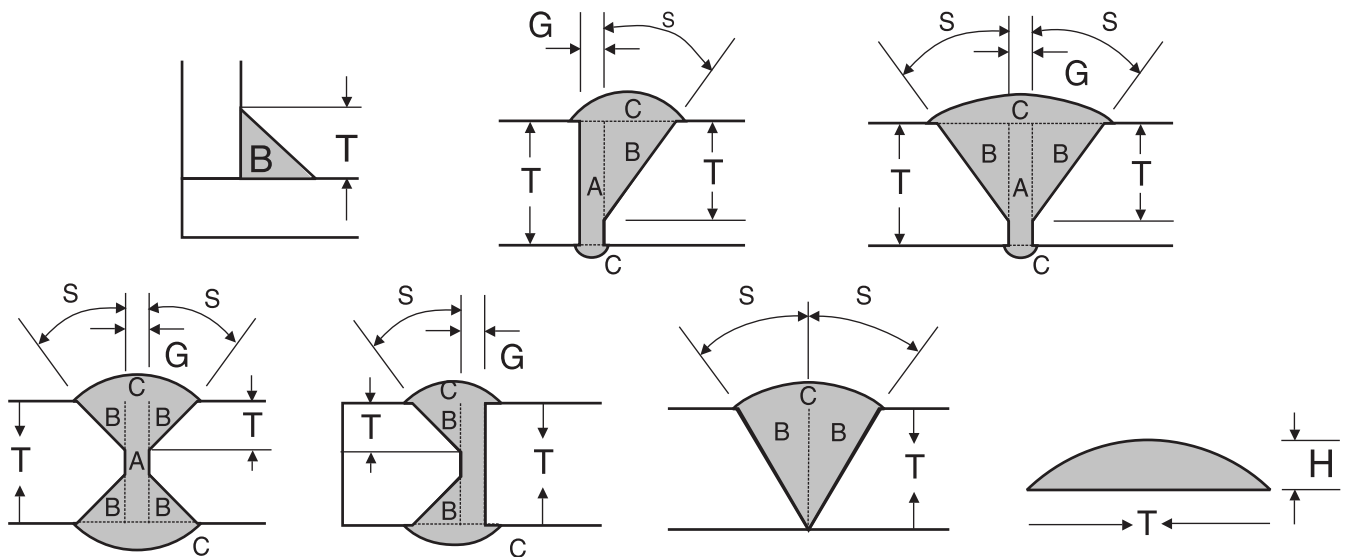
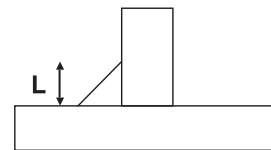
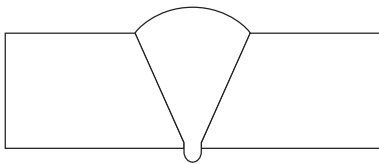

ANGLE 'V' JOINT - 60° Included Angle 'V'
FILLET WELD


PLATE THK Mm	ROOT GAP mm	THEORETICAL VOLUME mm	Weld cm3/m	WEIGHT WELD METAUm kg/m
4	1	13	12.5	0.1
5	1	19.5	19	0.15
6	1	27	25.5	0.2
7	1.5	39	38	0.3
8	1.5	49	46.5	0.37
9	1.5	60.5	56	0.44
10	2	77.5	72	0.57
11	2	92	83.5	0.66
12	2	107	97.5	0.77
14	2	141	130	1.02
15	2	160	146	1.15
16	2	180	157	1.23
18	2	223	204	1.6
20	2	271	247	1.94
25	2	411	375	2.94

FILLET SIZE mm	THEORETICAL WELD VOLUME cm3/m		WEIGHT WELD METAUm kg/m	
	L	T	L	T
2		6.0		0.05
3	4.5	12.5	0.036	0.10
4	8.0	21.0	0.064	0.16
6	18.0	42.0	0.142	0.33
8	32.0	73.0	0.252	0.58
10	50.0	114.0	0.394	0.89
12	72.0	162.0	0.567	1.27
15	112.0	248.0	0.887	1.85
18	162.0		1.277	
20	200.0		1.576	
25	312.5		2.463	

The figures above are for accurate weld volumes of exact dimensions. In practice it is difficult to obtain mitre shaped fillet welds, actual welds are generally convex in profile and an allowance of approximately 15% should be made when calculating consumable requirements.



DATA SHEETS - PIPE WELDING

ESAB Pipe Welding Electrodes

The following electrodes are specially designed for Pipe-welding

Designation	AWS classification	For line pipe steels API 5 LX
Pipeweld 6010	E 6010	X42,X46
Pipeweld 6010		
OK 22.46 P	E 7010	X46,X52,X56
OK 22.47 P	E 8010-G	X60,X65

Pipeweld 6010 is ideally suited for root bead welding. The welding technique, i.e. the use of Pipeweld 6010 for the root bead and also in some cases for the hot pass, together with a high strength electrode for the other passes, gives maximum resistance to cracking.

The practical technique is described in detail in the following pages.

Joint Preparation

Careful joint preparation, as shown in fig.1, is of utmost importance to achieve a perfect weld. With flame-cut edges the required tolerance are in general not obtained, so it has become common practice to machine the pipe ends. To avoid porosity and lack of fusion the weld faces must be free from foreign matter, such as oil, grease, mill scale, dirt and other destructive material.

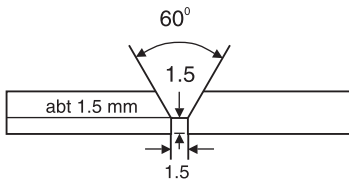
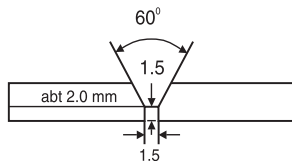


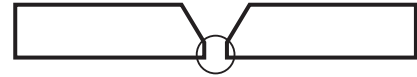
Fig. 1 Recommended joint preparation for pipe diameters up To 300 mm. Pipeweld 6010, 3.20 mm dia. for root bead.



For pipe diameters larger than 300 mm. Electrode Pipeweld 6010, 3.20 or 4 mm dia. for root beads.

Welding Procedure and Technique

The following schedule shows the range of application for all the electrode grades indicated. Selection of these electrodes depends on the line pipe steel grade used.



Root pass Pipeweld 6010 3.20 or 4 mm dia.



Filler passes
Pipeweld 6010
OK 22.46 P
OK 22.47 P
4 or 5 mm dia.



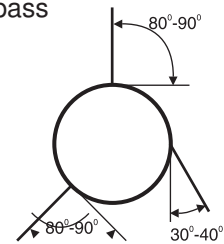
Hot pass Citoflex
OK 22.46 P
OK 22.47 P
4 or 5 mm dia.



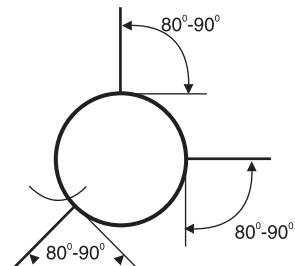
Capping pass
Pipeweld 6010
OK 22.46 P
OK 22.47 P
4 or 5 mm dia.

ESAB Pipe Welding Electrodes

Welding the hot pass



Welding the root bead, filler And capping passes



Line Pipe Steel Grades

The most common steels used for oil and gas cross-country pipelines conforming to API 5 L, 5 LS, and 5 LX.

Table 1, shows the chemical requirements to API Standard 5 LX for the individual line pipe steel grades. Chemistry of the pipe material is an important consideration prior to welding; otherwise difficulties may be experienced on high strength pipe material from the high carbon and manganese contents, particularly in cold weather. It is therefore advisable, depending on the surrounding temperature and weather conditions, to preheat the entire pipe circumference before applying the stringer bead.

Table 2, Shows the physical requirements to API 5 LX.

Composition and characteristics of cellulose pipeline electrodes

Cellulose electrodes contain a high amount of organic material; about 35% of the coating consist of cellulose powder, which in the arc is transformed into a shielding gas at high pressure. This results in a fierce, concentrated arc giving deep penetration. This is one of the reasons why cellulose pipeline electrodes - even in large electrode diameters - can be used for vertical down welding with excellent results.

Welding current ranges (DC positive or negative)

ESAB Designation	AWS Classification	Electrode diameters (mm) and currents (amp)		
		3.25	4.0	5.0
Pipeweld 6010	A5.1:E 6010	50-150	120-200	160-250
OK 22.46 P	A5.1:E 7010-G	50-150	120-200	160-250
OK 22.47 P	A5.1 :E 8010-G	50-150	120-200	160-250

Selecting the correct electrodes for API 5 LX steels

API 5 LX Grade	Esab Pipe Welding Electrode								
	Pipeweld 6010			OK 22.46 P			OK 22.47 P		
	root bead	hot pass	filler and cover	root bead	hot pass	filler and cover	root bead	hot pass	filler and cover
X42	X	X	X						
X46	X	X	X						
X52	X	X		X	X	X			
X56	X	X		X	X	X			
X60	X	X		X	X	X		X	X
X65	X	X						X	X
X70	X	X						X	X

Table 1: Chemical requirements

API 5 LX Grade	Ladle analysis %					
	Cmax.	Si	Mn	Nbmin.	Vmin.	Ti
X42	0.28	-	<1.25	-	-	-
X46	0.28	-	<1.25	-	-	-
X52	0.28	-	<1.25	-	-	-
X56	0.26	-	<1.35	0.005	0.02	0.03
X60	0.26	-	<1.350	.005	0.02	0.03
X65	0.26	-	<1.35	0.005	0.02	-
X70	0.23	-	<1.60	-	-	-

Table 2: Physical requirements

API 5 LX Grade	Yield stress min. N/mm ² (psi)	Tensile strength min. N/mm ² (psi)	Elongation min.%
X42	290 (42)	410 (60)	25
X46	315 (63)	430 (63)	23
X52	360 (66)	450 (66)	22
X56	385 (56)	490 (71)	22
X60	415 (60)	520 (74)	22
X65	450 (65)	550 (77)	20
X70	485 (70)	580 (85)	20



General recommendations

GMAW

GMAW - Gas Metal Arc Welding

The electrodes and joint faces should be clean. This is particularly important when welding aluminium and aluminium alloys. The shielding gasses which are used must be of a purity suitable for welding. Moisture in the gas can produce porous welds.

Shielding gas for mild and low-alloy steels

Carbon dioxide, CO₂, is the cheapest and most commonly used gas and, in most cases, it produces satisfactory welds in both mild and low alloy steel.

Mixed gas, of which the most commonly used consists of 80% Ar + 20% CO₂, is clearer than pure CO₂ but produces a softer arc, quieter welding, better bead appearance and less spatter. It is therefore often used, in spite of its higher price, for welding sheet steel 0.8-1.5 mm thick, which is more difficult to weld with pure CO₂. A further advantage of mixed gas is the higher quality, in particular notch toughness, compared with CO₂. For this reason, mixed gas is often recommended for welding low-alloy steels, such as creep-resistant steels, even in thicknesses greater than 1.5 mm. Mixed gas of the 80/20 type, in which the argon is of a lower purity, is also available. These gases are less expensive than those based on pure argon and can often be used with equally good results.

One drawback of argon/CO₂ mixtures is that they lead to increased ozone formation, compared with pure CO₂, when used as shielding gas in arc welding.

Another drawback when using the mixture is that the current load capacity of the welding gun is reduced by about 30% compared with welding with CO₂.

Shielding gas for stainless and heat resistant steels

Argon containing 1% oxygen is normally used for welding stainless and heat-resistant steels, but argon containing 2% O₂ or 5% O₂ is also available. The latter produces a more fluid weld pool. A shielding gas which consists of 98% argon + 2% CO₂ has gained favour for MIG welding stainless steels. It can often replace argon/helium mixtures, which are used to help fusion when welding thick stainless steel, and can very often replace argon/oxygen mixtures.

Choice of welding Process

Short arc or spray arc

The electrodes for gas metal arc welding listed in these pages are suitable for short arc welding in the smallest diameters and for spray arc welding in diameters 1.2-2.4 mm. Short arc welding (welding with short circuiting droplet transfer) can be carried out in all positions and is the best process for welding sheet material approximately 0.8-3 mm thick and for making the root run in prepared butt joints.

Spray arc welding (welding with finely divided free flight drop transfer) is carried out at higher currents and voltages than short arc welding and is therefore generally faster and more economical than short arc welding for plate thicknesses exceeding 2 - 3 mm. It is only used for welding in the horizontal or horizontal/vertical positions. The gas consumption is 6-10 litres/min for short arc welding and 12-20 litres/min for spray arc welding. The higher the welding current, the higher the gas flow required.

Welding technique

The welding gun is normally held in the right hand, which means that the weld is made from right to left with the gun directed away from the deposited weld at an angle of 75-80° between the electrode and the workpiece, thereby giving the operator a good view of the weld pool and the joint. This produces a smoother weld bead than if the gun is directed towards the finished weld.

Abbreviations

MIG welding = metal inert gas welding = metal arc welding in an atmosphere consisting mainly of an inert gas such as argon.

MAG welding = metal active gas welding = metal arc welding in an atmosphere consisting of an active gas, usually carbon dioxide. Gas mixtures containing 20% or more CO₂ are usually classified as active.



DATA SHEET - GTAW/GMAW

Solid wire classification for GTAW/GMAW

Indicates in 1000 PSi increments the minimum tensile strength of the weldmetal produced by the electrode when tested according to A5.18 specification. In this case 70 indicate 70,000 PSi.

ER 70 S - X

E indicates a filler wire/rod

Indicates chemical composition (%) of Solid electrode indicates that the filler metal is solid

Indicates that the filter metal is solid

X	C	Mn	Si	S	P	Ti	Zr	Al	Cu
2	0.07	0.90 /1.40	0.40 /0.70	0.035	0.025	0.05 -0.15	0.02 -0.12	0.05 -0.15	0.5
3	0.06 /0.15	0.90 /1.40	0.45 /0.75	0.035	0.025	-	-	-	0.5
4	0.06 /0.15	1.00 /1.50	0.65 /0.85	0.035	0.025	-	-	-	0.5
6	0.06 /0.15	1.40 /1.85	0.80 /1.15	0.035	0.025	-	-	-	0.5
7	0.07 /0.15	1.50 /2.00	0.50 /0.80	0.035	0.025	-	-	-	0.5
G	Chemical Compositions are not specified, however requirements shall be agreed to by the purchaser & supplier.								

Note : Cr, Ni & Mo content not to exceed 0.15 each.

GENERAL RECOMMENDATIONS

FCAW

Introduction

In recent years, pressure to increase productivity and reduce costs has been the main driving force behind the adoption of flux cored wires by fabricators. Productivity, ease of use and quality are the three main virtues on which the increasing popularity of Flux cored wires rest.

The welding processes with which flux cored wire must mainly compete are MMAW and semi automatic welding with solid wire (MIG/MAG). The superior productivity and the accompanying improved economics of flux cored wire welding over MMAW are very apparent. Even at the same duty cycle as MMAW cored wire process can give much higher productivity because it can operate at much higher current densities.

The deposition data of around 83 - 93% may be less convincing in case of flux-cored wire welding in comparison to MIG/MAG welding, which is nearly 96-98%. The ease of use of flux cored wires in out of position welding coupled with its greater process tolerance and comfort is an important aspect. The amount of time and money spent on reworking defects are less in flux cored welding in comparison to MIG welding and it becomes a very viable alternative to MIG/MAG welding. Possible elimination of quality problems like lack of fusion, cold laps, danger of hydrogen embrittlement etc. through the use of flux-cored wires has been a very important criterion for its selection all around the world for critical fabrication.

THE CORED WIRE PROCESS

Main Features

The important difference between MIG/MAG welding with solid wire and cored wire is performance, productivity, welding characteristics and Weldmetal integrity. Variations to suit a particular application or physical requirement are more easily achieved than with solid wire. This involves changes in the filling formulation and percentage in a similar way to that of manual arc electrodes. The coating formulation and thickness can have a significant effect, whereas little can be done with the electrode core wire alone to improve aspects of performance.

Economics

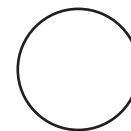
Whilst there are higher productivity processes available, such as submerged arc and robotics, cored wire semi-automatic MIG offers the fabricator a more flexible process with genuine increases in productivity for the least capital expenditure. Where solid wire is already

in use this may only involve a change of accessories such as feed rolls and torch consumables. A move to cored wire MIG/MAG from the use of manual arc will obviously involve the purchase of new equipment but the undisputed increase in productivity will usually guarantee a return on capital invested in less than one year.

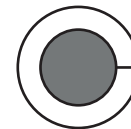
Deposition

The higher deposition rate from cored wires relies upon the I^2R heating effect that is greater than with solid wires, for a given current.

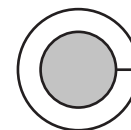
With the solid wire the total cross section carries all of the current but with metal cored wires a partial amount is carried by the core and in the case of flux cored wire all of the current is conducted by the tube. Thereby the current density and heating effect ensures a higher burn-off rate from cored wires.



SOLID



METAL CORED



FLUX CORED

ESAB Cored Wire Range

The ESAB range consist of rutile and fully basic flux cored wires, some of which are self-shielded, and a range of metal cored wires. For general fabrication work the metal cored type could satisfy the majority of applications, so the need for three principal types may be questioned.

There are a number of factors to be considered and can be summarised as follows:

- Downhand Rutile Flux Cored Wires are easy to use with a smooth arc action giving excellent weld appearance with easy slag detachment.
- Positional Rutile Flux Cored Wires when used with Argon rich gas offer spray transfer welding with a high level of operator appeal.
- Basic Flux Cored Wires produce a higher and more consistent level of mechanical properties. They also produce radiographic standard deposits with ease when compared to both rutile and metal cored wires.
- Metal Cored Wires when used on good quality clean plate will produce very little slag-similar to that of solid wires.
- Self-Shielded Wires produce their own gas shield via decomposition in the arc of various elements within the core.

OPERATING CONDITIONS

Polarity

DC electrode positive is recommended for the cored wires since the use of the negative pole produces inferior running characteristics and can occasionally produce porosity.

Some Cored wires however, are designed to operate on both DC positive & negative polarity.

Voltage

Arc voltage has a direct influence on the arc length that controls the weld shape depth of penetration and spatter level. As the arc voltage is reduced the penetration increases and this is particularly important in V butt joints. An increase in voltage will result in a long arc length and increase the risk of porosity and undercut.

When operating on dip transfer for positional welding at comparatively low currents the arc voltage should be kept at the highest practicable level to ensure adequate sidewall fusion.

Amperage

With flux cored wires the amperage used is ideally at the top half of the range specified for a particular size, except

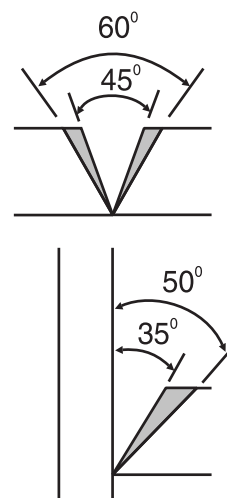
when positional welding with 1.0mm, 1.2mm, and 1.4 mm wires, and when the dip transfer mode is used at current below 220 amps.

Metal cored wires eliminate the need for current variations relative to plate thickness since one current

setting for a given wire size will cater to 90% of flat and HV applications. The weld cross-section is controlled by the travel speed whereas solid wire would require considerable current resetting to achieve the same flexibility.

Plate preparation

Due to superior sidewall fusion obtained particularly from the metal cored wires the combined angles of preparations can generally be reduced. A V-butt joint for instance that would normally need a 60° included angle for manual arc welding can be reduced to 45° thereby saving plate and hence weldmetal to fill the joint.



The higher levels of de-oxidation and higher current density available with cored wires allows them to be used where mill scale and primer have to be tolerated. This is particularly so with the metal and basic cored wires, since the rutile types are the least tolerant. However, in case of primer the degree of success will depend on the type and thickness, but generally Tubrod basic wires will achieve porosity free welds at speeds 45% faster than solid wires and the Tubrod metal cored wires are approximately 35% faster

For optimum radiographic standards with flux cored wires excessive rust and scale should be removed by grinding which will also serve to reduce slag formation to a minimum when using metal cored wires.

Further economies can be achieved from a reduction in Weldmetal required on single pass fillet joints.

The often-greater depth of fusion can increase the effective throat thickness and consequently allow a reduction in leg length by up to 20%. The savings in Weldmetal are considerable as can be seen from FIG.6 and some certification authorities will permit a reduction of 50% in weld dimensions for single pass fillets when produced fully automatically.



WELDING TECHNIQUES

Torch angles

Flux cored wires

With OK Tubrod / Dualshield flux cored wires the torch angle has a significant effect on slag control and weld deposit profile. For both fillet and butt joints the recommended angle between the wire axis and the line of joint is between 60° - 70° and using a backhand technique i.e. pulling, with the wire pointing toward the completed weld. In this way the arc force prevents the slag from running in front of the line of the weld pool and reduces the risk of slag traps. For HV fillets the wire tip should be directed toward the bottom plate at approximately 3-mm from the line of the joint with a torch angle of 45° from the vertical plate.

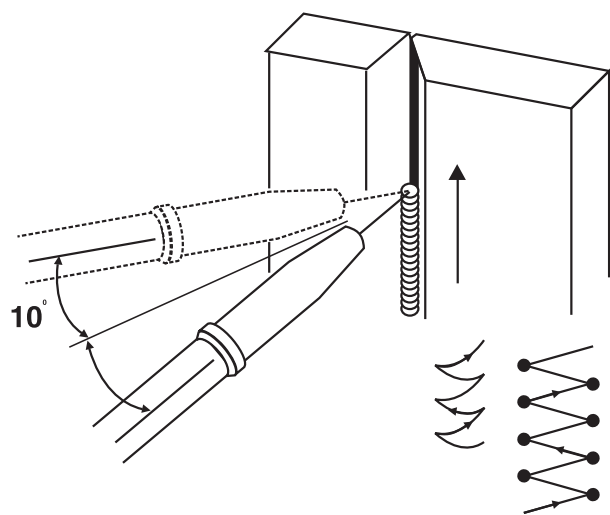
In certain circumstances the forehand technique i.e. pushing can be used to advantage. On small fillet welds where penetration is not of paramount importance the higher welding speeds required are such that the molten slag is prevented from running ahead of the weld pool. This also has the advantage of producing a mitre fillet where as the backhand method tends to produce a more convex profile.

Metal cored wires

Maximum penetration is obtained using a backhand (pulling technique with a torch angle of 70/80° between the wire axis and the joint line. This will also serve to optimise gas coverage and is particularly relevant to multipass butt welds. The fillet and lap welds superior weld appearance is achieved using a torch angle of 60/70° and a forehand technique (push). This results in a more even distribution of Weldmetal, accompanied by a reduction in penetration.

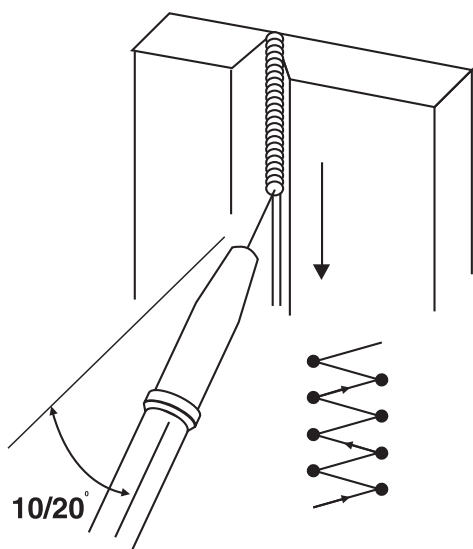
Torch angles and manipulation

Vertical butt-welds



Preparation with root face

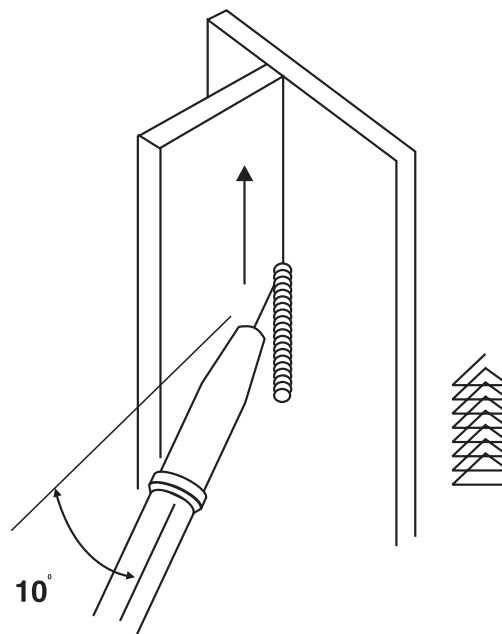
A torch angle of 100 above the horizontal may be used for root passes to assist arc stability and penetration control.



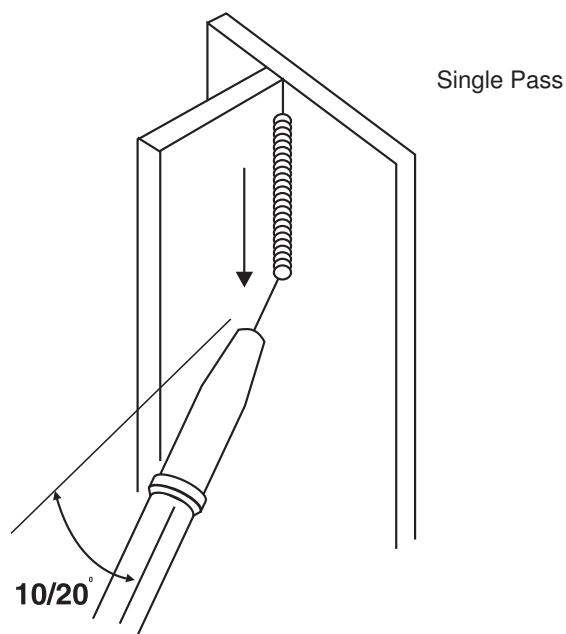
Preparation with feather edges

Torch angles and manipulation

Vertical fillet welds



Triangular weaves for single pass fillets. If necessary subsequent weld runs should be deposited using techniques similar to that for Filling vertical butt joints. No weaving is necessary for single pass fillets when using OK Tubrod 15.15



Single Pass

Restrict vertical down technique to thin plate or leg lengths of 6 mm maximum. May be used for first pass of multipass joints.



Travel Speed

Travel speed has an important influence on penetration. For example when using a 1.6mm metal cored wire at 305A an increase in travel speed from 30cms/min to 60cms/min approximately doubles penetration beyond the root of a fillet. At speeds in excess of 80/100 cms/min penetration will decrease. Similarly a reduction in penetration will occur if the welding speed should fall to below 30cms/min, as the arc can impinge on the molten pool in preference to the base material.

In addition the use of slow travel speeds should be avoided when low temperature impact properties are required. While the joint may be filled in fewer passes the individual weld deposits will be of large cross-section and therefore impact resistance will be reduced. Apart from this, in the case of flux cored wires there is the obvious difficulty of slag control to be considered.

Positional Welding

The majority of Tubrod cored wires are capable of positional welding in the smaller sizes. However, the choice of consumable must be given careful consideration in relation to the proposed applications because the various ranges require quite different manipulation techniques for optimum results.

Rutile (EX1T-1) Types

This type of wire allows the use of the spray transfer mode in all positions including overhead and as such affords very high deposition rates. In addition, the exceptional fusion Characteristics that results will have significant effect on the production of defect free welds. This is particularly relevant when compared to solid wire that by necessity can only be used for positional welding in the dip transfer mode. The reduced depth of fusion involved together with the greater degree of skill and concentration demanded will increase the risk of fusion related defects. Dualshield 7100 LH can achieve in excess of 4kg/hr in the vertical position compared to manual arc at approximately 2kg/ hr.

The required techniques for vertical up welding is almost identical to those employed by manual metal arc for both fillet and butt joints. However, root panes in open butt welds where a uniform bead of penetration required, when welded from one side are not recommended. This is due to the high arc energy and fluidity of the weld pool as well as the need to maintain highly accurate joint preparation that is considered not practical. In such circumstances the use of non-fusible backing is

recommended and this type of wire is eminently suitable for use with these materials and the speed of welding will be significantly higher.

Metal Cored (EX1T-G) and Fully Basic (EX1T-5)

These two groups may be treated as one with regard to positional welding techniques. To maintain optimum control welding is limited to the 1.0mm and 1.4mm sizes and is restricted to the dip transfer mode where greater welder skill is involved. The manipulation required be similar to that used for solid wire in that initial passes in the vertical position are completed using a triangular weave motion.

This is to ensure that the weld profile remains flat and not peaked, which would otherwise occur leading to possible lack of fusion defects at the edges after further welding as in the case of multipass joints.

The conventional straight weave may be used but only in circumstances when the face of the previous pass is wide enough such that the effect of heat sink will maintain a flat profile automatically.

Whilst the dip transfer method is slow and often demanding in terms of operator concentration the arc energy is greater than with solid wire and the possibility of defects, especially cold lapping is substantially reduced.

The root pass in an open butt weld, where full penetration is required from one side is always the most difficult regardless of welding process or position. However, when using Tubrod metal and basic cored wires the use of dip transfer and vertical down welding can be used for good advantage. Excellent results can be achieved more easily if it is rapid and dispensing with a root face can reduce plate preparation costs.

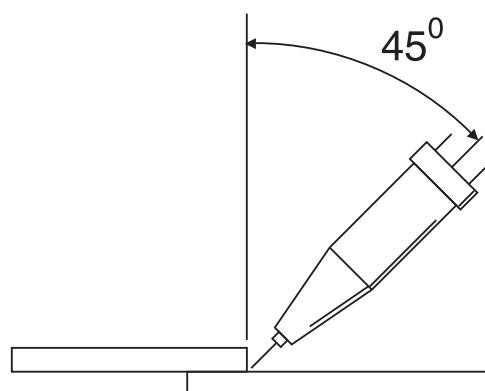
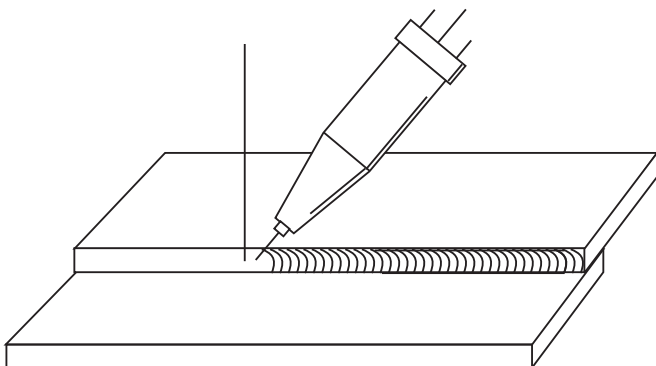
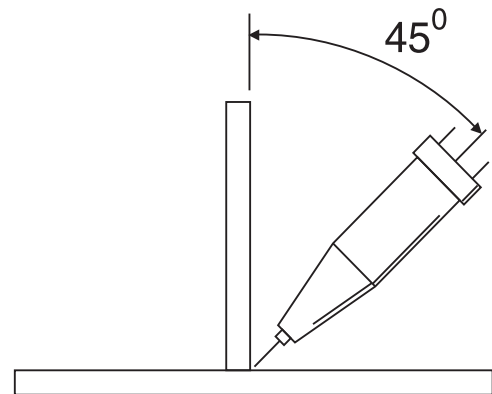
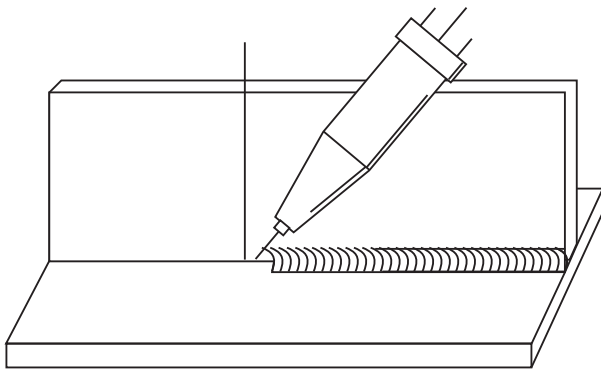
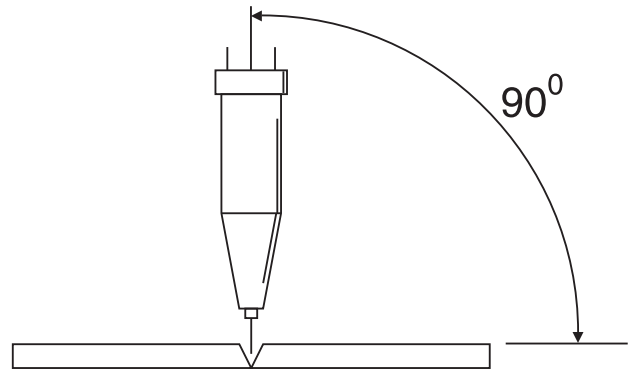
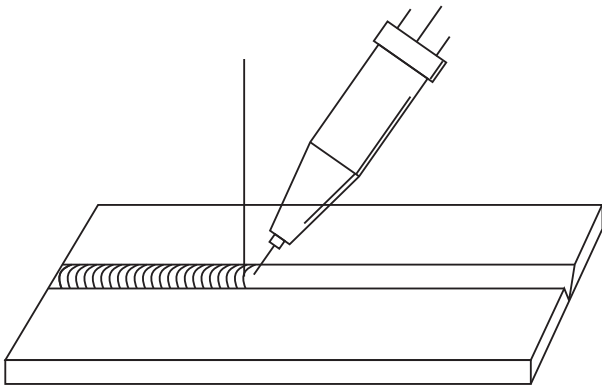
Fillet joints may be welded using either the vertical up or vertical down techniques. The choice will depend on the thickness of material and degree of root penetration desired. Multi-pass joints should be completed on a similar basis to that of butt welds using the vertical up technique.

Metal cored wire

Electrode extension

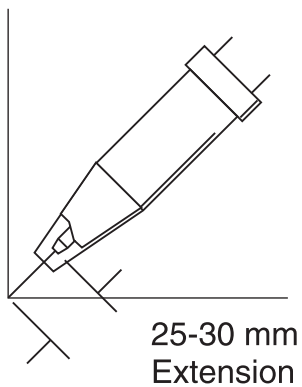
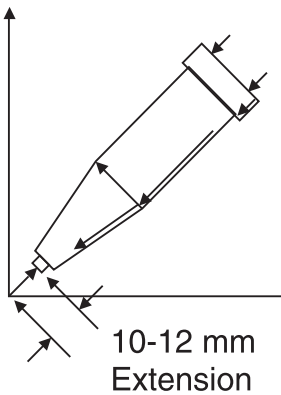
This term describes the distance between the contact tip of the torch and the work piece, sometimes described as 'electrode stickout'. The current conditions should be set for the job in hand but during welding it may be

necessary to reduce the amount of heat in the weld pool to accommodate poor fit-up or out of position welding. An increase in the stickout length and the extra electrical resistance that results will produce a cooler less fluid weld pool. Similarly any decrease in electrode extension will have the effect of increasing welding current and this characteristic can be of benefit in controlling penetration; especially where inconsistent fit-up is encountered.

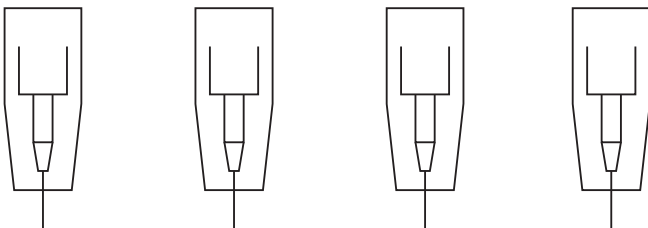


When operating with dip transfer an extension of 12 mm will suffice for most applications whereas spray transfer produces a greater amount of radiated heat and should have an extension of approximately 20-30 mm.

During actual welding any large variation will produce an inconsistent weld deposit and excessive electrode extension has the effect of reducing the amperage drawn from the power source. Increasing the wire feed speed to compensate for the current drop will result in a significant increase in weldmetal deposition.



ELECTRODE EXTENSIONS RELATED TO DEPOSITION RATE



EXTENSION MM	12	18	25	25
WIRE FEED M/Min	5.8	5.8	5.8	8.4
CURRENT AMPS	350	320	280	350
DEP RATE KGS/HR	4.7	4.7	4.7	6.5

DATA SHEET - FCAW

Flux cored wires classification E71T-X, E80T-X

Indicates the primary welding conditions for which the electrode is designed;
0 - Flat and horizontal positions
1 - All positions

Designates an electrode

Designator identifying as flux cored electrode

Tensile Strength designator in units of 10 KSi

Shielding Gas Designator C=100%
Co₂, M = 80% Ar 20% Co₂ in AWS
+ 5.20

Deposit Composition Designator in AWS A5.29)

E X X T - X X

Indicates usability and performance capabilities

1. Electrode classified for used with CO₂ or CO₂+Ar mixture to improve usability especially for out of position welding. Designed for single and multi-pass welding characterized by spray transfer, low spatter loss and a moderate volume of slag. Generally are rutile based and operate on DC+
4. Self-shielded electrode for single and multi pass welding in the flat, horizontal and vertical positions. Operates on DC+ and gives globular transfer.
5. Designed for use with CO₂ (Ar based gases may be used) for single and multi pass welding in the flat and horizontal verticals positions. Electrodes of this group have a lime fluoride based slag and produce weldmetal having improved impact properties and crack resistance in comparison to rutile type.
8. Self shielded electrode operating on DC with negative polarity. Designed for all positions and provides a weldmet with very good low temperature impact properties. Used for single and multi pass welding.

X	C	Mn	Ni	Cr	Mo	V	Al
Carbon - Molybdenum steel electrodes							
A1	0.12	1.25	-	-	0.40-0.65	-	-
Chromium - Molybdenum steel electrodes							
B2	0.05 - 0.12	1.25	-	1.0-1.5	0.40-0.65	-	-
B2L	0.05	1.25	-	2.0-2.5	0.90-1.20	-	-
B3	0.05 - 0.12	1.25	-	2.0-2.5	0.90-1.20	-	-
B3L	0.05	1.25	-	2.0-2.5	0.90-1.20	-	-
Nickel steel electrodes							
Ni1	0.12	1.50	0.80-1.10	0.15	0.35	0.05	1.80*
Ni2	0.12	1.50	1.75-2.75	-	-	-	1.80*
Ni3	0.12	1.50	2.75-3.75	-	-	-	1.80*
Manganese - Molybdenum steel electrodes							
D1	0.12	1.25-2.00	-	-	0.25-0.55	-	-
D2	0.15	1.65-2.25	-	-	0.25-0.55	-	-
D3	0.12	1.00-1.75	-	-	0.40-0.65	-	-
All other low alloyed electrodes							
K2	0.15	0.50-1.75	1.00-2.00	0.15	0.35	0.05	1.80*
K4	0.15	1.20-2.25	1.75-2.60	0.20-0.60	0.20-0.65	0.03	-
W2	0.12	0.5-1.3	0.4-0.8	0.45 - 0.70	-	-	Cu = 0.3-0.75

* Refer applicable code for detail.



Cored Wire Fault Finding

POSSIBLE CAUSE	REMEDY
POROSITY Insufficient shielding gas Excessive electrode extension Gas Nozzle too short Plate condition and impurities Equipment fault on gas control	Check recommended flow rate Reduced extension . refer notes Replace Remove non-metallic substances Check for leaks and air ingestion
POOR WIRE FEED Incorrect tip size Damaged liner or tip Incorrect types, size and pressure of feed rolls Spool brake too tight Blocked liner	Check and replace Replace Refer equipment manual Check tension and slacken if necessary Remove obstruction or replace
SLAG INCLUSIONS Incorrect welder technique Direction of travel	Refer to notes Refer to recommended technique
UNDERCUT Travel speed too fast parameters Incorrect torch angle Voltage too high	Reduced travel speed or check Refer to notes on torch angels Reduce voltage

POSSIBLE CAUSE	REMEDY
LACK OF FUSION Current too low Electrode extension too long for current being used Incorrect or inconsistent travel speed Torch angel or direction of travel Narrow joint preparation Root face too large	Refer to notes on electrode extension Adjust travel speed to suit desired degree of penetration Refer to welding techniques Modify preparation Modify preparation
LACK OF FUSION Direction and speed of travel Incorrect torch angle Incorrect parameters or torch manipulation	Refer to notes illustration Refer to notes illustration Check against recommended values for the wire in question and notes on torch manipulation
EXCESSIVE SPATTER Dirty plate Voltage too high for amperage being used Shielding gas pressure too high Poor current pick-up	Clean plate-wire brush or grinding Check against recommended values Check against recommended flow rates Check size or replace worn contact tip.

General recommendations for Submerged Arc Welding

1. **The flux must be dry.** Agglomerated fluxes must be protected from moisture pick-up.

In tropical, humid areas, re-drying agglomerated fluxes at 250-350°C before use is recommended. The remaining flux in the welding machine container should be removed and stored in a dry cabinet and should therefore not be left in the open container during the night.

During the transport of fluxes, a maximum of two pallets should be stacked to prevent the grains being crushed.

2. The fusion faces and the plate in the vicinity of the joint should be clean and dry. The cleaner the joint, the better the chances of obtaining a satisfactory weld. Rust, mill scale, paint, oil and residue from arc-air gouging or grinding can adversely affect the quality of the weld metal. The more impurities on the fusion faces, the greater the risk of weld metal defects.

3. The arc voltage must be kept constant. Increased arc voltage results in higher flux consumption. If the flux contains alloying elements, the amount transferred to the weld metal will increase as the arc voltage increases.
4. As a general rule, multi-run deposits made at moderate welding currents have better mechanical properties than one-or two-layer deposits made at high currents in similar plate thicknesses.

N.B. The chemical analysis given in this catalogue are for all weld metal deposited with DC+, 580 A, 29 V, 33 m/h, except for OK Flux 10.92, where DC+, 420 A, 27 V and 30 m/h has been used (wire Ø4 mm) and for OK Flux 10.90, where DC+, 300A, 30V, 24 m/h has been used (wire Ø2.4 mm).

The mechanical properties are obtained according to the welding conditions given in EN 756 (i.e. the same welding data as in EN 760).

Other welding conditions may produce weld metal analysis and mechanical properties which differ from those given in the handbook.

DATA SHEET - SAW

SAW Classification

Indicates the minimum tensile strength of the weldmetal, welded in accordance with AWS specifications.

Indicates Flux

Designated the condition of heat treatment in which tests were conducted.
 "A" as welded
 "P" Post weld heat treated

Indicates a solid electrode

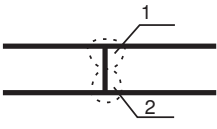
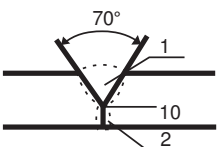
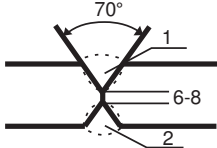
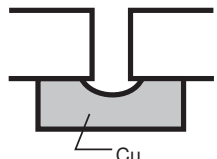
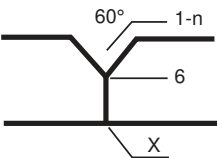
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Digit	Test Temperature		Average Energy Level (min)
	F	C	
Z	No impact requirements		27J
0	0	-18	
2	-20	-29	
4	-40	-40	
5	-50	-46	
6	-60	-51	
8	-80	-62	
10	-100	-73	
15	-150	-101	







XXX	C	Mn	Si
Low Manganese Electrodes			
EL8	0.10	0.25/0.60	0.07
EL8K	0.10	0.25/0.60	0.10/0.25
EL12	0.04/0.12	0.25/0.60	0.10
Medium Manganese Electrodes			
EM12	0.06/0.15	0.80/1.25	0.10
EM12K	0.05/0.15	0.80/1.25	0.10/0.35
EM13K	0.06/0.16	0.90/1.40	0.35/0.75
EM14K	0.06/0.19	0.90/1.40	0.35/0.75
EM15K	0.10/0.20	0.80/1.25	0.10/0.35
High Manganese Electrodes			
EH11K	0.07/0.15	1.40/1.85	0.80/1.15
EH12K	0.06/0.15	1.50/2.00	0.25/0.65
EH14	0.10/0.20	1.70/2.20	0.10

Welding data and joint preparation

Typical welding data and recommended joint preparation for submerged arc welding mild steel and carbon-manganese structural steels with OK Flux 10.40, OK Flux 10.47, OK Flux 10.70, OK 10.71, OK Flux 10.72, OK Flux 10.76 and OK Flux 10.81.

Type of joint	Plate thickness mm	Wire diameter mm	Run No	Arc voltage V	Welding current A	Welding speed cm/min.
	6	3	1	33	400	80
	8	4	2	33	430	60
			1	34	480	
	10	4	2	34	550	55
			1	34	550	
	12	4	2	35	650	50
1			35	650		
14	4	2	35	700	40	
		1	35	700		
		2	35	750		
	16	4	1	32	600	50
	18	4	2	35	650	50
			1	34	700	
	20	4	2	35	650	40
1			36	750		
		2	35	650		
	18	6	1	36	700	30
	20	6	2	36	850	25
			1	36	800	
	25	6	2	36	850	20
			1	36	850	
	30	6	2	36	950	15
1			36	900		
		2	36	1000		
	2	2	1	28	325	125
	4	2.5	1	30	450	70
	6	3	1	31	510	50
	8	3	1	32	525	45
	10	3	1	33	600	35
	20	4	1	29	650	50
			2	32	750	50
			3	34	750	40
			X	30	550	50
	25	4	1	29	650	50
			2	30	700	50
			3, 4	32	750	40
			5	36	750	40
			X	30	550	50
					1	29
	30	4	2	30	700	50
			3-5	32	750	50
			6	34	750	40
			7-8	36	750	40
X			30			

Typical welding data and for submerged arc fillet welding mild steel and carbon-manganese structural steels with OK Flux 10.47, OK Flux 10.71 and OK Flux 10.81.

Type of joint	Plate thickness mm	Wire diameter mm	Throat thickness mm	Arc voltage V	Welding current A	Welding speed cm/min.
Single welding head						
	≥ 6	3	3	30-32	500	100
	≥ 8	4	4	30-32	450	60
	≥ 10	4	5	30-32	650	50
	≥ 8	4	4	32-34	700	115
	≥ 12	4	4	32-34	800	140
	≥ 15	4	7	36	800	45
	≥ 15	4	—	36	750	45
	≥ 20	4	—	36	750	40
Twin wire						
	—	2x1.6	4	32	800	120
	—	2x2.0	5	34	300	110
Two welding heads + ~						
	—	4	4	+32 ~38	800 700	140
	—	4	4	+32 ~38	800 700	140
	—	4	4	+32 ~38	800 700	140
	—	4	5	+32 ~35	800 700	90

Submerged arc welding "18/8" stainless steel. Joint preparation and typical welding data for filler materials OK Autrod 16.10 + OK Flux 10.92, 10.93 and similar OK - combinations.

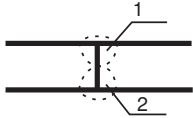
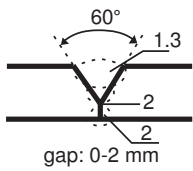
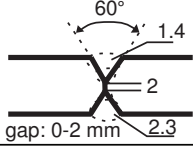
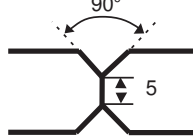
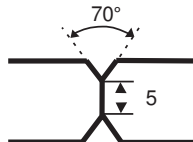
Type of joint	Plate thickness mm	Wire diameter mm	Run No	Arc voltage V	Welding current A	Welding speed m/h
	6	3	1 2	34	400 500	80 60
	8	4	1 2	34	500 600	80 60
Manual welded root bead						
	10	4	1 2	34	600 600	40 60
	12	4	1 2	34	600 600	35 50
	20	4	1 2 3	34	600 600 600	35 30 40
	25	4	1	34	600	40
			2			
			3			
			4			
	8	4	1 2	34 34	450 550	55 50
	10	4	1 2	34 34	500 600	40 50
	12	4	1 2	34 34	500 600	35 40
	14	4	1 2	34 34	550 600	35 35

Table 3: Typical welding data for different types of joint OK Flux 10.61 Land 10.62

Type of Joint	Plate Thickness mm	Wire mm	Run No.	Arc Voltage V	Welding Current A	Welding Speed m/h	
	6	3	1	29	350	40	
	8	3	2	30	425	40	
		3	1	31	450	40	
	10	3	2	31	500	40	
		4	1	30	500	40	
	12	4	2	30	575	40	
	16	5	1	32	750	35	
		5	2	32	800	35	
	20	6	1	31	950	23	
		6	2	32	950	23	
		25	6	1	31	1000	21
		30	6	2	31	1000	21
6			1	31	1000	20	
35		6	2	30	1050	20	
		6	5.1 :1*	30	1050	23	
6		2	32	900	30		
6	5.2:1**	30	1100	25			
6	2	32	900	30			

* First side

** Second side

Fillet	Throat Thickness a-mm	Wire Dia. mm	Arc Voltage V	Welding Current A	Welding Speed m/h
	6.0	5	32	800	30
	6.5	5	31	850	30
	7.0	5	30	900	30
	3.5	4	29	650	60
	4.5	4	29	650	50
	5.5	4	29	650	40

CONSUMABLES GUIDE FOR ASTM STEELS



ASTM Designation	Class or grade	Recommended Consumables			
		SMAW	GTAW/GMAW	FCAW	SAW
A-27/A-27M	All	ESAB 36H, OK 74.46, ESAB 56	ESAB MW1, OK Tigrod S2	Dualshield 7100 LH	
A-36/A-36M	All	ESAB 28, ESAB 36H, ESAB 56	ESAB MW1, OK Tigrod S2	Dualshield 7100 LH, OK Tubrod 15.00	OK Flux 10.81L/10.71, OK Autrod 12.08L/12.22L / 12.40L
A-53/A-53M	Type F - Grade A	OK 53.18 , ESAB 36H, ESAB 28	ESAB MW1, OK Tigrod S2	Dualshield 7100 LH, OK Tubrod 15.00	
	Type E and S - Grade A	ESAB 28, OK 53.18	ESAB MW1, OK Tigrod S2	Dualshield 7100 LH	
	Type E and S - Grade B	OK 53.18 , ESAB 36H, ESAB 28	ESAB MW1, OK Tigrod S2	Dualshield 7100 LH, OK Tubrod 15.00	
A-105/A-105M	All	ESAB 28, ESAB 36H , Pipeweld 6010 R	ESAB MW1, OK Aristorod 12.50, OK Tigrod S2 / S2 spcl	Dualshield 7100 LH	OK Flux 10.81L /10.71, OK Autrod 12.08L/12.22L / 12.40L
A-106/A-106M	Grade A	ESAB 28, Pipeweld 6010 R	ESAB MW1, OK Aristorod 12.50, OK Tigrod S2 / S2 spcl	Dualshield 7100 LH	OK Flux 10.81L, OK Autrod 12.08L
	Grade B and C	ESAB 28, ESAB 36H , Pipeweld 6010 R, OK 48.20 Spl	ESAB MW1, OK Aristorod 12.50, OK Tigrod S2 / S2 spcl	Dualshield 7100 LH	OK Flux 10.81L /10.71, OK Autrod 12.08L/12.22L / 12.40L
A-134/A-134M		ESAB 36H	ESAB MW1, OK Aristorod 12.50	Dualshield 7100 LH	OK Flux 10.71 / 10.74/10.81LS, OK Autrod 12.08L/12.24L
A-135/A-135M	Grade A and B	ESAB 28, Pipeweld 6010 R	ESAB MW1, OK Aristorod 12.50 , OK Tigrod S2 / S2 spcl	Dualshield 7100 LH	OK Flux 10.81L, OK Autrod 12.08L
A-178/A-178M	Grade A	ESAB 28	ESAB MW1,OK Tigrod S2	Dualshield 7100 LH	OK Flux 10.81LS, OK Autrod 12.08L/12.22L
	Grade C and D	ESAB 36H	ESAB MW1, OK Aristorod 12.50 , OK Tigrod S2	Dualshield 7100 LH , OK Tubrod 15.00	OK Flux 10.81LS, OK Autrod 12.08L/12.22L
A-179/A-179M	Grade C and D	ESAB 36H	ESAB MW1, OK Aristorod 12.50 , OK Tigrod S2	Dualshield 7100 LH , OK Tubrod 15.00	OK Flux 10.81LS, OK Autrod 12.08L/12.22L
A-181/A-181M	Class 60	ESAB 28	ESAB MW1,OK Tigrod S2	Dualshield 7100 LH	OK Flux 10.81LS, OK Autrod 12.08L/12.22L
	Class 70	ESAB 36H	ESAB MW1, OK Aristorod 12.50 , OK Tigrod S2	Dualshield 7100 LH , OK Tubrod 15.00	OK Flux 10.81LS, OK Autrod 12.08L/12.22L



ASTM Designation	Class or grade	Recommended Consumables			
		SMAW	GTAW/GMAW	FCAW	SAW
A-182/A-182M	F1	OK 74.46	OK Tigrod 13.09	Dualshield 7000A1	OK Flux 10.62 , OK Autrod 13.09
	F2 , F11, F12	OK 76.18, OK 76.18 M	OK Tigrod 13.16, OK Tigrod B2L	Dualshield 8000B2	OK Autrod 13.10, OK Flux 10.62
	F5, 5a	ESAB KV4, ESAB KV4L	OK Tigrod 13.32		
	F9	ESAB KV7	OK Tigrod 13.37		
	F91	ESAB KV7M, OK 76.98	OK Tigrod 13.38	Dualshiled B9	OK Autrod 13.35, OK Flux 10.93
	F22	OK 76.28 , OK 76.28M	OK Tigrod 13.17, OK Tigrod B3L	Dualshield 9000B3	OK Autrod 13.20 and OK Flux 10.62
	F6a	OK 68.10 , OK 68.15	OK Tigrod 410	Arcaloy 409-Ti	OK Autrod 410, OK Flux 10.92L
	F6NM	OK 68.00 , OK 68.25	OK Tigrod 410 NiMo	PZ 6166 / Shield- bright 410NiMo	OK Autrod 16.79, OK Flux 10.93
	F430	ESAB 430	OK Tigrod 430	Arcaloy 436	OK Autrod 430, OK Flux 10.92L
	F304 , 304H	OK 61.50, ESAB 308H	OK Tigrod 16.10, OK Ti- grod 308H	Shieldbright 308, 308L	OK Autrod 16.10 / 308H, OK Flux 10.92L
	F304L	OK 61.30 , ESAB 304B	OK Tigrod 16.10, OK Autrod 16.10	Shieldbright 308L, 308L Xtra	OK Autrod 16.10, OK Flux 10.92L
	F304N, F304LN	ESAB 304B(N)	OK Tigrod 16.10N		
	F309H	OK 67.67			
	F310	OK 67.13	OK Tigrod 16.13		
	F310MoLN	OK 310 MoL	OK Tigrod 16.13NF		
	F316, 316H	OK 63.50	OK Tigrod 316H	Shieldbright 316, Xtra	
	F316L	OK 63.30	OK Tigrod 16.30	Shieldbright 316L, Xtra	OK Autrod 16.30 , OK Flux 10.92L
	F317L	OK 64.30	OK Tigrod 317L	Shieldbright 317L Xtra	
	F321, 347 , 348	OK 61.80	OK Tigrod 16.11	Shieldbright 347	OK Autrod 16.11, OK Flux 10.92L
	F321H, 347H, 348H	OK 61.80	OK Tigrod 347H	Shieldbright 347	OK Autrod 347H, OK Flux 10.92L
A-192/A-192M		ESAB 28, ESAB 36H	ESAB MW1, OK Tigrod S2	Dualshield 7100 LH	OK Flux 10.71, OK Autrod 12.40L
A-202/A-202M	Grade A	OK 76.18	OK Tigrod / Autrod 13.16	Dualshield 8000B2	OK Autrod 13.10, OK Flux 10.62
	Grade B	OK 76.18	OK Tigrod / Autrod 13.17	Dualshield 9000B3	OK Autrod 13.20, OK Flux 10.62

ASTM Designation	Class or grade	Recommended Consumables			
		SMAW	GTAW/GMAW	FCAW	SAW
A-203/A-203M	Grade A and B	Filarc 75S , OK 73.68	OK Tigrod / Autrod 13.28	OK Tubrod 15.27	OK Autrod 13.27, OK Flux 10.62
	Grade D, E and F	OK 73.79			OK Autrod 13.49, OK Flux 10.63
A-204/ A-204M	Grade A and B	OK 74.46	OK Tigrod / Autrod 13.09	Dualshield 7000A1	OK Autrod 13.09, OK Flux 10.62
	Grade C	OK 76.18	OK Tigrod / Autrod 13.09	Dualshield 7000A1	OK Autrod 13.09, OK Flux 10.62
A-209/ A-209M	Grade T1, T1a, T1b	OK 74.46	OK Tigrod / Autrod 13.09	Dualshield 7000A1	OK Autrod 13.09, OK Flux 10.62
A-210/ A-210M	Grade A1, C	ESAB 28, ESAB 36H	ESAB MW1, OK Tigrod S2	Dualshield 7100 LH	OK Autrod 12.22/12.40L , OK Flux 10.71
A-213/ A-213M	T2, T11, T17	OK 76.18, OK 76.18 M	OK Tigrod 13.16, OK Tigrod B2L	Dualshield 8000B2	OK Autrod 13.10, OK Flux 10.62
	T5b, T5c	ESAB KV4, ESAB KV4L	OK Tigrod 13.32		
	T9	ESAB KV7	OK Tigrod 13.37		
	T91	ESAB KV7M, OK 76.98	OK Tigrod 13.38	Dualshiled B9	OK Autrod 13.35, OK Flux 10.93
	T21 , 22	OK 76.28 , OK 76.28M	OK Tigrod 13.17, OK Tigrod B3L	Dualshield 9000B3	OK Autrod 13.20 and OK Flux 10.62
	TP201, 202, 304	OK 61.50	OK Tigrod 16.10	Shieldbright 308, 308L	OK Autrod 16.10, OK Flux 10.92L
	TP304H	OK 61.50, ESAB 308H	OK Tigrod 16.10, OK Tigrod 308H	Shieldbright 308, 308L	OK Autrod 16.10 / 308H, OK Flux 10.92L
	TP304N, LN	ESAB 304B(N)	OK Tigrod 16.10N		
	TP309Cb	ESAB 309Cb			
	TP309S	OK 67.67	OK Tigrod / Autrod 16.53	Shieldbright 309L	OK Autrod 16.53 , OK Flux 10.92L
	TP310S	OK 67.13	OK Tigrod 16.13		
	TP316, 316H	OK 63.50	OK Tigrod 316H	Shieldbright 316, Xtra	
	TP316L	OK 63.30	OK Tigrod 16.30	Shieldbright 316L, Xtra	OK Autrod 16.30 , OK Flux 10.92L
	TP317L	OK 64.30	OK Tigrod 317L	Shieldbright 317L Xtra	
	TP321, 347, 348	OK 61.80	OK Tigrod 16.11	Shieldbright 347	OK Autrod 16.11, OK Flux 10.92L
	TP321H, 347H, 348H	OK 61.80	OK Tigrod 347H	Shieldbright 347	OK Autrod 347H, OK Flux 10.92L



ASTM Designation	Class or grade	Recommended Consumables			
		SMAW	GTAW/GMAW	FCAW	SAW
A-214/ A-214M		ESAB 28, ESAB 36H	ESAB MW1, OK Tigrod S2	Dualshield 7100 LH	OK Autrod 12.22L, OK Flux 10.71/10.81L
A-216/ A-216M	Grade WCA	OK 76.18	OK Autrod 13.16	Dualshield 8000B2	OK Autrod 13.10, OK Flux 10.62
	Grade WCB and WCC	ESAB 98	OK Tigrod / Aristorod 13.29		OK Autrod 13.44, OK Flux 10.62
A-217/ A-217M	Grade WC1	OK 74.46	OK Tigrod / Autrod 13.09	Dualshield 7000A1	OK Autrod 13.09, OK Flux 10.62
	Grade WC4	ESAB 98	OK Tigrod / Aristorod 13.29		OK Autrod 13.44, OK Flux 10.62
	Grade WC5 and WC9	OK 76.28	OK Tigrod / Autrod 13.17	Dualshield 9000B3	OK Autrod 13.20, OK Flux 10.62
	Grade WC6 and WC11	OK 76.18	OK Tigrod / Autrod 13.16	Dualshield 8000B2	OK Autrod 13.10, OK Flux 10.62
	C5	ESAB KV4	OK Tigrod / Autrod 13.32		
	C12	ESAB KV7	OK Tigrod / Autrod 13.37		
	C12A	ESAB KV7M	OK Tigrod / Autrod 13.38	Dualshield B9	OK Autrod 13.35, OK Flux 10.93
	CA15	OK 68.10	OK Tigrod / Autrod 410	Arcaloy 409-Ti	OK Autrod 410, OK Flux 10.92L
A-225/ A-225M	Grade C and D	ESAB 118	OK Aristorod 13.29	Dualshield T-115	OK Autrod 13.43, OK Flux 10.62
A-234/ A-234M	Grade WPB, WPC	Ferroweld W2		Dualshield 8100W	
	Grade WP1	OK 74.46	OK Tigrod / Autrod 13.09	Dualshield 7000A1	OK Autrod 13.09, OK Flux 10.62
	Grade WP12- CL1, WP12- CL2, WP11- CL1, WP11- CL2, WP11CL3	OK 76.18, OK 76.18 M	OK Tigrod 13.16, OK Tigrod B2L	Dualshield 8000B2	OK Autrod 13.10, OK Flux 10.62
	Grade WP22- CL1, WP22CL3	OK 76.28 , OK 76.28M	OK Tigrod 13.17, OK Tigrod B3L	Dualshield 9000B3	OK Autrod 13.20 and OK Flux 10.62
	Grade WP5	ESAB KV4, ESAB KV4L	OK Tigrod 13.32		

ASTM Designation	Class or grade	Recommended Consumables			
		SMAW	GTAW/GMAW	FCAW	SAW
A-240	Grade WP9	ESAB KV7	OK Tigrod 13.37		
	Grade WP91	ESAB KV7M, OK 76.98	OK Tigrod 13.38	Dualshield B9	OK Autrod 13.35, OK Flux 10.93
	Grade 201, 202, 301, 302, 304	OK 61.50	OK Tigrod 16.10	Shieldbright 308, 308L	OK Autrod 16.10, OK Flux 10.92L
	Grade 304H	OK 61.50, ESAB 308H	OK Tigrod 16.10, OK Tigrod 308H	Shieldbright 308, 308L	OK Autrod 16.10 / 308H, OK Flux 10.92L
	Grade 304L	OK 61.30	OK Tigrod 16.10	Shieldbright 308L	OK Autrod 16.10 / OK Flux 10.92L
	Grade 304N, LN	ESAB 304B(N)	OK Tigrod 16.10N		
	Grade 309S	OK 67.67	OK Tigrod / Autrod 16.53	Shieldbright 309L	OK Autrod 16.53 , OK Flux 10.92L
	Grade 309Cb	ESAB 309Cb			
	Grade 310S	OK 67.13	OK Tigrod 16.13		
	Grade 310MoLN	OK 310 MoL	OK Tigrod 16.13NF		
	Grade 316, 316L	OK 63.30	OK Tigrod 16.30	Shieldbright 316L, Xtra	OK Autrod 16.30 , OK Flux 10.92L
	Grade 317, 317L, 317LN	OK 64.30, ESAB 317L(N)	OK Tigrod 317L /N	Shieldbright 317L Xtra	
	Grade 321, 347, 348	OK 61.80	OK Tigrod 16.11	Shieldbright 347	OK Autrod 16.11, OK Flux 10.92L
	Grade 321H, 347H, 348H	OK 61.80	OK Tigrod 347H	Shieldbright 347	OK Autrod 347H, OK Flux 10.92L
	Grade 405, 409, 410, 410S	OK 68.10	OK Tigrod 410	Arcaloy 409-Ti	OK Autrod 410, OK Flux 10.92L
	Grade 430	ESAB 430	OK Tigrod 430	Arcaloy 436	
	A-249/ A-249M	TP201, 202, 304	OK 61.50	OK Tigrod 16.10	Shieldbright 308, 308L
TP304L, 304H		OK 61.50, ESAB 308H	OK Tigrod 16.10, OK Tigrod 308H	Shieldbright 308, 308L	OK Autrod 16.10 / 308H, OK Flux 10.92L
TP304N, LN		ESAB 304B(N)	OK Tigrod 16.10N		
TP309S		OK 67.67	OK Tigrod / Autrod 16.53	Shieldbright 309L	OK Autrod 16.53 , OK Flux 10.92L



ASTM Designation	Class or grade	Recommended Consumables			
		SMAW	GTAW/GMAW	FCAW	SAW
A-250/A-250M	TP309Cb	ESAB 309Cb			
	TP310S	OK 67.13			
	TP316, 316L	OK 63.30	OK Tigrod 16.30	Shieldbright 316L, Xtra	OK Autrod 16.30 , OK Flux 10.92L
	TP317, 317L	OK 64.30	OK Tigrod 317L	Shieldbright 317L Xtra	
	TP321, 347, 348	OK 61.80	OK Tigrod 16.11	Shieldbright 347	OK Autrod 16.11, OK Flux 10.92L
	TP321H, 347H, 348H	OK 61.80	OK Tigrod 347H	Shieldbright 347	OK Autrod 347H, OK Flux 10.92L
	Grade T1, T1a, T1b	OK 74.46	OK Tigrod / Autrod 13.09	Dualshield 7000A1	OK Autrod 13.09 , OK Flux 10.62
A-266/A-266M	Grade T2, T11, T12	OK 76.18, OK 76.18 M	OK Tigrod 13.16, OK Tigrod B2L	Dualshield 8000B2	OK Autrod 13.10, OK Flux 10.62
	Grade T22	OK 76.28, OK 76.28M	OK Tigrod 13.17, OK Tigrod B3L	Dualshield 9000B3	OK Autrod 13.20 and OK Flux 10.62
	Grade 1	ESAB 36H	ESAB MW1, OK Tigrod S2	Dualshield 7100 LH	OK Autrod 12.40 and OK Flux 10.71
A-268/A-268M	Grade 2 , 3 and 4	OK 76.18	OK Tigrod 13.16, OK Tigrod B2L	Dualshield 8000B2	OK Autrod 13.10, OK Flux 10.62
	TP405, 409, 410	OK 68.10, OK 68.15	OK Tigrod 410	Arcaloy 409-Ti	OK Autrod 410, OK Flux 10.92L
A-276	TP410 (UNS S 41500)	OK 68.25	OK Tigrod 410NiMo	PZ 6166 / Shieldbright 410NiMo	OK Autrod 16.79, OK Flux 10.93
	TP429, 430	ESAB 430	OK Tigrod 430	Arcaloy 436	OK Autrod 430, OK Flux 10.92L
	Type 201, 202, 302, 304, 308	OK 61.50	OK Tigrod 16.10	Shieldbright 308, 308L	OK Autrod 16.10, OK Flux 10.92L
A-276	Type 304L	OK 61.30	OK Tigrod 16.10	Shieldbright 308L	OK Autrod 16.10 / OK Flux 10.92L
	Type 304N, LN	ESAB 304B(N)	OK Tigrod 16.10N		
	Type 309, 309S	OK 67.67	OK Tigrod / Autrod 16.53	Shieldbright 309L	OK Autrod 16.53 , OK Flux 10.92L
	Type 310, 310S	OK 67.13			
	Type 314, 316	OK 63.30	OK Tigrod 16.30	Shieldbright 316L, Xtra	OK Autrod 16.30 , OK Flux 10.92L
	Type 317	OK 64.30	OK Tigrod 317L	Shieldbright 317L Xtra	
	Type 327, 347, 348	OK 61.80	OK Tigrod 16.11	Shieldbright 347	OK Autrod 16.11, OK Flux 10.92L

ASTM Designation	Class or grade	Recommended Consumables			
		SMAW	GTAW/GMAW	FCAW	SAW
A-283/A-283M	Type 405	OK 68.10, OK 68.15	OK Tigrod 410	Arcaloy 409-Ti	OK Autrod 410, OK Flux 10.92L
	Type 429, 430	ESAB 430	OK Tigrod 430	Arcaloy 436	OK Autrod 430, OK Flux 10.92L
	UNS S41500	OK 68.25	OK Tigrod 410NiMo	PZ 6166 / Shield-bright 410NiMo	OK Autrod 16.79, OK Flux 10.93
	Grade A and B	ESAB 28, ESAB 36H	ESAB MW1, OK Tigrod S2, OK Aristorod 12.50	Dualshield 7100LH, OK Tubrod 15.14A, Dualshield T5	OK Autrod 12.22L / 12.40L, OK Flux 10.71
A-285/A-285M	Grade C and D	ESAB 36H	ESAB MW1, OK Tigrod S2, OK Aristorod 12.50	Dualshield 7100LH, OK Tubrod 15.14A, Dualshield T5	OK Autrod 12.22L / 12.40L/SA10K, OK Flux 10.71/ 10.61L
	Grade A	ESAB 8018-G	OK Tigrod 13.09, OK Autrod 13.14	OK Tubrod 15.24	OK Autrod 12.24, OK Flux 10.71
A-299/A-299M	Grade B and C	ESAB 98	OK Aristorod / Tigrod 13.29	Dualshield II-101TC	OK Autrod 12.34, OK Flux 10.71
		ESAB 8018-G	OK Aristorod / Tigrod 13.29	Dualshield II-101TC	OK Autrod 12.34/ 12.24, OK Flux 10.71/10.62
A-302/A-302M	Grade A	OK 74.78	OK Tigrod / Aristorod 13.08 and 13.09	OK Tubrod 14.02	OK Autrod 12.34 and 12.44, OK Flux 10.62
A-311/A-311M	Grade B, C and D	OK 74.86	OK Autrod 13.25	-	OK Autrod 13.40, OK Flux 10.62
	1018, 1117	ESAB 28, ESAB 36H, OK 48.20 Spl	ESAB MW1, OK Aristorod 12.50, OK Tigrod S2 / S2 spcl	Dualshield 7100 LH	OK Flux 10.81L /10.71, OK Autrod 12.08L/12.22L / 12.40L
A-312/A-312M	TP304, TP304H	OK 61.50, ESAB 308H	OK Tigrod 16.10, OK Tigrod 308H	Shieldbright 308, 308L	OK Autrod 16.10 / 308H, OK Flux 10.92L
	TP304L, TP304N	ESAB 304B(N)	OK Tigrod 16.10		OK Autrod 16.10; OK Flux 10.92L
	TP316, 316H	OK 63.50	OK Tigrod 316H	Shieldbright 316, Xtra	OK Autrod 16.30, OK Flux 10.92L
	TP316L, 316LN	OK 63.30	OK Tigrod 16.30	Shieldbright 316L, Xtra	OK Autrod 16.30, OK Flux 10.92L
	TP317, 317L	OK 64.30	OK Tigrod 317L	Shieldbright 317L Xtra	OK Autrod 317L, OK Flux 10.92L
A-333/A-333M	TP321, 347, 348	OK 61.80	OK Tigrod 16.11	Shieldbright 347	OK Autrod 16.11, OK Flux 10.92L
	Grade 1 and 6	ESAB 36H(Spl)	OK Tigrod S2(Spl)/ OK Autrod 13.23	Dualshield 7100LH/ OK Tubrod 15.19	OK Autrod 12.24, OK Flux 10.62



ASTM Designation	Class or grade	Recommended Consumables			
		SMAW	GTAW/GMAW	FCAW	SAW
A-334/A-334M	Grade 3 and 4	ESAB 8016 C2 , OK 73.79	OK Tigrod / Autrod 19.81	-	OK Autrod 13.27, OK Flux 10.62
	Grade 7 and 9	Filarc 75S	OK Tigrod 13.28	-	OK Autrod 13.27, OK Flux 10.62
	Grade 8	OK 92.45, OK 92.55	OK Tigrod / Autrod 19.82 ; 19.85	-	OK Autrod 19.82/ 19.85, OK Flux 10.16 / 10.90
	Grade 10	Filarc 88S	OK Tigrod 13.28	Filarc PZ 6138	OK Autrod 13.27, OK Flux 10.62
	Grade 1 and 6	ESAB 36H(Spl)	OK Tigrod S2(Spl)/ OK Autrod 13.23	Dualshield 7100 LH/ OK Tubrod 15.19	OK Autrod 12.24, OK Flux 10.62
	Grade 3	ESAB 8016 C2	OK Tigrod / Autrod 19.81	-	OK Autrod 13.27, OK Flux 10.62
A-335/A-335M	Grade 7	Filarc 75S	OK Tigrod 13.28	-	OK Autrod 13.27, OK Flux 10.62
	Grade 8	OK 92.45, OK 92.55	OK Tigrod / Autrod 19.82 ; 19.85	-	OK Autrod 19.82/19.85, OK Flux 10.16 / 10.90
	Grade P1 and P2	OK 74.46	OK Tigrod 13.09	Dualshield 7000A1	OK Flux 10.62 , OK Autrod 13.09
	Grade P5, P5b, P5c	ESAB KV4, ESAB KV4L	OK Tigrod 13.32		
	Grade P9	ESAB KV7	OK Tigrod 13.37		
	Grade P11, P12	OK 76.18, OK 76.18 M	OK Tigrod 13.16, OK Tigrod B2L	Dualshield 8000B2	OK Autrod 13.10, OK Flux 10.62
A-336/A-336M	Grade P21, P22	OK 76.28 , OK 76.28M	OK Tigrod 13.17, OK Tigrod B3L	Dualshield 9000B3	OK Autrod 13.20, OK Flux 10.62
	Grade P91	ESAB KV7M, OK 76.98	OK Tigrod 13.38	Dualshiled B9	OK Autrod 13.35, OK Flux 10.93
	F1	OK 74.46	OK Tigrod 13.09	Dualshield 7000A1	OK Flux 10.62 , OK Autrod 13.09
	F3V	ESAB KV11			
	F11 classes 2&3, F12	OK 76.18, OK 76.18 M	OK Tigrod 13.16, OK Tigrod B2L	Dualshield 8000B2	OK Autrod 13.10, OK Flux 10.62
	F5, F5A	ESAB KV4, ESAB KV4L	OK Tigrod 13.32	Dualshiled B6	
A-336/A-336M	F6	OK 68.10 , OK 68.15	OK Tigrod 410	Arcaloy 409-Ti	OK Autrod 410, OK Flux 10.92L
	F9	ESAB KV7	OK Tigrod 13.37	Dualshiled B9	OK Autrod 13.35, OK Flux 10.93
	F91	ESAB KV7M, OK 76.98	OK Tigrod 13.38	Dualshiled B9	OK Autrod 13.35, OK Flux 10.93

ASTM Designation	Class or grade	Recommended Consumables			
		SMAW	GTAW/GMAW	FCAW	SAW
A-350/A-350M	F21, F22 - classes 1 and 3	OK 76.28, OK 76.28M	OK Tigrod 13.17, OK Tigrod B3L	Dualshield 9000B3	OK Autrod 13.20 and OK Flux 10.62
	F304 , 304H	OK 61.50, ESAB 308H	OK Tigrod 16.10, OK Tigrod 308H	Shieldbright 308, 308L	OK Autrod 16.10 / 308H, OK Flux 10.92L
	F304L	OK 61.30, ESAB 304B	OK Tigrod 16.10, OK Autrod 16.10	Shieldbright 308L, 308L Xtra	OK Autrod 16.10, OK Flux 10.92L
	F304N, F304LN	ESAB 304B(N)	OK Tigrod 16.10N		
	F309H	OK 67.67	OK Tigrod / Autrod 16.53	Shieldbright 309L	OK Autrod 16.53, OK Flux 10.92L
	F310 , F310H	OK 67.13	OK Tigrod 16.13		
	F316, 316H	OK 63.50	OK Tigrod 316H	Shieldbright 316, Xtra	
	F316L	OK 63.30	OK Tigrod 16.30	Shieldbright 316L, Xtra	OK Autrod 16.30, OK Flux 10.92L
	F321, 347, 348	OK 61.80	OK Tigrod 16.11	Shieldbright 347	OK Autrod 16.11, OK Flux 10.92L
	F321H, 347H , 348H	OK 61.80	OK Tigrod 347H	Shieldbright 347	OK Autrod 347H, OK Flux 10.92L
	LF1 , LF2 Class 2	ESAB 36H	OK Tigrod S2	Dualshield T5	OK Autrod 12.40 and OK Flux 10.71L
	LF2 Class 1	ESAB 36H(Spl)	OK Tigrod S2 (Spl)/ OK Autrod 13.23	Dualshield 7100LH/ OK Tubrod 15.19	OK Autrod 12.24, OK Flux 10.62
	LF3 Class 1 and 2 , LF9	ESAB 8016 C2	OK Tigrod / Autrod 19.81	-	OK Autrod 13.27, OK Flux 10.62
	LF5 Class 1 and 2	Filarc 88S	OK Tigrod 13.28	Filarc PZ 6138	OK Autrod 13.27, OK Flux 10.62
	LF6 Class 1 and 2	Filarc 88S	OK Tigrod 13.28	Filarc PZ 6138	OK Autrod 13.27, OK Flux 10.62
LF6 Class 3	OK 73.08	OK Tigrod 13.09	OK Tubrod 15.24	OK Autrod 12.24, OK Flux 10.71	
LF787 Class 2	OK 75.75	OK Aristorod 13.26	Dualshield T-115	OK Autrod 13.43, OK Flux 10.62	
A-351/A-351M	CF3, CF3A	OK 61.30 , ESAB 304B	OK Tigrod 16.10, OK Autrod 16.10	Shieldbright 308L, 308L Xtra	OK Autrod 16.10, OK Flux 10.92L
	CF3M, CF3MA, CF3MN	OK 63.30	OK Tigrod 16.30, OK Autrod 16.30	Shieldbright 316L, 316L Xtra	OK Autrod 16.30, OK Flux 10.92L



ASTM Designation	Class or grade	Recommended Consumables			
		SMAW	GTAW/GMAW	FCAW	SAW
A-352/A-352M	CF8, CF8A, CF8C, CF10	OK 61.50, ESAB 308H	OK Tigrod 16.10, OK Tigrod 308H	Shieldbright 308, 308L	OK Autrod 16.10 / 308H, OK Flux 10.92L
	CF8M, CF10M	OK 63.50	OK Tigrod 316H	Shieldbright 316, Xtra	-
	CH8, CH10, CH20	OK 67.67	OK Tigrod / Autrod 16.53	Shieldbright 309L	OK Autrod 16.53 , OK Flux 10.92L
	CK20, HK30, HK40	OK 67.13	OK Tigrod / Autrod 16.13	Shieldbright 310 Extra	-
	LCA, LCB, LCC	Ferroweld W2	-	-	-
	LC1	OK 74.46	OK Tigrod 13.09	Dualshield 7000A1	OK Flux 10.62, OK Autrod 13.09
	LC2	OK 73.68	OK Tigrod 13.28	-	-
	LC2-1	ESAB 120	-	-	-
	LC3	OK 73.79	-	-	-
	LC9	OK 92.45, OK 92.55	OK Tigrod / Autrod 19.82 ; 19.85	-	-
A-353/A-353M	CA6NM	OK 68.00 , OK 68.25, ESAB 410NiMo	OK Tigrod 410 NiMo	PZ 6166 / Shieldbright 410NiMo	OK Autrod 16.79, OK Flux 10.93
		OK 92.45, OK 92.55	OK Tigrod / Autrod 19.82, 19.85	-	OK Autrod 19.82, 19.85/OK Flux 10.16, 10.90
A-358/A-358M	Grade 304, 304H	OK 61.50, ESAB 308H	OK Tigrod 16.10, OK Tigrod 308H	Shieldbright 308, 308L	OK Autrod 16.10 / 308H, OK Flux 10.92L
	Grade 304L	OK 61.30	OK Tigrod 16.10	Shieldbright 308L	OK Autrod 16.10 / OK Flux 10.92L
	Grade 304N, LN	ESAB 304B(N)	OK Tigrod 16.10N		
	Grade 309S	OK 67.67	OK Tigrod / Autrod 16.53	Shieldbright 309L	OK Autrod 16.53 , OK Flux 10.92L
	Grade 309Cb	ESAB 309Cb			
	Grade 316, 316L	OK 63.30	OK Tigrod 16.30	Shieldbright 316L, Xtra	OK Autrod 16.30 , OK Flux 10.92L
	Grade 321, 347, 348	OK 61.80	OK Tigrod 16.11	Shieldbright 347	OK Autrod 16.11, OK Flux 10.92L
A-369/A-369M	FPA, FPB	ESAB 28, ESAB 36H, OK 48.20 Spl	ESAB MW1, OK Aristorod 12.50	Dualshield 7100 LH	OK Flux 10.81L /10.71, OK Autrod 12.08L/12.22L / 12.40L

ASTM Designation	Class or grade	Recommended Consumables			
		SMAW	GTAW/GMAW	FCAW	SAW
A-372/A-372M	FP1,FP2	OK 74.46	OK Tigrod 13.09	Dualshield 7000A1	OK Flux 10.62 , OK Autrod 13.09
	FP11, FP12	OK 76.18, OK 76.18 M	OK Tigrod 13.16, OK Tigrod B2L	Dualshield 8000B2	OK Autrod 13.10, OK Flux 10.62
	FP21, FP22	OK 76.28 , OK 76.28M	OK Tigrod 13.17, OK Tigrod B3L	Dualshield 9000B3	OK Autrod 13.20 and OK Flux 10.62
	FP5	ESAB KV4	OK Tigrod / Autrod 13.32	Dualshield B6	
	FP9	ESAB KV7	OK Tigrod / Autrod 13.37	Dualshield B9	OK Autrod 13.35 and OK Flux 10.93
	FP91	ESAB KV7M , OK 76.98	OK Tigrod / Autrod 13.38	Dualshield B9	OK Autrod 13.35 and OK Flux 10.93
	Grade A	ESAB 36H	OK Tigrod S2, ESAB MW1	Dualshield 7100 LH	OK Flux 10.81L /10.71, OK Autrod 12.08L/12.22L / 12.40L
	Grade B	OK 73.08	OK Tigrod 13.09, OK Autrod 13.14	Dualshield 7000A1	OK Flux 10.62 , OK Autrod 13.09
	Grade C, D	ESAB 118	OK Tigrod / Aristorod 13.13	Dualshield T-115	OK Autrod 13.43 and OK Flux 10.62
	Grade E, F, G, H, J (Class 55)	ESAB 118	OK Tigrod / Aristorod 13.13	Dualshield T-115	OK Autrod 13.43 and OK Flux 10.62
A-376/A-376M	Grade E, F, G, H, J (Class 65), Grade K, M Class A,B	ESAB 120	OK Aristorod 13.31		
	TP304, TP304N	OK 61.50	OK Tigrod 16.10	Shieldbright 308, 308L	OK Autrod 16.10, OK Flux 10.92L
	TP304H	OK 61.50, ESAB 308H	OK Tigrod 16.10, OK Tigrod 308H	Shieldbright 308, 308L	OK Autrod 16.10 / 308H, OK Flux 10.92L
	TP304LN	OK 61.30 , ESAB 304B	OK Tigrod 16.10, OK Autrod 16.10	Shieldbright 308L, 308L Xtra	OK Autrod 16.10, OK Flux 10.92L
	TP316, TP316H	OK 63.50	OK Tigrod 316H	Shieldbright 316, Xtra	
	TP316L, 316LN	OK 63.30	OK Tigrod 16.30	Shieldbright 316L, Xtra	OK Autrod 16.30 , OK Flux 10.92L
	TP321, 321H, 347, 347H, 348	OK 61.80	OK Tigrod 16.11	Shieldbright 347	OK Autrod 16.11, OK Flux 10.92L



ASTM Designation	Class or grade	Recommended Consumables			
		SMAW	GTAW/GMAW	FCAW	SAW
A-387/A-387M	Grade 2,12,11	OK 76.18, OK 76.18 M	OK Tigrod 13.16, OK Tigrod B2L	Dualshield 8000B2	OK Autrod 13.10, OK Flux 10.62
	Grade 22, 22L	OK 76.28 , OK 76.28M	OK Tigrod 13.17, OK Tigrod B3L	Dualshield 9000B3	OK Autrod 13.20 and OK Flux 10.62
	Grade 5	ESAB KV4, ESAB KV4L	OK Tigrod 13.32	Dualshield B6	
	Grade 9	ESAB KV7	OK Tigrod 13.37	Dualshield B9	OK Autrod 13.35, OK Flux 10.93
	Grade 91	ESAB KV7M , OK 76.98	OK Tigrod 13.38	Dualshield B9	OK Autrod 13.35, OK Flux 10.93
A-403/A-403M	WP/CR 304, 304N	OK 61.50	OK Tigrod 16.10	Shieldbright 308	OK Autrod 16.10 / OK Flux 10.92L
	WP/CR 304L	OK 61.30 , ESAB 304B	OK Tigrod 16.10, OK Autrod 16.10	Shieldbright 308L, 308L Xtra	OK Autrod 16.10, OK Flux 10.92L
	WP/CR 304H	ESAB 308H	OK Tigrod 308H	Shieldbright 308L	OK Autrod 308H, OK Flux 10.92L
	WP/CR 309	OK 67.67	OK Tigrod / Autrod 16.53	Shieldbright 309L	OK Autrod 16.53 , OK Flux 10.92L
	WP/CR 316, 316N	OK 63.50	OK Tigrod 316H	Shieldbright 316, Xtra	
	WP/CR 316L, 316LN	OK 63.30	OK Tigrod 16.30	Shieldbright 316L, Xtra	OK Autrod 16.30 , OK Flux 10.92L
	WP/CR 317L, 317LN	OK 64.30	OK Tigrod 317L	Shieldbright 317L Xtra	
	WP/CR 321, 347, 348	OK 61.80	OK Tigrod 16.11	Shieldbright 347	OK Autrod 16.11, OK Flux 10.92L
	WP/CR 347H, 348H	OK 61.80	OK Tigrod 347H	Shieldbright 347	OK Autrod 347H, OK Flux 10.92L
A-409/A-409M	TP304	OK 61.50	OK Tigrod 16.10	Shieldbright 308, 308L	OK Autrod 16.10, OK Flux 10.92L
	TP304L	OK 61.30 , ESAB 304B	OK Tigrod 16.10, OK Autrod 16.10	Shieldbright 308L, 308L Xtra	OK Autrod 16.10, OK Flux 10.92L
	TP309S	OK 67.67	OK Tigrod / Autrod 16.53	Shieldbright 309L	OK Autrod 16.53 , OK Flux 10.92L
	TP309Cb	ESAB 309Cb			
	TP310S	OK 67.13	OK Tigrod 16.13		
	TP316	OK 63.50	OK Tigrod 316H	Shieldbright 316, Xtra	
	TP316L	OK 63.30	OK Tigrod 16.30	Shieldbright 316L, Xtra	OK Autrod 16.30 , OK Flux 10.92L

ASTM Designation	Class or grade	Recommended Consumables			
		SMAW	GTAW/GMAW	FCAW	SAW
A-414/A-414M	TP317	OK 64.30	OK Tigrod 317L	Shieldbright 317L Xtra	
	TP321, 347, 348 Grade A, B, C,D, E and F	OK 61.80 ESAB 28, ESAB 36H	OK Tigrod 16.11 ESAB MW1, OK Tigrod S2	Shieldbright 347 Dualshield 7100 LH	OK Autrod 16.11, OK Flux 10.92L
A-420/A-420M	WPL 6	ESAB 28, OK 48.20 Spl	OK Tigrod S2 / S2 spl	Dualshield 7100 LH	OK Flux 10.81L /10.71, OK Autrod 12.08L/12.22L / 12.40L
A-423/A-423M	WPL 9 Grade 1	OK 73.08 OK 76.18, OK 76.18 M	OK Tigrod 13.16 OK Tigrod 13.16, OK Tigrod B2L	OK Tubrod 15.24 Dualshield 8000B2, OK Tubrod 15.24	OK Autrod 13.10, OK Flux 10.62
	Grade 2	OK 73.08		OK Tubrod 15.24	
A-426/A-426M	CP2, CP11, CP12	OK 76.18, OK 76.18 M	OK Tigrod 13.16, OK Tigrod B2L	Dualshield 8000B2	OK Autrod 13.10, OK Flux 10.62
A-430/A-430M	CP5, CP5b, CP21	OK 67.67, ESAB 309	OK Autrod/ Tigrod 16.53	Shieldbright 309L	OK Autrod 16.53 , OK Flux 10.92L
	FP304, FP304H, FP304N	OK 61.50, ESAB 308H	OK Tigrod 16.10, OK Tigrod 308H	Shieldbright 308, 308L	OK Autrod 16.10 / 308H, OK Flux 10.92L
	FP316, FP316H, FP316N	OK 63.50	OK Tigrod 316H	Shieldbright 316, Xtra	
	FP321, FP321H, FP347	OK 61.80	OK Tigrod 16.11	Shieldbright 347	OK Autrod 16.11, OK Flux 10.92L
A-451/A-451M	FP347, FP347H	OK 61.80	OK Tigrod 347H	Shieldbright 347	OK Autrod 347H, OK Flux 10.92L
	FP16-8-2H				
	CPF3, CPF3A	OK 61.30	OK Tigrod 16.10	Shieldbright 308L	OK Autrod 16.10 / OK Flux 10.92L
	CPF8, CPF8A	OK 61.50	OK Tigrod 16.10	Shieldbright 308, 308L	OK Autrod 16.10, OK Flux 10.92L
	CPF3M	OK 63.30	OK Tigrod 16.30	Shieldbright 316L, Xtra	OK Autrod 16.30 , OK Flux 10.92L
	CPF8M	OK 63.50	OK Tigrod 316H	Shieldbright 316, Xtra	
	CPF10MC	OK 63.80			
	CPF8C	OK 61.80	OK Tigrod 16.11	Shieldbright 347	OK Autrod 16.11, OK Flux 10.92L
CPH8, CPH20 CPK20	OK 67.67	OK Tigrod / Autrod 16.53	Shieldbright 309L	OK Autrod 16.53 , OK Flux 10.92L	



ASTM Designation	Class or grade	Recommended Consumables			
		SMAW	GTAW/GMAW	FCAW	SAW
A-479/A-479M	302, 304, 304H, 304N	OK 61.50	OK Tigrod 16.10	Shieldbright 308, 308L	OK Autrod 16.10, OK Flux 10.92L
	304L, 304LN	OK 61.30 , ESAB 304B	OK Tigrod 16.10, OK Autrod 16.10	Shieldbright 308L, 308L Xtra	OK Autrod 16.10, OK Flux 10.92L
	309S	OK 67.67	OK Tigrod / Autrod 16.53	Shieldbright 309L	OK Autrod 16.53 , OK Flux 10.92L
	309Cb	ESAB 309Cb			
	310S	OK 67.13	OK Tigrod 16.13		
	316, 316N	OK 63.50	OK Tigrod 316H	Shieldbright 316, Xtra	
	316L, 316LN	OK 63.30	OK Tigrod 16.30	Shieldbright 316L, Xtra	OK Autrod 16.30 , OK Flux 10.92L
	321, 321H, 347, 348	OK 61.80	OK Tigrod 16.11	Shieldbright 347	OK Autrod 16.11, OK Flux 10.92L
	403, 410, 414, 405, 430	OK 68.10, OK 68.15	OK Tigrod 410	Arcaloy 409-Ti	OK Autrod 410, OK Flux 10.92L
	A-487/A-487M	11A, 12A, 16A, 4B, 4D, 4E, 8B	ESAB 118	OK Aristorod 13.29	Dualshield T-115
8C, 9B, 9D, 10A, 11B, 12B, 13B, 6A, 6B, 7A, 14A, 10B		ESAB 120			
A-508/A-508M	1, 1A, 2, 3, 2A, 3A, 4B	ESAB 98	OK Tigrod / Aristorod 13.29		OK Autrod 13.44, OK Flux 10.62
	4,5	ESAB 118	OK Aristorod 13.29	Dualshield T-115	OK Autrod 13.43, OK Flux 10.62
A-513/A-513M	4A, 5A	ESAB 120			
	1008-1035	Pipeweld 6010R, Pipeweld 6010 plus,	ESAB MW1, OK Tigrod S2	Dualshield 7100LH	OK Autrod 12.24, OK Flux 10.71
A-515/A-515M	All	ESAB 28, ESAB 36H , Pipeweld 6010 R, OK 48.20 Spl	ESAB MW1, OK Aristorod 12.50, OK Tigrod S2 / S2 spcl	Dualshield 7100 LH	OK Flux 10.81L /10.71, OK Autrod 12.08L/12.22L / 12.40L
A-516/A-516M	All	ESAB 28, ESAB 36H , Pipeweld 6010 R, OK 48.20 Spl	ESAB MW1, OK Aristorod 12.50 , OK Tigrod S2 / S2 spcl	Dualshield 7100 LH	OK Flux 10.81L /10.71, OK Autrod 12.08L/12.22L / 12.40L
A-517/A-517M	All	ESAB 118, ESAB 120	OK Aristorod 13.29	Dualshield T-115	OK Autrod 13.43, OK Flux 10.62

ASTM Designation	Class or grade	Recommended Consumables			
		SMAW	GTAW/GMAW	FCAW	SAW
A-533/A-533M	Type A	OK 74.46	OK Tigrod 13.09	Dualshield 7000A1	OK Flux 10.62 , OK Autrod 13.09
	Type B	ESAB 118	OK Aristorod 13.29	Dualshield T-115	OK Autrod 13.43, OK Flux 10.62
A-537/A-537M	Type C and D	OK 73.08	OK Tigrod 13.16	OK Tubrod 15.24	
	Class 1	ESAB 36H, OK 73.08, OK 48.20 (spl)	ESAB MW1, OK Tigrod S2	Dualshield 7100 LH	
A-541/A-541M	Class 2	Filarc 75S, OK 73.68	OK Tigrod / Autrod 13.28	OK Tubrod 15.27	OK Autrod 13.27 , OK Flux 10.62
	1,1A	ESAB 36H, OK 74.46, ESAB 56	ESAB MW1, OK Tigrod S2	Dualshield 7100 LH	
A-543/A-543M	2,3,4	OK 73.08	OK Tigrod 13.16	OK Tubrod 15.24	
	3V, 22b	ESAB 98	OK Tigrod / Aristorod 13.29		OK Autrod 13.44, OK Flux 10.62
A-543/A-543M	2A, 3A, 7B, 22C, 7,8	ESAB 118	OK Aristorod 13.29	Dualshield T-115	OK Autrod 13.43, OK Flux 10.62
	22D, 7A, 8A	ESAB 120			
A-543/A-543M	1B, 1C, 3B, 3C	ESAB 118	OK Aristorod 13.29	Dualshield T-115	OK Autrod 13.43, OK Flux 10.62
	2B, 2C	ESAB 120			
A-556/A-556M	A2	Pipeweld 6010R, Pipeweld 6010 plus,	ESAB MW1, OK Tigrod S2	Dualshield 7100LH	OK Autrod 12.24, OK Flux 10.71
A-557/A-557M	B2, C2	ESAB 28, ESAB 36H , Pipeweld 6010 R, OK 48.20 Spl	ESAB MW1, OK Aristorod 12.50, OK Tigrod S2 / S2 spl	Dualshield 7100 LH	OK Flux 10.81L /10.71, OK Autrod 12.08L/12.22L / 12.40L
A-562/A-562M		ESAB 28, ESAB 36H , Pipeweld 6010 R, OK 48.20 Spl	ESAB MW1, OK Aristorod 12.50, OK Tigrod S2 / S2 spl	Dualshield 7100 LH	OK Flux 10.81L /10.71, OK Autrod 12.08L/12.22L / 12.40L
A-568/A-568M	All	Pipeweld 6010R, Pipeweld 6010 plus,	ESAB MW1, OK Tigrod S2	Dualshield 7100 LH	OK Autrod 12.24, OK Flux 10.71
A-572/A-572M	42, 50, 55, 60	ESAB 28, ESAB 36H , Pipeweld 6010 R, OK 48.20 Spl	ESAB MW1, OK Aristorod 12.50, OK Tigrod S2 / S2 spl	Dualshield 7100 LH	OK Flux 10.81L /10.71, OK Autrod 12.08L/12.22L / 12.40L
A-573/A-573M	65	OK 73.08	OK Tigrod 13.16	OK Tubrod 15.24	
	58,65	ESAB 28, ESAB 36H , Pipeweld 6010 R, OK 48.20 Spl	ESAB MW1, OK Aristorod 12.50, OK Tigrod S2 / S2 spl	Dualshield 7100 LH	OK Flux 10.81L /10.71, OK Autrod 12.08L/12.22L / 12.40L
	70	OK 73.08	OK Tigrod 13.16	OK Tubrod 15.24	



ASTM Designation	Class or grade	Recommended Consumables			
		SMAW	GTAW/GMAW	FCAW	SAW
A-592/A-592M	A,E,F	ESAB 118	OK Aristorod 13.29	Dualshield T-115	OK Autrod 13.43, OK Flux 10.62
A-612/A-612M	All	Filarc 75S , OK 73.68	OK Tigrod / Autrod 13.28	OK Tubrod 15.27	OK Autrod 13.27 , OK Flux 10.62
A-638/A-638M A-645/A-645M A-649/A-649M	2,4	ESAB 28, ESAB 36H , Pipeweld 6010 R, OK 48.20 Spl	ESAB MW1, OK Aristorod 12.50, OK Tigrod S2 / S2 spcl	Dualshield 7100 LH	OK Flux 10.81L /10.71, OK Autrod 12.08L/12.22L / 12.40L
	1A2 , 3	OK 76.18, OK 76.18 M	OK Tigrod 13.16, OK Tigrod B2L	Dualshield 8000B2	OK Autrod 13.10, OK Flux 10.62
	1B2	ESAB 118	OK Aristorod 13.29	Dualshield T-115	OK Autrod 13.43, OK Flux 10.62
A-660/A-660M	All	ESAB 36H, OK 48.20 Spl	ESAB MW1, OK Aristorod 12.50, OK Tigrod S2 / S2 spcl	Dualshield 7100 LH	OK Flux 10.81L /10.71, OK Autrod 12.08L/12.22L / 12.40L
A-662/A-662M	A&B	ESAB 36H, OK 48.20 Spl	ESAB MW1, OK Aristorod 12.50, OK Tigrod S2 / S2 spcl	Dualshield 7100 LH	OK Flux 10.81L /10.71, OK Autrod 12.08L/12.22L / 12.40L
	C			OK Tubrod 15.24	
A-666/A-666M	201, 202, 301, 302, 304	OK 61.50, ESAB 308H	OK Tigrod 16.10, OK Tigrod 308H	Shieldbright 308, 308L	OK Autrod 16.10 / 308H, OK Flux 10.92L
	304L, 304LN	OK 61.30 , ESAB 304B	OK Tigrod 16.10, OK Autrod 16.10	Shieldbright 308L, 308L Xtra	OK Autrod 16.10, OK Flux 10.92L
	316, 316M	OK 63.50	OK Tigrod 316H	Shieldbright 316, Xtra	
	316L	OK 63.30	OK Tigrod 16.30	Shieldbright 316L, Xtra	OK Autrod 16.30 , OK Flux 10.92L
A-671/A-671M A-672/A-672M	A45, A50, A55, B55, B65, B70, C55, C60, C65, C70, D70, D80, E55, E60	ESAB 36H, OK 48.20 Spl	ESAB MW1, OK Aristorod 12.50, OK Tigrod S2 / S2 spcl	Dualshield 7100 LH	OK Flux 10.81L /10.71, OK Autrod 12.08L/12.22L / 12.40L
	H75, H80	OK 74.46	OK Tigrod 13.09	Dualshield 7000A1	OK Flux 10.62, OK Autrod 13.09

ASTM Designation	Class or grade	Recommended Consumables			
		SMAW	GTAW/GMAW	FCAW	SAW
A-675/A-675M	J80, J90, J100, K75, K85, L65, L70, L75, M70, M75, N75	ESAB 118, OK 76.18, OK 76.18 M	OK Tigrod 13.16, OK Tigrod B2L	Dualshield 8000B2	OK Autrod 13.10, OK Flux 10.62
	45, 50, 55, 60	ESAB 36H, OK 48.20 Spl	ESAB MW1, OK Aristorod 12.50, OK Tigrod S2 / S2 spcl	Dualshield 7100 LH	OK Flux 10.81L /10.71, OK Autrod 12.08L/12.22L / 12.40L
A688-88a	65,70	ESAB 98	OK Tigrod / Aristorod 13.29		OK Autrod 13.44, OK Flux 10.62
	TP304	OK 61.50, ESAB 308H	OK Tigrod 16.10, OK Tigrod 308H	Shieldbright 308, 308L	OK Autrod 16.10 / 308H, OK Flux 10.92L
A691-85a	TP304L, 304H	OK 61.50, ESAB 308H	OK Tigrod 16.10, OK Tigrod 308H	Shieldbright 308, 308L	OK Autrod 16.10 / 308H, OK Flux 10.92L
	TP304LN	OK 61.30, ESAB 304B	OK Tigrod 16.10, OK Autrod 16.10	Shieldbright 308L, 308L Xtra	OK Autrod 16.10, OK Flux 10.92L
	TP316	OK 63.50	OK Tigrod 316H	Shieldbright 316, Xtra	
	TP316L	OK 63.30	OK Tigrod 16.30	Shieldbright 316L, Xtra	OK Autrod 16.30 , OK Flux 10.92L
	TP316LN	ESAB 317 LN	OK TIGROD 13.09		
	CM-65, CM-70	OK 74.46	OK TIGROD 13.09	OK TUBROD 15.22	
A695-81	CM-75, CMSH-70	OK 73.08	OK TIGROD 13.14		
	CMSH-80			OK TUBROD 15.24	
	0.5CR., 1CR	OK 76.18	OK TIGROD 13.16	OK TUBROD 15.20	
	1.2 CR			OK TUBROD 15.20	
A696-85	2.25 CR	OK 76.28	OK Tigrod 13.17, OK Tigrod B3L		
	Grades 35&40	ESAB 36H, OK 48.20	OK Tigrod S2	Dualshield 7100 Ultra	
	B	Pipeweld 6010R, Citoflex, Pipeweld 6011	OK Tigrod S2	Dualshield 7100 Ultra	

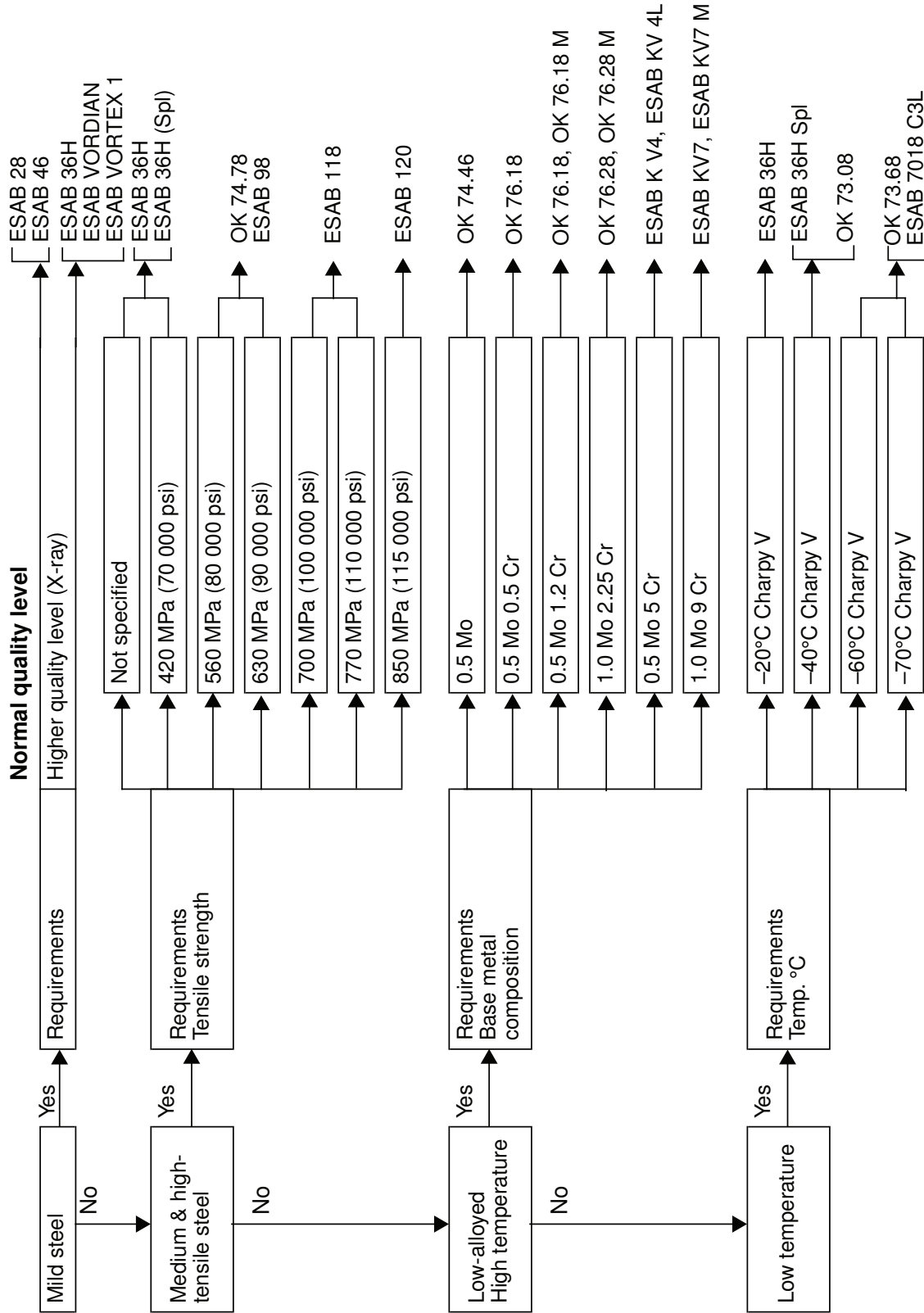


ASTM Designation	Class or grade	Recommended Consumables			
		SMAW	GTAW/GMAW	FCAW	SAW
A-724-88	C	ESAB 36H, OK 48.20	ESAB MW1, OK Tigrod S2	Dualshield 7100 Ultra	
A727-87	All	Esab 118		OK Tubrod 15.24	
A737-87	B	OK 74.46	OK Tigrod 13.09	DS 7000 A1	
A738-87a	B	OK 73.08	OK Tigrod 13.14	OK Tubrod 15.24A	
	C	Esab 118		OK Tubrod 15.27A	
	A	Ferroweld W		DS 8100W	
	B&C			DS 8100W	
	B11	OK 76.18	OK Tigrod 13.16	OK Tubrod 15.20	
A739-81a		OK 76.28	OK Tigrod 13.17	OK Tubrod 15.22	
A-765-87	B22				
	I	OK 73.08	OK Tigrod 13.14	OK Tubrod 15.24	
	II	OK 73.68		OK Tubrod 14.04	

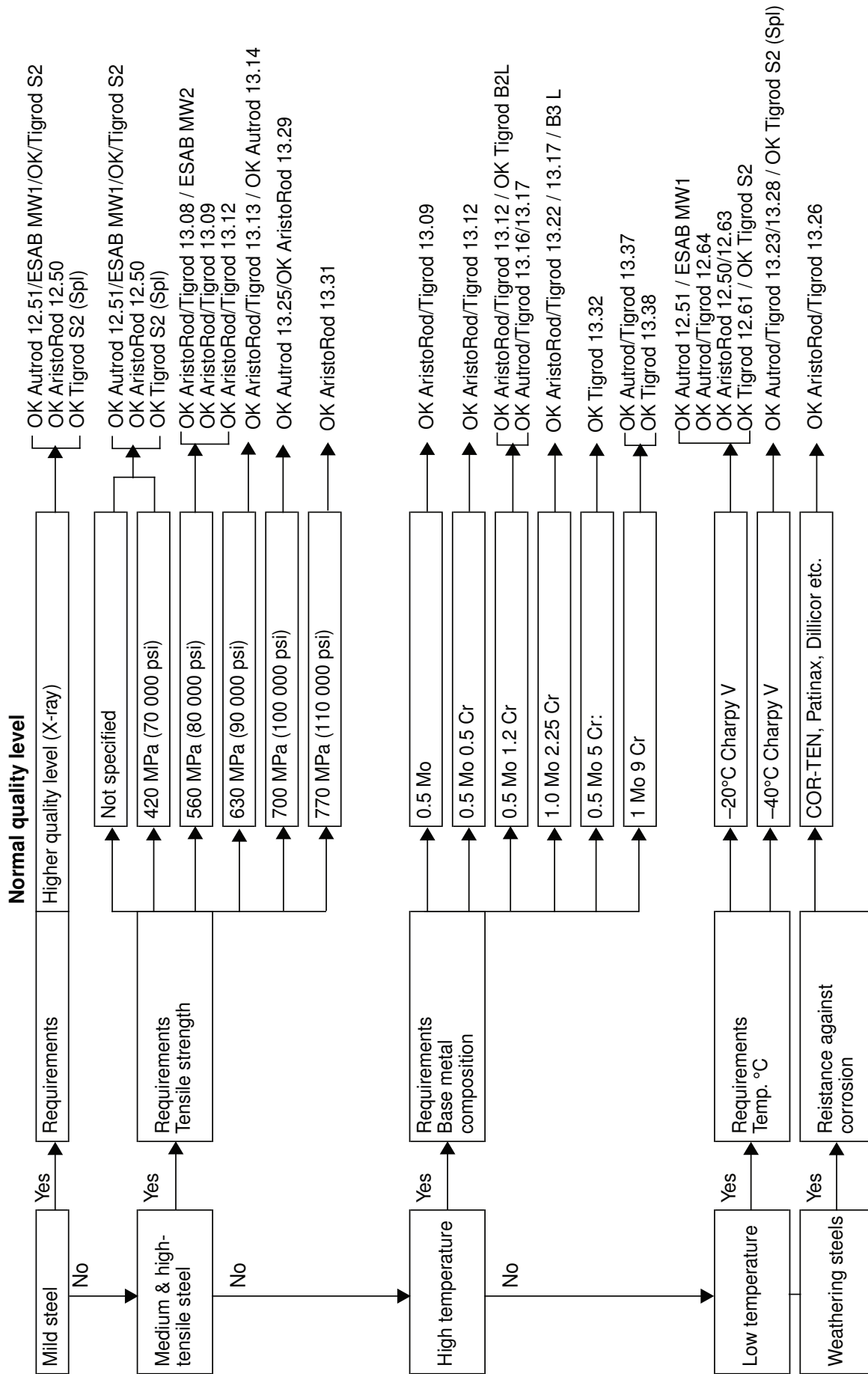


QUICK GUIDE

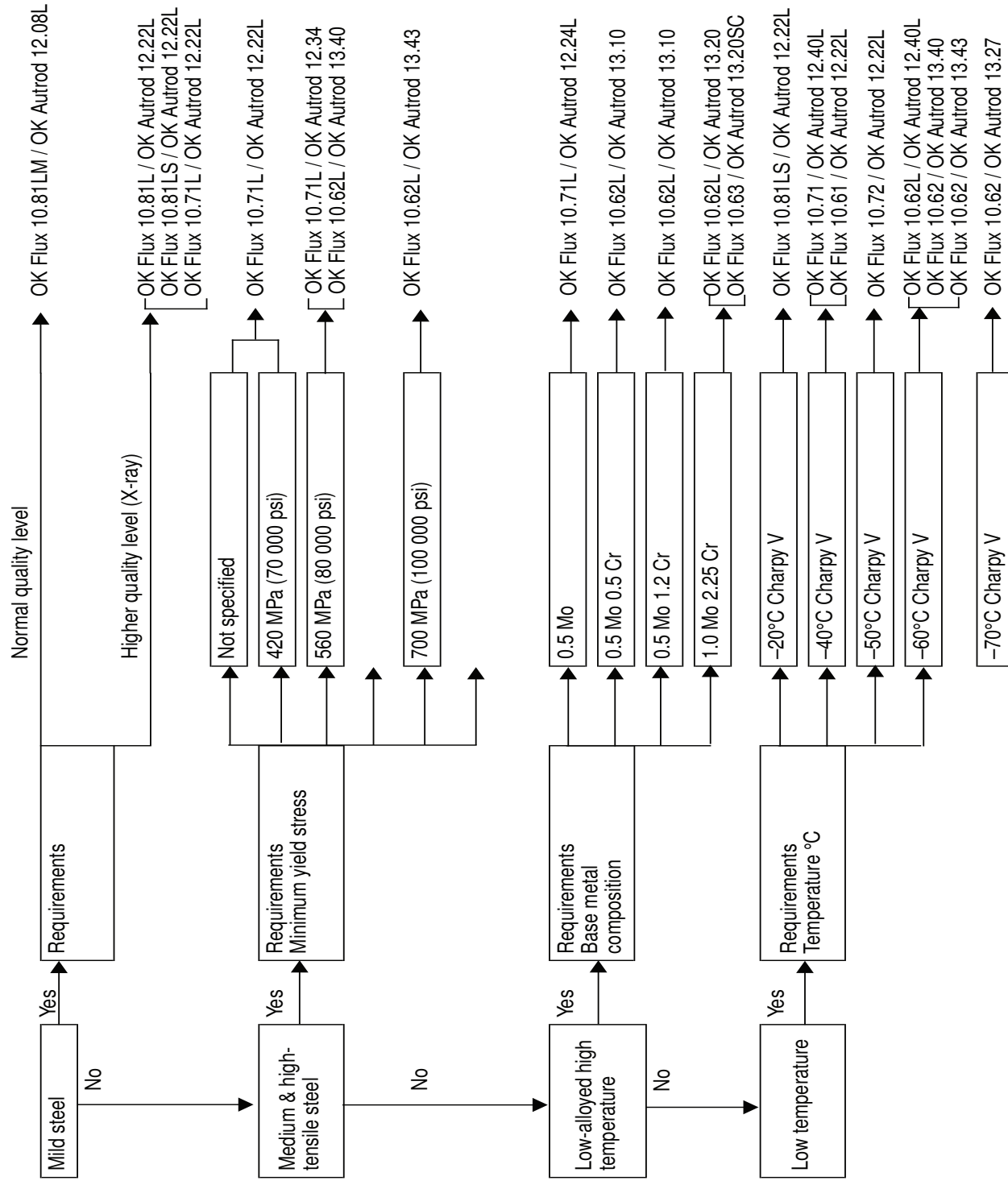
1. MMA electrodes for mild and low-alloyed steels



2. Solid wires

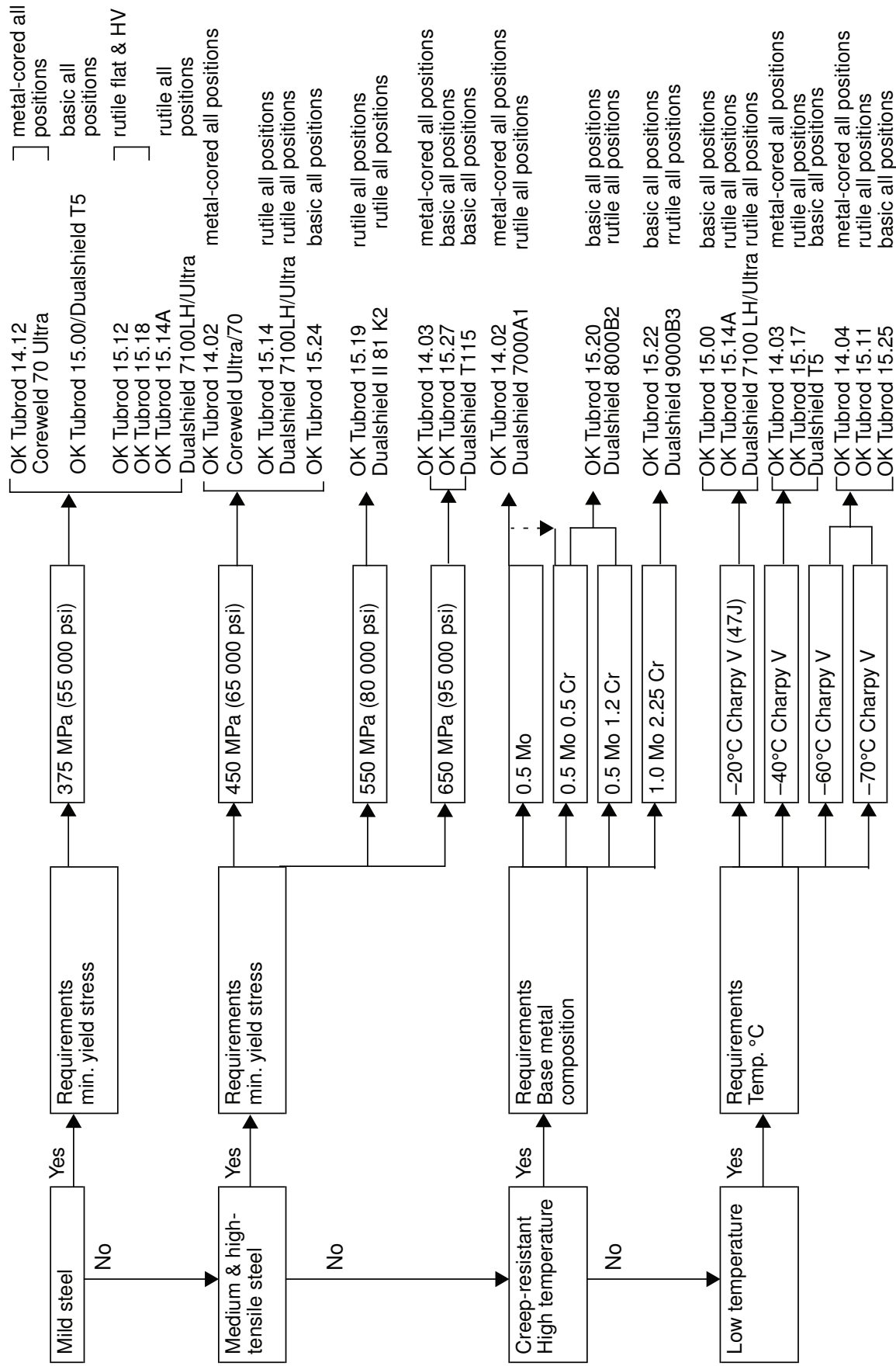


3. Fluxes and submerged arc wires

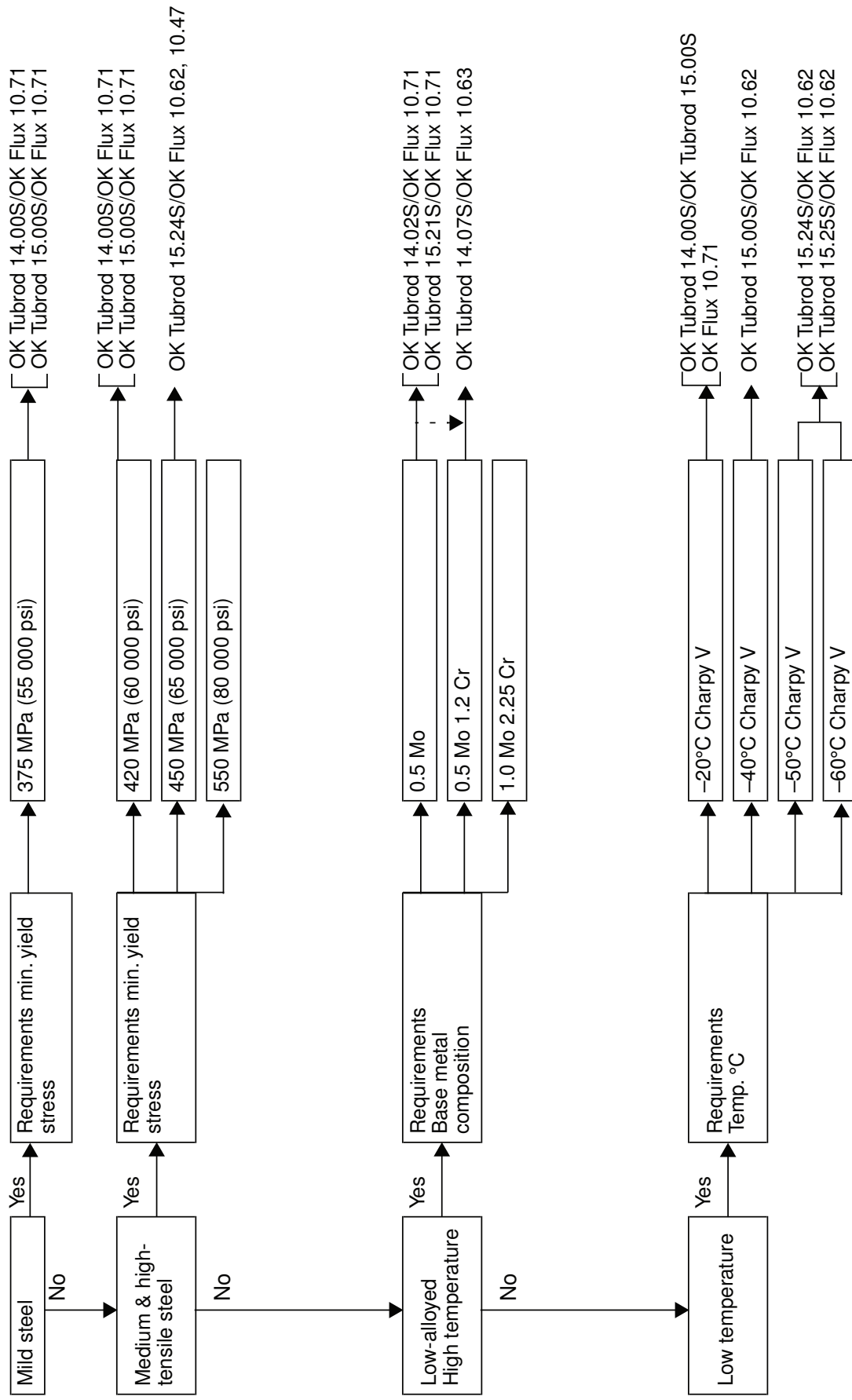




4. Cored wires



5. Submerged arc cored wires and fluxes





6. Wires for stainless steels. Selection by wire classification

EN 10088-1 Designation	Werkstoff. No	AISI	C	Cr	Ni	Mo	Other elements	MIG OK Autrod	TIG OK Tigrod
Austenitic									
X10CrNi18-8	1.4310	302	< 0.12	18	8			16.10	16.10
X5CrNi18-10	1.4301	304	< 0.07	18	10			16.10	16.10
X6CrNiTi18-10	1.4541	321	< 0.08	18	11		Ti 0.7	16.11	16.11, 16.10
X6CrNiNb18-10	1.4550	347	< 0.08	18	11		Nb 0.7	16.11	16.11, 16.10
X8CrNiS18-9	1.4305	303	< 0.12	18	9		S 0.2	16.53	16.53, 309L
X2CrNi18-9	1.4307	304L	< 0.03	18	10			16.10	16.10
X2CrNiN18-10	1.4311	304LN	< 0.03	18	10		N 0.15	16.10	16.10
		304N	< 0.08	18	9		N 0.15	16.10	16.10
X3CrNiMo17-13-3	1.4436	316	< 0.05	18	12	2.5		16.30	16.30
X5CrNiMo17-12-2	1.4401	316	< 0.05	18	12	2.5			
X2CrNiMo17-12-2	1.4404	316L	< 0.03	18	12	2.5			
X2CrNiMo18-14-3	1.4435	316L	< 0.03	18	13	2.5		16.38	16.38
X6CrNiMoTi17-13-2	1.4571	316Ti	< 0.08	18	12	2.5	Ti 0.7	318Si, 16.30	318Si, 16.30
X2CrNiMoN17-13-3	1.4429	316LN	< 0.03	18	12	2.5	N 0.5	16.30	16.30
X12CrMnNiN	1.4372	202	< 0.15	18	5		Mn 8	16.95	16.95
X2CrNiMo18-15-4	1.4438	S31703	< 0.03	18	16	3.5		317L	317L
X1NiCrMoCuN25-20-5	1.4539	N08904	< 0.03	20	25	4.5	Cu 1.5	385	385
X1CrNiMoCuN20-18-7	1.4547	S31254	< 0.02	20	18	6.2	Cu 0.8, N 0.2	19.81, 19.82	19.81, 19.82
X1NiCrMoCu31-27-4	1.4563	N08028	< 0.02	27	31	3.5	Cu 1.5	19.81, 19.82	19.81, 19.82
-	1.4652	S32654	< 0.02	24	22	7.3	Cu 0.5, N 0.5	19.81	19.81
X9CrNiSiNCE21-11-2	1.4835	S30815	< 0.10	21	11		N 0.17 + Ce	310	310
Austenitic-ferritic (Duplex)									
X2CrNiN23-4	1.4362	S32304	< 0.03	23	4		Mn 5	16.86	16.86
X2CrNiMoN22-5-3	1.4462	S31803	< 0.03	22	5	3	N 0.10	16.86	16.86
X2rNiMoN25-7-4	1.4410	S32750	< 0.03	25	7	4	N 0.25	16.88	16.88
X2CrNiMoCuWN25-7-4	1.4501	S32760	< 0.03	25	6	3	N 0.25 W 0.7	16.88	16.88

EN 10088-1 Designation	Werkstoff. No	AISI	C	Cr	Ni	Mo	Other elements	MIG OK Autrod	TIG OK Tigrod
Ferritic-martensitic									
X6Cr13	1.4000	403	< 0.08	13				16.10	16.10
X2CrNi12	1.4003	S41050	< 0.03	12	0.7			16.10	16.10
X12Cr13	1.4006	410	0.1	13				16.53	16.53
Ferritic									
X6Cr17	1.4016	430	< 0.08	16.5				430Ti, 430LNb, 16.10	430Ti, 16.10
X6CrTiNb18	1.4509	441	< 0.03	18			Ti, Nb	16.10	16.10
X6CrTi17	1.4510	439	< 0.8	17			Ti	430Ti, 430LNb	430Ti
X2CrMoTi18-2	1.4521	S44400	< 0.03	18		2		430Ti	430Ti
-	-	446	< 0.20	26				16.30	16.30
								16.13	16.13



7. The most common fluxes and wires for SAW of stainless steels

European standard EN 10082-1 Designation steel	German DIN 17440		England BS 970; 1=Part 1 BS 1449; 2=Part 2	France AFNOR NFA 35-572 to NFA 35-578	SS steel No	USA AISI	Recommended SAW consumables OK Flux + OK Autrod
	No	Designation steel					
X 6 Cr 13	1.4000	X 7 Cr 13	1.4000	Z 6 C 13	2301	403	10.92L+16.10 or 308H/10.92L+16.10
X 12 Cr 13	1.4006	X 10 Cr 13	1.4006	Z 12 C 13	2302	410	10.92L+16.10 or 308H/10.92L+16.10
X 20 Cr 13	1.4021	X 20 Cr 13	1.4021	Z 20 C 13	2303	420	10.92L+16.10 or 308H/10.92L+16.10
X 30 Cr 13	1.4028	X 30 Cr 13	1.4028	Z 30 C 13	2304	-	10.92L+16.10 or 308H/10.92L+16.10
X 6 Cr 17	1.4016	X 6 Cr 17	1.4016	Z 8 C 17	2320	430	10.92L+16.11 or 308H/10.92L+16.10
X 17 Cr Ni 16-2	1.4057	X 20 Cr Ni 17 2	1.4057	Z 15 CN 16.02	2321	431	10.92L+16.11 or 10.92L+16.11
			1.4749 ¹⁾	Z 10 C 24	2322	446	10.92L+16.13
		X 8 Cr Ni Mo 27 5 2 ¹⁾	1.4460 ¹⁾	-	2324	329	10.92L+2209 or 2509/10.94+2509
X 2 Cr Ni N 23-4	1.4362		-	-	2327	S32304	10.92L+2209 or 2509/10.94+2509
X 2 Cr Ni Mo N 22-5-3	1.4462		-	-	2377	S31803	10.92L+2209 or 2509/10.94+2509
X 2 Cr Ni Mo N 25-7-4	1.4410		-	-	2328	S32750	10.94+2509
X 2 Cr Ni Mo Ca WN 25-7-4	1.4501		-	-	-	S32760	10.94+2509
X 10 Cr Ni 18-8	1.4310		-	Z 10 CN 18.09	2331	302	10.92L+16.10/10.92L+16.10
X 5 Cr Ni 18-10	1.4301	X 5 Cr Ni 18 10	1.4301	Z 6 CN 18.09	2332	304	10.92L+16.10/10.92L+16.10
X 5 Cr Ni 18-10	(1.4301)	(X 5 Cr Ni: 18 10)	(1.4301)	(Z 6 CN 18.09)	2333	(304)	10.92L+16.10/10.92L+16.10
X 6 Cr Ni Ti 18-10	1.4541	X 6 Cr Ni Ti 18 10	1.4541	Z 6 CNT 18.10	2337	321	10.92L+16.11 or 10.92L+16.11
X 6 Cr Ni Nb 18-10	1.4550	X 10 Cr Ni Nb 18 10	1.4550	Z 6 CNNb 18.10	2338	347	10.92L+16.11 or 10.92L+16.11
X 3 Cr Ni Mo 17-13-3	1.4436	(X 5 Cr Ni Mo 17 13 3)	1.4436	(Z 6 CND 17.12)	2343	(316)	10.92L+16.30 or 10.92L+16.30
X 5 Cr Ni Mo 17-12-2	(1.4401)	(X 5 Cr Ni Mo 17 12 2)	(1.4401)	(Z 6 CND 17.11)	2347	(316)	10.92L+16.30 or 10.92L+16.30
X 2 Cr Ni Mo 17-12-2	1.4404	X 2 Cr Ni Mo 17 13 2	1.4404	Z 2 CND 17.12	2348	316 L	10.92L+16.30 or 10.92L+16.30
X 6 Cr Ni Mo Ti 17-12-2	1.4571	X 6 Cr Ni Mo Ti 17 12 2	1.4571	Z 6 CNDT 17.12	2350	316 Ti	(10.92L+16.30) or (10.92L+16.30)
X 2 Cr Ni 18-9	1.4307	X 2 Cr Ni 18 10	1.4306	Z 2 CN 18.10	2352	304 L	10.92L+16.10 or 308H/10.92L+16.10
X 2 Cr Ni Mo 18-14-3	1.4435	X 2 Cr Ni Mo 18 14 3	1.4435	Z 2 CND 17.13	2353	316 L	10.92L+16.10 or 10.92L+16.10
(EN 10095)	1.4845	X 12 Cr Ni 25 21 ¹⁾	1.4845 ¹⁾	(Z 12 CN 25-20)	2361	310 S	10.92L+310
X 8 Cr Ni 25-21							
X 2 Cr Ni Mo 18-15-4	1.4438	X 2 Cr Ni Mo 18 16 4	1.4438	Z 2 CND 19.15	2367	317 L	10.92L+317L or 10.92L+317L
X 2 Cr Ni N 18-10	1.4311	X 2 Cr Ni N 18 10	1.4311	Z 2 CN 18.10 Az	2371	304 LN	(10.92L+16.10) or (10.92L+16.10)
X 2 Cr Ni Mo N 17-13-3	1.4429	X 2 Cr Ni Mo N 17 13 3	1.4429	Z 2 CND 18.10 Az	2375	316 LN	(10.92L+16.30) or (10.92L+16.30)

1) not standard

9. MIG and TIG wires for aluminium

Base material

EN 573 Alloy designation Numerical	Chemical symbols	The Aluminum Association	ESAB filler metal OK Autrod/Tigrod
EN AW-1050A	EN AW-Al 99,5	AA 1050A	1070,1100, 1450
EN AW-1070A	EN AW-Al 99,7	AA 1070A	1070,1100, 1450
EN AW-1100	EN AW-Al 99,0Cu	AA 1100	1070,1100
EN AW-1200	EN AW-Al 99,0	AA 1200	1070,1100
EN AW-3003	EN AW-Al Mn1Cu	AA 3003	4043, 4047
EN AW-3103	EN AW-Al Mn1	AA 3103	4043, 5356
EN AW-3004	EN AW-Al Mn1Mg1	AA 3004	4043, 5356
EN AW-4045	EN AW-Al Si10	AA 4045	4043,4047
EN AW-5005	EN AW-Al Mg1(B)	AA 5005	5356
EN AW-5019	EN AW-Al Mg5	AA 5019	5356
EN AW-5050	EN AW-Al Mg1,5(C)	AA 5050	5356
EN AW-5052	EN AW-Al Mg2,5	AA 5052	5356
EN AW-5083	EN AW-Al Mg4,5Mn0,7	AA 5083	5183
EN AW-5086	EN AW-Al Mg4	AA 5086	5356
EN AW-5454	EN AW-Al Mg3Mn	AA 5454	5554
EN AW-6013	EN AW-Al Mg1Si0,8CuMn	AA 6013	4043, 5356
EN AW-6060	EN AW-Al MgSi	AA 6060	4043, 5356
EN AW-6061	EN AW-Al Mg1SiCu	AA 6061	5356
EN AW-6063	EN AW-Al Mg0,7Si	AA 6063	5356
EN AW-6082	EN AW-Al Si1MgMn	AA 6082	4043, 5356
EN AW-7005	EN AW-Al Zn4,5Mg1,5Mn	AA 7005	5356
EN AW-7021	EN AW-Al Zn5,5Mg1,5	AA 7021	5356
EN AW-7029	EN AW-Al Zn4,5Mg1,5Cu	AA 7029	5356
EN AW-7039	EN AW-Al Zn4Mg3	AA 7039	5356
EN AW-7050	EN AW-Al Zn6CuMgZr	AA 7050	5356

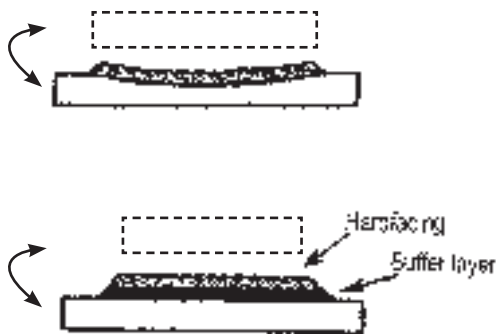
Reclamation Consumables



BUFFERING

Buffer layers are used as intermediate deposits between the base material and the actual hardfacing weldmetal so that the following aspects are taken care of:

- **Good bonding with the base material**
- **Hydrogen-induced underbead cracking is avoided, even on preheated workpieces**
- **Stress consequences are minimized**
- **Effect of dilution is limited**
- **Spalling in subsequent hard layers is avoided**
- **Prevention of cracks or relief checks from the hardfaced layers running into the base material**



Generally, austenitic consumables are widely used as ductile buffer layers in hardfacing applications. The choice of consumables depends on the base material and the type of hardfacing alloy given the wear factors.

The hardfacing layer tends to sink under high load conditions if the base material is a soft one like mild steel. This can result in the hardfacing layer spalling off. A tough and strong buffer layer is applied to prevent this occurrence.



In case of hardfacing with very hard and brittle alloys like the ones containing chromium carbides or with cobaltbased alloys, there should be a buffering by an austenitic consumable for one or two layers. The compression stresses generated in the subsequent hard layers during cooling are thus accommodated, reducing the risk of cracks in the hard weld metal.

The “relief checks” present in many hardfacing deposits can propagate into the base metal under heavy impact or flexing. High strength steels are most prone to such crack propagation. This is prevented by applying a tough buffer layer.

BUILD-UP LAYERS

In case of heavy wear, the component has to be built-up to its original dimensions. But hardfacing layers are limited to 2-3 layers. In that case, a similar type of alloy can be used to build it up before applying the hardfacing deposit. Otherwise, alternate layers of hard and ductile deposits can be made finishing off with the hard layer. E.g. hammers, crushers, cold shearing tools, and excavator teeth.



DUROID 250

Machinable build-up prior to hardfacing

A smooth running rutile coated general-purpose hardfacing electrode, depositing a tough air-hardening alloy weld metal, suitable for resisting moderate friction, abrasion and impact.

ALLOY BASE: Fe, Cr, Mn

SPECIAL FEATURES

- Smooth arc with low spatter.
- Normally machinable weld metal.
- Deposits a weld with self-lifting slag.

APPLICATIONS

Track links, rollers and sprockets, ropeway pulleys, trunion wearing plates, gears, shafts and general reclamation of all worn out carbon steel parts requiring

subsequent matching. Other applications are pump housing, rail ends (medium Mn steel) for railways and tramways, forging dies, wheels, axles, and couplings.

Suitable for use as a supporting buffer between a top layer of harder weld metal and a soft mild steel base. Recommended for hardfacing components and machine parts, which must be easily machinable after hardfacing.

PROPERTIES

Hardness : 24-27 HRC

CURRENT RANGE : (AC 50, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
3.15	450	90-120
4.00	450	130-170
5.00	450	155-200

DUROID 350

Machinable buffer for impact and moderate abrasion

A smooth running rutile coated hardfacing electrode depositing a tough air hardening type weld metal for resisting moderate abrasion and impact. The deposit is machinable with suitable carbide tipped tools.

ALLOY BASE: Fe, Cr, Mn

SPECIAL FEATURES

- Good for build-up and buffering.
- Excellent weld bead appearance.
- Deposits a weld with fine bead appearance and easy de-slagging properties.

APPLICATIONS

Roller, tractor idler wheels, brake shoes, crane wheels, wobblers, gears, shafts, forging dies, ploughshares, conveyor parts, track rollers, drive sprockets, tie tamping bars and picks, cams, cold punching dies, etc. where resistance to abrasion combined with toughness is needed.

PROPERTIES

Hardness : 33-36 HRC

CURRENT RANGE : (AC 50, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
3.15	450	90-120
4.00	450	120-170
5.00	450	160-240

DUROID 650

Abrasion resistant hardfacing

This rutile-coated electrode gives an air-hardening type weld deposit, which is resistant to severe abrasion and moderate impact between metal to mineral wearing stresses. It provides moderate resistance to corrosion and scaling.

ALLOY BASE: Fe, Cr, Mn

SPECIAL FEATURES

- Smooth arc with low spatter.
- It is very easy to use in all positions. • Excellent weld bead appearance.

APPLICATIONS

Bulldozer blades, excavator teeth, metal cutting & forming tools, hot & cold punching dies, bucket lips, chutes, conveyors, shears & croppers, oil expellers, pulping knives, ploughshares, road graders, crusher hammers, caterpillar treads, cane & bamboo cutting knives, etc. Recommended for applications involving metal to mineral wear.

PROPERTIES

Hardness : 55-58 HRC

CURRENT RANGE : (AC 70, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
3.15	450	90-120
4.00	450	120-170
5.00	450	160-240

DUROID 650B

No-problem abrasion resistance even for thicker plates

A high alloyed basic hardfacing electrode depositing a nonmachinable air-hardening weld metal. The weld deposit is resistant to severe abrasion and moderate impact between metal to mineral wearing stresses. It also resists scaling upto temperatures around 300°C and also moderate corrosion.

Apart from applications on mild and medium carbon steels Duroid 650B, being basic coated, can also be used over high carbon and alloy steel base metals and on jobs of thicker cross-section. Requirement of pre-heat can be lowered or avoided altogether to obtain weld deposit free from cracks, porosity and slag inclusions when normal welding practice for basic coated electrode is followed.

ALLOY BASE: Fe, Cr, Mn, Mo, V

SPECIAL FEATURES

- Can be used on thicker sections without the need of buffering.

- Smooth arc with low spatter.
- It is very easy to use in all positions. · Excellent weld bead appearance.

APPLICATIONS

Coal cutter blades, rock drills, drill bits, oil expeller worms, cane & bamboo cutting knives, excavator teeth, hot & cold punching dies, bucket lips, dipper teeth, impellers, muller ploughs, chutes, conveyors, shears & croppers, pulping knives, ploughshares, road graders, crusher hammers, caterpillar treads & shoes, etc. This electrode is specially recommended for applications involving metal to mineral wear.

PROPERTIES

Hardness : 57-59 HRC

CURRENT RANGE : (AC 70, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
3.15	450	100-140
4.00	450	120-180
5.00	450	160-250

ESAB 600B

Self-buffering abrasion resistant deposit

ESAB 600B is a basic coated electrode meant for depositing hard surface having high resistance to wear caused by scouring action or rolling friction. It is insensitive to cracking tendency so the deposit does not require any additional buffering. The weld metal consists of uniformly distributed hard carbides in a martensitic matrix which make this electrode ideally suited for hardfacing parts, subjected to severe service conditions involving a combination of abrasion, moderate impact, and friction.

Transverse relief cracks are welcome in the weld metal.

ALLOY BASE: Fe, Mn, C, Cr

SPECIAL FEATURES

- Excellent weld bead appearance.
- Slag is easily detachable.

- The deposit, hard as it is, can only be finished by grinding.

APPLICATIONS

Used for hardfacing of dredger buckets, draught bucket, working edges and surfaces of earth-moving equipment used in rocky soils, chain link, agricultural implements, vibrating shafts, steel sleeves, hammer mills, press tools, dies, punches and shears, tip of excavator, mill hammers for pulverizing coal & disintegrating chrome ore, iron ore, bucket teeth, shear blades, chutes and conveyors etc.

PROPERTIES

Hardness : 58-61 HRC

CURRENT RANGE : (AC 70, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
3.15	450	85-120
4.00	450	90-160
5.00	450	150-240

DUROMANGAN

Work hardening for extreme impact and abrasion

A basic coated electrode depositing an austenitic manganese steel weld metal. The deposit is highly resistant to heavy impact and abrasion. The deposit is work hardenable. The electrode is recommended for surfacing of worn-out austenitic manganese steel parts.

It can also be used to give impact protection on carbon steels.

ALLOY BASE: Fe, Mn, Ni, Cr

SPECIAL FEATURES

- Build-up is free from cracks (with proper welding procedure).

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- Superior arc stability than available grades of Mn Steel electrodes.
- It is very easy to use in all positions.

APPLICATIONS

Austenitic manganese steel components, crusher jaws, crusher hammers, crusher mantles, dredger bucket teeth, cement grinder rings, manganese steel railway points & crossings, manganese steel components used in the mining industry.

PROPERTIES

Hardness : As deposited : 24-26 HRC
Work hardened : 43-45 HRC

WELDING PROCEDURE

- The surface to be welded should be without prior work hardening.
- 14% Mn steel should never be preheated for welding.

- Welding should be done in stringer beads directing the arc towards the weld pool keeping the heat input to the base metal minimum. Skip welding/back step welding can also be adopted.
- The weld bead can be peened with ball pen hammer immediately after welding.
- Quenching has no adverse effect on welding and should be adopted whenever possible after slag removal and peening. If possible the Mn steel job can be submerged in water during welding.

CURRENT RANGE : (AC 70, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
3.15	450	80-120
4.00	450	130-170
5.00	450	160-220



HARDFACING

Hardfacing involves protecting parts exposed to different types of wear in order to obtain a certain specific wear resistance.

Hardfacing is primarily used to restore worn out parts back to usable condition in order to extend their service life but it can be successfully employed in new component manufacture as well. This technique will help in manufacturing a component from cheaper material with a wear resistant overlay providing the surface properties.

A higher hardness level does not necessarily imply improved wear resistance or longer life. The effectiveness of any hardfacing alloy depends of its suitability in the operating conditions.

So the appropriate hardfacing alloy has to be selected considering the following aspects:

- the wear factors
- the base material of the component
- the surface finish required
- the process to be used

WEAR FACTORS

Wear factors are the action of different agents on the metallic surface leading to degeneration and disintegration of the metal. A number of wear factors exist, which act individually or in combination. The weld metals have to be selected properly to counter these factors effectively.

The major types of wear factors are as follows:

Friction	Wear from metal parts that roll or slide against each other. It accounts for 15% of the total spectrum of industrial wear. This type of wear is likely to be most severe when parts rub together under load with little or no lubrication. Generally, contact between surface materials of the same hardness will result in excessive wear. E.g. shafts against bearing surfaces, chain links against a roll, sprockets, steel mill rolls.
Impact	The sudden action of a very large force for a very short time period gives rise to wear after some time. The mechanism is attributed to fatigue failure that has an incubation period prior to the appearance of surface damage. E.g. crusher rolls, impact hammers, railway points and crossings.
Abrasion	About 50% of all industrial wear is abrasion in different forms. The wear takes place when metal is removed from a surface by the cutting or gouging action of hard

non-metallic particles. Abrasion may be classified into three types:

- a) Gouging abrasion: This class of abrasion involves the removal of sizable particles from a metallic surface by the action of a coarse material. The high pressure and impact cause the particles to cut into the surface and produce large gouge marks and scratches. Eg. shovel diggers, chute impact areas, pulveriser mills.
- b) Low stress abrasion: This form of wear results from the sliding action of free moving hard particles along a surface. Material is removed by scratching or micro-machining process. Eg. chutes, mineral conveyors.
- c) High stress abrasion: It occurs where abrasive particles are forced between two metal parts and crushed under heavy loads. The wear involves surface damage accompanied by plastic deformation. Eg. rock drills, scraper blades, ball mills.

Erosion	This wear is similar to abrasion but the particles are carried by a fluid stream like water, steam, etc., generally at a higher velocity compared to low-stress abrasion. Eg. slurry transport systems, shot blasting equipment.
Cavitation	When a liquid is subjected to rapid changes of pressure, vapour or gas bubbles form in the lower pressure regions of the liquid. Entering high pressure areas at any metal/liquid interface, these bubbles collapse and the immense force causes cyclic stress and fatigue on the metal surface. E.g. ship propellers, pump impellers.
Heat	When metals are exposed to high temperature for long periods, they lose their durability mainly due to thermal fatigue cracking. Moreover, the metals tend to lose their strength and hardness at higher temperatures. These factors add up to wear. Eg. hot forging dies, extrusion dies, stamping dies, sinter crushing equipment.
Corrosion	It involves reaction between a metallic surface and a corrosive environment whence the former is dissolved away leading to wear. In the presence of any mechanical force, the corrosion products may be removed leading to virgin surface coming in contact with the

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corrosive environment again causing continued wear. E.g. valves, seating rings, screw conveyors.

Oxidation In an oxidizing atmosphere, possibly aided by high temperatures, the metal surface builds up an oxide layer, which is mostly brittle in nature. This may break due to expansion and the entire oxidation operation is repeated. E.g. blast furnace parts, exhaust valves of internal combustion engines, hot working shears.

BASE MATERIAL

The two main groups of base materials for hardfacing are:

- Carbon or low-alloy steels: These steels require preheating, post-weld heat treatment, slow cooling for hardfacing according to the chemical composition and the section thickness. The general guidelines for preheating are given at the end of this section.
- Austenitic manganese steels: These steels should be welded without any preheating or post-weld heat treatment at all. The interpass temperature should be kept as low as possible.

SURFACE FINISH

The surface finish requirements must be kept in mind while selecting the hardfacing alloy as they cover the entire range from easily machinable to non-machinable. Additionally, many of these deposits will contain “relief

checks”, which are formed across the bead as the bead releases the stress generated while the hard weld metal cools. These relief checks are not harmful to the deposit but may propagate into the base metal if the component is subjected to heavy impact or flexing.

So, the issues of acceptability of relief checks and finishing requirements should be addressed to when the hardfacing deposit is decided.

WELDING PROCESSES

- Shielded Metal Arc Welding** : Covers the widest range of weld metals
is a versatile process for on - site repairs and out-of-position work
is inexpensive
- Flux - Cored Arc Welding** : the same range of alloys available as in case of coated electrodes
on-site use is possible
self-shielded wires do not require any additional shielding gas
high deposition rate
- Submerged Arc Welding** : high deposition rate
no spatter loss
product range limited
positional welding not possible

RECOMMENDED PREHEATING TEMPERATURES IN °C

This chart is given as an indicative guide

Base Material Filler material	Plate thickness (mm)	Steel <90 HRB	Low alloy 95 HRB-30 HRC	Tool steel 30-43 HRC	Cr-steel 5-12% Cr 32-51 HRC	Cr-steel >12% Cr 95 HRB-30 HRC	Stainless steel -96 HRB	14% Mn steel 25-51 HRC
Low-alloy Steel ↕ 95 HRB - 30 HRC	20	N	100	150	150	100	N	N
	20-60	N	150	200	250	200	N	N
	60	100	180	250	300	200	N	N
Tool Steel ↕ 32 - 47 HRC	20	N	100	180	200	100	N	N
	20-60	N	125	250	250	200	L	N
	60	125	180	300	350	250	N	L
12% Cr Steel ↕ 32 - 51 HRC	20	N	150	200	200	150	N	X
	20-60	100	200	275	300	200	150	X
	60	200	250	350	375	250	200	X
Stainless Steel ↕ 95 HRS	20	N	N	N	N	N	N	N
	20-60	N	100	125	150	200	N	N
	60	N	150	200	250	200	100	N
Mn Steel ↕ 20 HRC	20	N	N	N	X	X	N	N
	20-60	N	N	*100	X	X	N	N
	60	N	N	*100	X	X	N	N
Co. based Gr.6 ↕ 40 HRC	20	100	200	250	200	200	100	X
	20-60	300	400	*450	400	350	400	X
	60	400	400	*500	*500	400	400	X
Carbide type ↕ 55 HRC	20	N	NIL	NL	NL	NL	NL	NL
	20-60	N	100	200	*200	*200	NL	NL
	60	NIL	200	250	*200	*200	NL	NL

N = Not necessary

L = Preheating when large areas are surfaced

X = This combination is not used



ASTRÄ HTB

Resistance to corrosion, cavitation and erosion

Astra HTB is the only machinable alloy that resists corrosion, cavitation along with erosion by suspended particles on the strength of the unique recipe of this electrode. The alloy also shows great resistance to deform in service and hence maintains shape and angularity of the original machined component at room temperature and also upto 700°C.

Astra HTB endures in high temperature service as well. It offers best combination of machinability, friction and fatigue resistance, and shape retention at high temperature.

ALLOY BASE: Fe, Cr, Mo, Mn, Ni, C

SPECIAL FEATURES

- Smooth running characteristics.
- Oxidation resistance retained upto 1100°C.

ESAB 116 Ni

Hot forge die repair high strength joining

A basic coated electrode suitable for build-up and repair of open and closed hot forge dies, moulds and tools. The deposit is insensitive to hot cracking.

The electrode has very good strength and hardness upto 400°C. It can also be used for high strength joining.

ALLOY BASE: Fe, Mn, Ni

SPECIAL FEATURES

- Resists annealing.
- Excellent weld bead appearance.
- Resists metal-to-metal wear and deformation at high temperatures.

APPLICATIONS

Recommended for joining of high tensile steels of strength of the order of 80 kg / mm².

OK 83.28

Joining and build-up on rails

A basic coated electrode suitable for hardfacing in metal-to-metal wear applications. It has got very good resistance to impact and therefore can be used as a build-up and support layer for subsequent harder deposits.

It is a special electrode, having good machinability, for special build-up on carbon-manganese steel rail tracks.

ALLOY BASE: Fe, Cr, Si, Mn

SPECIAL FEATURES

- Superb resistance to metal to metal friction.
- Extreme impact toughness for heavy build-up.

APPLICATIONS

Joining and surfacing of hydrel turbine blades, valve seats, pump casings, gates, key-ways, machine components exposed to corrosive atmosphere, matching parts for which shape retention in service is of paramount importance.

PROPERTIES

UTS : 85-90 kg/mm²
 Elongation : 18-24%
 Hardness : 42-45 HRC

CURRENT RANGE : (AC 70, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
3.15	350	80-120
4.00	350	110-170
5.00	350	160-220

It is suitable for build-up and repair of new, worn out or cracked steel structures, components, and heavy equipment. Repair of forge dies, moulds and tools, high strength joining of carbon-steel earth moving equipments, truck frames, penstocks.

PROPERTIES

UTS : 62-70 kg/mm²
 Elongation : 32-36%
 Hardness : 37-41 HRC

CURRENT RANGE : (AC 70, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
4.00	450	120-175
5.00	450	150-230
6.30	450	200-260
8.00	450	240-300

APPLICATIONS

Parts of rolling mills, grooved rolls and clutches, shafts, cog wheels, links and rollers for tractors, bearing journals. Joining and build-up of machinable carbon-manganese steel railway tracks. This electrode can also be used for joining hardenable steels.

PROPERTIES

Hardness : 29-31 HRC

CURRENT RANGE : (AC 70, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
2.50	350	60-90
3.20	450	100-140
4.00	450	130-190
5.00	450	180-260

OK 83.40

Infinite fissure-free build-up for impact loading

A smooth running touch welding low heat input electrode depositing a tough air hardening machinable multi-alloyed weld metal for low stress abrasion and good impact.

The deposit is free from surface micro-cracks even for higher build-up. It has high endurance limit and is suitable for compressive and fatigue loading.

Special additives in electrode coating make it smooth running and easily maneuverable. Superior bead finish is obtained independent of welder skill.

The flux is devoid of hygroscopic elements, making it ideal for site conditions.

ALLOY BASE: Fe, Mn, Cr, Ni

SPECIAL FEATURES

- Micro-crack free surface even for higher build-up.
- Very good resistance to metal-to-metal wear and fatigue.

- Smoothest running electrode of its class.
- Low tendency to moisture absorption.
- Marginal work hardening.

APPLICATIONS

Hammers, wobblers, railway equalizer beams, crane wheels, excavators, sprockets, rollers, pump shafts, gear teeth, concrete mixer blades, rims, carbon-alloyed rails, dies, striking tools and other machine parts subjected to heavy shock loading and pounding in service.

It is the right consumable to use for providing buffer layers where impact and abrasion occur together.

PROPERTIES

Hardness : 28-35 HRC

CURRENT RANGE : (AC 50, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
3.15	450	90-130
4.00	450	120-170
5.00	450	150-220

OK 84.76

Sugar mill roller dry and wet arcing

OK 84.76 is a basic coated high efficiency high chromium carbide type electrode for roughening the wet mill rollers used in the sugarcane crushing. It provides an electric arc of spray type, depositing weld metal in the form of fine globules in the grooves of the mill roll thus increasing its gripping and dragging power.

Enormous rollers are used in the sugarcane crushing process, which are subjected to excessive wear during the season. These rollers have to be continuously roughened, even when the crushing is in full swing. These are smothered in crushed, sludgy cane and the surface is wet. OK 84.76 accommodate these conditions and deposit a dispersion of small, hard and wear-resistant globules that fastens to the sidewalls of the ridges of the roller.

It can be observed that the roughness created on the surface of the mill roll increases its productivity considerably, permitting better utilization of the grounded material, which in turn increases the quantity of the sugarcane to be processed.

SPECIAL FEATURES:

- Spray type arc for better distribution of the globules
- Good bonding with the rollers, even in wet condition

HARDNESS: 57 – 64 HRC

WELDING PROCEDURE:

- Hold the electrode at right angles to the flans of the profile.
- Use "cold welding" technique; avoid excessive heat in the weld area.
- Use DC positive, for better results.

DEPOSITION DATA

Deposition rate	:	2.2 kg/hr
Deposition Efficiency	:	69%
Metal Recovery	:	205%

WELDING CURRENT: DC ±, AC 70

Size (mm)	Length (mm)	Current Range (Amps)
3.15	450	110-130
4.00	450	160-210
5.00	450	160-200



OK 84.78

Maximum abrasion resistance

OK 84.78 gives an alloy rich deposit, which offers best resistance to high-pressure abrasion by gritty particles. The stainless bead is temper resistant upto 600°C. The deposit resists corrosion and oxidation even at elevated temperature.

Relief cracks, transverse to the weld bead, are desirable.

ALLOY BASE: Fe,C,Cr

SPECIAL FEATURES

- Weld bead is convex and dilution is negligible.
- Weld metal is having good corrosion resistance and can withstand high temperatures.
- Smooth arc.

APPLICATIONS

Highly recommended for earthmoving, construction, cement and agriculture industries.

Road rippers, earth moving parts, excavator blades, crushing mills, edge runners, chutes, mixer blades, screw conveyors, asphalt phasing screws, coal mill exhauster fan blades, plough shares, tampers, scrapers, feeding screws, grader blades, pug mill knife etc.

PROPERTIES

Hardness : 57-60 HRC

CURRENT RANGE : (AC 70, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
3.15	450	110-160
4.00	450	120-170
5.00	450	150-220

TERROWELD EWR

Ultimate resistance to any type of wear

Terroweld EWR deposits a low dilution, high abrasion resistant alloy that is stainless and does not tarnish even in presence of aggressive chemicals.

The deposit is ripple-free and uniform. The electrode performs well even in out-of-position surfacing.

Oxidation resistance of the deposit is maintained upto a temperature of 1100°C. Hardness retention at high temperature is also remarkable.

ALLOY BASE: Fe, C, Cr, Mn, V, Ti

SPECIAL FEATURES

- Stainless bead with high volume of complex carbide.
- Temper resistant weld metal.
- State-of-art bead finish.

APPLICATIONS

For critical machine part hardfacing which does not require machining.

For complex wear involving simultaneous abrasion and corrosion.

For high life at elevated temperatures.

PROPERTIES

Hardness : 63-65 HRC

CURRENT RANGE : (AC 70, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
3.15	350	100-150
4.00	350	120-160
5.00	350	150-200

ESAB 550

Super hot hardness and edge retention

A basic coated hardfacing electrode giving a weld deposit suitable for rebuilding of hot working tools, forging tools etc. Intended for hardfacing of hot trimming blades, hot bar shears etc. Resistance to scaling and tempering is upto 600°C.

The weld-metal gives extremely good spalling resistance, hot hardness due to grain boundary pinning by fine carbides.

ALLOY BASE: Fe, Cr, Mn, W, V, Mo, Co

SPECIAL FEATURES

- Weld metal is resistant to scaling upto 600°C.
- The weld deposit gives extremely high secondary hardening.
- An excellent edge-retention property for repairing cutting and shearing tools.

APPLICATIONS

Highest metal-to-metal wear resistance in upto 500°C along with good impact resistance. To be used where cutting, shaving, and piercing properties are required to be maintained.

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Typical applications are shear blades, roll face repairs, tools for hot trimming and cold punching, lifting tongs for billets, high-speed steel dies and tools.

PROPERTIES

Hardness : As deposited : 49-52 HRC
 After tempering at 600°C for 1 hr. : 53-56 HRC

CURRENT RANGE : (AC 70, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
3.15	350	80-120
4.00	350	120-170
5.00	350	170-230

ASTRÄ MN

Ductile crack-free deposit for Mn steel build-up joining

High efficiency electrode with special coating, to resist massive impact by mineral or metal along with moderate to good resistance to mineral abrasion.

Despite the common tendency of cracking in manganese steel, this high purity bead remains ductile and crack-free even after die penetration tests.

The alloy also shows reluctance to necking in tensile specimen. In abrasion area also it is superior to all the above except high-density pre-formed carbides.

ALLOY BASE: Fe, Mn, Ni

SPECIAL FEATURES

Ripple free deposit.

Auto slag detachment, free from slag inclusion.

Low heat input even at high current capacity.

APPLICATIONS

Crushers, earthmoving equipment, hammers, shovel track pads, wear plates, building up manganese steel components, buffering before carbide hardfacing deposit.

PROPERTIES

Hardness : As deposited : 22-23 HRC
 Work hardened : 42-44 HRC

CURRENT RANGE : (AC 70, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
3.15	450	110-165
4.00	450	140-200
5.00	450	180-250

DUROBELL

Blast furnace bell and BLT chute reclamation

Durobell is a hardfacing electrode depositing a molybdenum-nickel enriched alloy steel that provides excellent resistance to both impact and abrasion. The weld deposit exhibits secondary hardening at high temperature that leads to retention of hardness at 500°C – 550°C. The alloy is amenable to heavy build-up and the deposit is crack-free. The weld bead is machinable with tungsten carbide tools.

ALLOY BASE: Fe, C, Ni, Mo

SPECIAL FEATURES

- Machinability with abrasion resistance.
- Smooth arc with low spatter.
- Excellent weld bead appearance.

APPLICATIONS

Repair and reclamation of seat area of blast furnace bells & hoppers, BLT chutes, tong-pins, hot shears, furnace rollers, knives, valve seats, idler rollers of hot strip mills etc.

PROPERTIES

Hardness : As deposited : 53-55 HRC
 At 500°C : 46-50 HRC

CURRENT RANGE : (AC 70, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
3.15	450	90-120
4.00	450	115-175
5.00	450	160-225



TERROWELD MN

Low heat build-up on manganese steel

This is a low heat input electrode suitable for surfacing, building up and joining of austenitic manganese steels of plain & alloy types. The austenitic deposit is more resistant to cracking, deformation and heat embrittlement. The deposit is tough to withstand metal to metal impact. It resists wear under rolling abrasion at high contact pressures.

ALLOY BASE: Fe, C, Mn, Ni

SPECIAL FEATURES

- Graphite free coating avoids carbon pick-up.
- Deposit gives high strength, combined with excellent resistance against impact.
- Smooth arc, fine ripples and a fluid but controlled slag, which is easily detachable.

APPLICATIONS

Manganese steel shovel bucket teeth & lips, pulverizing hammers, beaters, grinding ring & rollers, gyratory crusher mantle and liners, cone and ring, jaw crusher plates etc.

PROPERTIES

Hardness : As deposited : 22-24 HRC
 Work hardened : 42-45 HRC

WELDING PROCEDURE

- 14% Mn steel should never be preheated for welding.
- Welding should be done in stringer beads directing the towards the weld pool.
- Heat input to the base metal should be kept minimum, if required skip welding/back step welding can be adopted.
- The weld bead must be peened with ball pen hammer immediately after welding.
- Quenching has no adverse effect on welding and should be adopted whenever possible after slag removal and peening. If possible the Mn steel job can be submerged in water during welding.

CURRENT RANGE : (AC 70, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
3.15	450	80-100
4.00	450	110-160
5.00	450	180-225

TERROWELD SHR

Rare earth fortification for high temperature abrasion

A low heat input electrode depositing a weld deposit alloyed with metals and rare earths, ideal for applications involving excessive wear and abrasion at light to moderate impact loads.

Presence of special metals offer excellent resistance to oxidation at high temperatures, whereas the rare earth alloy additions helps the deposit to retain its hardness upto 600°C.

High volume of fine dispersed carbide is ideal to sustain life in service condition subjected to wear by fine particles.

The deposit is non-machinable and transverse relief cracks are accepted.

ALLOY BASE: Fe, C, Cr, Mo, V, W, Nb, Ta

SPECIAL FEATURES

- Temper resistance at high temperature upto 600°C.
- Oxidation resistance till 1000°C.
- High deposition efficiency.

APPLICATIONS

Blast furnace parts, railway tampers, pump casing & impellers, ore breaker teeth, rolling mill guides, furnace parts, sinter plant disintegrators, screw conveyors cold forming dies, chain saw, coal burner nozzles, mechanical stackers, steam valve flanges etc.

PROPERTIES

Hardness : As deposited : 56-58 HRC
 At 600°C : 46-48 HRC

CURRENT RANGE : (AC 70, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
3.15	450	110-130
4.00	450	150-185

TERROWELD 35

Low heat deposit for impact and pressure

A hardfacing electrode for operation at low heat input depositing a tough air hardening alloy, giving a combination of moderate abrasion and good impact resistance as encountered in rolling, reciprocating and sliding systems.

ALLOY BASE: Fe, Cr, Mn

SPECIAL FEATURES

- Low heat formulation.
- Tough machinable deposit.

APPLICATIONS

Hardfacing of rollers, tractor idler wheels, brake shoes, mine car wheels, drive sprockets, conveyor parts, gear teeth, briquette press, crane wheels, concrete mixer blades, mill pinions, knife edges etc.

PROPERTIES

Hardness : 33-36 HRC

CURRENT RANGE : (AC 50, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
3.15	450	75-110
4.00	450	110-160
5.00	450	140-185

TERROWELD 65

Multipass electrode for abrasion and moderate impact

A low heat input hardfacing electrode, specially designed for repairing of worn-out components to withstand high metal to metal and mineral abrasion with moderate impact. The weld deposit is a tough air hardening type complex alloy. Two-layer deposit exhibits an average hardness of around 57 HRC. Depositing larger number of layers is also permissible.

Deposit on mild/medium carbon steel is normally crack-free even after attaining full hardness.

ALLOY BASE: Fe, Mn, Cr, V, Mo

SPECIAL FEATURES

- Weldmetal is crackfree even at 58 HRC.
- Good combination property for impact and abrasion.

- Multipass build-up is possible.
- Performs equally well in all-position welding.

APPLICATIONS

Scraper blades, cane cutting knives, bucket lips, chutes, guides, plough shear, earn, rollers, gate valve seats, road grades, conveyor screws, drills, fibrizer hammers etc.

PROPERTIES

Hardness : 55-58 HRC

CURRENT RANGE : (AC 70, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
3.15	450	80-110
4.00	450	110-160
5.00	450	140-240

OK 84.80

Complex high pressure abrasion upto 800°C

OK 84.80 is a high-recovery electrode which deposits a high density of wear-resistant carbides in an austenitic matrix, resistant to extreme abrasion up to 800°C. While this electrode is best to solve most critical wear problem at high temperature, at room temperature also it performs better than any chrome-carbide electrodes. The weld metal is resistant to oxidation and corrosion upto 1100° C.

ALLOY BASE: Fe,C,Si,Mn,Cr,Mo,Nb,W,V

APPLICATIONS

- Exhaust fans
- Ash ploughs
- Conveyor screws
- Sinter plant components

CURRENT RANGE : (DC+, AC 65V)

Size (mm)	Length (mm)	Current Range (Amp)
3.25	450	90-120
4.00	450	110-220
5.00	450	190-290



OK 84.84

64 HRC in a single layer for extreme abrasion

OK 84.84 has been developed with unique alloying generating a microstructure so far unknown to metallurgists all over the world. This carbide system assumes a high packing density leaving virtually no matrix unsheltered. Dilution of carbide in base metal is minimal as expected from the super convex bead shape. This results in full hardness attainment in one layer itself and uniform hardness throughout the bead..

ALLOY BASE : Fe, Si, C, Cr, Ti, B

SPECIAL FEATURES

- Hardness of 64 HRC in the first layer.
- Full and uniform hardness in one layer only.

- Distribution of light micro carbides for resistance to abrasion by fine particles.

APPLICATIONS

Side ribs of oil drill bit and tricone rock roller bit. New line concrete mixture paddies, dredger bucket tooth area. Concrete mixer paddies, dredger bucket tooth area.

PROPERTIES

Hardness : 62-64 HRC on first layer

CURRENT RANGE : (DC+, AC 70)

Size (mm)	Length (mm)	Current Range (Amp)
3.20	450	100-150
4.00	450	110-200

TERROWELD CRC

Resistance to high-stress particle abrasion at low heat input

A low heat input hardfacing electrode depositing a complex carbide type weld metal. Deposit is highly resistant to abrasion & moderate impact coupled with good oxidation resistance at elevated temperatures. It has easy striking and re-striking properties, with smooth and stable arc giving low spatter. Relief cracks are desirable on the deposit.

ALLOY BASE : Fe, Cr, Mn, C

SPECIAL FEATURES

- Extreme resistance to abrasion, oxidation and moderate impact.
- Smooth arc, fine ripples and a fluid but controlled slag which is easily detachable.

- Flat bead can be produced whenever necessary.
- Easy striking and re-striking properties.

APPLICATIONS

The electrode can be successfully applied in earth moving equipment, coal handling, agriculture implements, mining equipment, cement and refractory industries, iron and steel industries and railroads.

PROPERTIES

Hardness : 58-62 HRC

CURRENT RANGE : (DC±, AC 70)

Size (mm)	Length (mm)	Current Range (Amp)
3.15	450	120-140
4.00	350	140-185
4.00	450	150-185
5.00	350	165-250
5.00	450	170-250

OK 84.52

Low heat input electrode for abrasion and corrosion resistant

A hard surfacing electrode depositing carbides in a fully martensitic matrix. The deposit is highly resistant to abrasion and corrosion. It has comparatively easy striking and re-striking properties with smooth and stable arc and low spatter.

ALLOY BASE : C, Si, Mn, Cr

SPECIAL FEATURES

- Resistant to abrasion and corrosion.
- Positional welding possible.
- Supplied in vacuum packed wrappers.

APPLICATIONS

The electrode is suitable for hardfacing, shafts, racks and pinions, links and pins, valve seats of cast steel, mixer arms, feed gears, knives, loading buckets and track rollers.

PROPERTIES

Hardness : 54-60 HRC

CURRENT RANGE : (DC(+), AC OCV 65V)

Size (mm)	Length (mm)	Current Range (Amp)
3.20	450	110-150
4.00	450	145-200
5.00	450	190-270

COBALARC

Cobalarc - the future of hardfacing. This range of tubular electrodes gives a host of advantages over conventional coated electrodes in respect of hardfacing applications owing to its unique features.

- The prime weapons that provide the hardness in hardfacing deposits are the metallic and nonmetallic carbides. In coated electrodes, the carbides are formed at the time of welding. Carbides, preformed, cannot be used in these electrodes because the high hardness renders them difficult to produce. But, Cobalarc electrodes have the advantage that the preformed carbides are put inside a hollow mild steel tube.
- In hardfacing controlling the heat input is important because greater dilution will lower the hardness of the deposit. In this respect, Cobalarc gives a major headway because only a thin walled tube has to be melted instead of a solid wire. So the heat requirement will be considerably less and automatically the heat input will really be low.
- The low heat input also reduces the heat-affected zone in the base metal.
- Cobalarc provides economy as the total loss involves only .butt end loss and very negligible slag loss. Moreover, the butt end does not contain any carbide inside - it is only the hollow tube that is lost, so the actual loss is even lower.
- The slag formation is very small in Cobalarc. So the welder can apply the next run without wasting any time for deslagging. This gives an immense advantage of speed and productivity. So in 1 hour of arcing, Cobalarc gives 2-2.5 times the weight of deposit than coated hardfacing electrodes.
- A near absence of slag does not mean that Cobalarc deposits are exposed to the atmosphere for oxidation. The outer coating contains ingredients that burn in the welding arc and generate copious amount of fumes, which provides the shielding to the weld pool.
- This outer coating has one more function. Since it contains non-hygroscopic stabilizers the mild steel tube is free from rusting giving these electrodes an indefinite shelf life. The rigid tube also protects the preformed carbides from degeneration over time.



COBALARC 1M

Preformed carbides to resist high stress abrasion

Cobalarc 1 M is the ultimate in welding technology.

It has autogenous fume shielding over preformed carbides in a tubular form, which gives the user genuine low heat input and infinite shelf life by dint of its non-hygroscopic coating.

It deposits fine chromium carbides in tough austenitic matrix and gives better abrasion resistance on mild and low alloy steel bases where impact requirement is limited. This will ensure excellent wear resistance on 12-14% manganese steel components.

SPOT COLOUR: YELLOW

ALLOY BASE: Fe, C, Cr, Si

SPECIAL FEATURES

- Exceptional resistance to severe abrasion and moderate impact.
- Oxidation resistance at elevated temperatures.
- Unmatched deposition rates - high integrity deposits.
- Compared to solid cored electrodes, the current requirement is low so the dilution by parent metal is contained to a minimum.

- Non-hygroscopic coating needs no storage precaution – infinite shelf life.

APPLICATIONS

I.D. fan blades, impeller casings, dredger bucket lips, crusher jaws, bulldozer cutting edges, muller tyres, sizing screens, pulveriser and crusher hammers, ball mill liner plates, scraper blades, crane grab shovel, dragline bucket lips, points and cutting edges, teeth augers, conveyor chains, rolling mill guides, agriculture implements. The electrode is suitable for 12-14% manganese steel parts and also for carbon steel parts when resistance to abrasion is required. Also for applications which call for oxidation resistance.

PROPERTIES

Hardness : 55-59 HRC

CURRENT RANGE : (AC 70, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
5.0	400	90-130
6.3	450	120-140
8.0	450	140-170
10.0	450	180-200

COBALARC 9

Preformed carbides to resist abrasion at high temperatures

Cobalarc 9 is the ultimate in welding technology.

It has autogenous fume shielding over preformed carbides in a tubular form, which gives the user genuine low heat input and infinite shelf life by dint of its non-hygroscopic coating.

The weld metal consists of complex high temperature carbides, with high-stress abrasion resistance withstanding moderate to heavy impact even at high temperature. The deposit is easily grindable, with good impact property.

SPOT COLOUR: GREEN

ALLOY BASE: Fe, C, Cr, Si, Mo, Mn, V

SPECIAL FEATURES

- Exceptional resistance to severe abrasion and moderate to heavy impact at elevated temperature.
- Unmatched deposition rates - high integrity deposits.

- Compared to solid cored electrodes, the current requirement is low so the dilution by parent metal is contained to a minimum.
- Non-hygroscopic coating needs no storage precaution – infinite shelf life.

APPLICATIONS

Coal burner nozzles, clinker conveyor chains, railway tampers, sizing screens, augers, agricultural implements, rolling mill guides, heat resistant steel castings, pump casings, I.D. fans, tie rods, pug mill and augers, brick press screws, etc. where high stress abrasion is the major factor of wear at high temperatures.

PROPERTIES

Hardness : 57-62 HRC

CURRENT RANGE : (AC 70, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
5.0	400	90-130
6.3	450	120-140
8.0	450	140-170
10.0	450	180-200

COBALARC 4

Preformed tungsten carbides for high pressure abrasion

Cobalarc 4 is the ultimate in welding technology.

It has autogenous fume shielding over preformed carbides in a tubular form, which gives the user genuine low heat input and infinite shelf life by dint of its non-hygroscopic coating.

The electrode deposits fine tungsten carbide embedded in a hard and tough martensitic-austenitic matrix, which is suitable for extreme abrasion with low to moderate impact. It resists all forms of abrasion and wear. Deposition efficiency is very high when compared with coated electrode.

SPOT COLOUR: PINK

ALLOY BASE: Fe, W, C, Co

SPECIAL FEATURES

- Exceptional resistance to severe abrasion and moderate to heavy impact at low to medium temperatures.
- Low spatter level.

- Unmatched deposition rates - high integrity deposits.
- Compared to solid cored electrodes, the current requirement is low so the dilution by parent metal is contained to a minimum.
- Non-hygroscopic coating needs no storage precaution – infinite shelf life.

APPLICATIONS

Rock drill bits, oil well drills, churn drills, sand gravel chutes, coal cutter bits and picks, bulldozer end plates, grader end bits, feed screens, scraper for sand and refractory materials, fan and pump impellers, pug mill augers and knives, choppers, post hole auger teeth, feed screws, mixer blades/paddles etc.

PROPERTIES

Hardness : 57-63 HRC

CURRENT RANGE : (AC 70, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
5.0	400	90-120
6.3	450	120-140

COBALARC MX

Preformed stabilised carbides for high temperature complex wear

Cobalarc MX is the ultimate in welding technology.

It has autogenous fume shielding over preformed carbides in a tubular form, which gives the user genuine low heat input and infinite shelf life by dint of its non-hygroscopic coating.

In this case, preformed carbides in the tube route have been adopted to derive supersaturated composite alloy with high volume fraction of extreme abrasion resistant alloys along with complex stabilized carbides. While the electrode is best to solve critical wear problems at high temperature, it also performs better than chrome-carbide electrodes even at room temperature. The deposit is absolutely unparalleled in its resistance to fine particle abrasion.

Oxidation and corrosion resistance upto 1200°C.

SPOT COLOUR: BLUE

ALLOY BASE: Fe, C, Cr, Mo, Nb, V, W, Ti

SPECIAL FEATURES

- Exceptional resistance to severe fine and coarse particle abrasion at ambient to temperatures around 800°C.

- Low spatter level.
- Unmatched deposition rates - high integrity deposits.
- Compared to solid cored electrodes, the current requirement is low so the dilution by parent metal is contained to a minimum.
- Non-hygroscopic coating needs no storage precaution – infinite shelf life.

APPLICATIONS

Exhaust fans handling high temperature flue gases with ash, catalyst particles, ash ploughs, conveyer screws, sinter plant components, copper ladles and other non-ferrous industry applications, zinc industry blast furnace bells, Paulworth chutes, etc.

PROPERTIES

Hardness : 66-70 HRC

CURRENT RANGE : (AC 70, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
5.00	400	90-100
6.30	400	120-140
8.00	450	130-170

Cast Iron Electrodes

WELDING CAST IRON

Cast iron is an alloy of iron with a carbon content of 2-5%, silicon content of 1-3% and upto 1 % manganese.

The major types of cast iron are:

- grey cast iron
- nodular cast iron
- malleable cast iron
- white cast iron

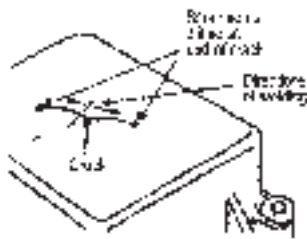
Cast iron has very low ductility, low strength and is very brittle. It is generally alloyed or heat-treated for improving these properties.

The high carbon content adversely affects the weldability of cast iron. Out of the grades mentioned above, white cast iron is considered unweldable for all practical purposes. The other types can be welded successfully with the consumables available.

PREPARATION FOR WELDING

The following steps should be kept in mind before commencing the welding of cast iron:

- Joint angles should be wider than for mild steel.
- All sharp edges should be rounded off.
- Preferably use U-grooves.
- For repairing cracks, either gouge/grind the entire crack or drill small holes at each end of the crack.
- The welding should start from the centre of the crack and proceed in both directions.
- The absorbed oil and liquid should be removed before welding. If that is not possible, use an electrode giving a spray transfer for an anchoring buffer layer.
- In critical welds, buttering by a ductile layer helps in absorption of the contractional stresses, thus saving the crack-susceptible HAZ.



Procedure for repairing a crack



Buttering technique

TERROWELD CLH

Buffer for oil soaked & dirty cast iron

A cast iron welding electrode for operation at low heat input depositing a non-machinable weld. The electrode is recommended for buttering of oily, greasy, and dirty cast iron to avoid contamination in the final welding. It is suitable for non-critical welding in cast iron with high preheat.

It is also suitable for welding in deep holes and tight corners for all types of sections giving good colour matching as the deposit oxidizes in a similar fashion.

ALLOY BASE: Fe, Mn, Si

SPECIAL FEATURES

- Spray type deposit insensitive to contamination.
- Good colour match.
- Can be used in final layer to give hardness and wear resistance.

APPLICATIONS

Pump housing, machine casing, rotor bodies, cast frames & cover, gear box, flywheel, oil soaked castings, ash pipes, oxidized cast iron furnace equipment, discs, etc.

PROPERTIES

UTS : 55-60 kg/mm²

WELDING PROCEDURE

- Preheat the job uniformly to 250°-350°C.
- Stringer bead to be used.

CURRENT RANGE : (AC 70, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
3.15	450	100-130
4.00	450	130-170
5.00	450	160-200

FERROLOID 1

Excellent colour match with all cast irons

Ferroloid 1 is a monel-cored electrode depositing a weldmetal, which bonds easily and matches in colour with cast iron. Weld deposit is soft, ductile and machinable. It is very effective for defect correction in foundries. It is excellent for joining cast iron to steel.

ALLOY BASE: Ni, Cu, Fe

SPECIAL FEATURES

- Smooth and stable arc with low spatter. · Excellent colour match.
- Good machinability.
- Slag is easily detachable.

APPLICATIONS

Repairing of cracks and for depositing buffer layer prior to building up with nickel-copper types of weld metal, rebuilding of broken, cracked, worn-out cast iron castings, gear teeth, pump impellers, pump casing etc. Pipes, especially with heavy wall thickness, can be welded in circumferential positions without cracks.

PROPERTIES

UTS : 35-40 kg/mm²

CURRENT RANGE : (AC 50, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
3.15	350	75-95
4.00	350	100-130
5.00	350	130-160

FERROLOID 3

Strength joints in grey and nodular cast iron

A nickel-alloyed machinable electrode for welding and repairing of all cast irons. The electrode deposits a high strength weld metal combined with good toughness of the weld joint, thus making it suitable for joining cast iron to mild steel.

ALLOY BASE: Ni, Fe, Si

SPECIAL FEATURES

- Strength joints with low heat.
- Good machinability.
- Slag easily detachable.

APPLICATIONS

Joining of cast iron components, welding of cast iron to steel, rectification and build-up of defective castings giving good colour matching. Repairing of complicated and cracksensitive castings involving hydrostatic pressure and dissimilar thickness, heavy sections and joints under restraint such as pumps, differential housing, cast iron dies etc.

PROPERTIES

UTS : 37-43 kg/mm²

WELDING PROCEDURE

- Clean the weld area of all scales, grease and dirt.
- The smallest possible electrode diameter and the lowest possible current should be used.

(Contd...)



- Skip welding sequence may be used.
- When welding thick sections and malleable irons, preheating to about 250-300°C is advisable to minimize the shrinkage stresses and cracking.
- On completion the casting should be allowed to cool slowly.

CURRENT RANGE : (AC 50, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
3.15	350	65-95
4.00	350	85-115
5.00	350	140-160

FERROLOID 4

Nickel based ductile electrode for cast iron

A Nickel-cored electrode depositing an almost pure nickel weld metal suitable for joining and repairing gray cast irons as well as for joining cast iron to steel, giving an easily machinable deposit.

ALLOY BASE: Ni,Si

SPECIAL FEATURES

- Smooth and stable arc with low spatter. · Excellent weld bead appearance.
- Slag is easily detachable.

APPLICATIONS

Reclamation of castings and machine parts, filling-in of blow holes in castings, joining cast iron to steel etc.

PROPERTIES

UTS : 28-31 kg/mm²

CURRENT RANGE & PACKING DATA

Size (mm)	Length (mm)	Current Range (Amp)
3.15	350	65-95
4.00	350	80-130
5.00	350	90-140

OK 92.18

State-of-the-art fail-safe cast iron electrode

OK 92.18 is the latest generation low heat electrode for most fail-safe welding of cast iron. It deposits an extremely soft and ductile weld metal. The weld metal has very high crack-resistance and easy machinability. The welding arc is smooth, stable and with a controlled penetration to ensure reduced base metal dilution.

ALLOY BASE: Ni,Si, Fe,

SPECIAL FEATURES

- Superb slag detachability.
- Excellent weld bead appearance.
- Preheat is seldom necessary.
- Barium Free

APPLICATIONS

Ductile repairs and build-up of cast iron components, salvaging of casting defects like blowholes, pit marks & scratches, reclaiming gears and pulleys, water pump housings, cylinder blocks, lathe beds. Buttering cast iron sections before joining with iron-nickel alloy consumables.

PROPERTIES

UTS : 36-38 kg/mm²

WELDING PROCEDURE

- Welding area should be cleaned of scales, grease, oil impurities and dirt.
- Cracks should be absolutely removed by gouging or cutting with OK 21.03.
- Welding should be done in stringer beads/skip welding/backstep welding.
- When welding thick sections, preheating upto 150-200°C will keep the weld more ductile.
- Reinforcing studs should be used when the volume of weld metal required is more.
- Light peening of the weld metal is advisable at hot stage to minimize shrinkage stresses.

CURRENT RANGE : (AC 50, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
3.20	350	90-140
4.00	350	110-170

OK 92.58

Strength welding for all cast irons

OK 92.58 is a new generation alloy electrode for welding and repairing of malleable and grey cast irons, and difficult-to-weld cast irons viz. S.G. iron.

The weldmetal is machinable, possesses high strength coupled with good toughness, thus making it suitable for joining cast iron to steels and filling-up cavities in castings.

ALLOY BASE: Ni, Fe, Mn, Si

SPECIAL FEATURES

- Smooth bead consists of fine ripples.
- Excellent slag peel-off.
- Barium Free

APPLICATIONS

Joining of cast iron components, welding of cast iron to steels, rectification and build-up of defective castings giving good colour match. Repairing of complicated and cracksensitive castings involving hydrostatic pressure and dissimilar thickness, heavy sections and joints under restraint such as pumps, differential housings, cast iron dies, etc. Other applications are cast iron gears

and pulleys, sliding tables for machine tools, cylinder blocks.

PROPERTIES

UTS : 44-47 kg/mm²

WELDING PROCEDURE

- Clean the weld area of all scales, grease and dirt.
- The smallest possible electrode diameter and the lowest possible current should be used.
- Skip welding sequence may be used to limit the heating of the base metal.
- Although mostly preheating is not required, when welding thick sections and malleable irons, preheating to about 250-300°C is advisable to minimize the shrinkage stresses and cracking.
- Just after welding the joint can be lightly peened and should be allowed to cool slowly.

CURRENT RANGE : (AC 50, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
3.20	350	60-120
4.00	350	90-150

OK 92.60

The last word in cast iron welding

OK 92.60 is latest development in cast iron welding. With a specially designed slag it can weld extremely difficult to weld cast irons, in all positions. The refining action of the slag prevents hot shortness in high sulphur cast iron, giving a sound radiographic joint.

The weld deposit produced has exceptional strength over those created by run-of-the-mill cast iron electrodes. For repairing thick joints in cast iron it provides fail-proof performance and prolonged service life.

It can also be used for radiographic quality joints between cast iron and stainless steel/mild steel/manganese steel/Inconel alloys.

ALLOY BASE: Ni, Fe, Mn

SPECIAL FEATURES

- High quality joints in any critical cast iron repairs.
- Nitrogenous slag gives clean inclusion-free joint.
- Barium Free.

APPLICATION

OK 92.60 is applicable for any cast iron application - joining buffering and surfacing. Applications involving high joint strength and fatigue in service condition should be welded only with this grade.

PROPERTIES

UTS : 56-61 kg/mm²

WELDING PROCEDURE

- Clean the weld area of all scales, rust, grease and dirt.
- Use the smallest possible electrode diameter.
- OK 92.60 has high current capacity, so for big jobs use sufficient current for proper base metal fusion and bonding.
- One may use skip welding sequence to limit the heating of the base metal.
- Although preheating is not required in most cases, when welding complicated castings preheat to about 250-300°C to minimize the shrinkage stresses generated in the base metal.
- Just after welding peen the joint lightly with ball pen hammer and cool slowly.

CURRENT RANGE : (AC 50, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
3.25	350	75-150
4.00	350	90-175



ESAB 802 KG

Economical strength welding of cast iron

A nickel-iron alloy, low heat input electrode designed to weld all weldable cast irons. Weld metal is fully machinable with good strength that helps in the rectification of defects in heavy casting and for welding of cast iron to mild steel. Suitable for nodular cast iron repairs.

ALLOY BASE: Ni, Fe, Si

SPECIAL FEATURES

- Versatility in usage.
- Good colour match.

APPLICATIONS

Repairing and joining of cast iron components and parts, repairing of engine heads, casings, impellers, rope drums,

ingot moulds etc. Rectification and build-up of defective castings in cast iron foundry giving good colour matching and also for welding of cast iron to steel.

PROPERTIES

UTS : 38-40 kg/mm²

CURRENT RANGE : (AC 50, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
2.50	350	40-65
3.15	350	50-90
4.00	350	80-125
5.00	350	110-165



WELDING DISSIMILAR STEELS

Joining stainless steel to low alloy or carbon steel

The most common and important instance of dissimilar metal joining is that of welding stainless steel to carbon-manganese steel or to low alloy steel. The most common application is attachments or transitions.

The welding is almost always carried out with over-alloyed stainless consumables i.e. having higher alloy content than the base metal. Two different methods are employed for this type of welding. The entire weld groove can be filled up with the over-alloyed stainless steel or any nickel based consumable. Otherwise, the lower alloyed surface can be buttered with an over-alloyed stainless weld metal and then the groove can be filled up with a consumable matching with the stainless side. The welding can usually be performed without preheating. However, if there is any recommendation for that particular grade of steel, then that has to be followed.

WELDING MANGANESE STEELS

Manganese steel typically contains 11-14% manganese and 1.0-1.4% carbon. Some other grades can have other minor alloying elements. This steel has an ability to workharden e.g. under high impact and/or high surface pressure. These steels have to be reconditioned by repairing cracks or breakages, rebuilding worn out portions and hardfacing to extend service life.

Weldability of manganese steel is governed by the fact that it tends to become brittle when reheated and slow-cooled. Consequently, the interpass temperature should not exceed 200°C. As a result, during welding of these steels, the following matters should be noted :

- the heat input should be as low as possible
- stringer beads should be used
- simultaneous working with several components should be done, as far as practicable
- the component can be cooled by putting it in cold water

Welding manganese steel involves anyone of the following cases:

- joining manganese steel to itself or to unalloyed, low alloy steel
- rebuilding worn out surfaces

For joining manganese steels and manganese steels to carbon steels, austenitic stainless consumables have to be used to obtain a tough and strong joint.

Prior to surfacing also it is advisable to add a buffer layer of austenitic stainless consumables. On top of that regular 13% manganese type deposit is put as the surfacing layer.

WELDING “DIFFICULT TO WELD STEELS”

The following types of steel are regarded as ‘difficult to weld’ for their high hardenability :

- high carbon steels
- high strength steels
- spring steels
- tool steels
- wear-resistant steels

Steels of unknown composition are also treated as having limited weldability so that the weld does not fail in any respect.

Welding theory says that all these steels can be welded with matching ferritic consumables with proper preheating and post-weld heat treatment (PWHT). But repair welding, by nature, does not always allow preheating or PWHT. Therefore, the safest way is to weld with austenitic stainless or nickel-based consumables. The risk of cracking due presence of hydrogen is neutralized by the greater solubility of hydrogen in austenite and also by the higher ductility of the weld metal. For welding steels of unknown composition, the best choice is a ferritic-austenitic duplex type of consumable.

WELDING TOOL STEELS

Tool steels have a higher carbon content along with chromium, nickel, molybdenum, vanadium and are generally heat-treated to achieve certain specific properties.

The repair welding of tool steels without changing their inherent properties is very difficult. This calls for use of consumables producing a weld metal with matching composition, microstructure and properties. But practically, this is very difficult as it involves scaling change of dimension and time.

The welding is simplified by using specific consumables developed for tool steels:

Shock resistance, toughness, abrasion resistance	Straight chrome martensitic deposit
Hot strength, abrasion resistance at high temperature	Fine carbides in martensitic matrix
Edge retention at high temperature, impact toughness	High speed steel deposit

The welding is done by preheating the job to 200-500°C (as per the type of steel) and maintaining it during the course of the welding. The preheating and PWHT to be followed can be found in different international standards like SAE/AISI.



TERROWELD DMS

High speed touch welding electrode for x-ray quality

Auto-run Terroweld DMS is characterized by 'Push-arc' that speeds up the output even for unskilled welders. The low heat electrode is preferred to any similar electrode due to its very high speed of welding and ability to weld thin sheets without burn-through. Terroweld DMS is suitable for touch welding in all positions, so even unskilled welders can give X-ray quality welds.

No slag cleaning is required by the welder since the nonsynthetic slag detaches itself from the bead automatically.

ALLOY BASE: Fe, Mn, Si

SPECIAL FEATURES

- Auto-run characteristic - low welder skill involved.
- Self-lifting slag ensures no slag cleaning for the welder. · Runs on low OCV transformers.

APPLICATIONS

Joining thin sheets at high speed, welding boiler quality steels, ship plates, and general repair and maintenance operation of containers, air conditioning units, ducts, tanks, bus bodies, for great finish and shiny bead appearance.

PROPERTIES

UTS : 47-52 kg/mm²

Elongation : 24-28%

CURRENT RANGE : (AC 50, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
2.50	350	50-110
3.15	350	70-140
4.00	350	100-190
5.00	350	150-210

Size (mm)	Length (mm)	Current Range (Amp)
3.15	450	80 - 150
4.00	450	110- 200
5.00	450	160- 220

ESAB 116

Low heat electrode for very high tensile strength joining

A medium-to-heavy coated electrode, Esab 116 gives a hydrogen-controlled deposit for welding high-tensile low-alloy steels. The deposit has excellent resistance to creep and has a high corrosion resistance. It is used regularly for repairs of hot dies.

SPECIAL FEATURES

- Resists annealing
- Stupendous weld strength
- Weld deposit is insensitive to hot cracking

APPLICATIONS

Recommended for joining and repair of machine parts fabricated out of high tensile steels. It is also suitable for automotive parts, specific grades of armour plate

steel, and chemical plant parts where Ni-Cr-Mo steels are used. It is suitable for build-up and repair of forge dies. The maintenance of strength upto 538°C renders it usable on steam turbine rotors that operate upto this temperature.

PROPERTIES:

UTS : 95 – 106 kg/mm²

Elongation : 15 - 18%

CURRENT RANGE (AC 70, DC±):

Size (mm)	Length (mm)	Current Range (Amp)
2.50	350	60-90
3.15	450	100-140
4.00	450	130-180
5.00	450	170-230

OK 53.18

For welding galvanising baths

OK 53.18 is a special purpose electrode which gives a deposit that is almost pure iron that makes it the absolute choice for welding galvanising baths. The low impurity content, especially silicon, ensures excellent resistance to molten zinc corrosion.

The weld metal is fairly strong and ductile. The weld beads are smooth and shiny with easy slag detachability. The electrode gives very low spatter for a pleasing welding experience.

ALLOY BASE: Fe

SPECIAL FEATURES

- Pure iron deposit.
- Stunning resistance to hot zinc corrosion.
- Smooth arc, a ripple free bead and a slag that releases itself.

TYPICAL APPLICATIONS

Special formulation for welding and repairing hot dip galvanising baths. Other applications include filling up holes and building up worn out shafts and other machine parts that are not exposed to excessive wear.

(Contd...)

PROPERTIES

UTS : 44-48 Kg/mm²
 Elongation (l = 4d) : 28-32%

CURRENT RANGE : (AC 50, DC+)

Size (mm)	Length (mm)	Current Range (Amp)
2.50	350	60-100
3.25	350	80-130
4.00	350	125-180
5.00	350	170-250

TERROWELD DBL

Super ductile joining and buffering

Terroweld DBL deposits a high strength low alloy weld metal recommended for building up and joining of low, medium carbon and low alloy steels. It is also suitable for giving buffer layers on medium and high carbon steels prior to hard surfacing.

The weld deposit is extremely ductile and crack resistant. Produces excellent result in highly constrained heavy machinery joining.

Low heat formulation suitable for joining thin section without risk of burn-through.

ALLOY BASE: Fe, Mn, Si, Ni

SPECIAL FEATURES

- Super-ductile weld.
- Suitable for high speed welding.
- Bonds easily with parent metal.

APPLICATIONS

Joining and build-up of medium tensile steels, joining dissimilar sections, restrained joints, giving buffer layers on pipes, flanges, pressure vessels, cross members, gun plates, steel castings, heavy machine components, etc.

Perfect in welding steels like free-cutting steels, where sulphur and other alloys are added.

PROPERTIES

UTS : 52-55 kg/mm²
 Elongation : 28-32%

CURRENT RANGE : (AC 50, DC±)

Size (mm)	Length (mm)	Current Range (Amp)	Size (mm)	Length (mm)	Current Range (Amp)
3.15	450	90-135	3.15	350	90-135
4.00	450	140-165	4.00	350	140-165
5.00	450	170-220	5.00	350	170-220

TERROWELD DLH

Vacuum packed electrode for constrained sections

This low alloy high strength weld metal is recommended for building up and joining heavy sections of low, medium carbon and low alloy steels in critical components. The weld deposit is ductile and crack resistant.

This process along with the special flux enables the electrode to be used directly in critical field condition without welding precautions as electrode redrying, preheating the workpiece, etc.

The electrode needs no baking upto 8 hours after opening the VacPac.

ALLOY BASE: Fe, Mn, Ni

SPECIAL FEATURE

- No welding precautions are required.

APPLICATIONS

Joining & build-up of medium tensile steels, restrained joints, steel castings, heavy machine components, etc., dragline bucket and chains, dipper stick, repairing cranks and undercarriage, dozer blades repair, chassis of earthmoving equipment like dumper, shovel, dragline etc. and repairing pulleys of dragline.

PROPERTIES

UTS : 54-59 kg/mm²
 Elongation : 28-32%

CURRENT RANGE : (AC 50, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
3.15	350	90-135
4.00	350	140-165
5.00	350	170-220



DUROCHROME

Dissimilar and unknown steel strength joining

Esab Durochrome is an electrode for welding complex dissimilar alloys and high strength steels with low heat input giving sound joints, free from any cracks and fissures. The electrode is also suitable for depositing buffer layers prior to hard surfacing on high strength and high alloy steels.

The deposit is corrosion resistant and resists high temperature oxidation. It provides excellent metal to metal frictional resistance.

ALLOY BASE: Fe, Cr, Ni, Mn

SPECIAL FEATURES

- Operates at low amperages on both AC & DC.
- Smooth arc, fine ripples and easily detachable slag.
- The duplex structure steel weld metal is extremely tolerant to dilution.

APPLICATIONS

Welding of high strength alloy steels, dissimilar joints, rebuilding of chemical agitator blades, shafts, rolling mill spindles, bucket lips, steel mill wobblers, coupling boxes, mill hammers, bar mill guides, sinter plant parts, etc.

Joining and surfacing of high carbon, low and high alloy steels, tool steels, spring steels, manganese steels, case hardening steels, etc.

PROPERTIES

UTS : 77-82 kg/mm²

Elongation : 30-35%

CURRENT RANGE : (AC 70, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
2.50	350	40-65
3.15	350	55-95
4.00	350	85-135
5.00	350	110-165

TERROWELD DS1

Crack free joining and buffering of manganese steel

Terroweld DS1 provides a manganese alloyed chrome - nickel steel deposit having high resistance to hot cracking with low heat input. It is ideally suited for joining manganese steel to carbon steel and for buffer layer deposition on manganese steel. Being able to withstand heavy impact, corrosion and moderate abrasion, this electrode can be used for build-up layers on high strength high alloy steel.

ALLOY BASE: Fe, Cr, Ni, Mn

SPECIAL FEATURES

- Weld metal is resistant to hot cracking.
- Slag is easily detachable.

APPLICATIONS

Joining and reinforcing of manganese steel components, joining of dissimilar steels, buffer layer prior to hard surfacing of crusher jaws, bucket teeth, sprockets etc.

PROPERTIES

UTS : 54-62 kg/mm²

Elongation : 38-42%

CURRENT RANGE : (AC 70, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
2.50	350	60-90
3.15	350	70-110
4.00	350	100-130
5.00	350	110-150

TERROWELD DS2

High strength dissimilar joining applications

Terroweld DS2 is a low heat input electrode depositing super stainless weld metal recommended for joining of carbon steels and alloy steels to themselves or to other high strength high alloy steels giving a high strength joint. It gives a good combination of impact, heat, and corrosion resistant properties.

It can be used to join fatigued and dirty cast steel components.

ALLOY BASE: Fe, Cr, Ni, Mo

SPECIAL FEATURES

- Superior bonding with all steels.
- Crack-less joint.
- Very good strength and impact toughness.

APPLICATIONS

Joining high strength alloy steels, heat and scale resistant steels. Suitable for stainless cladding on steels, furnace and combustion chamber parts, hydrogenation plants.

(Contd...)

Repair and surfacing of gears, spindles, worn out sprockets, valves, rolls, pinions, hot dies, reinforcing of manganese steel components, salvaging of broken rolling mill spindles, hydel turbine blades, trash beams, etc.

PROPERTIES

UTS : 72-80 kg/mm²
 Elongation : 29-34%

CURRENT RANGE : (AC 70, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
2.50	350	60-90
3.15	350	70-100
4.00	350	100-130
5.00	350	110-140

TERROWELD DS3

Strength joining for dissimilar and unknown steels

Terroweld DS3 deposits a high ferrite stainless steel deposit suitable for joining, building up and buffering applications. The specially designed microstructure of the weld deposit ensures superior resistance to crack, corrosion and oxidation. The electrode is suitable for joining dissimilar, unknown and difficult to weld steels. It is suitable for welding thick sections with deep groove in all positions. Weld deposit is of excellent quality ensuring fail-safe performance.

ALLOY BASE: Fe, Cr, Ni, Mn, Si

SPECIAL FEATURES

- Deposit gives high strength, combined with excellent resistance against impact, friction.
- Heat and corrosion resistant surfacing.
- Smooth arc and fine ripples.

APPLICATIONS

Joining, surfacing and rebuilding shafts, spindle, gears, pinions, springs, bull gears and sprockets, pump, gear box casing, rolling stock couplings, universal coupling, chassis frames, shovel booms, wobblers, kiln tyres, hammer shafts etc.

Also used as a buffer layer before hard surfacing of mining and earth-moving machinery.

PROPERTIES

UTS : 80-86 kg/mm²
 Elongation : 30-34%

CURRENT RANGE : (AC 70, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
2.50	350	60-90
3.15	350	70-100
4.00	350	100-130
5.00	350	110-140

TERROWELD DS4

Welding stainless steels to any other steel and overlays

Terroweld DS4 is a smooth running rapid flowing electrode giving a deposit that is strong and ductile for very good resistance to impact. The weld metal is also suitable for stainless overlays, 'butter layers' as they are known, on carbon steels prior to joining with other stainless steels. It is also used for joining stainless steels to any other steel.

ALLOY BASE: Fe, Cr, Ni, Mn, Mo

SPECIAL FEATURES

- Ease of operation.
- Easy slag peel off revealing shining bead.
- Thick bead facilitating smooth surfacing.

APPLICATIONS

Welding stainless steels to carbon steels, mild Steel, low alloy steels, cast steels and austenitic manganese steels. This can be used for high temperature applications for temperatures upto 1200°C like Kiln Anchor Joining, Immersion tube welding and all other high temperature applications. This product is widely used in all Cement Industries for these applications.

PROPERTIES

UTS : 55-65 kg/mm²
 Elongation : 28-34%

CURRENT RANGE : (AC 70, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
2.50	350	40-80
3.15	350	70-100
4.00	350	80-130
5.00	350	110-140



TERROWELD DS6

Single electrode for railway points and crossings

Terroweld DS6 is a heavy-coated basic electrode for applications, which demand resistance to high abrasion coupled with heavy to moderate impact. It is a very smooth running electrode having very good slag detachability and bead appearance.

The weld deposit consists of fine austenite grains with about 5% carbide precipitated at the grain boundaries.

ALLOY BASE: Fe, Cr, Ni, Mn, Mo

SPECIAL FEATURES

- Beautiful bead appearance.
- Exceptional slag detachability.
- High recovery deposition.

APPLICATIONS

Suitable for welding and surfacing manganese steels where heavy impact loads accompanied by severe abrasion and friction is prevalent, such as in railway points and crossings. This electrode obviates the need

for separate electrodes for joining the points & crossings and hardfacing.

PROPERTIES

UTS	: 59-65 kg/mm ²
Elongation	: 18-22%
Hardness : As deposited	: 22-26 HRC
Work hardened	: 40-44 HRC

WELDING PROCEDURE

- Welding is recommended to be done by stringer beads.
- All precautions, as necessary for welding manganese steel parts, should be taken.
- Peening at hot condition has beneficial effect.

CURRENT RANGE : (AC 70, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
3.15	350	100-140
4.00	350	120-180

TERROWELD S1

Stainless steel electrode for heat and corrosion

Terroweld S1 is an all-purpose stainless steel electrode having a high corrosion and heat resistance, which can be operated at very low heat input. It is specially recommended for repairing and joining extra low carbon grades of stainless steels, where a combination of corrosion resistance, heat resistance and scaling resistance is called for.

ALLOY BASE: Fe, Cr, Ni

SPECIAL FEATURES

- Superior welding characteristics.
- Finely rippled bead with minimum spatter.
- All positions.

APPLICATIONS

Terroweld S1 is recommended for welding all austenitic stainless steels of 18/8 and 19/9 types, particularly the ELC grades, and can be used for joining and repairing of mixers, valves, sterilizers etc., in dairy, chemical and

distillery equipment. The electrode can also be used as a preventive overlay on steel.

PROPERTIES

UTS	: 50-57 kg/mm ²
Elongation	: 38-44%

WELDING PROCEDURE

- The weld area should be cleaned of all dirt, grease and oil.
- Stringer bead welds are preferable, maintaining a short arc.
- Use smaller size of electrode wherever practicable.

CURRENT RANGE : (AC 70, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
2.50	350	45-70
3.15	350	60-100
4.00	350	90-130
5.00	350	110-160

TERROWELD S2

Stainless steel electrode for pitting corrosion

Terroweld S2 is a low heat input stainless steel electrode having a high resistance to acid pitting. It is specially recommended for repairing and joining of extra low carbon and standard grades of stainless steels with or

without molybdenum, stainless clad steels and carbon steels.

ALLOY BASE: Fe, Cr, Ni, Mo

(Contd...)



SPECIAL FEATURES

- Suitable for all position welding.
- Finely rippled bead with minimum spatter and easy detachability of slag.

APPLICATIONS

Terroweld S2 is recommended for corrosion resistance welds on 18/8 Mo stainless steel, especially 316 & 316L types. It is also suitable for protective overlay on 315, 318, 329 steels for medium hardness, for high corrosion resistance, for restrained joints and crack sensitive alloys.

PROPERTIES

UTS : 62-64 kg/mm²
Elongation : 34-39%

WELDING PROCEDURE

- The weld area should be cleaned of all dirt, grease and oil.
- Stringer beads are preferable, maintaining a short arc.
- Smaller size of electrode should be used wherever practicable.

CURRENT RANGE : (AC 70, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
2.50	350	45-70
3.15	350	60-100
4.00	350	90-130
5.00	350	110-160

TERROWELD S3

Stainless steel electrode for oxidation resistance

Terroweld S3 is an all-purpose high alloy stainless steel electrode having high corrosion and heat resistance, which can be operated at low heat input. This electrode is specially recommended for repairing and joining of heat resistant stainless steel plates and pipes for protection against oxidation and corrosion. It is also suitable for joining dissimilar metals and overlays.

ALLOY BASE: Fe, Cr, Ni

SPECIAL FEATURES

- Suitable for all position welding.
- Finely rippled bead with minimum spatter and easy detachability of slag.

APPLICATIONS

Terroweld S3 is recommended for welding all austenitic stainless steels for heat & oxidation resistance upto 1100°C in dairy, chemical & distillery equipment for applications like valves, heat exchangers etc.

This can also be used for joining of SS anchors to Mild Steel Base material and for welding of immersion tubes and for all other high temperature applications.

PROPERTIES

UTS : 56-58 kg/mm²
Elongation : 30-35%

WELDING PROCEDURE

- The weld area should be cleaned of all dirt, grease and oil.
- Stringer bead welds are preferable, maintaining a short arc.
- Use smaller size of electrode wherever practicable.

CURRENT RANGE : (AC 70, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
2.50	350	45-70
3.15	350	60-100
4.00	350	90-130
5.00	350	110-160

ESAB CSA

Cost effective means to crack resistant welding

The most crack-resistant electrode for welding steels of limited weldability, Esab CSA gives a tough weld metal that is designed to give superior crack resistance than what is available with normal 18-8-6 varieties. The electrode has high current tolerance and maximum deposition rate.

Extremely suitable for crack free root-runs in 14% Mn steels.

ALLOY BASE: Fe, Cr, Ni, Mn

SPECIAL FEATURES

- Deposition efficiency: 190% (approx.)

- Electrode gives high current tolerance and maximum deposition rate.
- Most economic electrode for dissimilar steel joints.

APPLICATIONS

Welding and repairing manganese steels, cladding worn out parts in bulldozers, rail crossing, dredgers, contact layer etc. Joining austenitic manganese steel to carbon steel or hardenable steels without preheat and welding machine parts to excavating machine components.

PROPERTIES

UTS : 57-62 kg/mm²
Hardness : As deposited : 20-22 HRC
Work hardened : 45-49 HRC

(Contd...)



WELDING PROCEDURE

- 14% Mn steel should never be preheated for welding.
- Heat input to the base metal should be kept minimum.
- The weld bead may be peened with ball pen hammer just after welding.
- Quenching has no adverse effect on welding and should be adopted whenever possible after slag removal and peening.

- If required the Mn steel job may be submerged in water during welding.

CURRENT RANGE : (AC 70, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
3.15	350	100-150
4.00	350	150-200
5.00	350	200-250

OK 68.82

Versatile electrode for joining any steel to any steel

OK68.82 deposits a high strength oxidation and corrosion resistant weld metal suitable for dissimilar steel joining and building-up applications. The weld metal, being free from dilution effects and having high strength combined with good elongation, can successfully join thick section of any unknown steel and steels which are difficult to join.

The high scaling temperature of weld metal makes the electrode usable for working at high temperatures.

ALLOY BASE: Fe, Cr, Ni, Mn

SPECIAL FEATURES

- Extremely smooth running performance.
- 'Fail-safe' alloying.
- Bonds with any steel.
- Self-releasing slag.

APPLICATIONS

Joining unknown steels, steels of limited weldability, and dissimilar steel joining.

Reclamation of shafts, universal coupling, gear teeth, pump casings, rolling mill spindles, buffer layers prior to hardfacing in mining and earthmoving equipment, coal pulverisers, pinions, crusher roller gears etc.

PROPERTIES

UTS : 79-86 kg/mm²

Elongation : 22-29%

CURRENT RANGE : (AC 70, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
2.50	350	50-80
3.15	350	75-110
4.00	350	100-140
5.00	350	130-160

OK 68.53

OK 68.53 is a coated electrode for welding austenitic ferritic steels of Super Duplex types, e.g. SAF 2507 and Zeron 100. OK 68.53 has good welding characteristics in all positions and the slag is easily detachable.

CURRENT RANGE : (DC+, AC OCV 60 V)

Size (mm)	Length (mm)	Current Range (Amp)
2.50	300	55-85
3.25	350	70-110
4.00	350	110-150

OK 69.33

Increased resistance to acid corrosion

OK 69.33 is a basic-rutile stainless steel electrode which deposit weld metal with better corrosion resistance to sulphuric acid than lower alloyed weld metal of AISI 316L and 317L type. The weld metal of OK 69.33 also has good resistance to intergranular and pitting corrosion.

ALLOY BASE: C, Si, Mn, Cr, Ni, Mo, Cu

SPECIAL FEATURES:

- Fully austenitic deposit.
- Increased resistance to sulphuric, phosphoric, acetic acid.
- All positional, smooth arc and ripple free welding.

APPLICATIONS

OK 69.33 is designed for welding of stainless steel with

corresponding composition. This type of steel has better resistance to sulphuric acid. OK 69.33 is recommended for Swedish Standard steel SS 2562. Avesta 254 SLX UHB 904L. Sandvik 2RK 65, 2 RN 65. This electrode can be successfully applied in the pipe line, storage tank, pump and other equipments handling sulphuric, phosphoric, acetic, oxalic, formic and fatty acids.

PROPERTIES

Yield stress : 38-42 Kg/mm²
 UTS : 56-60 kg/mm²
 Elongation : 35%

CURRENT RANGE : (DC+, AC>65

Size (mm)	Length (mm)	Current Range (Amp)
2.50	300	60-90
3.20	350	85-130
4.00	350	120-180

ASTRÄ ZF

Super resistance to sulphuric acid corrosion

Asträ ZF is a high performance electrode with excellent corrosion resistance to acids than the standard AISI 316L or 317L types where the alloy content is lower. A rutile based electrode, Asträ ZF is characterized by smooth running and a selfpeeling slag.

ALLOY BASE: Fe, Cr, Ni, Cu, Mo

SPECIAL FEATURES:

- Nil-ferrite deposit
- Stunning resistance to sulphuric, phosphoric, acetic acids
- Smooth arc, a ripple free bead and a slag that removes itself

APPLICATIONS

The electrode is designed for welding stainless steels of

corresponding composition viz. Carpenter 20, SS 2562, Avesta 254 SLX UHB 904L, Sandvik 2RK65, 2RN65, etc. The weld deposit is resistant to sulphuric, phosphoric, acetic, oxalic, formic and other acids like fatty acids. The electrode can be successfully applied in pipeline and storage applications handling the above chemicals.

PROPERTIES

UTS : 56-58 kg/mm²
 Elongation (l=4d) : 33-35%
 Ferrite : 0

CURRENT RANGE : (DC+, AC 65

Size (mm)	Length (mm)	Current Range (Amp)
2.50	350	90-110
3.15	350	120-140
4.00	350	150-185
5.00	350	170-250

TERROCHROME

Value-for-money dissimilar steel strength joining

This is a rutile electrode for welding complex dissimilar alloys and high strength steels with low heat input, giving sound joints free from any cracks and fissures. Also suitable for depositing buffer layers prior to surfacing on high strength and high alloy steels. The deposit is corrosion resistant and resists high temperature oxidation.

SPECIAL FEATURES:

- Smooth arc, a ripples and a fluid, controlled, and easily detachable slag.
- The duplex stainless steel weld metal is tolerant to dilution from hostile base metals.
- Excellent crack resistance and high strength

APPLICATIONS

Welding of high strength alloy steels, difficult-to-weld steels, dissimilar joints, re-building of chemical agitator blades, shafts, rolling mill spindles, bucket lips, coupling boxes, mill hammers, bar mill guides, sinter plant parts etc.

PROPERTIES

UTS : 79-85 kg/mm²
 Elongation (l=4d) : 20-30%

CURRENT RANGE : (DC±, AC 70

Size (mm)	Length (mm)	Current Range (Amp)
2.50	350	40-65
3.15	350	55-95
4.00	350	85-135
5.00	350	110-165

WELDING NON-FERROUS ALLOYS

NICKEL AND NICKEL ALLOYS

Nickel and nickel based alloys are used in industrial applications for:

- corrosion resistance
- heat resistance and high temperature properties
- cryogenic properties

Preheating is not normally required unless there is a risk of porosity from moisture condensation. PWHT is not usually needed to restore corrosion resistance.

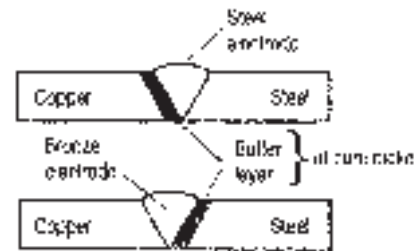
Inconel type of deposit is used for obtaining high temperature, high strength joints designed to perform at over 200°C such as on creep resistant chrome-molybdenum steels to stainless steels. These types are suitable when welding sections over 25 mm. For welding tool steels requiring toughness under repeated cyclic stress and oxidation resistance upto 1000°C, Hastalloy C type of deposit is regularly used. The drop in strength and hardness as the temperature goes up is very gradual.

COPPER AND COPPER ALLOYS

The main features of copper and its alloys;

- corrosion resistance
- electrical and thermal conductivity

In terms of weldability, the alloys have quite different welding characteristics. Copper needs substantial preheat to counteract the high thermal conductivity. But alloys like cupro-nickel can be fusion welded without any preheat, as the thermal conductivity is similar to low carbon steel.



Buttering technique should be used to join copper alloys to carbon/stainless steel. This is to take care of the copper migration to the HAZ and precipitation at the grain boundaries. The buffering, with a pure nickel electrode, can be applied on either the copper or the steel side. The groove has to be filled up a stainless or a bronze type of deposit.

The preheating should be 300-500°C when buttering copper or bronze whereas the preheating temperature has to be chosen according to the base material if the buttering is done on the steel side.

COBALT ALLOYS

Cobalt alloys are known for excellent wear resistance at high temperatures and the weld metal is used in cutting and shearing operations at temperatures exceeding 600°C. These deposits exhibit high shock resistance, high hardness at elevated temperatures and scaling resistance and can be used in stamping dies, trimming cutters, trimming punches, etc.

ESAB CN 1G

Excellent high temperature and corrosion resistance

Esab CN1 G is an electrode designed to deposit weld with excellent resistance to corrosion and oxidation. It provides superior strength at temperatures above 650°C.

ALLOY BASE: Ni, Cr, Fe, Mn, Mo

SPECIAL FEATURES

- Smooth and stable arc with low spatter loss.
- Excellent resistance to acid corrosion.
- Superior strength at higher temperatures.

ESAB CN 182

High temperature resistance ultimate bonding

Esab CN182 virtually bonds with everything like ferrous metals, stainless steels, nickel steels, chromium steels, cobalt-based alloys, carbides. It is perfectly suitable for re-buffering hardfaced layer and welding dissimilar alloys. It can be used for welding 5% and 9% nickel steels, Inconel, Incoloy, etc.

The weld metal is tough and ductile and can withstand severe thermal fluctuations.

ALLOY BASE: Ni, Cr, Mn, Fe, Nb

SPECIAL FEATURES

- Withstands stresses generated by thermal cycles.
- Tolerant to dilution and produces crack resistant welds/clads, even in massive sections.
- Superior bonding properties.

APPLICATIONS

Repair of rotary kiln tyres, heat treatment equipment such as trays, tongs, cryogenic equipment, and

ESAB MONEL

Corrosion resistant surfacing and joining monel

Esab Monel is a nickel-copper electrode for welding monel and similar alloys to themselves and to steels and for corrosion resistant cladding. The electrode has very low heat input characteristics and deposits homogeneous welds of superior quality.

ALLOY BASE: Ni,Cu,Ti

SPECIAL FEATURES

- Weld metal is ductile and crack resistant.
- Resistance to marine corrosion.
- Deposits a weld with fine bead appearance and easy de-slagging properties.

APPLICATIONS

ESAB CN1 G is ideally suited for joining Inconel, Incoloy, etc. and their combination with stainless steels.

PROPERTIES

UTS : 60-64kg/mm²
 YS : 40-44 kg/mm²
 Elongation : 30-40%

CURRENT RANGE : (AC 70, DC+)

Size (mm)	Length (mm)	Current Range (Amp)
3.15	350	80-120
4.00	350	100-160
5.00	350	140-190

fabrication of nickel steels for corrosion resistant tanks and containers, heat exchangers, furnace components and fittings, and low temperature applications.

It is suitable for welding of nickel, inconel, monel, stainless steels, heat-resisting steels and difficult-to-weld steels. This electrode is perfect for joining dissimilar metals and alloys like carbon steels, stainless steels, nickel and nickel alloys to each other.

PROPERTIES

UTS : 60-64 kg/mm²
 Elongation : 42-48%
 Impact (CVN) at -196°C : 45-55 J

CURRENT RANGE : (AC 70, DC+)

Size (mm)	Length (mm)	Current Range (Amp)
2.50	350	60-100
3.15	350	80-120
4.00	350	100-160
5.00	350	140-190

APPLICATIONS

Ideally suited for welding monel and monel-plated steels and for repairing monel casting defects. Joining monel to carbon steels and for overlaying on steel to obtain superior corrosion resistance. Regularly used in chemical, food, dairy, and pharmaceutical industries.

PROPERTIES

UTS : 48-54 kg/mm²
 Elongation : 42-48%

CURRENT RANGE : (DC+)

Size (mm)	Length (mm)	Current Range (Amp)
2.50	350	40-70
3.15	350	60-90
4.00	350	90-125



OK 92.35

Strength, hardness and impact properties at high temperature and corrosive media

OK 92.35 is a nickel based superalloy electrode, which offers resistance to most common acids.

The weld metal obtained is machinable and retains hardness even after prolonged heating at high temperatures. Tensile strength of the weld metal at 800°C is about ten times higher than mild steel which implies that resistance to deformation from static and cyclic loading is much superior.

It has smooth and pleasing welding performance with low spatter and easy slag detachability.

ALLOY BASE: Ni, Cr, Mo, Fe, W

SPECIAL FEATURES

- Super hot strength.
- Bonds with all ferrous and Ni-base alloys.
- Super resistance to corrosion from oxidizing acids, mixed acids, chloride salts.

APPLICATIONS

Repair and hardfacing of hot pressing tools, hot forging dies, hot shear blades, hot trimming dies, joining of Nimonic and Inconel alloys, valves, stirrers and pump components requiring wear, oxidation and corrosion resistance.

Also recommended for overlaying or joining dissimilar superalloys like Hastalloy, Inconel, etc., and for joining these alloys to mild, low alloyed and stainless steels.

PROPERTIES

UTS : 54-62 kg/mm²
 Hardness : 25-30 HRC

CURRENT RANGE : (AC 70, DC+)

Size (mm)	Length (mm)	Current Range (Amp)
3.15	350	110-130
4.00	350	160-190
5.00	350	190-230

OK 93.60

Resistance to high temperature wear

A cobalt base electrode depositing a Co-Cr-Walloy high in carbon. The weld metal has excellent resistance to friction, abrasion, impact, corrosion, oxidation and abrasion at high temperature. The alloy resists spalling due to thermal cycling exceptionally and is characterized by its spatterless smooth arc and easy slag detachability.

ALLOY BASE: C, Cr, W, Fe, Co

SPECIAL FEATURES

- Only solution to complex wear system.
- Minimal loss of costly weld metal by minimizing spatter
- Shining bead finish.

APPLICATIONS

Hardfacing parts subject to wear at elevated temperatures, also in corrosive environment. Surfacing of hot rolls, kneading rolls, press screws, band screws, skid buttons, dies, valves, burner nozzles, drawing valves, seats, steam ends etc.

PROPERTIES

Hardness : at 20°C : 52-55 HRC
 : at 600°C : 40-44 HRC
 : at 800°C : 30-34 HRC

CURRENT RANGE : (DC+, AC)

Size (mm)	Length (mm)	Current Range (Amp)
3.20	350	70-110
4.00	350	110-160

OK 92.26

Extreme toughness, spalling and oxidation resistance joins dissimilar metal combinations

An electrode that joins any difficult-to-weld steels, dissimilar steels, Nicket, Chromium and Cobalt alloys with same or dissimilar metal. OK 92.26 yields a really crack proof weld metal. It is relatively tolerant to dilution. The weld metal has good impact strength down to -200°C, and good tensile strength up to 800°C. Corrosion and oxidation resistance of the deposit is remarkable. It can also be used for welding low temperature steels such as 5% and 9% nicket steel. The special formulation of the electrode is also suitable for overlaying previously

hardfaced layer before further hardfacing. It has high thermal spalling resistance.

ALLOY BASE: Ni, Cr, Fe, Mn, Nb, Ta, Mo, Cu, Si, C.

SPECIAL FEATURES

- Excellent resistance to corrosion, oxidation and thermal shock.
- Smooth and stable arc with low spatter loss.
- All positional welding electrodes.
- Redrying is not required due to vacuum packed.

Contd...

PROPERTIES

UTS	: 64-68kg/mm ²
YS	: 40-42 kg/mm ²
Elongation A4, %	: 40%

CURRENT RANGE : (DC+)

Size (mm)	Length (mm)	Current Range (Amp)
2.50	300	50-80
3.20	350	90-130
4.00	350	120-150
5.00	350	150-200

OK 92.05

Electrode for joining nickel

OK 92.05 is an electrode that is used extensively for joining nickel and nickel and nickel alloys. The weld deposit other than being highly ductile is resistant to most common acids. It has smooth and pleasing welding performance with low spatter and easy slag detachability.

SPECIAL FEATURES

- Corrosion resistance.
- Bonds with all ferrous and nickel-base metals.

APPLICATIONS

Joining nickel and nickel alloys, dissimilar joining of nickel with steels and copper as well as copper alloys. The

solubility of nickel makes it perfectly suitable for joining copper and copper alloys steels.

PROPERTIES

UTS	: 46-53 kg/mm ²
Elongation (l=4d)	: 25-30%

CURRENT RANGE : (DC+, AC70)

Size (mm)	Length (mm)	Current Range (Amp)
3.15	350	60-120
4.00	350	90-170

OK 93.62

Excellent wear resistance upto 600°C

The weld metal has excellent resistance to friction, abrasion, impact, corrosion & oxidation and abrasion at high temperature. The alloy resists spalling due to thermal cycling is exceptional. And is characterized by its spatterless smooth arc and easy slag detachability.

APPLICATIONS

Hardfacing of parts subject to wear at elevated temperatures, also in corrosive environment. Surfacing of hot rolls, kneading rolls, press screws, band screws, skid buttons, dies, valves, burner nozzles, drawing valves, valve seats, steam ends etc.

SPECIAL FEATURES

- Only solution to complex wear system.
- Minimal loss of costly weld metal by minimizing spatter.
- Slag is easily detachable.
- Shining bead finish.

WELDING PROCEDURE

- Clean weld area for oil, grease and other impurities.
- Preheat job wherever possible.
- Hold electrode perpendicular to work piece and weld in stringer beads.
- Interpass temperature should not exceed 300°C
- Cooling should be slow.

PROPERTIES

Hardness	: at 20°C	: 42-49 HRC
	at 300°C	: 42-49 HRC
	at 600°C	: 30-35 HRC

CURRENT RANGE : (AC 70, DC+)

Size (mm)	Length (mm)	Current Range (Amp)
3.20	350	70-100
4.00	350	110-160



OK 93.66

High temperature chemical inertness

OK 93.66 deposits a highly crack resistant weld metal of Stellite Gr. 6 type. The electrode is characterized by its spatter less smooth arc and easy slag detachability. The weld metal has excellent resistance to friction, abrasion, impact, corrosion and oxidation and abrasion at high temperature. These features make it suitable for combined wear conditions. The alloy resists spalling due to thermal cycling and has good sliding properties.

ALLOY BASE: Cr, Co, C, W

SPECIAL FEATURES

- Retains about 40 HRC hardness at 750°C.
- Only solution to complex wear system.
- Exceptional resistance to corrosion.

APPLICATIONS

Hardfacing of parts subject to wear at elevated temperatures and also in corrosive environment like hot forging tools, hot shear blades and dies, cutting edges, grab tongs, hot punches, knives, chemical valve seats, steam ends, pump sleeves, wear pads, screw conveyors, etc. in chemical, petroleum and sugar industries and also in steel plants.

WELDING PROCEDURE

- Clean weld area for oil, grease and other impurities.
- Preheat job wherever possible.
- Hold electrode perpendicular to work piece and weld in stringer beads.
- Maintain interpass temperature 300°C or lower.
- Cooling should be slow.

PROPERTIES

Hardness	: At 20°C As deposited	: 39-42 HRC
	Work Hardened	: 43-46 HRC
	At 750°C As deposited	: 19-22 HRC
	Work Hardened	: 38-43 HRC

CURRENT RANGE : (AC 70, DC+)

Size (mm)	Length (mm)	Current Range (Amp)
3.20	350	70-100
4.00	350	110-160

BRONZOID 1

Excellent welding of copper alloys

Bronzoid 1 is an electrode that provides an alloy suitable for welding brass, bronze, deoxidized copper, cast iron, steels and dissimilar metals.

It has easy slag detachability and produces homogeneous and sound weld metal free from porosity and cracks. Excellent colour match on bronze.

ALLOY BASE: Cu, Sn, P

SPECIAL FEATURES

- Smooth and stable arc with almost no spatter loss.
- The deposit can be machined to a smooth finish with low coefficient of friction.
- Resistance to marine and steam corrosion.

APPLICATIONS

Welding and surfacing of copper brass and bronze, cracked engine jackets, cylinder heads, electrical fittings, propeller blades, pump parts, bearing bushing, shaft, castings, stampings and valves. Filling cavities in copper alloy castings, joining copper and bronze to cast iron overlays and steel.

PROPERTIES

UTS	: 28-36 kg/mm ²
Elongation	: 18-26%

CURRENT RANGE : (DC+)

Size (mm)	Length (mm)	Current Range (Amp)
3.15	450	60-120
4.00	450	90-170
5.00	450	125-230



CUTTING AND GOUGING

The cutting, gouging and piercing by means of shielded metal arc welding principles is a flexible and economic method of removing metal. The process does not require any compressed air, gas or any type of special electrode holder as standard equipment can be used.

The coating on cutting and gouging electrodes develops a strong gas jet, which blows away the molten material. These electrodes are excellent for preparation prior to repair of cast iron. The jet drives out and burns away impurities and/or graphite on the surface and thus reduces the risk of cracking and porosity when welding later. Gouging of manganese steel can also be suitably done.

For gouging normally AC or DC- should be used, whereas for cutting and piercing DC+ is recommended. The arc is struck holding the electrode at 90° to the workpiece. Once the arc is ignited, the electrode has to be pointed in the appropriate direction at 5-10° to the job surface and pushed in the forward direction. A to-and-fro motion has to be maintained to carry on with the cutting or gouging action. For piercing, the arc has to be struck in a vertical position and the electrode pushed down to penetrate through the material. The electrode is manipulated with a sawing motion to enlarge the bore.



TERROCUT

Precision cutting electrode

Specially designed electrode producing a highly forceful and concentrated arc, which can be efficiently used for cutting and piercing holes in carbon steels, cast irons and manganese steels.

Terrocute does not heat up the material excessively due to ionizing additives in coating design. This results in lower heat affected zone.

SPECIAL FEATURES

- High cellulose roaring arc.
- Low heat affected zone.

APPLICATIONS

Cutting of mild steels, low carbon steels, manganese steels, cast iron, copper, manganese, aluminium, nickel and their alloys, casting risers, gates, dressing for filling up, etc. Absolutely suitable for burning rivets, dismantling work at site and for cutting out unwanted metal in castings.

CURRENT RANGE : (AC 70, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
3.15	300	160-250
4.00	350	220-300
5.00	350	260-350

OK 21.03

Single electrode for gauging, precision cutting and chamfering

OK 21.03 has a specially developed coating which produces a strong gas jet that blows away the molten material so that the electrode is absolutely suitable for gouging, cutting, chamfering, piercing, drilling holes. It can be used in all positions except in vertical up. Grooves are even and smooth and subsequent welding can follow without further preparation since the volume of slag is almost nil.

With this electrode, the cutting and gouging activity can be taken up without the necessity of any gas or special electrode holder.

SPECIAL FEATURES

- Roaring arc force.
- Thinner coating than other gouging electrodes - better positional properties.
- Excellent performance even under water.
- Sharp and clean kerfs.

APPLICATIONS

Cutting, chamfering, gouging, and piercing of steel, cast iron, copper and its alloys, aluminium and its alloys, manganese, stainless steel, zinc, nickel and its alloys. Used for beveling, for joint preparation, gouging of cracks and back gouging of root runs especially when welding of steel structures, storage tanks, etc. and for removal of unnecessary metal in castings.

PROCEDURE

- Strike arc perpendicular to work piece.
- Tilt the electrode at 10-15° and push forward.
- Move the electrode sequentially up and down to melt and remove metal.

CURRENT RANGE : (AC 70, DC±)

Size (mm)	Length (mm)	Current Range (Amp)
3.15	350	160-180
4.00	350	220-270
5.00	350	240-320



OK TUBROD 14.17

All position self-shielded basic fluxcored wire

OK Tubrod 14.17 is a self-shielded flux cored wire for the single and multi-pass welding of mild and medium/high tensile steels in all positions including vertical up and overhead. The deposit is suitable as a buffer underneath higher hardness deposits.

It is ideally suited for on site welding and can run in ordinary MIG machines as well as constant current flux cored arc welding wire feeders.

ALLOY BASE: Fe, C, Mn

SPECIAL FEATURES

- No shielding gas is required.
- Equally suitable for flat and drooping characteristic power sources.

OK TUBROD 14.18

Flux-cored wire for on-site buffering and build-up

OK Tubrod 14.18 is a self-shielded flux cored wire for single and multi-pass welding of mild and medium tensile steels not exceeding 51 kg/mm² in the flat and horizontal-vertical positions. It is capable of high deposition rates, which is ideal for welding on site where notch toughness requirements are not binding.

ALLOY BASE: Fe, C, Mn

SPECIAL FEATURES

- Self-shielded wire - does not require costly shielding gas.
- Excellent ductility.

OK TUBRODUR 14.70

Carbide rich flux-cored wire for super abrasion resistance

OK Tubrodur 14.70 is a self-shielded flux-cored wire for resistance to extreme abrasive wear by fine grained gritty particles like earth, ore, clay, sand, etc. As it is rich in chromium-based carbides, the weld deposit also provides good resistance to corrosion. It also has the added benefit of excellent wear resistance at high temperatures.

The deposit should be made between two to three layers.

ALLOY BASE: Fe, C, Cr, Mo, V

APPLICATIONS

Field equipment maintenance and repair, joining of MS and carbon manganese steels and cast and forged steel components as well as site welding of general and structural steel work.

Also suitable for buffering in difficult positions at high deposition rate prior to hardfacing.

PROPERTIES

UTS : 58-62 kg/mm²
Elongation : 22-27%

CURRENT RANGE : (DC-)

Size (mm)	Welding position	Current (Amps)	Voltage (Volts)
1.2	F.H.V.O	100-280	24-26
1.6	F.H.V.O	110-350	22-28
2.0	F.H.V.O	220-400	25-29

APPLICATIONS

Field equipment maintenance and repair as well as site welding of general and structural steel work.

It is suitable for build-up and buffering prior to hardfacing with very high hardness alloys.

PROPERTIES

UTS : 54-62 kg/mm²
Elongation : 21-26%

CURRENT RANGE : (DC+)

Size (mm)	Welding position	Current (Amps)	Voltage (Volts)
1.6	F.H	200-400	30-36
2.4	F.H	350-450	27-32

SPECIAL FEATURES

- Superior resistance to abrasion and corrosion.
- Grinding finish only.
- No need of shielding gas.

APPLICATIONS

It is used widely in hardfacing of bucket lips, auger points, scraper blades, and a multiplicity of mining components and earthmoving machinery where exceptional abrasion resistance is necessary.

PROPERTIES

Hardness : 50-60 HRC

(Contd...)

**CURRENT RANGE :**

Diameter (mm)	Welding position	Current (Amps)	Voltage (Volts)
1.6	F.H	200-400	30-36
2.4/2.8	F.H	350-450	30-36

OK TUBRODUR 14.71**Flux-cored wire for crack-free dissimilar steel welding**

OK Tubrodur 14.71 is a stainless steel self-shielded fluxcored wire for joining of dissimilar steels as well as joining and cladding of 14% manganese steel. The weld metal, which is austenitic in nature, is ideal for buffering applications on manganese steels and hardenable steels for better impact toughness.

ALLOY BASE: Fe, C, Cr, Mn, Ni

SPECIAL FEATURES

- Stainless steel wire - no risk of rusting.
- Tremendous impact toughness.

APPLICATIONS

It is used widely for joining dissimilar steels, welding of buckets, tooth points, and buffering of earth-moving machine components beneath hardfaced layers and for joining manganese steel to other steels.

PROPERTIES

UTS : 65-72 kg/mm²
 Elongation : 32-35%
 Hardness : 20-22 HRC

CURRENT RANGE :

Diameter (mm)	Welding position	Current (Amps)	Voltage (Volts)
1.6	F.H	150-300	30-37
2.4/2.8	F.H	300-450	30-37

OK TUBRODUR 15.40**Flux-cored wire for good wear resistance**

OK Tubrodur 15.40 is a gas shielded flux-cored wire which deposits weld metal rich in alloys which helps it give excellent performance for metal-to-metal wear and impact loading conditions. The weld metal is perfectly machinable with standard cutting tools.

ALLOY BASE: Fe, C, Cr, Mn, Si

SPECIAL FEATURES

- Impact resistance is exceptional.
- Rutile based flux gives excellent running performance.

APPLICATIONS

Used widely for cost effective surfacing of wheel runners, track links, wheels and rollers for conveyor belts, wheels for mine trucks, rolls and shafts. It can also be used for buffering in case of heavy compressive and pounding loading.

PROPERTIES

Hardness : 32-40 HRC

CURRENT RANGE :

Diameter (mm)	Welding position	Current (Amps)	Voltage (Volts)
1.6	F.H	150-300	29-35
2.4	F.H	300-400	30-37

OK TUBRODUR 15.41**Flux-cored wire for excellent metal-to-metal resistance**

This is a tubular self shielded flux cored wire with a basic type of flux which deposits a weld metal that is endowed with alloying elements for providing excellent resistance for metal-to-metal wear and good impact resistance. The weld metal is machinable.

ALLOY BASE: Fe, C, Mn, Cr, Al

SPECIAL FEATURES

- Resistance to impact loads.
- Basic flux ensures better recovery of alloys.

- Weld deposit is machinable with absolutely no difficulty.

APPLICATIONS

OK Tubrodur 15.41 wire is used for on-site rebuilding of worn out parts of carbon-manganese rails, point frogs, rollers, shafts, and also intermediate build-up for harder final deposit giving the entire hardfaced layer a considerable resistance to impact.

PROPERTIES

Hardness : 28-36 HRC

CURRENT RANGE :

Diameter (mm)	Welding position	Current (Amps)	Voltage (Volts)
1.6	F.H	150-300	29-35
2.4	F.H	280-460	30-37

OK TUBRODUR 15.52

Flux-cored wire imparting abrasion resistance

OK Tubrodur 15.52 is an open-arc/gas-shielded/self-shielded flux-cored wire, which deposits a martensitic weld metal containing some grain boundary carbides. It works excellent for combined wear of low-pressure abrasion and impact. The weld metal can only be machined by grinding.

This can also be used safely for multilayer build-ups.

ALLOY BASE: Fe, C, Cr, Mn, Mo, Si

SPECIAL FEATURES

- Flexibility of operation - can be used with or without shielding gas.
- High hardness ensures resistance to abrasive wear.

APPLICATIONS

It is used widely for cost effective surfacing of earthmoving equipment, agricultural implements and other material handling applications like augers, mixer blades and vessels, scraper blades, cement mill crushers, and quarrying components. It is specifically designed for hardfacing of feed screws and ring grooves on diesel motor pistons.

PROPERTIES

Hardness : 56-60 HRC

CURRENT RANGE : (DC+)

Diameter (mm)	Welding position	Current (Amps)	Voltage (Volts)
1.6	F.H	150-300	22-28
2.4	F.H	280-460	23-30

OK TUBRODUR 15.60

Tough and work hardening flux-cored wire deposit

OK Tubrodur 15.60 is a self-shielded flux cored wire for producing austenitic work hardening deposit with very good combination of impact and wear resistance. The deposit is absolutely crack-free and can be used for hassle-free joining of restrained and heavy sections of manganese steel. It can also be utilized for extremely fast overlays and is specially suitable for heavy or big jobs on which lot of metal has to be deposited.

The interpass temperature, while welding, should not exceed 200°C.

ALLOY BASE: Fe, C, Mn, Ni, Si

SPECIAL FEATURES

- Self-shielded - liberty from gas costs.

- Extreme crack resistance from the austenitic type of deposit.
- High deposition rate upto 5.5 kg/hour.

APPLICATIONS

Rebuilding 12-14% manganese steel, which is normally found in crusher jaws, swing hammers, and innumerable parts and components of earth moving, mining and quarrying equipment.

PROPERTIES

Hardness : As welded : 20-25 HRC
Work hardened : 44-48 HRC

CURRENT RANGE : (DC+)

Diameter (mm)	Welding position	Current (Amps)	Voltage (Volts)
1.6	F.H	150-300	22-28

OK TUBRODUR 15.73

Flux-cored wire for can cast roll rebuilding

OK Tubrodur 15.73 is a versatile hardfacing flux-cored wire producing a highly alloyed steel deposit, which is especially suitable for applications involving wear at elevated temperatures. This special alloy is resistant to fatigue and impact at those temperatures owing to its hot hardness properties.

1.6 and 2.4 mm wires are to be used with a shielding gas - either CO₂ or Ar + 20%CO₂ mixture. 3.0 and 4.0 mm wires are for the submerged arc process and should be used with OK Flux 10.61.

Machinable with only cemented carbide tools before cooling below about 100°C. On cooling to room temperature the machinability is considerably poor and

reheating to 100°C does not improve the machinability significantly.

ALLOY BASE

Fe, C, Mn, Cr, Ni, Mo, Nb, V

SPECIAL FEATURES

- Roll reclamation - concast and other hot rolls.
- Non-scaling and non-sticking characteristics.

APPLICATIONS

Hardfacing of different kinds of shafts, valve seats, concast rolls and any other part subjected to wear and corrosion at higher temperatures.

PROPERTIES

Hardness : 45-51 HRC

(Contd...)



WELDING PROCEDURE FOR SUBMERGED ARC WELDING

- OK Tubrodur 15.73 should be deposited on DC (\pm). Negative polarity gives a higher deposition rate and less fusion of the base material and is recommended when the minimum possible dilution of the weld metal is desired.
- Except at the start, preheat is not required while hardfacing solid carbon steel shafts having diameter upto about 200 mm.

- When multi-pass welding is being done, the inter-pass temperature should preferably not fall below 300°C.

CURRENT RANGE : (DC \pm)

Diameter (mm)	Welding position	Current (Amps)	Voltage (Volts)
1.6	F.H	150-300	24-30
2.4	F.H	280-460	24-32
3.0	F	300-450	25-33
4.0	F	400-600	30-36

OK TUBRODUR 15.80

Flux-cored wire for high pressure particle abrasion

A self-shielded flux-cored wire, OK Tubrodur 15.80, deposits a martensitic weld metal containing a high volume of patented light carbides. This wire has been developed for maximum resistance to abrasive wear under load arising out of fine and lumpy particles along with moderate impact. The deposit is normally crack-free and maintains very good hot hardness.

The weld metal can only be machined by grinding and for best results restrict to one or two layers.

ALLOY BASE: Fe, C, Cr, Mn, Ti, Mo

SPECIAL FEATURES

- Special patented design for cement mill crushers.
- Basic type flux gives inclusion free deposit.

APPLICATIONS

This continuous flux-cored wire is used for items subjected to a high degree of abrasive wear by fine grained materials under pressure like augers, mixer blades, scraper blades and cement mill crushers as well as many earth moving and quarrying components.

PROPERTIES

Hardness : 56-60 HRC

CURRENT RANGE : (DC+)

Diameter (mm)	Welding position	Current (Amps)	Voltage (Volts)
1.6	F.H	150-300	22-32

OK TUBRODUR 15.86

Cored wire for all wear factors

OK Tubrodur 15.86 is a gas-shielded metal-cored wire that deposits an alloy weld metal which can provide excellent resistance to all wear factors and patterns. Thus it can be used for wide spectrum of surfacing applications. The wire gives maximum resistance to erosion, abrasion, high temperature, corrosion, impact and friction. The deposit is crack-free and perfectly machinable.

ALLOY BASE: Fe, C, Cr, W, Co, Ni, Si, Mn

SPECIAL FEATURES

- Only continuous welding solution to complex wear system.
- Gas shielding ensures a good and clean deposit.

APPLICATIONS

It can be used for regular hardfacing of parts subjected to complex and combined wear patterns at elevated temperatures and also in corrosive environments. Typical applications are hot forging tools, hot shear blades & dies, hot punches, valve seats, steam ends etc.

PROPERTIES

Hardness : At room temperature : 40-43 HRC
At 750°C : 20-23 HRC

CURRENT RANGE : (DC+)

Diameter (mm)	Welding position	Current (Amps)	Voltage (Volts)
1.2	F.H	120-240	22-32



BRAZING

Brazing is a welding process, which produces coalescence of materials by heating them to a suitable temperature and by using a filler metal having melting point above 450°C. The filler metal is distributed between closely fitted surfaces of the joint by capillary action.

The placement of the filler metal affects the quality of the joint. For normal lap joints, the filler metal should be supplied from one end only and allowed to flow completely through the joint by capillary action.

The correct fluxing material must be used. The placement of the flux also affects the quality of the brazed joint. Paste flux is the most common form and is usually spread over the surfaces to be joined. It is also painted on the pre-placed brazing filler materials.

For some of the brazing methods a special atmosphere is used instead of flux, which is selected based on the metals being joined. When atmospheres are used flux may not be required. The atmosphere is the product of the combustion of the flame. The neutral or reducing flame is usually used. A slightly oxidising flame may be used for certain other materials. The general guideline for selection of flames is given below:

Base Metal	Flame type
Aluminiums	Slightly reducing
Brasses	Slightly oxidising
Bronzes	Slightly oxidising
Copper	Neutral
Cupro-nickel	Reducing
Inconel	Slightly reducing
Cast Iron	Neutral
Wrought Iron	Neutral
Monel	Slightly reducing



RUPATAM 2

Brazing of copper and copper alloys

SPECIAL FEATURES

- Strong clean ductile joints in copper and copper alloys without flux.
- Flame should be slightly oxidizing on copper and neutral on alloys.

APPLICATIONS

Extensive employment of the alloy in electrical

engineering for joints in motor windings, wires and cables, braided conductor, system and other conductor assemblies where any risk of corrosion by flux must be avoided.

FLUX

No flux for brazing of copper. In other cases use Rupertam A.

PROPERTIES

Melting Range 638 - 694°C

Available DIA - (mm) - 1.6, 2.5, 3.15

RUPATAM 14

Brazing of brass, bronze, molybdenum and silver

SPECIAL FEATURES

- Rupertam 14 is used for obtaining strong, clean, and high tensile brazed joints in brasses, bronzes. It also effectively joins silver and molybdenum.
- It is not recommended for ferrous metals or alloys of high nickel content due to the possibility brittle phosphide formation.
- Flame should be slightly oxidizing on Cu and neutral on Cu alloys.
- The deposit obtained has a high tensile strength.

APPLICATION

Extensive employment of the alloy in electrical engineering for joints in motor windings, wires and cables, braided conductor and other conductor assemblies where any risk of corrosion by flux constituents must be avoided.

FLUX

No flux for brazing of Cu. In other cases use Rupertam A.

PROPERTIES

Melting Range : 643-802°C

Available DIA - (mm) - 1.6, 2.5, 3.15

RUPATAM 35

Brazing joints having non-uniform clearances

SPECIAL FEATURES

- It can be used in operations requiring a slightly higher brazing temperature.
- The alloy is a free-flowing one with melting range for ensuring a good joint for joints where clearances are not even uniform.

APPLICATION

It is an alloy suitable for general purpose work on engineering metals with excellent capillary flow with better ductility for filling gaps.

FLUX

Rupertam A

PROPERTIES

Melting Range : 607-702°C

Available DIA - (mm) - 1.6, 2.0, 2.5, 3.15

RUPATAM 43

Single brazing alloy for a range of applications

SPECIAL FEATURES

- This alloy can be used in brazing operation requiring a low temperature giving a quick and complete penetration.
- It produces neat joints of very high strength that need little or no finishing.
- It is essentially for use on joints that are closely fitted.

APPLICATION

Rupertam 43 can be used in brazing steel, copper, brass, gunmetal, tin bronzes, aluminium and magnesium bronzes, copper nickel alloys and nickel silver of all varieties.

FLUX

Rupertam A

PROPERTIES

Melting Range : 608-617°C

Available DIA - (mm) - 1.6, 2.5, 3.15

RUPATAM 50

Brazing tungsten carbide tips

SPECIAL FEATURES

- This alloy has a wide wetting range, hence the solid and the liquid portions do not separate.
- Good corrosion resistance - brazing stainless steels.
- Rumatam 50 is ideal for bridging gaps.

RUPATAM 60

Brazing alloy for joints requiring high electrical conductivity

SPECIAL FEATURES

- For brazing in applications needing high degree of electrical conductivity.
- Good colour match on silver.
- It is essentially for use on joints that are closely fitted.

ESAB SILICON BRONZE

Economic high strength brazing alloy

SPECIAL FEATURES

- Economy brazing for ferrous metals, copper and copper alloys.
- Exceptional joint strength.

APPLICATION

Esab Silicon Bronze is an alloy that is ideally suited for

ESAB RUF-KUT

Rugged overlay alloy with tungsten carbide particles for maximum abrasion resistance

SPECIAL FEATURES

- Angular carbides, varied in size, resist extensive stresses and impact.
- Good tinning qualities.
- High tensile and shear strength – shock absorption.

Esab Ruf-Kut deposits hard tungsten carbide in a tough but ductile nickel-silver matrix that results in maximum abrasion and impact resistance from media like sand, earth, gravel and other minerals. This gives rise to a superior cutting action. The carbides are angular and varied in size embedded in the matrix, which resists extensive compressive stresses and impact loading.

High tensile strength and shear strength provides shock-absorbing characteristics. Good tinning qualities.

APPLICATIONS

Widely used in oil, earth moving, agriculture, dredging, brick and cement industries to overlay drills, reamers, stabilizers, core bits, augers, mill hammers, plough shares, dredge bucket lips, crusher rolls, mixer blades and pipe forming shoes.

APPLICATION

This alloy is ideally suited and used extensively for brazing carbide tool tips to tool shanks as it wets the tip beautifully. It is also suitable for brazing stainless steels.

FLUX

Rumatam A

PROPERTIES

Melting Range : 632-688°C
Available DIA - (mm) - 1.6, 2.5, 3.15

APPLICATION

This alloy is ideally suited and used extensively for brazing electrical components requiring high electrical conductivity.

FLUX : Rumatam A

PROPERTIES

Melting Range : 690-735°C
Available DIA - (mm) - 1.6, 2.5, 3.15

brazing tubular and sheet metal joining of steel, copper, galvanized iron. Also used for fusion welding of brass and bronze. Use an oxidising flame.

FLUX

Brazotectic

PROPERTIES

Melting Point (approx.) : 875°C
UTS : 42-48 kg/mm²
Available DIA - (mm) - 1.6, 2.0, 2.5, 3.15, 4.0, 5.0

TYPICAL PROPERTIES

Carbide hardness : 1500 VHN
Matrix hardness : 200 VHN

PROCEDURE

- The surface should be cleaned and degreased.
- The surface is to be pre-tinned using the pure matrix end.
- A very large tip size to be used and the flame adjusted to neutral for heating the tinned area.
- The carbide-bearing end is introduced into the flame and the alloy is allowed to melt and flow on to the substrate. The temperature of bonding is 750-800°C.
- The carbide deposition to be uniformly maintained by rotating the rod.
- The work should be continued to heat, slightly ahead of the overlay.
- Overheating is to be avoided.
- Cooling should be slow and the flux residue has to be removed.

CARBIDE MESH SIZES

-3.2 mm to +1.5 mm; -5.0 mm to +3.2 mm
-6.0 mm to +5.0 mm; -10.0 mm to +6.0 mm

TIG Filler Wires

CRYSTALLOY 60

TIG filler for resistance to combined complex wear

Crystalloy 60 is an alloy that exhibits excellent resistance to friction, abrasion, impact, corrosion & oxidation and abrasion at high temperature. Resistance to spalling due to thermal cycling is exceptional. The alloy has good sliding properties.

Good resistance to abrasion, impact and oxidation, friction makes it suitable for combined wear.

ALLOY BASE: C,Cr,Co,W,Fe,Ni,Mo,Mn

SPECIAL FEATURES

- Retains 40 HRC hardness at 750°C
- Only solution to complex wear system

CRYSTALLOY 61

TIG filler for resistance to heat and corrosion

Crystalloy 61 is an alloy that exhibits excellent resistance to impact, corrosion & oxidation and also abrasion at high temperature. The alloy has good sliding properties. The alloy resists galling and corrosion to splendid levels.

Exceptional resistance to impact friction, and oxidation makes it suitable for combined wear.

ALLOY BASE: C,Cr,W,Fe,Co

SPECIAL FEATURES

- Gives 25 HRC hardness at 750°C

APPLICATIONS

Valves, valve seats, hot forging tools, hot shear blades & dies, hot punches, steam ends, pump sleeves, wear

CRYSTALLOY 62

TIG filler for resistance to high temperature wear

Crystalloy 62 is an alloy that exhibits excellent resistance to friction, abrasion, impact, corrosion, & oxidation at high temperature. The alloy has good sliding properties giving rise to exceptional abrasion resistance.

Good resistance to abrasion, impact and oxidation, friction makes it suitable for combined wear.

ALLOY BASE: C,Cr,W,Fe,Co

SPECIAL FEATURES

- Retains 40 HRC hardness at 600°C
- Machinable by cemented carbide tools

CRYSTALLOY 80

TIG filler for corrosion resistant monel coating

Crystalloy 80 gives a ductile and crack resistant weld deposit that meets rigid requirements on corrosion resistance against seawater. The alloy also works

APPLICATIONS

Resurfacing and hardfacing of parts subjected to wear at elevated temperatures and in corrosive environment. Valves, valve seats, hot forging tools, hot shear blades & dies, hot punches, steam ends, pump sleeves, wear pads, screw conveyors, etc. in chemical, petroleum, sugar and steel plants.

PROPERTIES

Hardness	As deposited	Work Hardened
At 20°C:	39-42 HRC	43-46 HRC
At 750°C:	19-22HRC	38-43 HRC

AVAILABLE DIA. (MM)

0.8, 1.2, 1.6, 2.4, 3.2

pads, screw conveyors, cutting edges of knives for wood, paper, plastic and carpets. Refacing and hardfacing of parts subjected to wear at elevated temperatures and in corrosive environment.

PROPERTIES

Hardness	
At 20°C:	52-57 HRC
At 600°C:	41-46 HRC
At 800°C:	32-37 HRC

AVAILABLE DIA. (MM)

1.6, 2.4, 3.2, 4.0

APPLICATIONS

Surfacing hot rolls, kneading rolls, press screws, band saws, feeder screws, wood-working tools, valves, valve seats, hot forging tools, hot shear blades & dies, hot punches, steam ends, etc.

PROPERTIES

Hardness	As deposited
At 20°C:	44-49 HRC
At 600°C:	36-41 HRC

AVAILABLE DIA. (MM)

1.6, 2.4, 3.2, 4.0

exceptionally in both types of acids: reducing and oxidizing.

It joins corrosion resistant Monel alloy used in petroleum and ammonium sulphate industry. This alloy is also used by power plants and any plant that handles seawater.

(Contd...)

APPLICATIONS

Seawater corrosion resistant overlay, joining Monel metal

PROPERTIES

UTS: 50-56 kg/mm²

Elongation: 42-48%

AVAILABLE SIZES

1.2, 1.6, 2.0, 2.4, 3.2 mm

CRYSTALLOY 81

Filler wire for joining nickel

Crystalloy 81 is used extensively for joining nickel and nickel alloys. The weld deposit other than being highly ductile is resistant to most common acids.

ALLOY BASE: Ni, Ti, Al

SPECIAL FEATURES:

- Corrosion resistance
- Bonds with all ferrous and nickel-base metals

APPLICATIONS:

Joining nickel and nickel alloys, dissimilar joining of nickel with steels and copper as well as copper alloys.

The solubility of nickel makes it perfectly suitable for joining copper and copper alloys with steels.

PROPERTIES:

UTS : 46 - 53 kg/mm²

Elongation (l=4d) : 25 - 30%

AVAILABLE SIZES (mm):

1.2, 1.6, 2.4, and 3.2

CRYSTALLOY 82

Filler wire with corrosion and heat resistance

Crystalloy 82 is used to weld high alloyed heat resisting and corrosion resisting materials, 9% Ni steels and similar steel for cryogenic applications.

It has also exceptional notch toughness values, and resists stress corrosion cracking.

It never hardens or embrittles even when diluted with high carbon.

ALLOY BASE : Ni, Cr, Mn

SPECIAL FEATURES

- Superb corrosion and heat resistance.
- Resistant to carbon pickup.
- Can take care of thermal or any cyclical loads.

APPLICATIONS

High temperature joining and surfacing, chemical handling equipment surfacing, welding 9% nickel steels and other cryogenic or high impact steels.

PROPERTIES

UTS : 66-72 kg/mm²

Elongation : 42-46%

Available DIA - (mm) - 1.2, 1.6, 2.5, 3.2

CRYSTALLOY 85

Filler wire for corrosion resistance from acids and seawater

Crystalloy 85 is a filler alloy for TIG welding which shows good resistance to corrosion against seawater, chlorides, acids and alkalis. It can be used for joining of 90-10 and 70-30 cupronickel. The alloy has smooth flow and good wetting properties with base metal.

ALLOY BASE: Ni, Cu

SPECIAL FEATURES

- Resistance to marine corrosion.
- Smooth welding properties.

APPLICATIONS

Chemical and sea water handling areas.

PROPERTIES

UTS : 33-38 kg/mm²

Elongation : 36-44%

Available DIA - (mm) - 1.2, 1.6, 2.5, 3.2

CRYSTALLOY 90

Crack free welding of brass, bronze, deoxidized copper

A copper-tin alloy suitable for welding brass, bronze, deoxidised copper, cast iron, steels and dissimilar metals. It produces homogeneous and sound weld metal free from porosity and cracks. It gives an excellent colour match on bronze.

ALLOY BASE

APPLICATIONS

Welding and surfacing of copper brass and bronze, cracked engine jackets, cylinder heads, electrical fittings, propeller blades, pump parts, bearing bushing, shaft, castings, stampings and valves. Also usable for filling cavities in copper alloy castings, joining copper and bronze to cast iron overlays and steel.

SIZES AVAILABLE: 1.6, 2.4, 3.2, 4.0 mm

Hot Metal Spray Powders

POWDER SPRAYING

The powder welding process basically uses a simple oxy-acetylene torch where finely divided powder is fed into the flame from a hopper attached to the torch. The powder melts to give a dense coating and forms a strong bond with the base material by surface alloying and diffusion. Fluxing elements such as boron and silicon are necessary in the powders for good metallurgical bond. This process is typically used for deposits having thickness between 0.2-12 mm, in particular for smaller parts or repairs. The process is applicable only in iron-base, nickel-base or copper-base material.

Hot metal powder alloys are mostly nickel-based. Nickel when added with boron gives hardness due to formation of borides. The percentage of boron can be monitored to achieve a particular hardness range. Boron also brings down the melting point of nickel and helps the powder to fuse much below melting point of steel. For enhanced protection against wear and increased corrosion resistance, silicon along with other special alloys is added. Some cobalt-based powders are also available but are not as cost-effective as nickel-based powders. Tungsten carbide is added to a nickel boride matrix to combat high-pressure abrasion.

The flow of powder and spreading on base metal depends primarily on two characteristics: Powder particle shape and size. The mesh size determines the acceptability of the powder to be used by hot metal spray process. Usual range is between 15-160 microns. The shape of powder is very important for the welder as it solely determines the ease of flow of the powder through the nozzle of hot spray gun. The powder shape is dependent on the method of manufacture of the powders. Gas atomized powder have spherical particles resulting in a smooth flow through the nozzle and higher deposition rate. Ground powders have irregular shape and the flow characteristics are poor.

Advantages of powder spray:

- Thin layer can be given with hardness upto 65 HRC (upto 0.15 mm thickness).
- Coating is uniform; hardly any post-machining required.
- No heat treatment is required.
- Self-fluxing: no slag cleaning required.
- For machine parts, life obtained is much higher.

The limitations are:

- Not economic for thicker build-up on big jobs.
- Not applicable for aluminium, magnesium components.
- For big jobs furnace preheating and melting is required.

CAST COAT 20

Buffer for coating on cast irons and machinable build-up on steels

Cast Coat 20 extends the benefit of powder coating to cast irons. It has excellent machinability and can be used for original or worn out components. For higher hardness requirements, it can be used as buffer layer to be coated by harder alloy grades. This Cast Coat technology saves castings from being scraped and abraded. The wettability and fluidity adds to the advantage of being used for brazing and joining. The inertness of the base alloy can be utilized with much success to counter corrosion and oxidation related problems in the industry.

The powder can also be used as a superbly machinable build-up and buffer layer on steels for subsequent coating by harder powders or welded alloy deposits.

ALLOY BASE: Ni, B, Si, Fe

SPECIAL FEATURES

- Machinable deposit.
- Good resistance to corrosion and oxidation.
- Allowable build-up: 20 mm.
- Coverage for a 1 mm thick layer: 650 cm²/500 gms.

APPLICATIONS

This powder is used for casting defect repairs, brazing and joining cast iron components, building up funnels or moulds in the glass industry, cast iron cylinder heads, engine blocks, housings, manifolds, and vessels handling acetic acid.

PROPERTIES

Hardness	: 20-22 HRC
Melting Point	: 1100°C

MULTI WELD 40

Good resistance to impact and corrosion

Multi Weld 40 allows reclamation of steel components which otherwise would have gone to the scrap yard as no other powder alloy has the fluidity and build-up capacity along with optimum properties for service.

It is the only powder with machinability along with wear resistance. The versatility and dependability of the alloy makes it an indispensable powder for all maintenance departments in different industries.

ALLOY BASE: Ni, B, Si, Fe

SPECIAL FEATURES .

- Machinable deposit.
- Good resistance to friction, corrosion and impact.

- Allowable build-up: 10 mm.
- Coverage for a 1 mm thick layer: 650 cm²/500 gms.

APPLICATIONS

This powder is used for making hard deposit on gears and splines, cams and crankshafts, bearing surfaces, plungers and neckrings, automobile parts, railroad wheel burns, glass moulds, valve gates, sprockets and pistons, gauges, machine components.

PROPERTIES

Hardness	: As-welded	: 40-44 HRC
	At 500°C	: 36-38 HRC
Melting Point		: 1100°C

BOROSTRENGTH 60

Enhanced protection against abrasion and corrosion

BoroStrength 60 offers enhanced protection against friction, abrasion and corrosion for all machine components. Additionally, BoroStrength takes polish and resists oxidation at elevated temperature. The characteristic to produce very thin overlays obviates the necessity of machining later. The low coefficient of friction ensures simultaneous protection of matching parts if it is used in any such application.

ALLOY BASE: Ni, B, C, Cr, Fe

SPECIAL FEATURES

- Nil wear for metal-to-metal friction.
- Excellent resistance to acidic/alkaline corrosion and oxidation.

- Non-machinable deposit - can only be ground by silicon carbide or diamond wheel.
- Allowable build-up: 1.5 mm.
- Coverage for a 1 mm thick layer: 470 cm²/500 gms.

APPLICATIONS

This spray powder is used for making hard deposits on components like cams and indexing heads, turbine blades, pump shafts, extruder screws, seal rings, rocker arms, fan blades and liners, timber cutting blades, bushings, brick dies, mandrels.

PROPERTIES

Hardness	: As-welded	: 60-62 HRC
	At 500°C	: 50-52 HRC
Melting Point		: 1100°C



TUNGSTRENGTH 70

Ultimate abrasion protection technology

A protective coating by TungStrength 70 can effectively enhance component life and reduce spares inventory holding. As it retains its hardness upto 450°C, it can solve regular abrasion problems faced by maintenance engineers. TungStrength 70 exhibits a slag free deposit and better surface coverage. The composite alloy system based on tungsten carbide ensures better microstructural properties and ease of bonding with any ferrous and nickel based material.

ALLOY BASE: Ni, B, W, C, Cr, Si, Fe

SPECIAL FEATURES

- Optimum matrix-carbide ratio prevents distortion during spraying.

- Economic repair in case of chronic abrasion related jobs.
- Non-machinable deposit - can only be ground by silicon carbide or diamond wheel. · Allowable build-up: 1.2 mm.
- Coverage for a 1 mm thick layer: 460 cm²/500 gms.

APPLICATIONS

TungStrength 70 provides a hard deposit for prolonged life on machine parts viz. shear blades, die frames, wire drawing rolls, pulleys & capstans, wear rings, crusher teeth, guide rolls, conveyors, chains, mixer blades and paddles.

PROPERTIES

Hardness : As-welded	: 62-64 HRC
Retained upto	: 450°C
Melting Point	: 1100°C

ESAB WEAR PLATES

ESAB wear plates are composite plates having a highly alloyed wear resistant surfacing on a low carbon steel base. These plates are manufactured by customized automatic hardfacing process resulting in a hard, tough and highly wear resistant surface. The mild steel base makes the plates amenable to easy forming, welding or bolting to the component surfaces. The superiority of the ESAB range of wear plates is a result of strict scientific and metallurgical control of all the stages of the production process backed up by the technical know-how of ESAB in welding consumables.

Advantages of using ESAB wear plates

1. Ease in fabrication of components viz. pipes, ducts, chutes, etc.
2. Ease of welding to carbon steel structures.
3. Available in cut shapes as per the drawing provided by the customer - No additional cutting operation involved
4. High concentration of carbides - excellent resistance to wear factors like abrasion, friction, erosion, impact, oxidation
5. Tough matrix ensures proper anchorage of the carbide particles
6. Very small heat - affected zone ensures minimum metallurgical degradation

Applications in Industry Sectors

Power	Wagon tippler, Burner nozzle, Ventury outlet, nozzle chutes, primary and secondary crushes, coal pipes, bunkers, apron feeders, mill vane wheel segments, boiler flue gas ducts, ash pipelines, screw conveyors.
Cement	DPC chute, Cage mill, ID fan blades, chutes, coal pipes, crushers, earth moving equipment, Y-ducts, clinker chutes, cyclones.
Steel	Sinter screen decks, Coke screen, Sinter fan, BLT hot discharge chutes, downcomer pipes, burden lines, rapper rolls, Sinter hammer, Grizzle bar.
Mining	Excavator bucket, Chute liners, shovel buckets, dragline buckets dumper bodies, dozer blades, crusher parts, apron feeders, conveyor systems, Crushing liners.

Type	Item Description	Alloy base	Hardness (HRC)	Applications
Chrome - C	Complex carbides in a tough matrix for resistance to severe abrasion and moderate impact loads	C, Cr, Mn, Mo	58-60 HRC	Crusher parts, bucket lips, conveyor screws
Micro - C	Dense micro carbides in a hard martensitic matrix resisting severe coarse and fine particles abrasion.	C, Mn, Cr, Mo, Ti	58-64 HRC	Mixer blades, scrapers, mill parts, pipes
Therm - C	High temperature carbides in an austenitic matrix to resist complex wear at elevated temperatures. Retains hardness upto 800°C.	C, Cr, Mn, Mo, Nb, V	62 - 64 HRC	Sinter plant parts, chutes, boiler flue gas ducts
Esab Hard HT 4	Wear Plate is a quality, quenched and tempered plate designed for abrasion resistance and impact. This plate can be used for all material handling equipment.	C, Cr, Mn, Si, Mo, B	-380-440 BHN	Bodies, buckets & cutting edges, wear parts of mining machines, concrete mixing plants feeders & funnels, cutting edges wearing parts of concrete mixing plants feeders & funnels, cutting edges
Esab STH plate	Esab STH plates, by virtue of their superior manufacturing Process and metallurgy, have proved their excellence in the cut-throat world of abrasion, erosion, heat & corrosion. Compare to any stainless steel Esab STH plates exhibit high life factor. When overlaid plates, have sticking problem of material causes slow down in production ESAB STH plates exhibits higher Productivity factor.	C, Cr, Ni alloy	-450-480 BHN (Micro-hardness)	Screen Duct Liner Pipe wear plate
Esab Sinter MN	ESAB Sinter Mn wear plate is an Extremely high impact moderate abrasion resistant plate designed to sustain complex wear of impact & abrasion. Easily weld able metal which is Difficult to bend	C, Mn, Cr, Si, P	400 BHN- 500 BHN (work hardened)	Hammer, Liners guide, Jaws crusher liners



CONVERSION CHART

	To Convert from	To	Multiply by
Mass	kg	lb	2.205
	metric tonne	ton	1.102
Force	N	kgf	0.102
		lbf	224.8
Stress	MPa	kgf/mm ²	0.102
		ksi	0.145
		psi	1421.57
		Pa	1 x 10 ⁶
		atm	0.987
Energy	J	ft-lb	0.7376
		kg-m	0.102
Velocity	mm/sec	in/min	2.362
		m/hr	3.6
Flow rate	lit/min	cu.ft/hr	2.119
		cu.m/hr	0.06
Length	mm	in	0.039

Temperature $F = C \times 1.8 + 32$
 $^{\circ}C = (F-32)/1.8$

PROPERTIES OF COMMON METALS

All the given values are correct for these elements in their pure form

Name	Symbol	Melting Point ($^{\circ}C$)	Sp. Gravity
Aluminium	Al	658	2.58
Boron	B	2300	2.5
Cadmium	Cd	320	8.64
Chromium	Cr	1510	6.5
Cobalt	Co	1490	8.6
Copper	Cu	1083	8.9
Iron	Fe	1525	7.86
Manganese	Mn	1220	7.39
Nickel	Ni	1452	8.9
Niobium	Nb	1950	8.4
Silicon	Si	1370	2.0-2.4
Silver	Ag	960	10.5
Tin	Sn	232	7.3
Titanium	Ti	1850	4.54
Tungsten	W	3000	19.1
Vanadium	V	1710	5.5
Zinc	Zn	418	7.12

COMPARATIVE HARDNESS SCALES

This chart is given as an indicative guide

Vickers VHN	Brinell BHN	Rockwell	
		HRB	HRC
80	76.0		
85	80.7	41.0	
90	85.5	48.0	
95	90.2	52.0	
100	95.0	56.2	
105	99.8		
110	105	62.3	
115	109		
120	114	66.7	
125	119		
130	124	71.2	
135	128		
140	133	75.0	
145	138		
150	143	78.7	
155	147		
160	152	81.7	
165	156		
170	162	85.0	
175	166		
180	171	87.1	
185	176		
190	181	89.5	
195	185		
200	190	91.5	
205	195	92.5	
210	199	93.5	
215	204	94.0	
220	209	95.0	
225	214	96.0	
230	219	96.7	
235	223		
240	228	98.1	20.3
245	233		21.3
250	238	99.5	22.2
255	242		23.1
260	247	(101)	24.0
265	252		24.8
270	257	(102)	25.6
275	261		26.4
280	266	(104)	27.1
285	271		27.8
290	276	(105)	28.5
295	280		29.2
300	285		29.8
310	295		31.0
320	304		32.2
330	314		33.3
340	323		34.4
350	333		35.5

Vickers VHN	Brinell BHN	Rockwell	
		HRB	HRC
360	342		36.6
370	352		37.7
380	361		38.8
390	371		39.9
400	380		40.8
410	390		41.8
420	399		42.7
430	409		43.6
440	418		44.5
450	428		45.3
460	437		46.1
470	447		46.9
480	(456)		47.7
490	(466)		48.4
500	(475)		49.1
510	(485)		49.8
520	(494)		50.5
530	(504)		51.1
540	(513)		51.7
550	(523)		52.3
560	(532)		53.0
570	(542)		53.6
580	(551)		54.1
590	(561)		54.7
600	(570)		55.2
610	(580)		55.7
620	(589)		56.3
630	(599)		56.8
640	(608)		57.3
650	(618)		57.8
660			58.3
670			58.8
680			59.2
690			59.7
700			60.1
720			61.0
740			61.8
760			62.5
780			63.3
800			64.0
820			64.7
840			65.3
860			65.9
880			66.4
900			67.0
920			67.5
940			68.0

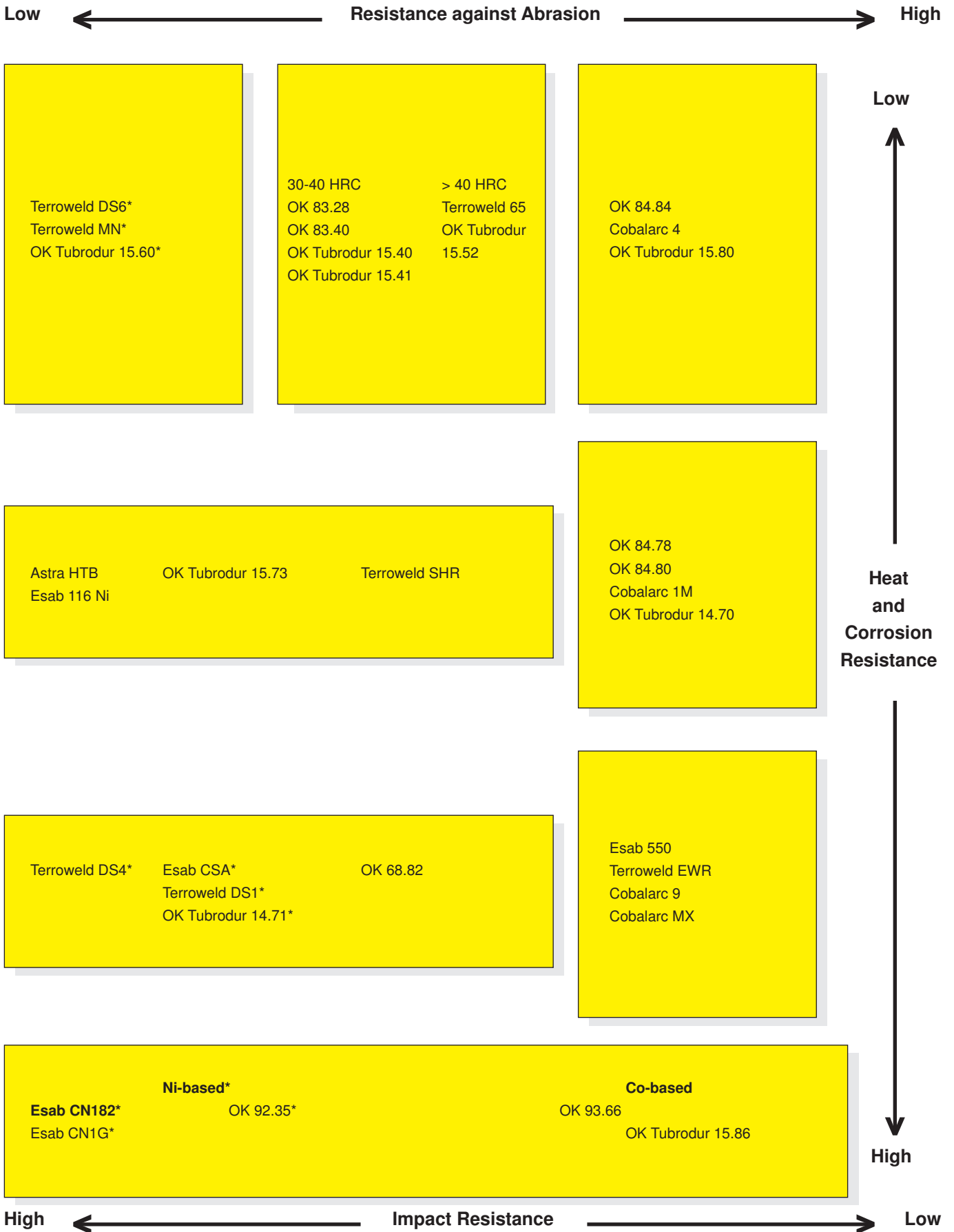
Metal Selection Guide

ESAB CONSUMABLES FOR DIFFERENT REPAIR WORK

Base Material	Gouging	Joining	Hard Facing			
			Build-up	Metal to Metal	Mineral Abrasion	Impact Abrasion
Mild steel	OK 21.03	Terroweld DBL OK Tubrod 14.17	OK 83.40	OK 83.40	Cobalarc 1 M OK Tubrodur 14.70	Cobalarc 9 OK Tubrodur 15.52
High strength steel	OK 21.03	OK 68.82	OK 68.82	OK 68.82	Cobalarc 1 M OK Tubrodur 14.70	Cobalarc 9 OK Tubrodur 15.52
14% Manganese steel	OK 21.03	ESAB CSA OK Tubrodur 14.71	Astra MN OK Tubrodur 15.60	Astra MN OK Tubrodur 15.60	Cobalarc 1 M OK Tubrodur 14.70	Cobalarc 9 OK Tubrodur 15.52
Stainless steel	OK 21.03	Terroweld S2 OK Tubrodur 14.71	ESAB CSA OK Tubrodur 14.71	OK OK Tubrodur 68.82	Cobalarc 1 M OK Tubrodur 14.70	Cobalarc 9 OK Tubrodur 15.52
Cast iron	OK 21.03	OK 92.58 OK Tubrodur 15.66	OK 92.58 OK Tubrodur 15.66	OK 92.58		
Copper Alloys	OK 21.03	Bronzoid 1	Bronzoid 1	Bronzoid 1		
Aluminium (12% Si)	OK 21.03	OK 96.50	OK 96.50			



SELECTION OF HARD FACING CONSUMABLES





ESAB CONSUMABLES FOR JOINING OF DISSIMILAR METALS

Material	Mild Steel High Strength	Stainless Cr-Ni-Steel	14% Mn-Steel	Ni-Cr-Alloys Inconel Type	Ni-Cr-Alloys Monel Type	Bronzes	Cast Iron
Mild Steel High Strength Steel	OK 68.82	OK 68.82	Esab CSA	Esab CN182	Esab CN182	Bronzoid1	Esab CN182 OK Tubrodur 15.66
	Stainless Cr-Ni Steel	Esab CSA OK Tubrodur 14.71	Esab CSA OK Tubrodur 14.71	Esab CN182	Esab Monel	Bronzoid1	OK 92.58 OK Tubrodur 15.66
		14% Mn-Steel	Astra MN OK Tubrodur 14.71	Esab CN182	Esab CN182	Bronzoid1	OK 92.58 OK Tubrodur 15.66
			Ni-Cr-Alloys Inconel Type	Esab CN182	Esab CN182	Bronzoid1	OK 92.58 OK Tubrodur 15.66
				Ni-Cr-Alloys Monel Type	Esab CN182	Bronzoid1	OK 92.58 OK Tubrodur 15.66
					Bronzes	Bronzoid1	Esab CN182
						Cast Iron	OK 92.58 OK Tubrodur 15.66

· Avoid high dilution.

· Preheating may be used for copper alloys, high carbon magnetic steels and cast iron.

- Do not preheat non-magnetic steels.
- For stainless material of known composition, use similar grade of electrode for best corrosion resistance. **If** the composition is unknown use OK 68.82 or Terroweld DS3.

METAL IDENTIFICATION CHART

Magnet	File	Surface Colour	Grinding sparks	Metal type	Welding tips
Magnetic	Soft	Dark grey	Long Yellow lines	Low carbon Cast steel	
		Malt-grey cast iron colour	Red feathery lines	Cast iron	Pre-heating Peening Slow cooling
	Hard	Dark grey	Long Yellowish-white lines with starts	High carbon steel Low alloy steel	Pre-heat heavy sections to 150°C
		Shiny grey	Yellowish-red coarse lines	13% Cr steel	Can be pre-heated
Non-Magnetic	Soft	Bright silver-grey	Yellowish-red coarse lines	Austenitic stainless steel	Low interpass
		Reddish-yellow shiny	No visible sparks	Copper alloys	Pre-heat coarse materials to 200-300°C
		Shiny Very light	No visible sparks	Aluminium alloys	Pre-heat coarse materials to 150-200°C
	Hard	Matt-grey cast iron colour	Yellowish-white lines and sparks	14% Mn steel	Low interpass

Arc Equipment





TRANSWELD 400

Welding Transformer for Shop and Site Application

- Natural air cooled for increased safety of the transformer.
- Horizontal shunt core design ensures longer operational life of the shunt-core moving mechanism.
- Well-spaced coils for adequate airflow to the transformer ensures longer service life.
- Robust and compact construction to withstand rough handling at sites.
- Ideal for TIG welding with optional TIG attachments.

Technical Data	Transweld 400
Mains supply, V/Ph, Hz	415 / 2 Lines of 3, 50
Open circuit voltage, VAC (Max)	80
Welding current range, A	50 - 400
Output at 60% duty cycle, A	300
Class of insulation	H
Type of cooling	Natural Air
Dimensions, l x w x h, mm	600 x 410 x 720
Weight, Kg	115

THH 630

Welding Transformer for Industrial and Fematic Welding

- Heavy-duty fan cooled welding transformers for MMA welding with basic, rutile and high recovery electrodes.
- Horizontal shunt core design ensures longer operational life of the shunt-core moving mechanism.
- Well-spaced coils for adequate airflow to the transformer ensures longer service life.
- Robust construction and rubber wheels for easy mobility.
- Ideal for TIG welding with optional TIG attachments.

Technical Data	THH 630
Mains supply, V/Ph, Hz	415 / 2 Lines of 3, 50
Open circuit voltage, VAC (Max)	73 - 80
Welding current range, A	90 - 630
Output at 60% duty cycle, A	500
Class of insulation	H
Type of cooling	Forced Air
Dimensions, l x w x h, mm	820 x 675 x 1050
Weight, Kg	210



RS 400/400S

The All Purpose Thyristorised MMA Welding Rectifier

- Reliable and high performance thyristorised MMA welding rectifier for construction, fabrication, projects and pipe welding.
- Built-in Hot Start facility for easy arc striking.
- RS 400S burns MSGP and E7018 electrodes and RS 400 can burn any class of MMA electrodes including E6010.
- Suitable for long lead welding with any type of electrode.
- Robust construction with large rubber wheels - ideal for site applications.
- Remote Control to adjust welding current during welding.
- Ideal for TIG welding with optional TIG attachments.

Technical Data	RS 400	RS 400S
Mains supply, Ph x V, Hz	3 x 415 ± 10%, 50	3 x 415 ± 10%, 50
Open circuit voltage, VDC (Max)	90	95
Welding current range, A	10 - 400	10 - 400
Class of insulation	H	H
Type of cooling	Forced Air	Forced Air
Dimensions, l x w x h, mm	825 x 695 x 1070	695 x 675 x 870
Weight, Kg	195	195



EasyWeld SSR 400 / 600

Fully Thyristorised Heavy Duty Thyristorised MMA Welding Rectifier

- Compact and high capacity thyristorised rectifiers with outstanding welding characteristics.
- Hex phase rectification ensures excellent welding output with spatter level close to zero.
- Hot Start, prevention against electrode freezing and protection against HF interference.
- True vertical welding characteristics.
- Remote Control to adjust welding current during welding.
- Ideal for TIG welding with optional TIG attachments.

Technical Data	EasyWeld SSR 400	EasyWeld SSR 600
Mains supply, Ph x V, Hz	3 x 415±10%, 50	3 x 415±10%, 50
Open circuit voltage, VDC (Max)	100	100
Welding current range, A	10 - 400	10 - 600
Output at 60% duty cycle, A	400	600
Class of insulation	H	H
Type of cooling	Forced Air	Forced Air
Dimensions, l x w x h, mm	675 x 350 x 690	675 x 455 x 850
Weight, Kg	122	160



LHJ 425 / 750

Heavy Duty MMA Welding Rectifiers for Welding and Gouging

- Heavy-duty diode based MMA welding rectifiers for MMA welding and arc gouging (LHJ 750).
- Stepless current control by hand crank.
- Fan cooled for optimum cooling of the power source larger operational life.
- Rugged construction - body made of powder-coated steel to suit all weather application.
- Large rubber wheels and handle - easy maneuverability.
- Suitable for Scratch TIG.

Technical Data	LHJ 425	LHJ 750
Mains supply, Ph x V, Hz	3 x 415, 50	3 x 415, 50
Open circuit voltage, VDC (Max)	76	87
Welding current range, A	55 - 425	80 - 750
Output at 60% duty cycle, A	300	600
Class of insulation	H	H
Type of cooling	Forced Air	Forced Air
Dimensions, l x w x h, mm	765 X 580 X 530	795 X 585 X 575
Weight, Kg	185	237



Origo Arc 200

Single Phase Portable Inverters for MMA Welding

- Burns 2.5/3.15 mm electrodes of any class continuously including E6010.
- Practical and rugged design - convenient to use.
- Can be used with longer input supply cable - provides a larger area of operation.
- Suitable for Scratch TIG.

Technical Data	Origo Arc 200
Mains supply, Ph x V, Hz	1 x 230±10%, 50
Fuse (slow), A	16
Open circuit voltage, VDC (Max)	60 - 75
Welding current range, A	5 - 180
Output at 60% duty cycle, A	140
Enclosure class	IP 23C
Application class	S
Standards of compliance	IEC 60974-1, EN50199
Dimensions, l x w x h, mm	380 x 180 x 300
Weight, Kg	8



Buddy Arc 200

Portable Inverter Welder for MMA and Scratch TIG

- Portable inverter power source for MMAW and Scratch TIG.
- IGBT based single phase inverter power source.
- Outstanding performance with MSGP electrodes.
- Burns up to 3.15mm MMA electrodes continually.
- Generator compliant – runs on generator power.
- Protected against thermal overloading.

Technical Data	Buddy Arc 200
Mains voltage, V, Ph, Hz	230 ± 10%, 1, 50
Current range, A	5 – 200
Open circuit voltage, V	66
Output at 35% duty cycle, A	200
Output at 60% duty cycle, A	135
Dimensions, l x w x h, mm	360 x 140 x 230
Weight, Kg	7.5
Enclosure class	IP23S
Standards of conformity	IEC 60974 -1, -10



Buddy Arc 400i / 400i XC

Compact and Powerful Inverter MMA Welder

- IGBT based inverter power sources for MMAW and Scratch TIG.
- Adjustable current, arc force and hot start.
- Suits any MMA application – MSGP and LH electrodes by 400i and 6010 by 400i XC as well.
- Current control from panel/remote, higher user convenience.
- Wide mains voltage tolerance – operates over 340 – 460V input supply, stable welding controls.
- Protected against thermal overloading and over/under voltage.

Technical Data	Buddy Arc 400i / 400i XC
Mains voltage, V, Ph, Hz	400 ± 10%, 3, 50
Current range, A	20 – 400
Open circuit voltage, V	68/78 (400i/400i XC)
Reduced OCV (VRD), V	< 35
Output at 60% duty cycle, A	400
Output at 100% duty cycle, A	310
Dimensions, l x w x h, mm	540 x 280 x 510
Weight, Kg	29/31 (400i/400i XC)
Standards of conformity	IEC 60974 -1, -10



Origo Arc 4001i A24

Heavy Duty Inverters for MMA Welding

- Burns MMA electrodes of any class.
- Control panel A24 comes with digital display and finer controls.
- Adjustable arc-force and hot start options available.
- Dust filter and laquered electronics - increased reliability.
- Live TIG start for smooth and safe operation in TIG.

Technical Data	Arc 4001i
Mains supply, Ph x V, Hz	3 x 400±10%, 50
Fuse (slow), A	20
Open circuit voltage, VDC (Max)	91
Welding current range, A	16 - 400
MMA MIG / MAG	20 - 400
TIG	4 - 400
Output at 60% duty cycle, A	320
Type of cooling	Forced Air
Enclosure class	IP 23
Application class	S
Standards of compliance	IEC/EN 60974 -1/-10
Dimensions, l x w x h, mm	652 x 249 x 423
Weight, Kg	40



Caddy Arc 251i A34

Portable inverter power sources for MMA Welding

- Burns up to 4.0 mm electrodes of any class continuously.
- Rugged design - impact resistant polymer design.
- Built-in PFC to eliminate harmonics, digital display, Arc Plus II regulator.
- VRD (Reduced CCV <35V) for enhanced safety.
- Adjustable arc force, hot start and 2 job memories.
- Handles 100m long mains cable.
- LiveTIG Start for smooth and safe operation in TIG.

Technical Data	Caddy Arc 251i
Mains supply, Ph x V, Hz	3 x 400 ± 15%, 50
Fuse (slow), A	16
Open circuit voltage, VDC (Max)	65
Welding current range, A (TIG/MMA)	4 - 250 / 3 - 250
Output at 60% duty cycle, A	190
Enclosure class	IP 23
Application class	S
Standards of compliance	IEC 60974 -1 / -10
Dimensions, l x w x h, mm	418 x 188 x 208
Weight, Kg	10.5



Origo Arc 410c / 650c / 810c A12 Offshore

Chopper Based DC Power Sources for MMAW / AAG / GTAW

- Robust construction to handle tough working conditions.
- Built-in arc force, hot start and anti stick functions.
- Burns electrodes of any class including cellulosic.
- Stepless welding current control and optional remote.
- Mains voltage compensation - stable welding.
- Digital VA meter to display the welding parameters.

Technical Data	OrigoArc 410c	OrigoArc 650c	OrigoArc 810c
Mains supply, Ph x V, Hz	3 x 400±10%, 50	3 x 400±10%, 50	3 x 400±10%, 50
Fuse (slow), A	25	50	63
Open circuit voltage, VDC	56	56	56
Welding current range, A	20 - 400	20 - 650	20 - 800
Output at 60% duty cycle, A	310	490	630
Type of cooling	Forced Air	Forced Air	Forced Air
Enclosure class	IP 23	IP 23	IP 23
Application class	S	S	S
Standards of compliance	EN 60974 -1/-10	EN 60974 -1/-10	EN 60974 -1/-10
Dimensions, l x w x h, mm	1310 x 800 x 780	1310 x 800 x 780	1310 x 800 x 780
Weight, Kg	157	223	245

Special CVCC variants of the above are available in the 400 / 500 / 650A segment.

LFD 1500/3000

Multi-operator power source

- For indoor and site use
- Portable regulator Recode.

Technical Specifications	LFD 1500	LFD 3000
Rectifier		
Input	3 x 415V 50 Hz 87 KVA	3 x 415V 50 Hz 163 KVA
Rated Output @ 60% duty cycle	1500A	3000A
Power Factor	0.93	0.95
Welding Line voltage - selectable	50 - 60 V	50 - 60 V
Weight	540 Kg	720 kg
Dimensions, d x w x h, mm	1020 x 870 x 1434	1020 x 870 x 1434
Control Unit	RC 500	RC 500
Setting Range	6-593	6-593
Enclosure	IP 22	IP 22

EDW 350 / 400 / 500

Engine Driven Welder + Power Unit

- Diesel engine driven welding units for MMA welding and auxiliary power supply unit.
- MMA welding with any class of electrode including cellulosic with long lead.
- Remote control unit is provided as standard to adjust welding parameters, while welding in progress.
- Highly efficient and powerful engine to work under any climatic conditions.
- Needs minimum maintenance except regular wear-parts.



Technical Data	EDW 350	EDW 400	EDW 500
Engine			
Make	Mahindra & Mahindra	Cummins	Cummins
Model	3305GM	S3.8G4	S3.8G4
No. of cylinders	3	4	4
Type of cooling	Water	Water	Water
Starter	12V Lucas	12V Lucas	12V Lucas
Battery capacity, Ah	75	120	120
Governor	Mechanical	Mechanical	Mechanical
Power at 1500 rpm, BHP	30	58	58
Fuel	Diesel	Diesel	Diesel
Fuel tank volume, ltr	75	80	80
Fuel consumption, ltr/hr	3.2	4.5	4.5
Welding Output			
Open circuit voltage, VDC	90	90	90
Welding current range, A	10 - 350	10 - 400	10-500
Output at 60% duty cycle, A	300	400	400
Electrode type	All including cellulosic	All including cellulosic	All including Cellulosic
Electrode size, mm	4.0 / continuous	5.0 / continuous	5.0 / continuous
Auxiliary Output			
3Ph supply, kVA, V/Ph, Hz	7.5, 415 / 3, 50	10, 415 / 3, 50	10, 415 / 3, 50
1Ph supply, kVA, V/Ph, Hz	2.5, 230 / 1, 50	5, 230 / 1, 50	5, 230 / 1, 50
Size			
Dimensions, l x w x h, mm	2600 x 1030 x 1800	2900 x 1400 x 2010	2900 x 1400 x 2010
Weight approximate, Kg	900	1250	1270
Undercarriage with tow bar	2 wheels as standard	2 wheels as standard	2 wheels as standard
Noise Level			
DB at 1 m distance	75	75	75
Compliance	CPCB	CPCB	CPCB



Power Compact 255

Compact MIG / MAG Welding Package

- Compact MIG/MAG with enclosed wire feeder.
- Spot, stitch and continuous welding operations.
- Adjustable burn back control
- Ideal for thin sheet fabrication and automotive industry.

Technical Data	Power Compact 255
Power Source	
Mains supply, Ph x V, Hz	3 x 415, 50
Open circuit voltage, VDC (Max) / steps	16 - 37 / 10
Welding current range, A	30 - 250
Output at 60% duty cycle, A	190
No. of inductance outlets	2
Spot / interval welding time, sec	0.2 - 2
Type of cooling	Forced Air
Dimensions, l x w x h, mm	840 x 375 x 736
Weight, Kg	90
Wire Feeder (Enclosed)	
Wire feed speed, m/min	1.5 - 22
Wire diameter, mm / type	0.8 - 1.2 / MS

Migmatic 250 / Auto Mig 300

Power Source for MIG / MAG Welding

- Rugged and reliable design.
- Continuous welding with 0.8mm wire on MS/SS.
- Auto Mig 300 is specially designed for automotive industry for high speed/high current application on 24x7 basis.

Technical Data	Migmatic 250	Auto Mig 300
Power Source	Migmatic 250	Auto Mig 300
Mains supply, Ph x V, Hz	3 x 415, 50	3 x 415, 50
Open circuit voltage, VDC (Max) / steps	16 - 34 / 10	19-40
Welding current range, A	30 - 250	40-300
Output at 60% duty cycle, A	250	300
Type of cooling	Forced Air	Forced Air
Dimensions, l x w x h, mm	620 x 390 x 580	620 x 390 x 580
Weight, Kg	78	87
Wire Feeder	Migmatic	Migmatic
Wire feed speed, m/min	1.5 - 22	1.5 - 22
Wire diameter, mm / type	0.8 - 1.2 / MS	0.8 - 1.2 / MS
Weight, Kg	6	6



Auto K 400 / 600

Thyristorised Power Sources for MIG / MAG Welding

- Compact yet thyristorised rugged power sources for high quality manual or mechanized MIG/MAG.
- Hex phase rectification gives almost ripple free welding output free from spatter.
- Fresh Tip Treatment (FTT) control eliminates formation of globules at the wire tip during weld stop condition.
- Fresh Arc Start (FAS) control instantaneously enhances the arc-striking rate for better arc striking.
- Self hold circuitry with crater control module.
- Pre-flow of shielding gas with burn-back control for optimum utilizations.
- Protected against thermal overloading and single phasing.
- An ideal choice for MIG/MAG welding application with enhanced productivity and quality.


Technical Data	Auto K 400	Auto K 600
Power Source		
Mains supply, Ph x V, Hz	3 x 415±10%, 50	3 x 415±10%, 50
Open circuit voltage, VDC (Max)	55	68
Welding current range, A	60 - 400	60 - 600
Output at 60% duty cycle, A	400	600
Output at 100% duty cycle, A	310	470
Adjustment of welding current	Stepless	Stepless
Remote current regulator type		
	RCU-AUTO K 400	RCU-AUTO K 400
Type of cooling	Forced Air	Forced Air
Dimensions, l x w x h, mm	675 x 350 x 690	617 x 455 x 850
Weight, Kg	122	160
Wire Feeder		
	Servo - I	Servo - II
Drive system	DC motor	DC motor
Speed control	Stepless	Stepless
Wire feed mechanism	Double roll quick changeover type	Double roll quick changeover type
Length, m (Standard)	5	5
Length, m (Optional)	10 / 15 / 20	10 / 15 / 20 / 30
Wire feed speed, m/min	1.5 - 16 m/min	1.5 - 16 m/min
Wire diameter, mm / type	0.8 - 1.2	0.8 - 1.6
Weight, Kg	7	9



Auto K 400 / 600 Synergic

Thyristorised Power Sources with Synergic Feature for MIG / MAG

- Synergic feature coupled with the features of standard Auto K 400 to operate in manual / synergic mode.
- Software based auto selection of parameters using inputs of wire diameter, material and shielding gas.
- User settable non-volatile and editable job memories.
- Separate adjustment for crater.
- LCD display for welding parameters.
- Mounted on rubberized wheels for better mobility along with gas cylinder base.

Technical Data	Auto K 400 Synergic	Auto K 600 Synergic												
Power Source														
Mains supply, Ph x V, Hz	3 x 415±10%, 50	3 x 415 50 Hz												
Open circuit voltage, VDC (Max)	55	64												
Welding current range, A	60 - 400	60 - 600												
Output at 60% duty cycle, A	400	600												
Output at 100% duty cycle, A	310	470												
Adjustment of welding current	Stepless	Stepless												
Type of cooling	Forced Air	Forced Air												
Dimensions, l x w x h, mm	930 x 480 x 800	675 x 455 x 850												
Weight, Kg	115	180												
Remote Current Regulator type Synergic Pendant	RCU-AUTO K 400	RCU AUTO K 600												
Wire and gas combinations for operation in the synergic mode	<table border="1"> <thead> <tr> <th>Wire</th> <th>Wire Dia</th> <th>Gas</th> </tr> </thead> <tbody> <tr> <td>Fe</td> <td>0.8 / 1.2 / 1.6</td> <td>CO2</td> </tr> <tr> <td>SS</td> <td>0.8 / 1.2 / 1.6</td> <td>Argon Mix</td> </tr> <tr> <td>Al</td> <td>0.9 / 1.2 / 1.6</td> <td>Argon</td> </tr> </tbody> </table>	Wire	Wire Dia	Gas	Fe	0.8 / 1.2 / 1.6	CO2	SS	0.8 / 1.2 / 1.6	Argon Mix	Al	0.9 / 1.2 / 1.6	Argon	
Wire	Wire Dia	Gas												
Fe	0.8 / 1.2 / 1.6	CO2												
SS	0.8 / 1.2 / 1.6	Argon Mix												
Al	0.9 / 1.2 / 1.6	Argon												
No. of job memories (User-defined)	9	9												
Wire Feeder	Servo - I	Servo - 11												
Drive system	DC motor	DC motor												
Speed control	Stepless	Stepless												
Wire feed mechanism	2-roll quick changeover type	2-roll quick changeover type												
	4-roll drive optional	4-roll drive optional												
Length of interconnection, mtr	5	5												
Wire feed speed, m/min	1.5 - 16 m/min	1.5 - 16 m/min												
Wire diameter, mm	0.8 - 1.2	0.8 - 1.6												
Wire type	MS / Al / FC	MS / Al / FC												
Weight, Kg	7	9												



SCR 400(S)

MIG / MAG Welding units for Shipyard

- Heavy-duty thyristorised power sources designed specially to meet the welding applications for shipyards.
- Wire feeder interconnection up to 50m available.
- Suitable for all types of wires - Solid/flux-cored.
- Light weight and compact wire feeder for reaching all locations.
- Standard 2-roll quick changeover mechanism or optional 4-roll drive.
- Outstanding welding performance.

Buddy Mig 500i

Rugged and Reliable Inverter MIG/MAG

- IGBT based Inverter MIG/MAG.
- High duty cycle – 387A @ 100%, ideal for operating on 24 x 7.
- Stepless inductance – better arc performance.
- Feeder mounted remote – easy parameter control.
- Welding voltage and wire feed speed by remote and crater voltage and crater current control on panel.
- Versatile – Excellent performance on MS, SS and Al.
- Wide mains voltage tolerance – operates over 340 – 460V input supply, stable welding controls.
- Protected against thermal overloading and over/under voltage.

Technical Data	SCR 400(S)
Power Source	
Mains supply, Ph x V, Hz	3 x 415 ± 10%, 50
Welding current - Max, A	400
Dimensions, l x w x h, mm	710 x 435 x 760
Weight, Kg	149
Wire Feeder	Servo-I
Wire feed mechanism	2-roll quick changeover type
	4-roll drive optional
Weight, Kg	7

Technical Data	Buddy Mig 500i
Power Source	
Mains voltage, V, Ph, Hz	400 ± 10%, 3, 50
Current range, A	50 – 500
Open circuit voltage, V	50
Output at 60% duty cycle, A	500
Output at 100% duty cycle, A	387
Dimensions, l x w x h, mm	610 x 335 x 640
Weight, Kg	56
Standards of conformity	IEC 60974 -1, -10
Wire Feeder	Buddy Feed 402
Wire feed speed, m/min	1.5 – 20
Wire diameter, mm	0.8 – 1.6
Dimensions, l x w x h, mm	460 x 200 x 280
Weight, Kg	9



MIG C3000i U6

MIG 3001i/4001i + Aristo Feed 3004w U6

- Lower power rating
- Higher rated current at 100% duty cycle for continuous usage of 0.8mm wire.
- Digital Display
- Pulse and Synergic Pulse MIG / MAG
- Remote control option



Technical Data	MIG C3000i	MIG 3001i (w)	MIG 4001i (w)
Mains voltage V, Hz	400, 3-50 / 60	4-300, 50/60	400, 3-50/60
Fuse, slow A	16	16	20
Mains cable, Ø mm ²	4x4	4x4	4x4
Setting range A MIG / MAG	16-300	16-300	20-400
MMA	16-300	16-300	16-400
TIG	4-300	4-300	4-400
Permitted load MIG / MAG at			
35% duty cycle A/V	300	300	400
60% duty cycle A/V	240	240	320
100% duty cycle A/V	200	200	250
Open circuit voltage V	60	60	91
Open circuit voltage (VRD active)	35	35	35
Open circuit power W	30	30	60
Dimensions l x w x h, mm	625x410x420	652x249x423	652x249x423
Water colling unit	CoolMidi 1800	CoolMidi 1000	CoolMidi 1000
Weight	38	33	43.5
Cooling unit (Empty / Full) kg	19 / 23	14 / 19	63.5 (in-built cooler)
Insulation class	H	H	H
Enclosure class	IP 23	IP 23	IP 23
Application class	S	S	S
Standards	IEC/EN 60974-1,-10	IEC/EN 60974-1,-10	IEC/EN 60974-1,-10
Wire feeder	In-built 4-roll	External 4-roll	External 4-roll
Model (Feed)	Enclosed	3004w / 4804w	3004w / 4804w
Wire Feed Speed, m/min	0.8-25	0.8-25	0.8-25
Wire diameter, mm	0.6-1.2	0.6-1.2 (3004w) 0.6-2.4 (4804w)	0.6-1.2 (3004w) 0.6-2.4 (4804w)
Wire type	MS / SS / AL	MS / SS / AL	MS / SS / AL
Control Panel / Pendant	U6	U6 / U8-2 Plus	U6 / U8-2 Plus



Aristo Mig 5000i (w)

Heavy-duty Multi-process Inverter Power Sources for MIG/MAG (Pulse / Synergic / Non-Pulse), MMA Welding and Arc Gouging

- Inverter power source for applications demanding high level of performance.
- Robust construction, body made of aluminium to prevent corrosion and handle tough working environments.
- Both Cooling Fan and Pump function on demand, extremely low no-load power consumption.
- Communication system is based on CAN-bus for efficient control with minimization of cables.
- Dust filter to handle tough and dirty working environment and avoid grinding dust and metal particles inside the chassis of the power source.
- Suitable for both manual and mechanized applications with outstanding welding characteristics.

Technical Data	Mig 5000i
Power Source	
Mains supply, Ph x V, Hz	3 x 400±10%, 50
Open circuit voltage, VDC / VRD activated	68 - 88 / <35
Welding current range, A	16 - 500
Output at 60% duty cycle, A	500
Output at 100% duty cycle, A	400
Type of cooling	Forced Air
Enclosure class	IP 23
Application class	S
Standards of compliance	IEC/EN 60974 -1, -2, -10
Dimensions, l x w x h, mm	625 x 394 x 476 625 x 394 x 776*
Weight, Kg	68 / 88*
Cooling Unit*	
Cooling power, W**	2500*
Coolant quantity, ltr	5.5*
Maximum water flow, ltr/min	2*

* Applies to water cooled models Aristo Mig 5000iw only

** At 40 Deg C temperature difference and flow rate 1.5 ltr/min



Aristo Mig U4000iw / U5000iw

Heavy-duty Multi-process Inverter Power Sources for MIG/MAG (Pulse / Synergic / Non-Pulse), MMA Welding and Arc Gouging (U5000iw)

- Inverter power source for applications demanding high level of performance.
- Robust construction, body made of aluminium to prevent corrosion and handle tough working environments.
- Both Cooling Fan and Pump function on demand, extremely low no-load power consumption.
- VRD for enhanced operator safety.
- Compatible Feeder / Control Panel Combination.
- Communication system is based on CAN-bus for efficient control with minimization of cables.
- Dust filter to handle tough and dirty working environment and avoid grinding dust and metal particles inside the chassis of the power source.
- Suitable for both manual and mechanized applications with outstanding welding characteristics.

Technical Data	Mig U4000iw	Mig U5000iw
Power Source		
Mains supply, Ph x V, Hz	3 x 400±10%, 50	3 x 400±10%, 50
Open circuit voltage, VDC (Max)	80	80
Welding current range, A	16 - 400 / 4 - 400#	16 - 500 / 4 - 500#
Output at 60% duty cycle, A	320	500
Output at 100% duty cycle, A	250	400
Type of cooling	Forced Air	Forced Air
Enclosure class	IP 23	IP 23
Application class	S	S
Standards of compliance	IEC/EN 60974 -1 IEC/EN 60974 -10	IEC/EN 60974 -1 IEC/EN 60974 -10
Dimensions, l x w x h, mm with cooling unit	625 x 394 x 776	625 x 394 x 776
Weight (Power source + Cooling unit), Kg	63.5 + 20	71 + 20
Cooling Unit		
Cooling power, W*	2500	2500
Coolant	50% water and 50% glycol	50% water and 50% glycol
Coolant quantity, ltr	5.5	5.5
Maximum water flow, ltr/min	2	2

Current range for TIG

* At 40 Deg C temperature difference and flow rate 1.5 ltr/min



Feed 3004w / 4804w U6

Feed 3004w / 4804w + Pendant U8_2 Plus

Wire Feeders for Aristo Mig U4000iw / U5000iw

- Heavy-duty construction with 4-roll drive.
- All feed rollers are geared and grooved for maximum grip and positive force to facilitate better feeding.
- Digital V/A meter for displaying welding parameters.
- Remote control available optionally.
- Fully enclosed wire spool to protect the wire spool.

Technical Data	Feed 3004w	Feed 4804w
Mains supply, Ph x V, Hz	1 x 42, 50	1 x 42, 50
Drive system	4-Roll Drive	4-Roll Drive
Length of interconnection, m	1.7/5/10/15/25/35	1.7/5/10/15/25/35
Max. diameter of wire spool, mm	330 / 440**	330 / 440**
Wire feed speed, m/min	0.8 - 25	0.8 - 25
Wire type	MS / Al / FC	MS / Al / FC
Wire diameter, mm	0.6 - 1.6	0.6 - 2.4
Enclosure class	IP23	IP23
Standards of compliance	IEC/EN 60974 -5/-10	IEC/EN 60974 -5/-10
Dimensions, l x w x h, mm	690 x 275 x 420	690 x 275 x 420
Weight, Kg	15	19
Coolant - max pressure, bar	5*	5*

** With additional bobbin adapter.

Technical Data	Control Panel U6	Pendant U8_2 Plus
2/4 Stroke	X	X
Crater filling	X	X
Adjustable burn back time	X	X
Creep start	X	X
Hot start	X	X
Inductance	X	X
Gas pre/post flow	X	X
Digital V/A meters	X	X
Gas purge/wire inching	X	X
Pre-programmed synergic lines	X (60)	X (>230)
Memory 10 set	X	
Memory 255 set		X
Pulse / synergic pulse	X	X
Create synergic lines		X

Can also be used with Aristo Mig 4000i / 5000i without TIG functionalities



MIG Torches - Air / Water Cooled

PSF 250 / 305 / 405 / 505 3/4.5m Air Cooled

PSF 410w / 510w 3/4.5m Water Cooled

- Heavy-duty construction.
- Ergonomically designed handle.
- All torches come with EURO connection as standard.
- All torches come with 50° swan neck as standard.
- Straight neck and 60° swan neck available optionally.
- 360° swiveling facility.
- Wide range of wear parts e.g. liners, contact tips and gas nozzles available for welding in all positions.
- Conforms to IEC / EN 60974-7.

Technical Data	PSF 250	PSF 305	PSF 405	PSF 505
Type of cooling	Air/Gas	Air/Gas	Air/Gas	Air/Gas
Wire diameter, mm	0.6 - 1.0	0.8 - 1.2	0.8 - 1.6	1.0 - 2.4
Wire type	MS/Al/FC	MS/Al/FC	MS/Al/FC	MS/Al/FC
Rating, A @ % duty cycle	250@60%	315@60%	380@60%	475@60%
Length, m	3/4.5	3/4.5	3/4.5	3/4.5
Weight, Kg	1.8/2.5	2.5/3.3	3.1/4.2	3.9/5.3

Technical Data	PSF 410w	PSF 510w
Type of cooling	Water	Water
Wire diameter, mm	0.8 - 1.6	1.0 - 2.4
Wire type	MS/Al/FC	MS/Al/FC
Rating, A @ % duty cycle	400@100%	500@100%
Length, m	3/4.5	3/4.5
Weight, Kg	3.0/3.9	3.3/4.0



EasyWeld SSR400-T / 400T-Pulse

Thyristorised Power Source for DC TIG and MMA

- Robust and compact construction.
- Outstanding welding characteristics in TIG / MMA.
- Hex-phase rectification gives almost ripple free output.
- Suitable for all positional welding.
- True vertical welding characteristics.
- Built-in HF for smooth start in TIG.
- Higher OCV for better arc striking.
- Heavy-duty design, suitable for manual well as mechanized TIG applications of any kind.
- Built-in hot start and anti-stick in MMA improves droplet separation from the electrode and improves weldability.
- Remote control for adjustment of welding current while welding in progress.

Technical Data	EasyWeld SSR 400-T
Mains supply, Ph x V, Hz	3 x 415±10%, 50
Open circuit voltage, VDC (Max)	100
Welding current range, A	10 - 400
Output at 60% duty cycle, A	400
Output at 100% duty cycle, A	310
Class of insulation	H
Type of cooling	Forced Air
Dimensions, l x w x h, mm	675 x 350 x 690
Weight, Kg	155

* 400T Pulse Comes with Pulsing unit.



Buddy Tig 160

Portable Inverter Welder for DC TIG and MMA

- Portable inverter power source for DC TIG and MMA.
- IGBT based single phase inverter power source.
- Choice of TIG starting by HF or Scratch Start.
- 2/4 stroke control in TIG.
- Current and arc force control in MMA.
- Generator compliant – runs on generator power.
- Protected against thermal overloading.

Technical Data	Buddy Tig 160
Mains voltage, V, Ph, Hz	230 ± 10%, 1, 50
Current range, A	5 – 160
Open circuit voltage, V	58
Output at 25% duty cycle, A	160
Output at 60% duty cycle, A	100
Dimensions, l x w x h, mm	310 x 140 x 230
Weight, Kg	6
Enclosure class	IP23S
Standards of conformity	IEC 60974 -1, -10



Caddy TIG 2200i TA33 / TA34

Single Phase Portable Inverters for DC TIG / Pulse TIG / MMA Welding

- Rugged design - impact resistant polymer design.
- Built-in PFC to counter harmonics, Arc Plus II regulator for smooth output, handles 100m long mains cable.
- TIG - Start by HF/Lift Arc, up/down slope, pre/post gas.
- TA33 - Automatic setting of parameters based on sheet thickness.
- TA34 - Manually set pulse parameters in TIG.

Technical Data	Caddy Tig 2200i
Mains supply,	1 x 230 V, 50 Hz
Fuse (slow), A	16
Open circuit voltage, VDC (Max)	72
Welding current range, A (TIG/MMA)	4 - 220 / 3 - 220
Output at 60% duty cycle, A	150
Enclosure class	IP23
Application class	S
Standards of compliance	IEC 60974 -1 / -10
Dimensions, l x w x h, mm	488 x 188 x 208
Weight, Kg	9.4
Cooling Unit	Cool Mini
Coolant Vol., Ltr.	2.2
Max. flow, Ltr./min	2



Origo Tig 3001i TA24

Inverter Power Sources for DC TIG/Pulse TIG/MMA

- Inverter power sources for MMA, DC TIG (TA23) and also DC Pulse TIG (TA24) with excellent welding output.
- Robust and compact construction.
- Digital display of the welding parameters.
- 2 job memories (TA24).
- All positional welding.
- Burns MMA electrodes of any class of size up to 4.0 mm continuously.
- Trolley, remote hand / foot control optional.
- 3001iw variant also available with cooling unit.

Technical Data	Tig 3001i (TA24)
Power Source	Tig 3000i
Mains supply, Ph x V, Hz	3 x 400±10%, 50
Open circuit voltage, VDC	60
Open circuit voltage direct (VRD active), v	35
Welding current range, A (TIG)	4 - 300
Welding current range, A (MMA)	16 - 300
Output at 60% duty cycle, A	240
Output at 100% duty cycle, A	200
Type of cooling	Forced Air
Enclosure class	IP 23
Application class	S
Dimensions, l x w x h, mm	652 X 249 X 423
Weight, Kg	33.5
Standards of compliance	IEC/EN 60974 - 1/-3 / -10
Control Panel	TA24
TIG start mode	HF / Lift Arc
2/4 Stroke	2 / 4
Slope up, sec	0 - 10
Slope down, sec	0 - 10
Gas pre-flow, sec	0 - 5
Gas post-flow, sec	5 - 25
Pulse/background current, A	4 - 300
Pulse/background time, sec	0.01 - 2.5
Cooling Unit	CoolMidi 1000
Cooling power, W*	1100
Coolant volume, ltr	5
Max flow, ltr/min	4
Dimensions, l x w x h, mm including cooling unit	714 x 249 x 693
Weight (including cooling unit), Kg	54
Standards of compliance	IEC/EN 60974-2/10

* At 40 Deg C temperature difference and flow rate 1 ltr/min



Aristo Tig 4000iw TA6

Inverter Power Sources for DC TIG / Pulse TIG / MMA

- Heavy-duty power sources for MMA, DC TIG and also DC Pulse TIG (TA6) with excellent welding output.
- Robust and compact construction.
- Dust filter to withstand tough working environment.
- 10 job memories (TA6).
- Welding thin sheets using pulse TIG (TA6).
- All positional welding with high efficiency and quality.
- Suitable for manual and mechanized TIG applications.
- Burns MMA electrodes of any class of size up to 6.3 mm.
- Trolley, remote hand / foot control optional.

Technical Data	Tig 4000iw (TA6)
Power Source	Tig 4000i
Mains supply, Ph x V, Hz	3 x 400±10%, 50
Open circuit voltage, VDC (Max)	90
Welding current range, A (TIG)	4 - 400
Welding current range, A (MMA)	16 - 400
Output at 60% duty cycle, A	320
Output at 100% duty cycle, A	250
Type of cooling	Forced Air
Enclosure class	IP 23
Application class	S
Dimensions, l x w x h, mm with Cooling Unit	625 x 394 x 776*
Weight, Kg	79*
Standards of compliance	IEC / EN 60974 -1 / -3 / -10
Cooling Unit*	
Cooling power, W**	2000
Coolant volume, ltr	5.5
Max flow, ltr/min	2
Control Panel	TA6
TIG start mode	HF / Lift Arc
2/4 Stroke	2 / 4
Slope up, sec	0 - 5
Slope down, sec	0 - 10
Gas pre-flow, sec	0 - 5
Gas post-flow, sec	5 - 25
Pulse / background current, A	4 - 400
Pulse / background time, sec	0.001 - 0.1

* Applies to water cooled models Aristo Tig 4000iw TA6 only

** At 40 Deg C temperature difference and flow rate 1 ltr/min



Caddy Tig 2200i AC/DC, TA33 / TA34 AC/DC

Inverter Power Sources for AC/DC TIG / DC Pulse TIG / MMA

- Portable power sources with wide functionalities.
- Digital display, 2 job memories.
- TA33 - parameters adjusted based on plate thickness.
- TA34 - manually adjust all parameters.
- Burns MMA electrodes of any class of size up to 3.15 mm continuously.
- Trolley and remote control available optionally.

Technical Data	Tig 2200i AC/DC (TA33 AC/DC)	Tig 2200i AC/DC (TA34 AC/DC)
Power Source	Tig 2200i	Tig 2200i
Mains supply, Ph x V, Hz	1 x 230±10%, 50	1 x 230±10%, 50
Open circuit voltage,	55-60	55-60
Open circuit voltage direct, (VRD active), v	35	35
Welding current range, A (TIG)	4 - 220	4 - 220
Welding current range, A (MMA)	16 - 160	16 - 160
Output at 60% duty cycle, A	150	150
Type of cooling	Forced Air	Forced Air
Enclosure class	IP 23	IP 23
Application class	S	S
Dimensions, l x w x h, mm	418 X 188 X 345	418 X 188 X 345
Weight, Kg	15	15
Standards of compliance	IEC/EN 60974 -1/-3 IEC/EN 60974 -10	IEC/EN 60974 -1/-3 IEC/EN 60974 -10
Control Panel	TA33	TA34
TIG start mode	HF / Lift Arc	HF / Lift Arc
2/4 Stroke	2 / 4	2 / 4
Slope up, sec	0 - 10	0 - 10
Slope down, sec	0 - 10	0 - 10
Gas pre-flow, sec	Preset	Preset
Gas post-flow, sec	0 - 10	5 - 25
Pulse frequency DC, sec	--	0.01 - 2.5
Frequency AC, Hz	--	10 - 150
AC balance, %	--	50 - 98
Plate thickness, mm	1 - 5	--
Cooling Unit	CoolMini	CoolMini
Cooling power, W*	700	700
Coolant volume, ltr	2.2	2.2
Max flow, ltr/min	2	2
Dimensions, l x w x h, mm	418 x 188 x 137	418 x 188 x 137
Weight (empty), Kg	4.5	4.5
Standards of compliance	IEC/EN 60974 -2/-10	IEC/EN 60974 -2/10

* At 40 Deg C temperature difference and flow rate 1 ltr/min



Origo Tig 3000i AC/DC, TA24 AC/DC

Inverter Power Sources for AC/DC TIG / DC Pulse TIG / MMA

- Designed to weld any metal e.g. aluminium, copper, stainless steel and its alloys with high performance.
- Digital display, 2 job memories.
- QWave - High performance AC welding with low noise.
- Electrode preheating - excellent arc start and extended electrode life-time.
- Energy save made - cooling fan and pump on demand.
- Burns MMA electrodes of any class of size up to 4.0 mm continuously.
- Trolley, remote hand / foot control optional.

Technical Data	Tig 3000i AC/DC, TA24 AC/DC
Mains supply, Ph x V, Hz	3 x 400±10%, 50
Open circuit voltage, V	54-64
Welding current range, A (TIG)	4 - 300
Welding current range, A (MMA)	16 - 300
Output at 60% duty cycle, A	240
Output at 100% duty cycle, A	200
Type of cooling	Forced Air
Enclosure class	IP 23
Application class	S
Dimensions, l x w x h, mm	652 X 412 X 423
Weight, Kg	42
Standards of compliance	IEC/EN 60974 -1 / -3 / -10
TIG start mode	HF / Lift Arc
2/4 Stroke	2 / 4
Slope up, sec	0 - 10
Slope down, sec	0 - 10
Gas pre-flow, sec	0 - 5
Gas post-flow, sec	5 - 25
Pulse / background current, A	4 - 300
Pulse / background time, sec	0.01 - 2.5
AC balance, %	50 - 98
AC frequency, Hz	10 - 152
Electrode preheating	1 - 100
Cooling Unit	CoolMidi 1800
Cooling power, W*	1800
Coolant volume, ltr	4.2
Max flow, ltr/min	4
Dimensions, l x w x h, mm	710 x 385 x 208
Weight (empty), Kg	19
Standards of compliance	IEC/EN 60974 -2 / -10

* At 40 Deg C temperature difference and flow rate 1 ltr/min



Origo Tig 4300iw AC/DC, TA24 AC/DC

Heavy-duty Inverter Power Sources for Manual / Mechanized TIG (AC/DC TIG / DC Pulse TIG) and MMA Welding

- Designed to weld any metal e.g. aluminium, magnesium, copper and its alloys, MS and SS with high performance.
- Robust construction, Digital display, 2 job memories.
- QWave - High performance AC welding with low noise.
- Electrode preheating - excellent arc start and extended electrode life-time.
- VRD - Voltage Reduction Device, safety feature in MMA.
- Energy save made - cooling fan and pump on demand.
- Burns MMA electrodes of any class of size up to 6.3 mm.
- Arc force, hot start, polarity switch for welding in MMA.
- Trolley and remote hand / foot control optional.

Technical Data	Tig 4300iw AC/DC, TA24 AC/DC
Mains supply, Ph x V, Hz	3 x 400±10%, 50
Open circuit voltage, without VRD V (Max)	83
Open circuit voltage direct, (VRD activated), v	<35
Welding current range, A (TIG)	4 - 430
Welding current range, A (MMA)	16 - 430
Output at 60% duty cycle, A	400
Output at 100% duty cycle, A	315
Type of cooling	Forced Air
Enclosure class	IP 23
Application class	S
Dimensions, l x w x h, mm	625 x 394 x 776
Weight, Kg	95
Standards of compliance	IEC/EN 60974-1/-2/-3/-10
TIG start mode	HF / Lift Arc
2/4 Stroke	2 / 4
Slope up, sec	0 - 10
Slope down, sec	0 - 10
Gas pre-flow, sec	0 - 5
Gas post-flow, sec	5 - 25
Pulse / background current, A	4 - 430
Pulse / background time, sec	0.01 - 2.5
AC balance, %	50 - 98
AC frequency, Hz	10 - 152
Electrode preheating manual, MS	15 - 100
Cooling Unit	Built-in
Cooling power, W*	2000
Coolant volume, ltr	5.5
Max flow, ltr/min	2

* At 40 Deg C temperature difference and flow rate 1.0 ltr/min



TIG Torches - Air / Water Cooled

TXH 201 4/8m Air Cooled

TXH 251w/400w/400w HD 4/8m Water Cooled

TXH 201r 4/8m Air Cooled with Remote Functions

TXH 251w/401w/401w HD 4/8m Water Cooled with Remote Functions

TXH 201V 4/8m Air Cooled for Scratch TIG

- Rugged construction - trouble free operation with minimum maintenance.
- Ergonomically designed handle.
- Effective cooling system.
- All torches come with OKC connection as standard.
- TXH 201r / 251wr / 401wr / 401wr HD TIG torches available with remote control for CAN-bus based TIG machines i.e. for Caddy Tig 2200i, Caddy Tig 2200i AC/DC, Origo Tig 3001i, Origo Tig 3000i AC/DC, Aristo Tig 4000i and Origo Tig 4300iw AC/DC.
- Gas valve mounted TIG torches TXH 150V/200V for scratch TIG using rectifiers.
- Wide range of wear parts e.g. collet, collet body, nozzle, and gas lens available for welding in all positions.
- All the TIG torches conform to international standard IEC/EN 60974-7.

Technical Data	TXH 201 / 201r / 201V
Type of cooling	Air / Gas
Connection	OKC 50
Size of TIG rod, mm	1.0 - 4.0
Rating, A@% duty cycle	200 @ 35%
Length, m	4 / 8

Technical Data	TXH 251w / TXH 251wr	TXH 401w TXH 401wr	TXH 401w HD / TXH 401wr HD
Type of cooling	Water	Water	Water
Connection	OKC 50	OKC 50	OKC 50
Size of TIG rod, mm	1.0 - 3.2	1.0 - 4.8	1.0 - 4.8
Rating, A@% duty cycle	250 @ 60%	400 @ 35%	430 @ 35%
Length, m	4 / 8	4 / 8	4 / 8



LPH 50 / 80 / 120

Rugged Power Sources for Air Plasma Cutting

- Faster and economical on Al, SS and CS below 20 mm.
- Cutting can be done from gauge thickness to thick plates.
- Very safe and convenient.
- No distortion even on sheets below 6 mm.
- Light weight torches make cutting effortless.
- Circle cutting attachments and available optionally.
- Trolley for straight line cutting using manual PT-25/27 cutting torch is available optionally.

Technical Data	LPH 50	LPH 80	LPH 120
Mains supply, PhxV, Hz	3x415, 50	3x415, 50	3x415, 50
OCV, VDC (Max)	320	310	310
Output@% duty cycle, A	--	--	--
Pressure, bar	4.5 - 7	4.5 - 7	4.5 - 7
Cutting capacity, mm	12/15*	25/35*	35/45*
Enclosure class	IP23	IP23	IP23
Type of cooling		Forced Air	Forced Air
Dimensions, lwxhx, mm	680x325 x515	760x390 x845	760x390 x845
Weight, Kg	89	131	167
Torch/length, m	PT-27/7.6	PT-27/7.6	PT-25/7.6

* Quality cut / sever capacity



PowerCut 900 / 1600

Inverter Power Sources for Air Plasma Cutting

- Inverter based power source, excellent cutting output.
- Robust and compact construction.
- Cuts thin sheets of gauge thickness to thick plates.
- Cutting packages with mechanized cutting torch also available for PC-1600.
- Straight torch Circle cutting attachments are available optionally.

Technical Data	PC-900	PC-1600
Mains supply, PhxV, Hz	3x400, 50	3x400, 50
OCV, VDC (Max)	275	278
Output@% duty cycle, A	60@60%	90@60%
Air supply, ltr/min / bar	150/5.2	165/5.5
Cutting capacity, mm	22/32**	38/45**
Type of cooling	Forced Air	Forced Air
Dimensions, lwxhx, mm	516x275 x409	800x318x419
Weight, Kg	39.5	42.7
Manual cutting torch	PT 38	PT-38
Torch length, m	7.6/15.2	7.6/15.2

* Also available in 3 x 400V version

** Quality cut / sever capacity

CPRA 800(S) / 1200(S) CPRA 1000T / 1200T

Power Sources for SAW

- Rugged construction with sheet metal body, mounted on rubberized wheels.
- Heavy-duty construction, designed for continuous applications up to 1000 Amps.
- 4-step voltage control in coarse and fine mode.
- Mains voltage compensation ensures minimal fluctuation in arc voltage.
- Built-in protection against thermal overloading.
- Power and control units are housed separately for the easy of servicing.

SAW Tractor LW - Tractor Mounted Welding Head

- Heavy-duty design ensures stable wire feeding and good welding output.
- Available in standard tractor mountable version and optional boom mountable version.
- Nozzle designed suitably for a no. of applications e.g. linear / fillet welding etc.
- User-friendly control panel with controls within easy reach of operator, for adjustment of parameters, while welding in progress.
- Creep feed start for non-explosive and smooth start of the welding.



Technical Data	CPRA 800(S)	CPRA 1200(S)	CPRA 1000T	CPRA 1200T
Power Source				
Mains supply, Ph x V, Hz	3 x 415, 50	3 x 415, 50	3 x 415, 50	3 x 415, 50
Open circuit voltage, VDC	22 - 55	30 - 60	59	59
Output at 100% duty cycle, A	800	1000	850	950
Type of cooling	Forced Air	Forced Air	Forced Air	Forced Air
Dimensions, l x w x h, mm	960 x 760 x 880	1000 x 800 x 900	830 x 670 x 1400	830 x 670 x 1400
Weight, Kg	325	375	440	440
Welding Head	SAW Tractor LW	SAW Tractor LW	SAW Tractor LC	SAW Tractor LC
Wire (single) diameter range, mm	2.4 - 5.0 / 6.3*	2.4 - 5.0 / 6.3*	2.4 - 5.0 / 6.3*	2.4 - 5.0 / 6.3*
Wire feed speed, m/min	0.5 - 4.5	0.5 - 4.5	0.5-4.5	0.5-4.5
Welding current range, A	200 - 1200	200 - 1200	300 - 1000	300 - 1200
Vertical adjustment, mm	100	100	140	1400
Swivel arrangement, degree	180°	180°	360°	360°
Speed range of tractor, m/min	0 - 1.5	0 - 1.5	0 - 1.5	0 - 1.5
Wheel center of tractor, mm	350	350	350	350
Dimensions, l x w x h, mm	1368 x 410 x 1145	1368 x 410 x 1145	1368 x 410 x 1145	1368 x 410 x 1145

* Optional

Welding Automation

Thyristorised SAW Power Sources - DC

LAF 635 / 1000 / 1000M / 1250 / 1250M / 1600 / 1600M

- Excellent welding characteristics throughout the entire current and voltage.
- Good arc stability at low as well as high voltages.



	LAF 635	LAF 1000	LAF 1000M	LAF1250M	LAF 1250M	LAF 1600M	LAF 1600M
Mains supply, V/Hz	400/50-60	400/50-60	400/50-60	400/50-60	400/50-60	400/50-60	400/50-60
Max output at 60% duty cycle, A	800/44	1000/44	1000/44	-	-	-	-
Max output at 100% duty cycle, A	630/44	800/44	800/44	1250/44	1250/44	1600/44	1600/44
Setting range, A/V, MIG/MAG	50/17-630/44	50/17-1000/45	50/17-1000/45	60/17-1250/44	60/17-1250/44	-	-
Setting range, A/V, SAW	30/21-800/44	40/22-1000/45	40/22-1000/45	40/22-1250/44	40/22-1250/44	40/22-1600/46	40/22-1600/46
Open circuit voltage, V	54	52	52	51	51	54	54
No load power, W	150	145	145	220	220	220	220
Efficiency at max current	0.84	0.84	0.84	0.87	0.87	0.86	0.86
Power factor at max current	0.90	0.95	0.95	0.92	0.92	0.87	0.87
Voltage, 3 ph 60 Hz, V	400/415	400/415/500	230/400/415/ 500	400/415/500	230/400/415/ 500	400/415/500	230/400/415/ 500
Voltage, 3 ph 60 Hz, V	440	400/440/550	230/400/440/ 550	400/440/550	230/400/440/ 550	400/440/550	230/400/440/ 550
Enclosure class, protection	IP 23	IP 23	IP 23	IP 23	IP 23	IP 23	IP 23
External dimensions, LxWxH, mm	670x490x1090	646x552x1090	646x552x1090	774x598x1428	774x598x1428	774x598x1428	774x598x1428
Weight, kg	260	330	330	490	490	585	585



Thyristorised SAW Power Sources - AC

TAF 800 / 1250

- Heavy-duty thyristorised AC power sources with square wave output.
- Excellent arc ignition characteristics and good welding properties.
- Ideal for SAW.

	TAF 800	TAF 1250
Max output at 100% duty cycle, A	800	1250
Setting range, A/V	300/28- 800/44	400/28- 1250/44
Open circuit voltage, V	71	72
Efficiency at max current	0.86	0.86
Power factor at max current	0.75	0.76
Voltage, 1 ph 50 Hz, V	400/415/500	400/415/500
Voltage, 1 ph 60 Hz, V	400/440/550	400/440/550
Enclose class, protection	IP 23	IP 23
External dimensions, LxWxH, mm	774x598x1228	74x598x1228
Weight kg	495	608

A2/A6 Process Controller PEH

- Control boxes usable for SAW and GMAW together with A2/A6 automatic welding machines.
- Adaptable to LAF/TAF series of power sources, technical specifications as under.

Enclosure class, protection	IP 23
External dimensions, LxWxH, mm	355x210x164
Mains supply, V/Hz	42 (AC)/50-60
Weight, kg	5.5
Max power consumption, VA	900

Orbital TIG Welding

A21 PRB/PRC/PRD 160/ POC 12-60, Aristo Mech Tig 4000iw

The ESAB welding program for mechanised tube welding is based on the TIG welding method with a non-consumable tungsten electrode. To further improve weld quality and decrease costs, ESAB have developed microprocessor controlled power sources for orbital TIG welding, the Aristo MechTig 4000iw with control boxes Aristo MechControl 2 and 4.



A21 PRB welding head is compact and easy to use as a result of its unique pincer action, which reduces setting-up times to a minimum. The welding head is positioned and secured around the tube with great accuracy in seconds. The PRB welding heads are available in three sizes for tubes with outer diameters of 17 to 170 mm.



A21 PRC welding head has a weaving movement and arc voltage control, which produces higher productivity and better welding quality, particularly when welding thick-walled tubes.



A21 PRD 160 is a water-cooled flexible pipe-welding head for pipes with an outer diameter of 160 mm or

more. It consists of an articulated carriage that travels around the pipe on a rack adapted to match the diameter of the pipe. To ensure maximum flexibility it is built in modular form.



A21 POC 12-60 is a welding head for tube-to-tube sheet TIG welding. It is a precision-built, robust and versatile welding head 12 to 60 (93) mm outer tube diameter. It has a very high centering accuracy and centering mandrels are available for inner tube diameters from 10 mm.



Aristo MechTig 4000iw is designed to work together with the **Aristo MechControl 2 and 4**. This is a 400A heavy-duty inverter based power source having compact design with outstanding welding characteristics. Connection cables up to 8m provide a working range of 16m.



Tractor Automats - Miggytrac

Miggytrac 1001

It is a compact motor powered tractor into which a standard ESAB welding torch can be attached. It is mounted on four driving wheels together with the magnet ensuring stable operation. The magnet holds the tractor in the correct position on the work-piece, even if it is bent or angled.

Welding speed, m/min	0.15-1.2
Control voltage, V, AC	36-46
Power, W	20
Weight, kg	7
External dimensions, LxWxH, mm	266x257x267

Miggytrac 2000



Miggytrac 2000

It is a small, compact, motor-operated trolley designed for the mechanisation of GMAW, gas metal arc welding, in particular. The permanent magnet built-in magnet, which can be switched on/off, holds the tractor in the correct position on the work-piece.

Travel speed, m/min	2.5
Welding speed, m/min	0.15-1.5
Control voltage, V, AC	36-42
Max power consumption, W	25
Intermittent welding range, cm	1-99
Crater fill duration, s	0-9.9
Weight, kg	8.5
External dimensions, LxWxH, mm	400x340x370

Miggytrac 3000



Miggytrac 3000

It is a small, compact, motor-powered tractor with four wheel drive, integrated wire feed and water-cooled welding torch, designed for horizontal MIG/MAG welding of plates and beams. The carriage follows the weld joint by one front and one rear guide and wheel.

Travel speed, m/min	2.5
Welding speed, m/min	0.15-1.5
Control voltage, V, AC	36-46
Max power consumption, W	80
Intermittent welding range, cm	1-99
Crater fill duration, cm	0-9.9
Weight, kg	17
External dimensions, LxWxH, mm	370x400-530x520

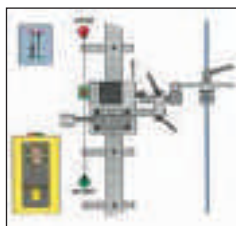


Tractor Automats - Railtrac

Railtrac F1000

Railtrac F1000, Flexi, for welding and thermal cutting.

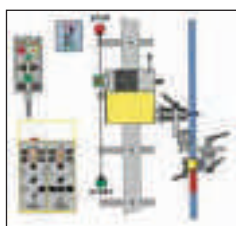
- Welds and cuts in all positions on magnetic and non-magnetic materials
- Quick assembly and easy operation
- Programmable with five programs
- Calibrated setting values in cm, mm and sec
- Programmable “backfill” for crater filling



Railtrac FR1000

Railtrac FR1000, Flexi Return, for welding and outing with automatic return.

- Welds and cuts in all positions on magnetic and non-magnetic materials
- Quick set-up and easy operation
- Programmable with five programs
- Calibrated setting values in mm, cm and sec
- Programmable “backfill” for crater filling

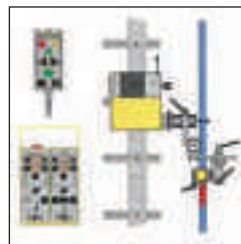


Railtrac FWR1000

Railtrac FWR1000, Flexi Weaver Return, for oscillated welding with automatic return.

- Welds in all positions on magnetic and non-magnetic materials

- Quick set-up and easy operation
- Programmable with five programs
- Calibrated setting values in mm, cm and sec
- Programmable “backfill” for crater filling



Railtrac FW1000/FW1000 L

Railtrac FW1000, Flexi Weaver, for oscillated welding. The Railtrac FW 1000 can be delivered in a “FW1000 L” version if the welding process need to be done with a lower welding speed than with FW1000.

- Welds and cuts in all positions on magnetic and non-magnetic materials
- Quick set-up and easy operation
- Programmable with five programs



Railtrac BV1000 / BVR1000

Railtrac BV1000 and BVR1000 are two automatic units for mechanising the repair and hardfacing of rail profiles smoothly and efficiently. The equipment can be assembled, and controlled quickly and easily by one person. Learning to use it is easy and extremely fast.

Rail length, m	2
Welding speed, m/min	0.1-1.5
Weaving range, mm	1-80
Weaving speed, mm/s	7-50
Max power consumption,	W 80
Control voltage, V, AC	36-46
Crater fill duration, s	0-9.9
Zero-line shift, mm	25 (+-12.5)
Programmable edge length, cm	6-99
Weight, kg	7

The track for all the above models of Railtrac are made of Aluminium and can be either extended or cut to get the required length.



Tractor Automats - Trippletrac / Multitrac / Mastertac

A2 Trippletrac

It is a three-wheeled tractor carriage steers with the front wheel. It is used for internal circumferential welding of large cylindrical objects due to its clever design with a steering wheel. The tractor can be equipped with A2-A6 Process Controller PEH or A2 Welding Controller PEI.

Max load at 100% duty cycle, A	800
Wire feed max, m/min	0.2-9.0
Travel speed, m/min	0.1-1.7
External dimensions, LxWxH, mm	594x686x956
Weight, excl wire and flux, kg	47



A2 Multitrac with

A2/A6 Process Controller PEH

The A2 Multitrac with the A2/A6 process controller PEH is available for both SAW and the GMAW. If the SAW-version is chosen, the A2 Multitrac is capable of working with single or twin wire.

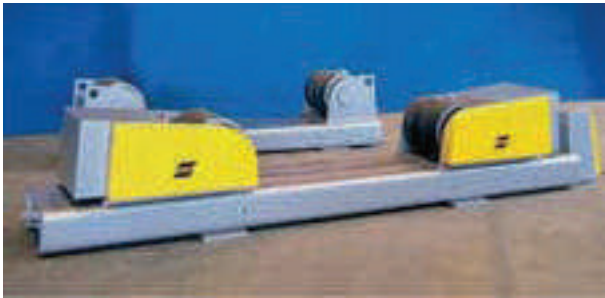
Wire Ø, unall, solid	1.6-4.0	2x1.2-2.5	0.8-1.6	0.8-1.6
Wire Ø, SS	1.6-4.0	2x1.2-2.5	0.8-1.6	0.8-1.6
Wire Ø, Al	-	-	1.2-1.6	1.0-2.0
Wire Ø, CW	1.6-4.0	-	1.2-2.4	1.2-2.4
Wire feed, m/min	0.2-9	0.2-9	0.2-16	2.0-25
Travel speed, m/min	0.1-1.7	0.1-1.7	0.1-1.7	0.1-1.73
External dimensions,	870x400	870x400	870x400	870x400
LxWxH, mm	x830	x830	x830	x830
Weight, kg	47	47	43	43



A6 Mastertrac

It is a heavy-duty self-propelled, fourwheel drive, automatic welding machine. The advanced electronic control provides high precision and the digital display enables all the welding parameters to be preset accurately. It can be used for SAW as well as for GMAW.

Max load at 100% duty cycle, A	1500	600	1500	2 x 1500
Wire diameter, mm	3.0-6.0	1.0-3.2	2x2.0-3.0	2x3.0-6.0
Wire lead, m/min	0.2-4.0	0.8-16.6	0.2-4.0	0.2-4.0
Travel speed, m/min	0.1-2.0	0.1-2.0	0.1-2.0	0.1-2.0
External dimensions,	1410x750	1410x750	1410x750	1410x990
LxWxH, mm	x850	x850	x850	x850



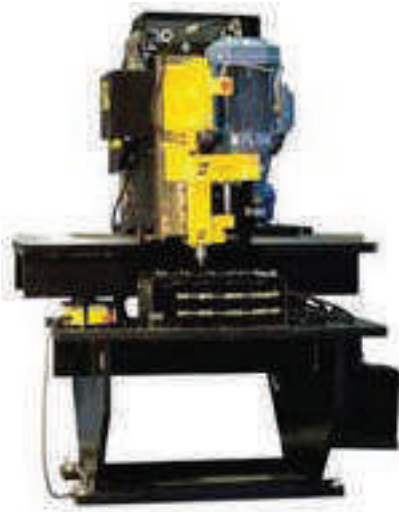
Roller Beds

Esab offers a wide range of roller beds with capacity varying from 5 - 250 tons. The roller beds have mechanical adjustment for circular work-pieces and self-aligning roller beds, which automatically adapt to the roller bed diameter. These roller beds are designed to operate in combination with A2/A6 automatic welding equipment and Esab's columns and booms.



Positioners

Esab offers a comprehensive range of positioners for automatic welding. These very versatile welding tools enable welding to be carried out in the optimum positions to benefit the quality of the work. The positioners can be integrated with A2/A6 automatic welding equipment.



Friction Stir Welding

Legio Friction Stir Welder

The LEGIO combines the latest technology with proven quality. The modular system makes it possible to assemble welding stations to suit the most varied Friction Stir Welding applications.

The LEGIO system consists of five basic designs in a series of seven sizes, covering a welding depth of 1.2 mm (.045 in) to 60 mm (2.4 in). These basic types can be supplemented with different types of equipment to suit the most varied production needs and give maximum flexibility to any production line.

The versatile Legio family includes linear motion with single or dual (over /under) heads, with or without tables. Dual axis (x-y) model is available with or without table. Tables include a whole pattern for attaching fixtures.

Legio includes ESAB HMI control specifically designed for the Friction Stir Welding. It is a closed loop welding control, with ability to control Z-axis either by pressure or by position. PC network connections and data transfer are available optionally.



Friction Stir Welding

Super Stir Friction Stir Welder

The SuperStir program includes a variety of machines developed from a standardized SuperStir base unit having working ranges of 0.5x1.5m (19.7x59in) up to 10x20m (33x66 ft) within the same concept.

This includes customized models of various designs for specific customer requirements in different production areas.

These different designs are used worldwide in R&D centers for joining of extrusions to panels, in production of pressure vessels as well as small parts for the automotive and electronic industries.

Robotics for Arc Welding

Esab offers a wide range of automated welding solutions using a range of robots from ABB. Robotics can provide a cost-effective and modular solution for a variety of welding applications with increased productivity. The various advantages of using robotics are:

Built on an Open Structure

The robots are equipped with a wide range of universal communications interfaces, configurable from S4Cplus, the robot's controller. They can be connected to a PC for servicing purposes or the factory data network using one or two Ethernet links. The robots controller contains the standard field-buses and serial-channels for interfaces with a wide range of power sources and distributed devices.

Flexibility - Develop Custom Functionality

Using the arc-welding software ArcWave the robots can be configured. For advanced and critical welding applications customized functionality can be configured using RAPID, the high level programming language from ABB.

Pre-program Offline

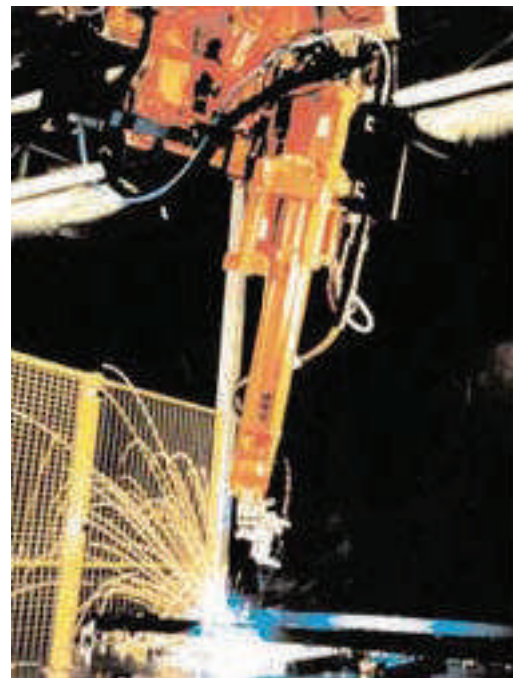
New programs can be created, programs can be stimulated or robots can be pre-programmed for a specific functionality.

Position Anywhere - Portability

The robots can be mounted on a wall or inverted from gantries, columns with booms and elevators for heavy-duty welding, allowing for a wide variety of working range capabilities. Workpiece positioners with one or two axis can also be added to this to increasing the flexibility in positioning.

High Level of Accuracy

The software is designed to achieve high-level accuracy to maintain the quality in the welding applications.





Range of Robots

IRB 140

ABB's fastest and smallest arm-based industrial robot. Highly flexible with slim wrist, 6-axis robot able to reach into narrow, small spaces. Easy-to-mount equipment. Robust and compact. The standard IRB 140 can be mounted at any angle without modification for optimum reach and efficiency. Load capacity: 5 kg; supplementary load is: 1.5 kg; reach: 0.81 meters.



IRB 2400L

Slim yet robust arm-based, 6-axis robot. All the IRB 2400 industrial robots are ideal for arcwelding applications. Features unlimited axis 6. IRB 2400L load capacity is 7 kg; reach 1.8 meters. IRB 2400/10 load capacity is 10 kg; reach 1.5 meters. IRB 2400/16 load capacity; 16 kg; reach: 1.5 meters.



IRB 1400

Robust, well-proven, 6 axis, arm-based industrial robot with a large installed base. Well-balanced arm construction, plus maintenance-free gearboxes and cabling, reducing noise levels and maintenance requirements. Load capacity: 5 kg; reach: 1.44 meters.



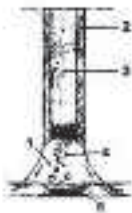
IRB 4400

Compact, versatile robot with medium to heavy handling capacity. The B-axis robot can handle loads up to 60 kg, or up to 45 kg at very high speeds. Reach: 1.96 meters.

CHOICE OF FUSION WELDING METHOD

When choosing welding methods, you need to pay attention to several factors:

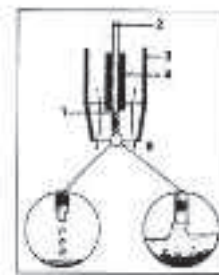
1. Required weld quality.
2. Which welding method is fit for use with the material in question.
3. Which welding method may be used in view of accessibility and position of the weld.
4. Availability of welding consumables of proper quality for the proposed welding method.
5. Number of workpieces to be welded or estimated welded volume, e.g per year.
6. Available welding equipment, positioners, roller beds, swivel tables, hosting gears etc.
7. Possibility or intention to invest money in highly productive welding equipment.
8. Workstation: a workshop or a building site? These differ with regard to the possibilities to weld acceptably, taking into consideration the general environment (outdoors, indoors with or without draft), possibilities to rotate, lift, transport or otherwise move the workpiece.
9. The welding methods for which the available welders are trained. The methods for which the company is authorized. Training possibilities.
10. Choice of welding method which gives the lowest costs. Calculation of consumables consumption.
11. Estimate of the accuracy of the joint preparation which must match the welding method.
12. Please also compare table-key data for the most common fusion welding methods.



Welding Methods

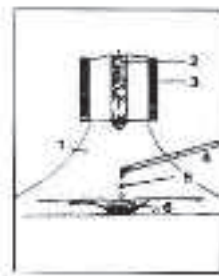
MMA-welding-manual Metal Arc Welding or Manual stick electrode welding.

1. Gas shield from the electrode coating
2. Electrode coating
3. Core Wire
4. Metal drops
5. Molten pool



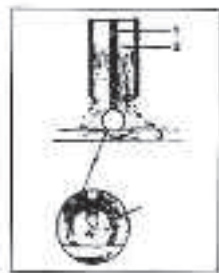
MIG/MAG-welding or Semi-Automatic welding

1. Electrode
2. Electrode from spool, solid or alternatively flux cored wire
3. Gas nozzle
4. Contact tip
5. Gas shield diagram shows spray arc and short-arc, respectively



TIG-welding.

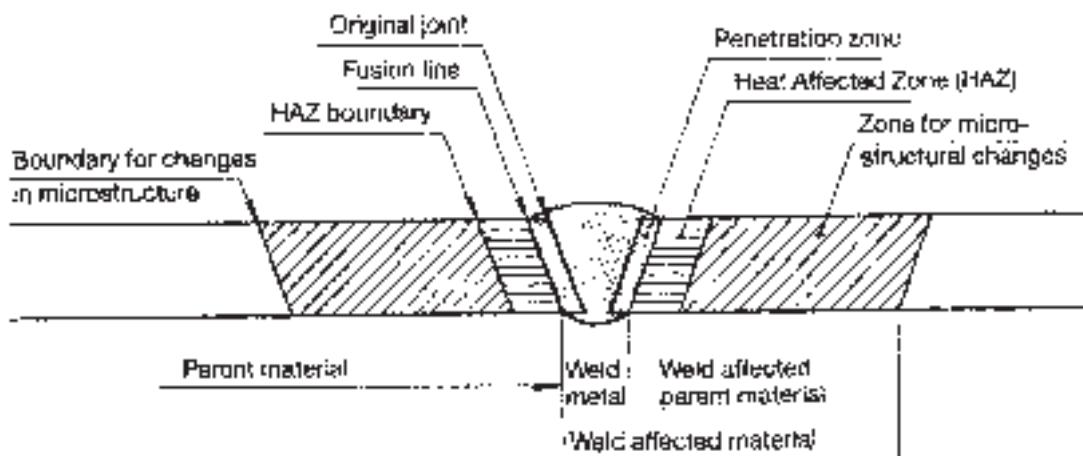
1. Gas shield
2. Tungsten electrode
3. Gas nozzle
4. Filter wire
5. Metal drops
6. Molten pool



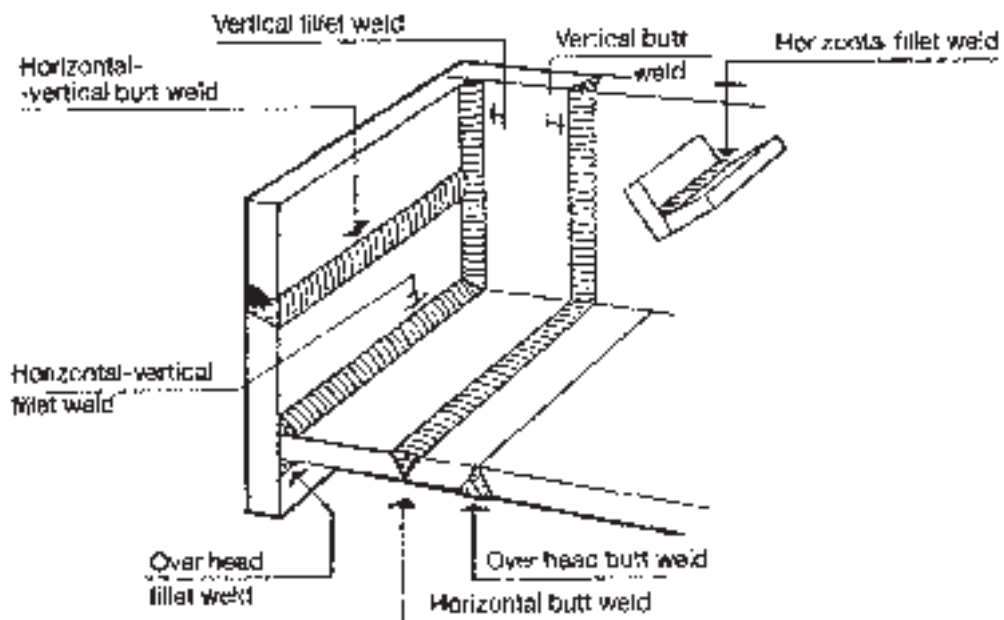
SAW-welding (submerged Arc Welding).

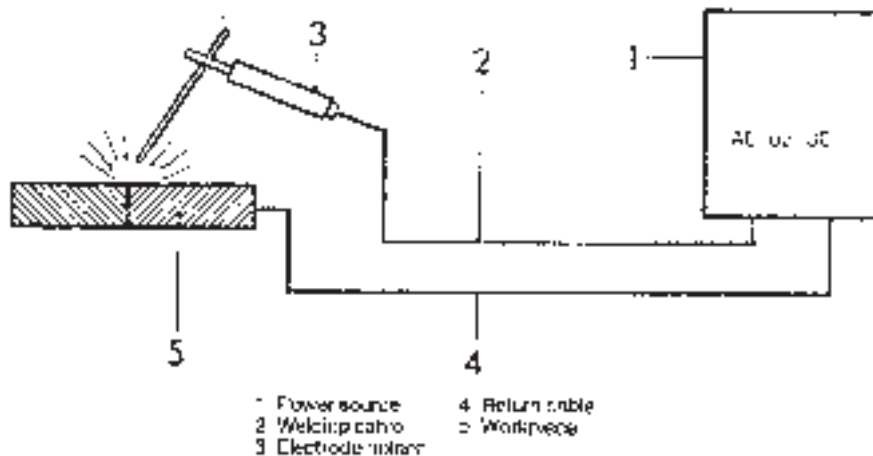
1. Electrode from spool
2. Flux
3. Molten pool. Diagram shows the electrode surrounded by flux and a cover of melted flux

The different zones and zone boundaries of the welding joint



Welding positions and types





Manual Metal Arc welding, also called hand welding, is still the best known and most common method of welding.

Manual Metal Arc welding is noted for:

1. Low investment cost.
2. Low cost of filler material in relation to kgs. weld deposit.
3. Filler material (stick electrodes) are easily available in a wide range of types and dimensions.
4. Less strict demands on edge preparation and purity of the parent material than by other welding methods.
5. The same equipment can be used for all non-alloyed, low alloyed and stainless welding construction steels. Also for cast iron, modular iron and weldable non-ferrous metals.
6. Short set-up times, good at piece fabrication.
7. Can be used in all positions. Also in narrow spaces with hard to get at welding points.
8. Often gives a more machineable weld deposit than Gas Metal Arc Welding.
9. Reasonable heat input to the parent material. This gives reasonable grain growth and thus a transformation zone less exposed to brittle fracture than other methods working with higher heat input.

The efficient and economical use of the Manual Metal Arc welding method can be summed up in the following seven recommendations.

1. Weld in the horizontal position with high recovery stick electrodes whenever possible. This minimizes both weld time and energy consumption. The use of roller beds and positioners can often contribute to a shorter weld time by making horizontal welding possible.
2. Use sufficiently strong power sources to make possible the use of fast welding high recovery electrodes.
3. Save on electricity by using power sources with high efficiency and low no load rating.
4. Use welding transformers for heavy plates, framework and in other cases when DC welding will

interfere through magnetic arc blow.

5. Use a static welding converter (rectifier or inverter) for welding of heavy plates if the mains supply is weak.
6. Use gravity welding for mass production of long straight fillet welds.
7. Weld vertical down instead of up whenever possible.

Equipment

The equipment consists of power source, welding cable, electrode holder and return cable. Below is a survey of the characteristics of different power sources.

Welding transformers

They give alternating current (AC) and are the least expensive power sources. They have a high efficiency 80-90% for the most commonly used transformers for welding. They are used for welding of unalloyed, low-alloyed stainless steels and cast iron but not for e.g. aluminium.

Certain electrodes have better welding characteristics on alternating current (AC) than on direct current (DC). Among these electrodes you find in particular the high recovery types, and notably the larger dimensions.

Welding rectifiers

In this case a rectifier has been added to the transformer, thus supplying DC. It costs approximately twice as much as a transformer of corresponding size. For modern rectifiers, the efficiency is 60-80%.

For both rectifiers and transformers, the efficiency is lower, the lower the used current is. Vice-versa a higher utilization of the capacity of the power source gives a higher efficiency. The rectifier may be used for all weldable materials.

Welding converters

One electric motor (AC) is coupled to a generator (DC). Generally, a more expensive solution than a rectifier of corresponding size. The efficiency is 50-60%.

Its range of use is the same as that of the rectifier.

Engine driven generators

These normally provide DC. They are more expensive than converters and as a rule heavier.

The smaller types normally have 2-stroke petrol engines, whereas larger ones have diesels. In both cases the engine drives the DC generator.

Welding inverters

This is the most recent development within Manual Metal Arc welding. Inverters produce DC or AC/DC. The efficiency is high - 80-90%. The cost is somewhat higher than that of a conventional thyristor regulated rectifier.

The Inverter's main components are:

- A rectifier which turns the incoming 3-phase AC (sometimes only 1-phase AC) into DC.
- An inverter which changes this DC into HIGH FREQUENCY AC.
- A transformer which takes this current down to a lower voltage (20-50 V).
- A rectifier which transforms the AC into DC suitable for welding.

The entire process is controlled by a control circuit.

The inverter's main features are low weight and volume. Since both efficiency and power factors are high, smaller mains cables and fuses may be used in comparison to conventional rectifiers.

Productivity-Welding Speed

A modern high recovery electrode, such as OK Femax 38.95, 6.0 mm and an efficient power source, such as THH 630, can reach a weld deposit of 13 kgs/hour when welding horizontally. Maximum weld deposit for OK Femax 33.80, dia 6.0 mm, is about 8.5 kgs/hour.

For fillet welds with 4-5 mm effective throat thickness, the maximum weld speed is 0.5 m/min when using OK Femax high recovery electrodes.

For gravity welding using 600-700 mm long electrodes, you can reach a speed of up to 60m/manhour when welding straight fillet joints. For gravity welding, AC is always used. The effective throat thickness may be varied by using different electrode dimensions.

Range of application-Material types

Manual Metal Arc welding is used for all unalloyed, low alloyed and stainless common structural steels according to Swedish Standard (SS) and other comparable steels. See also "Standards, Classification System and Codes" in the ESAB Welding handbook-Filler Materials.

These steels comprise:

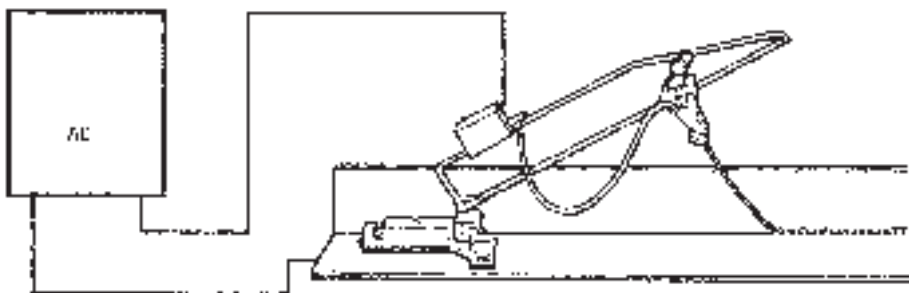
- Common structural steel.
- Pressure vessel steel.
- Ship plate.
- Cast steel and machine steel.

Manual Metal Arc welding is also used for:

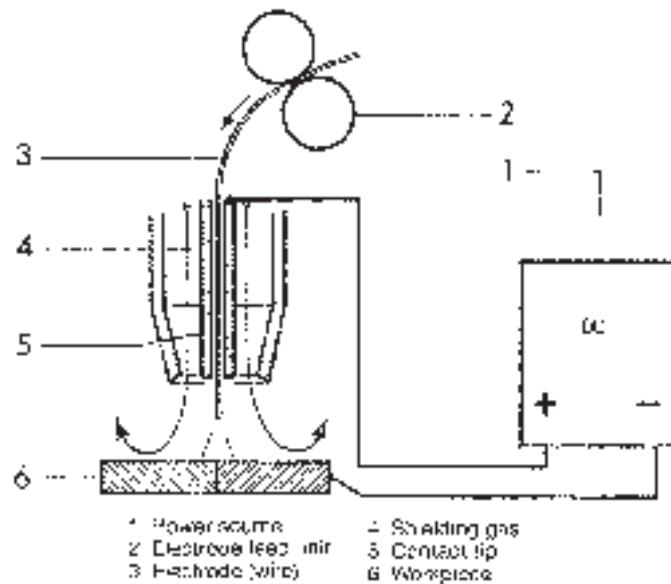
- Cast iron.
- Spherulitic cast iron.
- Malleable iron.
- Weldable non-ferrous metals.

Range of application-Plate thickness

Metal Arc welding is used for plate thicknesses from about 2 mm to the thickest normally used.



MAG WELDING



Gas metal arc welding with active gas

For this method it is significant that DC is used, and that the electrode is a wire which is automatically fed to workpiece. The arc is surrounded by the shielding gas.

The negative pole of the power source is connected to the workpiece.

MAG welding takes place in a shielding gas zone consisting of Carbon Dioxide (CO₂) or a gas mixture consisting of 80% Ar/10% and 20% Carbon Dioxide.

The Argon/CO₂ mixture is costlier than pure CO₂. But it gives a softer arc, smoother weld and less spatter. The mixture also contributes to a higher strength and ductility of the weld metal.

The Argon/CO₂ mixture is therefore generally preferred for welding of thin plate and often for low alloyed steel.

The electrodes are usually solid wires with diameters 0.6, 0.8, 1.0, 1.2 or 1.6 mm, usually on spools of 5-15 kgs, or flux cored wires with diameters 1.2, 1.4, 1.6, 2.0 or 2.4 mm on spools of 15 and 25 kgs.

Short Arc welding means a low arc voltage giving a short arc. Practically all metal transfer through the arc is completed by short-circuiting globules.

Spray Arc welding needs more than 200 A and 25 V. On the whole, the metal transfer is by free-flight globules being forcefully propelled through the arc.

Short Arc welding is the best method for:

- Thin plate.
- Thin pipes.
- Root runs in butt joints with edge preparation.

With Short Arc welding you weld in all positions. Welding vertical down should be limited to thin plate. There is a risk of insufficient penetration which grows with a growing plate thickness. This is more apparent at vertical down than in other welding positions.

Spray Arc welding IS the best method for plate thickness above 3 mm.

Spray Arc welding is only used in horizontal and vertical butt position.

Productivity-Welding speed

The welding speed of MAG welding is measured in kgs of weld deposit per hour. When welding horizontal fillet weld in thick materials, MAG welding is slower than Manual Metal Arc welding using high efficiency stick electrodes.

MAG welding is suitable for thin plates. You can also weld medium size plate, piece constructions and small to medium sized crossbar jobs with good economy.

The advantages of MAG welding are:

1. No stoppages for change of stick electrodes (in comparison with Manual Metal Arc welding)
2. Less distortion due to shrinking in comparison with Manual Metal Arc welding. The advantages are:
 - less straightening work after welding
 - often simpler welding fixtures
 - possibly a better bead appearance
3. Smaller joint volumes when compared to Manual Metal Arc welding because of the thinner electrode. A 6.0 mm coated high recovery stick electrode may have an outside diameter of about 15 mm.
4. There is no de-slugging. A certain quantity of metal oxide is found as "slag isles" on the bead. The origin is a chemical reaction between Mn, Si and CO₂. They should be removed, if strict rules apply to the surface of the weld.
5. There is no risk of hydrogen brittleness in quenching steels caused by moisture in a stick electrode coating.
6. The weld deposit quality may well be compared with what can be achieved with normal basic electrodes.



Range of application - Materials - Plate thickness

All unalloyed and low alloyed steels may be welded.

Use Short Arc from about 0.8 to 3 mm and Spray Arc from about 3 mm plate thickness.

MAG welding with flux cored wires is done with plate thicknesses from about 8 mm for longer beads and up to 10 mm for shorter (less than 0.5 m).

MIG WELDING

Gas Metal Arc welding with Inert (non-active) Gas

In MIG welding, as in MAG welding, you work with Short Arc as well as Spray Arc. The most common gas is Argon, but mixtures of Argon and Helium are also used. When welding stainless steel, it is often difficult to achieve a good penetration. If some few per cents of Oxygen are added to the mixture, this disadvantage is overcome and the arc will be stabilized.

Helium-Argon mixtures give a "hotter" weld than pure Argon. These mixtures are therefore often preferred for thick copper and aluminium materials.

For aluminium welding of medium thickness, pure Argon is used.

Welding positions are: Short Arc-all positions, Spray Arc-horizontal position.

The radius of action is 3-16 m from the wire reel, depending on machine model.

The equipment is the same as for MAG welding.

The shielding gas Argon with 2% CO₂ has given as good results as Helium with Argon, when welding heavy stainless plate. Since Argon with 2% CO₂ is less expensive than Argon/Helium, the former gains in popularity for stainless.

However, steels with extra low carbon content should not be welded with Argon/Helium. Instead, Argon+2% O₂ is used.

In any case, the quality of the weld deposit is the best, provided parent material and the filler material are of good quality and the welding carried out professionally.

Productivity - welding speed

For materials which are welded by MIG, you seldom use as high welding current as for unalloyed or low alloyed steels.

The maximum weld speed is therefore usually lower with MIG than with MAG welding. The MIG method in comparison with Manual Metal Arc welding is highly productive method for stainless steel, aluminium, copper, copper alloys, nickel and nickel alloys.

Range of application - materials - plate thickness

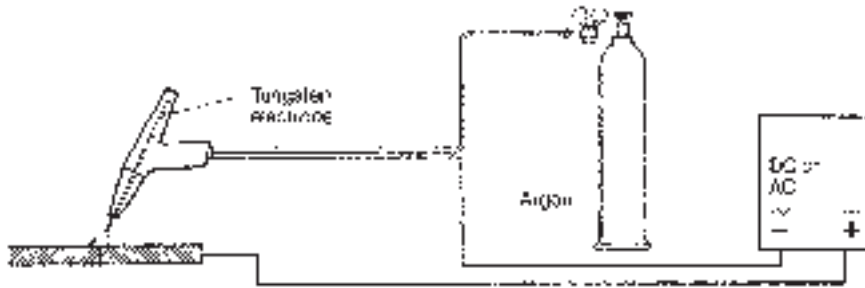
MIG is used for

- Stainless steels.
- Aluminium and aluminium alloys.
- Copper and copper alloys.
- Nickel and nickel alloys.

These materials are welded from about 1 mm thickness and up.

Unalloyed steel is MIG welded in the same joint preparations as for Manual Metal Arc welding.

TIG (GTAW WELDING)



TIG is a welding method where the electric arc is created between a non-melting electrode and the workpiece in an atmosphere of inert gas. That means that the gas does not take part in any chemical reaction during welding.

The arc melts the parent metal and the welding consumable, if any. The molten pool, as well as the electrode, is protected from Oxygen and Nitrogen in the air by the shielding gas. This gas is usually Argon, but Helium or mixtures of Helium and Argon are also used.

TIG welding is done with DC or AC. DC negative pole is used for all metals which do not form oxides which are difficult to weld, like e.g. aluminium and magnesium. They are instead welded with AC, the positive amplitude of which has a good breakdown effect of the oxide.

The name of this method was taken from the first letters of Tungsten Inert Gas.

Range of application

The TIG process is noted for high weld quality, purity of weld material and an even surface. It is used where quality demands are high, e.g. within the nuclear and process industries, but also for difficult-to-weld materials such as titanium, monel, copper-nickel etc. The largest range of application is for stainless steels and light metals.

TIG is used both for manual and mechanized welding. For manual welding, the welding consumable is fed by hand, as for oxyacetylene welding. In equipment for mechanized welding, a feed unit is used for wire. The welding wire is on a spool and is automatically fed to the welding torch.

TIG welding is used from 0.5 mm material thickness and up to 5-6 mm. For heavier material, TIG is often used for root beads in order to make sure of a perfect root pass. No other method equals TIG in this respect. Consecutive beads are made with more productive methods and filler materials such as Gas Metal Arc, Submerged Arc or Manual Metal Arc with high recovery electrodes.

With plate thickness of less than 1 mm, you often use flange butt joints and edge joints. Butt joints are welded up to 3-4 mm thickness. Above that, you use V- or U-joints. Sometimes also x-joints. In this case the groove angle should be 60° and the unbevelled edge 1-1.5 mm.

A general rule for selecting the welding current is: Aluminium 45 A, copper 70 A, steel 50 A per mm thickness.

TIG is used in all positions.

Productivity-Welding speed

Manual TIG welding : about 30 cm/min

Mechanized TIG welding : about 80 cm/min



Range of application - plate thickness - edge preparation

Use I-joints for plate thickness about 2-12 mm. Use Vjoints or double V-joints above that. The joint must be accurately cut. Gaps, if any, must not exceed 1 mm.

In order to profit from the economical benefits of the method, the joint must be well planned and executed. It should be easy to weld with this method, all dimensions are to be exact. This will give an even weld without burning through or giving root defects. It should have a proper bottom section, consisting either of parent material, a backing bar or a handwelded root bead. Having this, the joint will withstand the deep penetration which is typical for Submerged Arc welding.

Of course the joint must be clean. Impurities of water, oil, paint and rust will always mean a risk of pores being formed.

Submerged Arc Welding requires in short a more expensive edge preparation than Manual Metal Arc. The difference in cost is, however, so small that there is no reason to try to save on the preparation work. A clean, well prepared joint permits higher welding speed. This amply compensates for the more expensive edge preparation.

Weld faults are in most cases hidden deep under the surface of the weld, and therefore difficult to detect. The most common and reliable methods of detection presently used are ultrasonic and X-ray tests. These methods permit quality control of the weld without changing or destroying it. You can expose most faults with respect to type, size and position.

The X-ray test has also proven to be of great importance to the welder himself. It has been established that certain faults, which the welder perhaps makes more or less unconsciously, gradually disappear if he is shown X-ray pictures and informed of what they reveal.

In other words, the X-ray picture is an excellent educational means. It makes the weld so to speak "transparent" and shows it in full length. The welder can easily learn from the fault, since you can conclude how the fault arose from the nature and position them. In this way, the welder can steadily manage to eliminate possible shortcomings and improve his craftsmanship.

The most common faults are pinholes, slag inclusion, undercuts, root defects, incomplete penetration, and cracks.

Above all, incomplete penetration, slag inclusion, undercuts and root defects can be linked to lack of skill and precision on behalf of the welder.

Incomplete penetration that is incomplete fusion between weld and parent material, may easily occur at Gas Metal Arc welding if not done professionally. In most cases, the cause is a too short training period. The welder

has been put into the production before theoretical and practical training have been carefully accomplished.

A common cause of incomplete penetration with Gas Metal Arc welding is usually too low travel speed. This gives a molten pool too large for the arc to melt the joint walls.

On the other hand, incomplete penetration is not rare when thick stick electrodes are used in Manual Metal Arc.

Incomplete penetration will occur if the welder strikes the arc against one of the fusion faces and lets the molten pool run down onto the other, cold face. It may also occur if too low current is used on very thick material. Then the heat supply will not be sufficient to melt the parent material.

Slag inclusions

On an X-ray picture, slag inclusions stand out as lines. The picture below shows a cross section of the weld. Here, the de-slagging has been incomplete between the beads. When the top bead was welded, pieces of slag from the previous bead were not melted. Instead, the top bead sealed them in.

You will observe this on the X-ray picture as typical lines.

The risk of creating this fault is greater if the underlying bead is strongly convex. If, for some reason, a strongly convex bead is welded, it is recommended to grind off some of it. Then the risk of fault is eliminated.



Incomplete penetration
A fault caused by insufficient fusion between weld and parent material.



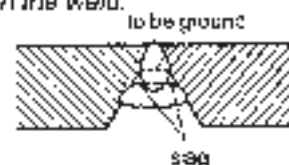
Appearance on the X-ray picture
A thin dark line with sharp edges. Depending on the fault orientation in relation to the X-radiation, the line might give a blurred appearance.



Stage in grooves



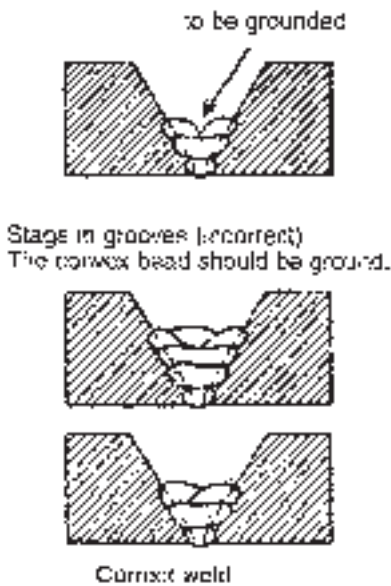
Appearance on the X-ray picture
Long, more or less contours parallel with the weld.



sag

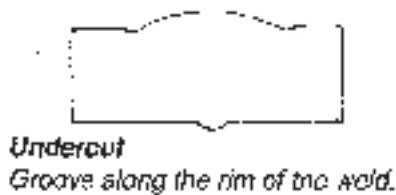
Please pay special attention to multi-bead welds! check carefully that there exist no sharp angles between the different beads. If so, it may be impossible to remove the slag or melt down slag deposits all the way to the bottom when laying the next bead.

The pictures below shows a multi-bead weld which is incorrectly done. Narrow grooves have been created between the beads. The same weld, but correctly done, is shown further on.



Undercut

Undercut may be caused by too high current, incorrect electrode movement, or welding electrode/gun/head angle. Under certain conditions they are disastrous. Through their form they can serve as dangerous indications of fracture especially so if the welded joint is exposed to variations in pressure and elongation.



Undercut will always mean a weakening of the joint. Therefore please always weld so that undercut is avoided. If, in spite of all precautions, this cannot be achieved, then in most cases the undercut should be welded up.

In undercut, it is common to find slag deposits remaining inside the weld. But the X-ray film will reveal slag inclusions.

Root defects

Root defects are simply caused by incomplete penetration. They appear on the X-ray film as sharp straight lines.

In Manual Metal Arc welding, they may be caused by the use of an electrode of too large diameter. The electrode has been too thick to go down far enough. Root defects can also arise if the gap between joint edges is too small.

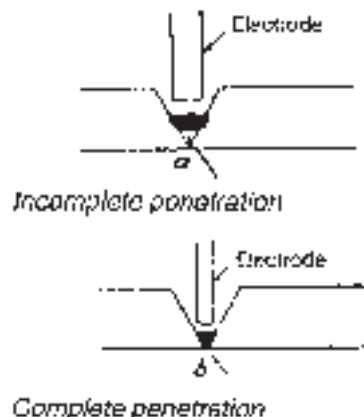


Root defects
Incomplete penetration at the root or a gap which was not filled by weld metal.



Appearance on the X-ray picture
Dark continuous or interrupted line at the middle of the weld.

In the case of V-joints, the welder should often check, by looking, if there is a root defect or not. If there is a defect, it must be removed through root gouging. If it is not



removed, the defect is closed-in by the backweld. It will then be revealed by the X-ray or ultrasonic inspection.

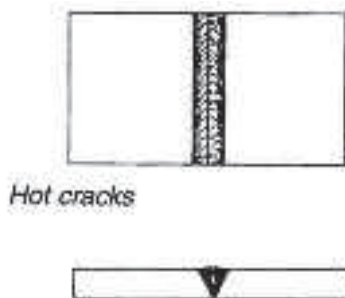
In Submerged Arc welding, the penetration in the joint is an important factor. When root defects appear, the penetration has been inefficient.

If, in the case of double-sided welding, the beads have not met at the bottom, there could be several reasons such as:

- The joint had a too big unbevelled edge.
- Too small groove angle.
- Possibly both these causes together.
- Too low welding current.
- Too high or low welding speed.
- The two beads are not exactly facing each other.

Cracks

In most cases, cracks are not directly dependant on the welder's skill. But a weld can be done in such a way that formation of cracks is promoted. If there are faults in the weld, of course the risk of cracks is greater due to tension or other influences than if the weld is completely homogeneous.



X-ray pictures often show that cracks emanate from slag inclusions, small root or other defects - especially with alloyed steels.

Incorrect weld sequences and the tensions they cause may be of course also result in cracks. If welding jobs are well planned, the weld sequences should be decided by the construction department or works management and marked out on drawings.

In this connection, attention should also be devoted to the tack welds. If you want to achieve a truly high-quality weld, you should remove the tacks as the welding proceeds. It sometimes happens that weak tack welds crack due to influence of shrink-tensions. If you weld over such a cracked weld, you cannot be sure that it is molten and absorbed in the pool. The result might be a remaining crack in the finished weld. In cases where the workpiece is accessible for welding from both sides, you often tack weld at the back. The tacks are then removed

in connection with the gouging of the root before the back bead is welded.

It should, however, also be noted that cracks may appear in the weld or the parent material which have nothing to do with the welding procedure.

Examples of this are hot cracks or solidification cracks which run along in the middle of the weld. These are common at fillet welds, where a difficult tension situation is at hand.

The reason for these cracks may be parent material. This could be difficult-to-weld steel, having too high contents of Carbon, Sulphur and possibly Phosphorus. These elements give certain segregation effects when the molten pool solidifies.

Acid electrodes are especially sensitive to impurities. Rutile electrodes are less sensible and basic ones are practically nonsensitive.

Unlimited weldable steels have maximum proportions of Carbon 0.20%, Sulphur 0.05% and Phosphorus 0.04%. If parent metals containing more of these are to be welded, basic electrodes should be used. Then you will avoid hot tears also by high proportions of these elements.

The same advice is given also for the use of basic electrodes if you have to weld a material where the composition is unknown.

Hot tear

The most common cause of hot tear in Submerged Arc Welded joints is a pipe-formation combined with segregation of Carbon and Sulphur.

The relation between width and depth of the weld reinforcement should be greater than 1. If this is insufficient, formation of pipes will occur. In such a case it is in reality a question of shrink holes and not crack formation as such.

If crack formations are found in the parent material in close vicinity of the weld, these are definitely hardening cracks. The composition of the parent material has been such that the sections heated by the welding up to hardening temperature cracked during the subsequent cooling.

The result is a hard and brittle zone close to the weld, giving cracks. This is a risk always at hand with hardenable parent materials if the cooling-off speed is not prolonged. Such a prolongation is to a certain extent achieved by using thicker electrodes. These give a greater heat input during the welding. But often this is not enough, for instance at welding of low alloyed steels, which also a relatively low Carbon contents are very disposed to hardening.



The relation width: depth should be greater than 1



Hardening crack



The parent material must then be preheated. Depending on the disposition to hardening of it, you chose a higher or lower preheating temperature or rather working temperature. If this temperature is correctly chosen, also steels disposed to hardening may get a soft transformation zone.

Pinholes

Pinholes may appear in different forms. Gases formed during the solidification of the molten pool do not escape. They are "stuck" and the solidification takes place around the gas bubbles. One kind of pinhole is called surface porosity and may form a string along the weld - easily visible. In this case, the gas formation occurred under heavy



*Pinholes
Caused by trapped gas bubbles*



*Appearance on the X-ray picture
Sharp marked round blackenings*

pressure and the direction was oriented up through the middle of the molten pool. This is the last portion to become solidified.

In Manual Metal Arc welding, porosity is commonly caused by Hydrogen from basic electrodes which were stored incorrectly. Porosity can also be caused by moisture, paint and other impurities on the fusion faces.

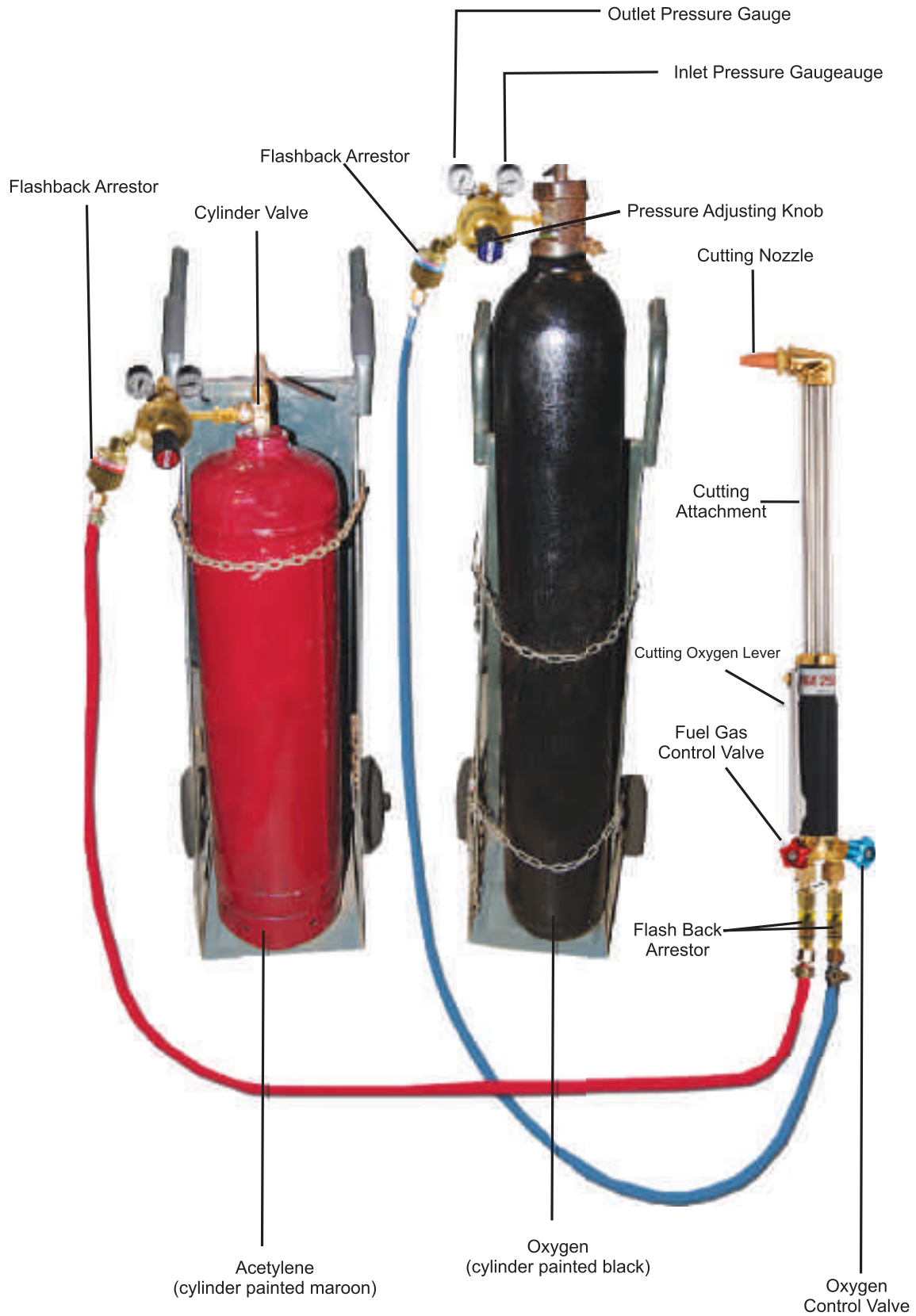
Gas Metal Arc welding is even more sensitive when it comes to paint, oil and other impurities. Porosity may also be caused by a poor gas shield. The surrounding air is sucked into the molten pool and form CO (carbon monoxide).

In Submerged Arc welding, the penetration is powerful. Porosity may occur if the plates are lamellated. During the penetration, the weld will absorb too much of the oxides present in this kind of defect. Submerged Arc welding requires the same cleanliness of the fusion faces as Gas Metal Arc welding.

Industrial Gas Equipment



A TYPICAL OXYFUEL GAS WELDING AND CUTTING SYSTEM





Oxy- Fuel Process

Oxy-fuel welding and oxy-fuel cutting are processes that use fuel gases and oxygen to weld and cut metals, respectively.

Oxy-fuel is one of the oldest welding processes, though in recent years it has become less popular in industrial applications. However, it is still widely used for welding pipes and tubes, as well as repair work. It is also frequently well-suited, and favoured, for fabricating some types of metal-based artwork. Oxy-fuel equipment is versatile, lending itself not only to some sorts of iron or steel welding but also to brazing, braze-welding, metal heating (for bending and forming), and also oxy-fuel cutting.

In oxy-fuel welding, a welding torch is used to weld metals. Welding metal results when two pieces are heated to a temperature that produces a shared pool of molten metal. The molten pool is generally supplied with additional metal called filler. Filler material depends upon the metals to be welded.

In oxy-fuel cutting, a cutting torch is used to heat metal to kindling temperature. A stream of oxygen then directed on the metal combines with the metal which then flows out of the cut as an oxide slag.

Apparatus

The apparatus used in gas welding consists basically of an oxygen source and a fuel gas source (usually cylinders), two pressure regulators and two flexible hoses (one of each for each cylinder), and a torch. This sort of torch can also be used for soldering and brazing. The cylinders are often carried in a special wheeled trolley.

Regulator

The regulator is used to control pressure from the tanks by reducing pressure and regulating flow rate. Oxy-gas regulators usually have two stages : The first stage of the regulator releases the gas at a constant rate from the cylinder despite the pressure in the cylinder becoming less as the gas in the cylinder is used, as in the first stage of a scuba-diving regulator. The second stage of the regulator controls the pressure reduction from the intermediate pressure to low pressure. It is constant flow. The valve assembly has two pressure gauges, one indicating cylinder pressure, the other indicating hose pressure.

Some oxy-gas regulators only have one stage, and one pressure gauge, and in them the gas flow becomes less as the cylinder pressure drops.

Gas Hoses

The hoses used are specifically designed for welding and cutting. The hose is usually a double hose design, meaning that there are two hoses joined together. The oxygen hose is blue and the fuel hose is red. The type of gas the hose will be carrying is important because the connections will have different threads for different types of gas. Fuel gases (red) will use left hand threads and a groove cut into the nut, while the oxygen (blue) will use right-hand threads.

Non-return valve

Between the regulator and hose, and ideally between hose and torch on both oxygen and fuel lines, a flashback arrestor and/or non-return valve should be installed to prevent flame or oxygen-fuel mixture being pushed back into either cylinder and damaging the equipment or making a cylinder explode.

The flashback arrestor (not to be confused with a check valve) prevents the shock waves from downstream coming back up the hoses and entering the cylinder (possibly rupturing it), as there are quantities of fuel/oxygen mixtures inside parts of the equipment (specifically within the mixer and blowpipe/nozzle) that may explode if the equipment is incorrectly shut down; and acetylene decomposes at excessive pressures or temperatures. The flashback arrestor will remain switched off until someone resets it, in case the pressure wave created a leak downstream of the arrestor.

Welding torch

A welding torch head is used to weld metals. It can be identified by having only one or two pipes running to the nozzle and no oxygen-blast trigger and two valve knobs at the bottom of the handle letting the operator adjust the oxygen flow and fuel flow.

Cutting torch

A cutting torch head is used to cut metal. It is similar to a welding torch, but can be identified by having three pipes that go to a 90 degree nozzle and by the oxygen-blast trigger.

Only iron and steel can be cut using this method, the metal is first heated by the flame until it is cherry red. Once this temperature is attained, oxygen is supplied to the heated parts by pressing the "oxygen-blast trigger". This oxygen reacts with the metal, forming iron oxide and producing heat. It is this heat which continuous the cutting process. The cutting torch only heats the metal to start the process; further heat is provided by the burning metal.

The melting point of the iron oxide is around half of that of the metal; as the metal burns, it immediately turns to liquid iron oxide and flows away from the cutting zone. However, some of the iron oxide remains on the work piece, forming a hard "slag" which can be removed by gentle tapping, and/or a grinder.

Single Stage Regulators

ESAB Single Stage Regulators

Conform To : IS 6901-2009 & BSEN ISO 2503-1998

'B' Series single stage regulators continue the tradition of superior performance in single stage range. The latest materials and advanced component design make these regulators suitable to meet the stringent demands of use in shop-floor as well as outdoor conditions with enhanced safety. ESAB IOX-13B and ESAB IDA-4B are the toughest and most reliable units for oxy fuel gas service. These are provided with two pressure gauges one to indicate outlet pressure & other to inlet pressure. Also available are 'C' series single stage regulators with only one gauge to show the cylinder pressure. The working pressure calibrated on the bonnet can be set by the pressure adjusting knob. A low pressure LPG regulator suitable for Oxy-LPG cutting, Air-LPG equipment and heating applications is also available. The outlet adjustable pressure is 0-1 kg/cm².



Imported safety pressure gauges designed for 300 bar service pressure, confirming to ISO 5171 standards.

Specifications

Type of Gas	Code Letter	Model	Max. Inlet Pressure (Bar)	Max. Outlet Pressure (Bar)	Max. Flow		Inlet Connection	Outlet Connection	Main Application
					Lit/min	ft ³ /h			
Acetylene	"A"	IDA-4B	20	1	200	423.8	5/8" BSP L/H (Male)	3/8" BSP L/H (Male)	All Welding cutting & heating process
		IDA-4C							
Oxygen	"O"	IOX-13B	300	10	1000	2119	5/8" BSP L/H (Male)	3/8" BSP L/H (Male)	Heavy cutting & heating process
		IOX-13C							
LPG	"P"	LPG-18B	16	1	200	423.8	5/8" BSP L/H (Male)	3/8" BSP L/H (Male)	All Welding cutting & heating process
Nitrogen	"N"	INI-42B	300	10	1000	2119	5/8" BSP L/H (Male)	3/8" BSP L/H (Male)	Pressure, purging & refrigeration

Type of Gas	Code Letter	Model	Max. Inlet Pressure (Bar)	Flow		Inlet Connection	Outlet Connection	Main Application
				Lit/min	ft ³ /h			
CO ₂	"N"	ICO-32B	200	35	74	0.860 x 14 TPI R/H (Female)	3/8" BSP R/H (Male)	MIG
Argon	"N"	IAR-52B	300	25	53	5/8" BSP R/H (Male)	3/8" BSP R/H (Male)	MIG & TIG

* RH Connections for Oxygen & *LH Connections for Acetylene & Hydrogen.

ESAB IOX-14 Single Stage Oxygen Regulator

Conform To :IS 6901-2009

For extra high performance, this regulator is designed and engineered to a high standard of excellence. With the unique safety and sophistication, this regulator can meet service demands where high flow-oxygen is required. These regulators are suitable for heavy cutting, thermic lancing and light scarfing. Also they are suitable for use with cylinders and pipelines.

Imported safety pressure gauges designed for 300 bar service pressure, confirming to ISO 5171` standards.

- Maximum Inlet Pressure 300 bar
- Maximum Outlet Pressure 14 bar
- Maximum Flow (Cylinder) 3500 LPM
- Maximum Flow (Pipeline) 2594 LPM at 14 bar



Single Stage Argon Flowmeter Regulator

This is a single stage flowmeter regulator, which provides precise regulation and measurement of gas flow. This is well suited for a wide variety of industrial uses.



- Service Pressure: 200 bar
- Rated flow : 25 lit/min.
- Inlet connection : Thread EXT-5/8" BSP RH.
- Outlet connection : Thread EXT-3/8" BSP RH.
- Preset Type : Provides accurate control of gas pressure to the flowmeter.
- Imported safety pressure gauges designed for 250 bar pressure,confirming to ISO 5171 standards.
- Body : Chrome plated

Double Stage Regulators

DURA Series Regulators

Conform To : IS 6901-2009 & BSEN ISO 2503-1998

Salient Features

- First time in India a regulator suitable for 300 bar inlet pressure and imported safety pressure gauges designed for 400 bar pressure, confirming to ISO 5171 standards.
- Much more rugged.
- Longer life.
- Much bigger plenum chamber (2nd stage plenum chamber is 5 times the volume of 1st stage plenum chamber) ensures :
 - Outlet pressure stability.
 - Steady flow of gases.
- Fire-retardant valve material.
- Stainless Steel Diaphragm in 1st stage
 - can withstand stock of full cylinder pressure.
- Neoprene valve in 2nd stage
 - Gives flexibility and better pressure regulation.

Look For Seal of Safety

- "ISI" certification.



Flowmeter Regulators have proven performance in MIG Welding and TIG Welding applications. Here the outlet gauge is replaced with flow calibrated gauge to show flow rate in lit/min. This eliminates additional glass flow meter, which prone to get damaged.



1. Safety valve
2. Plenum chamber
3. Captive P.A. knob- Can not be lost of change with unsuitable type.
4. Bonnet- Manufactured from high strength die cast alloy material.
5. Diaphragm neoprene rubber
6. Forged body
7. S.S. valve pin
8. Forged-cap spring
9. Non-bursting S.S. diaphragm
10. Valve made of fire retardant polymer
11. High strength bull nose nipple
12. Inlet filter prevents foreign matter

'B' Series Regulators

Conform To : IS 6901-2009 & BSEN ISO 2503-1998

Esab Multi Stage Regulators **IOX63B** & **IDA50B** continues the tradition of superior performance in the Double Stage range. The latest materials and advanced component design make these regulators suitable to meet the stringent demands of use in shop-floor as well as in outdoor conditions with enhanced safety. This regulators is provided with two pressure gauges one to indicate the Inlet Pressure and the other to indicate the Outlet Pressure. The working pressure can be adjusted by the Pressure Adjusting Knob.



Salient Features

- Steady flow of gas at the outlet irrespective of cylinder gas volume
- Pressure reduction from manifold or cylinder is achieved in two stages
- Much bigger plenum chamber ensures steady flow of gas
- Forged brass body & cap spring
- Fire retardant valve
- Safety valve
- Inlet filter



Specifications

Type of Gas	Code Letter	Model	Max. Inlet Pressure (Bar)	Max. Outlet Pressure (Bar)	Max. Flow		Inlet Connection	Outlet Connection	Main Application
					Lit/min	ft ³ /h			
Acetylene	"A"	DURA "A-1.5"	40	1.5	250	529.7	5/8" BSP L/H (Male)	3/8" BSP L/H (Male)	All Welding cutting & heating process
Oxygen	"O"	DURA "O-10"	300	10	1000	2119	5/8" BSP R/H (Male)	3/8" BSP R/H (Male)	Heavy cutting & heating process
Oxygen	"O"	DURA "O-2"	300	2	450	953.5	5/8" BSP R/H (Male)	3/8" BSP R/H (Male)	Medium cutting & heating process
Nitrogen	"N"	DURA "N-10"	300	10	1000	2119	5/8" BSP R/H (Male)	3/8" BSP R/H (Male)	Pressure, purging & refrigeration
Hydrogen	"H"	DURA "H-10"	300	10	1000	2119	5/8" BSP L/H (Male)	3/8" BSP L/H (Male)	Pressure, purging & refrigeration
Oxygen	"O"	IOX-63B	300	10	1000	2119	5/8" BSP R/H (Male)	3/8" BSP R/H (Male)	Heavy cutting & heating process
Acetylene	"A"	IDA-50B	40	1.5	250	529.7	5/8" BSP LH (Male)	3/8" BSP L/H (Male)	All Welding, cutting & heating process

Gas Flow Regulator

Type of Gas	Code Letter	Model	Max. Inlet Pressure (Bar)	Flow		Inlet Connection	Outlet Connection	Main Application
				Lit/min	ft ³ /h			
CO ₂	"N"	DURA "CO ₂ -35L"	200	35	74	0.860x14 TPI R/H (Female)	3/8" BSP R/H (Male)	MIG
Argon	"N"	DURA "Ar2-25L"	300	25	53	5/8" BSP R/H (Male)	3/8" BSP R/H (Male)	MIG & TIG

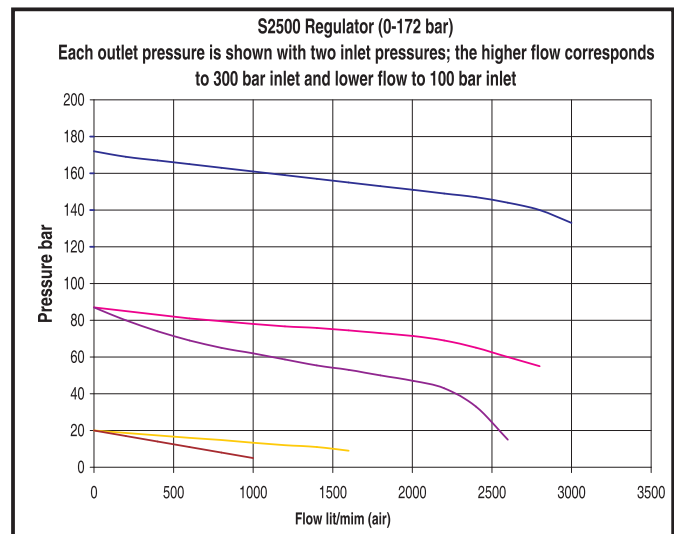
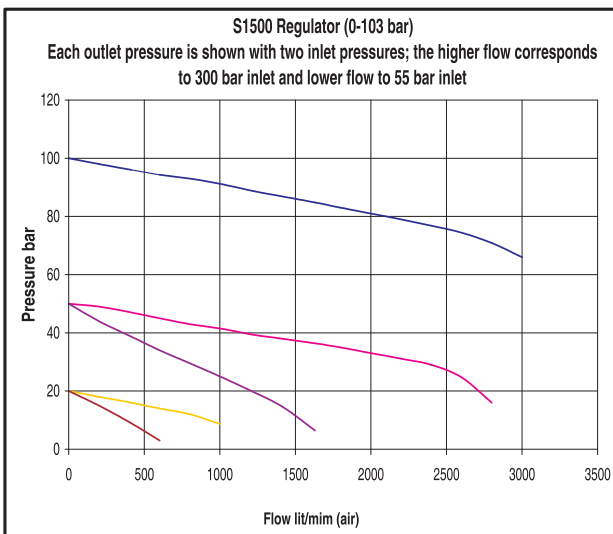
High Pressure Regulators

S-1500/2500 & R-89 - High Pressure Regulators

- Typical applications include cartridge filling, pressure testing of vessels and pressurization of recoil cylinders.
- For high delivery pressures - 200 to 6000 psig.
- Standard HP cylinder connections - ready to use on cylinders or manifolds. Standard 1/4in. NP 1-to-37 deg. flared tubing outlet connection on R-89 models.
- Forged brass bodies.



S-1500/2500



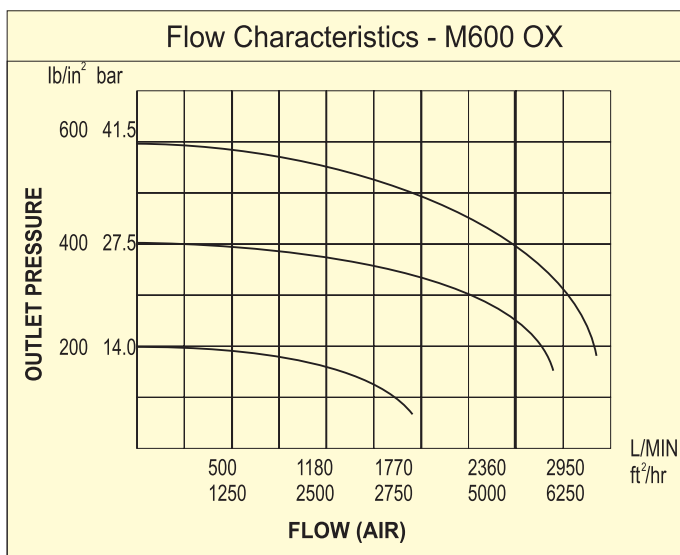
R-89-3M-580

Specifications

Model	Maximum Delivery pressure PSIG	Connection Outlet	Pressure Gauge Inlet	Pressure Gauge Outlet
R-89-3M-580	3000	Flare	4,000	4,000
R-89-4M-680	4000	Flare	6,000	6,000
S-1500	1417	-	6,000	2,500
S-2500	3000	-	6,000	6,600

M600 - Heavy Duty Regulator

This Regulator is in wide spread use through-out the industry. It has a proven performance in applications where stable high pressure and flows are required. This regulators are used in jobs of critical nature, such as aerated bottling plants, cable pressurisation, power generating, pipeline testing, refrigeration, air conditioning industry and a wide variety of laboratory applications in universities, nuclear and chemical industry.



M600

Design/Construction

- Forged brass construction
- Double safety feature - safety valve and bursting disc prevention at second stage
- Inlet filter to prevent ingress of foreign particles at high velocity
- Stainless steel diaphragm on first stage to withstand shock of full cylinder pressure. Neoprene to give flexibility and long life on second stage.
- Easy read pressure gauges.

Specifications

Service Pressure	230 bar
Max. Outlet pressure	40 bar
Rated flow	3200 lit./min
Weight	4.30 Kg.
Inlet connection	5/8" BSP RH (Male)
Outlet connection	3/8" BSP RH (Male)
Gas Service*	Oxyten Nitrogen

Pipe Line Regulators

LM Series -Linemaster Pipeline Regulators

The increased use of manifold cylinders and piped gasses have created a need for specialised regulators. One benefit of a piped gas supply is relatively low pressure of gas within the building. This demands a regulator with large orifics and streamline gas passage to pass large volumes at low inlet pressure.

The LINEMASTER is specially designed for this service and is available for use with most gasses at range outlet pressure 14 bar and is now fitted with a captive pressure adjustment knob for added control and safety.



LM - 200



LM - 9

Specifications : Pipeline Regulators

Model	Max. Outlet Pressure		Gas Application
	Bar	lbf./sq.in.	
LM 9	0.6	9	Acetylene
LM 30	2	30	Fuel gas, Oxygen, Nitrogen
LM 70	5	70	Fuel gas, Oxygen, Argon
LM 200	14	200	Oxygen, Nitrogen

Flow Characteristics of Linemaster Regulators

Delivery Range (lb/sq.in)	Max. Inlet Pressure (lb/sq.in)	Capacity* (cu.ft./hr.)	Inlet Connections	Outlet Connedctions
9	22	100	1/4" NPT (Male)	3/8" BSP
30	435	500	1/4" NPT (Male)	3/8" BSP
70	435	850	1/4" NPT (Male)	3/8" BSP
200	435	2000	1/4" NPT (Male)	3/8" BSP

ISG 43 Series for High Purity Gases

The ISG 43 Series Regulators are the latest in a long line of superb gas control equipment manufactured with world class ESAB technology.

ISG 43 incorporates latest design changes and proven diffusion-resistant materials to control the exacting requirements of services for speciality gases and provides the user with enhanced safety, durability and precision.

The ultra - high purity gases are expensive and use of diffusion prone components in this most critical control equipments (i.e. regulators) may lead not only to their wastage but may also distort the analytical results. Hence, the need for use of only specially engineered ISG 43 regulators.

The SS packless flow control valve available as an optional extra ensures constant flow of gases at varying pressure ranges.

ISG 43 regulators offer another exclusive feature - provision for using three instruments simultaneously with a single regulator (by adding outlets to ports for purging and relief valve.)



● **Flow :**

Upto 9000 Liters per Hour

● **Purge Facility :**

The special purge assembly available optionally can be connected to the port for body purge to drive away undesirable contaminating elements before use.

● **Extremely Low inboard Leakage Rate**

Helium leak-tested to ensure non-contamination by diffusion - an assurance of the highest degree of gas purity.

● **Packless Diaphragm Valve for high - precision Flow Control (Optional extra)**

Stainless steel packless diaphragm - type valve ensures extremely fine control of outlet flows. Models with suffix 'F' are supplied with flow control valve.

● **Constructed from**

Non Contaminating materials

- Body made of Austenitic Stainless Steel AISI 304/316 grade
- Seat made of TEFZEL
- Teflon Seals
- Teflon - lined Stainless Steel Diaphragm
- Gauge-Stainless Steel with SS Bourdon Tubes.

● **For a Wide Variety of Gases**

Ammonia, Argon, Helium, Hydrogen, Nitrogen, Nitrous Oxide, Nitric Oxide, Oxygen, Sulphur Dioxide, Rare Gases like Neon, Krypton & Xenon, Arsine, Carbon Monoxide, Carbon Sulphide, Methylene and for many other gases e.g. doping gases etc.

● **Standard Accessories**

- Inlet & Outlet Gauges
- Inlet Connection of Ext G 5/8" with Bull Nose Nipple
- Bonnet Vent Pipe
- Outlet Compression Fitting for (6.35 mm OD) stainless steel tube

● **Optional Accessories**

- Stainless Steel Packless Flow Control Valve with one way Check valve
- Stainless Steel Purge Assembly
- Special inlet connections made to customer's specification

● **Ordering Details**

- Specify the model with the gas/gas mixtures for which the regulators are required
- Specify if any optional items required with details

● **Special Gas Regulators with Brass Body**

ISG regulators with Brass body can also be made available - please refer to us for further details.

Description

Single Stage Regulators

1. ISG 43 S RH I SS
2. ISG 43 S LH I SS
3. ISG 43 S RH II SS
4. ISG 43 S LH II SS
5. ISG 43 S RH III SS
6. ISG 43 S LH III SS

Double Stage Regulators

7. ISG 43 D RH I SS
8. ISG 43 D LH I SS
9. ISG 43 D RH II SS
10. ISG 43 D LH II SS
11. ISG 43 D RH III SS
12. ISG 43 D LH III SS

Note :

- ISG 43 denotes - Regulators for speciality Gases.
- S Denotes - Single Stage.
- RH/LH denote - Type of thread used.
- I, II, III denotes - Pressure and Flow Rate Range as indicated in the box under "Specifications".
- F denotes - with Flow control valve

Specifications

Model	ISG 43 I	ISG 43 II	ISG 43 III
Max. inlet Pressure (kg/cm ²)	250	250	250
Outlet Pressure Range (kg/cm ²)	0.14-5.27	0.8-15	5-25
Flow Ltrs. per hour (Max.)	6000	9000	9000

Available with RH or LH threads depending upon the type of gas

Cutting Blowpipes

Nozzle Mixing Type Hand Cutting Blowpipe NM250 / NM400

Conform To : IS 7653-1975 & BSEN ISO 5172-1997

New generation Nozzle Mixing Technology for new standards in **Safety** and **Efficiency**, Light weight (1.44 kg) NM Cutters are easy to handle and can withstand rough usage for longer time. Not only piercing is made easier by NM Cutters, but they can also be used for gouging with NM 400 Torch & suitable Nozzles.



Special Features

- NM Type Nozzle** : Much safer, virtually no backfire due to mixing of gases in the 3 seat nozzle only. Making chances of backfire/flashback very remote.
- Angle Head** : Forged from brass rods - much stronger and longer life.
- Tubes for O₂ & Fuel Gas** : Seamless Stainless Steel
- Lever for Cutting Oxygen** : Stainless steel Lever, positioned for convenient handling by operator. Provided with a Latch Facility to avoid operator fatigue.
- Filter** : S.S. Filter at inlet (oxygen side)
- Handle** : Metallic instead of plastic - longer life, much better appearance and grip.
- Knobs** : Metallic - better grip, longer life.
- Weight of cutter** : Much lighter - lower fatigue to operator, weight only 1.44 Kg. (without nozzle).

Specifications

	NM250	NM400
Cutting Capacity	300mm thick M.S.	450mm thick M.S.
Type of Cutter	Nozzle-Mixing	Nozzle-Mixing
Suitable for Fuel Gas	Acetylene or LPG with suitable nozzle	Acetylene or LPG with suitable nozzle
Length	450mm	675mm
Angle Head	90°	75°
Standard set includes	<ul style="list-style-type: none"> ● Blowpipe - 1 No. ● Cutting Nozzle - ANM (3/64") 1 No. ● Nut & Nipple for hose connection (10mm) - 1 each for O₂ & Fuel gas ● Guarantee Card ● Data Card for cutting 	<ul style="list-style-type: none"> ● Blowpipe - 1 No. ● Cutting Nozzle - ANM (5/64") 1 No. ● Nut & Nipple for hose connection (10mm) - 1 each for O₂ & Fuel gas ● Guarantee Card ● Data Card for cutting ● Data Card for Gouging

Injector Type Hand Cutting Blowpipe CUTOGEN 5

Conform To : IS 7653-1975 & BSEN ISO 5172-1997

A sturdy well balanced Injector Type hand cutting Blowpipe. To cut upto 300 mm. thick mild steel. Injection type cutters can be used with dissolved Acetylene Cylinders. Can also be used for LPG with suitable nozzle. Standard version is 450 mm/ 90°. Also available in different lengths and head angles (180°). The other models can be made available against specific orders.



Special Features

- Body and head are of forged brass. Eliminate casting porosity and ensure total safety and gas economy.
- Gas flow geometry designed to prevent backs flow.
- Laminar gas flow for quality cutting and gas saving.
- Swaged nozzles ensure parallel beam of heating flame; refacing of nozzles possible which enhance nozzle life without compromising on “cut” quality.

Look for seal of safety

- ISI Certification mark

Specifications

	CUTOGEN 5
Cutting Capacity	300 mm thick M. S.
Type of Cutter	Injector Type
Suitable for Fuel Gas	Acetylene or LPG with suitable nozzle
Length	450 mm
Angle Head	90° & 180°
Standard set includes	<ul style="list-style-type: none"> ● Blowpipe - 1 no. ● Cutting Nozzle "A" (3/64") 1 no. ● Nut & Nipple for hose connection (10mm)-1 each) Oxygen & Fuel gas ● Guarantee Card ● Data Card for cutting

Welding & Heating Blowpipe

SAFFIRE 2HP Welding Blowpipe for medium duty Welding applications

Conform To : IS 7653-1975 & BSEN ISO 5172-1997

An ideal blowpipe for welding various metals in general workshop use and general heating purpose. It is supplied with tips suitable for welding mild steel in the range of 1.25 mm. to 8.5mm thickness.

The blowpipe is supplied complete with hose connections, spanner, operating data card and 6 nos. swaged tips-sizes : 2, 3, 6, 13, 20 and 30.

Specifications

Capacity	Weld mild steel upto 8.5mm thickness
Approx. Weight	610 gms
Gas Valves	Stainless steel spindles, taper ended
Control Knob	Red for Acetylene, Blue for Oxygen
Tips	Swaged Copper



SAFFIRE LWHP Welding Blowpipe for light duty welding applications

Conform To : IS 7653-1975 & BSEN ISO 5172-1997

ESAB Saffire Light Weight Welding Blowpipe has been developed for use in light sheet metal in garages and workshops. It is ideally suitable for repetitive work in production lines, where its handiness minimizes operator fatigue. Careful design of tips, mixer and shank gives trouble-free operation, high performance, economy and safety. The blowpipe is supplied with complete hose connection, operating data card and 4 nos. of swaged tips in sizes : 2, 3, 6 and 13.

Specifications

Capacity	Weld mild steel upto 5 mm thickness.
Inlet	Oxygen 1/4" B.S.P. RH & Acetylene 1/4" BS.P. LH
Weight Approx.	360 gms.
Length	23.5 cm (without tip)
Hose	5 mm bore hose (Blue-Oxygen & Red-Acetylene)



Design / Construction

- **Tip** : Swaged copper for better performance, long life and weld area visibility.
- **Control** : Durable leak proof design with S.S. taper ended spindle valve for long maintenance free operation.
- **Mixer** : Specially designed to give freedom from backfires.

MODEL 'O' - Welding blowpipe for light duty welding applications

Conform To : IS 7653-1975 & BSEN ISO 5172-1997

ESAB Model "O" blowpipe is a finely balanced injector type blowpipe ideally suited for fine welding and brazing applications, including the fusion welding and brazing applications. It is used for fusion welding of thin sheet up to 1.5 mm. (e.g. Zinc or Aluminium). It is also suitable for delicate lead welding. Careful design of tips neck and injector gives trouble free operation, high performance, economy and safety. Model "O" welding blowpipe is ideal for production lines where its handiness minimizes operator fatigue. Model "O" blowpipe is available in different lengths for different types or operations.



Specifications

Capacity	Thin sheet metal upto 1.5 mm
Inlet	Oxygen 1/4" B.S.P. RH & Acetylene 1/4" B.S.P. LH
Weight	250 gms
Length	20 cm (without tip)
Hose	5 mm bore hose (Blue-Oxygen & Red-Acetylene)

Design / Construction

- **Injector:** The injector capability makes the blowpipe equally suitable for use with acetylene or hydrogen gas and hence can be used in electronics.

HD Heating Welding Blowpipe for heavy duty Heating applications

Conform To : IS 7653-1975 & BSEN ISO 5172-1997

An Injector type Oxy-Acetylene, ESAB H.D. Heating Blowpipe, is used for localized heating. It is particularly useful for large construction sites, pipe bending and other applications for general purpose heating.

The standard blowpipe is about 750mm long and supplied with nozzle size 30. A large nozzle size 33 can be supplied as optional extra.

The blowpipe is designed to be used with Oxygen and dissolved Acetylene, preferably drawn from suitable manifold cylinders.



Specifications

Metal thickness	Head size	Oxygen pressure (PSI)
Over 1½ inch	30	75-80
Over 1½ inch	33	100-110

Inlet Connections

3/8" BSP RH for Oxygen & 3/8" BSP LH Acetylene

Cutting Nozzles

NOZZLE

- Hard drawn Tellurium copper used in one piece nozzles
 - withstands heat & wear
 - out lasts any copper nozzles
- One piece nozzle has swaged interior
 - Gas passages are mirror smooth with internal angles rounded
 - Non-turbulent more efficient gas flow.
 - Clean smooth cuts with minimal kerf loss
- Preheat ports are closely spaced around cutting orifice
 - For greater concentration of preheat flames.
- Long parallel preheat passages
 - Permit redressing of nozzle without affecting performance

ANM (Acetylene) Nozzle for NM 250 / NM 400

NOZZLE (inch)	PLATE THICKNESS (mm)
1/32	6
3/64	12
1/16	25,50,75
5/64	100
3/32	150
1/8	200,250,300



AGNM (Gouging) Nozzle for NM 400



NOZZLE width (mm)	Maximum Groove Width (mm)
13	8
19	11
25	12

PNM (LPG) Nozzle for NM 250 / NM 400

NOZZLE (inch)	PLATE THICKNESS (mm)
1/32	6
3/64	12
1/16	25,50,75
5/64	100
3/32	150
1/8	250



NOZZLE

A-Type (Acetylene) Nozzle for Cutogen 5

NOZZLE SIZE	PLATE THICKNESS (mm)
A8 (1/32")	6
A12 (3/64z")	12
A16 (1/16")	50,75,100
A20 (5/64")	150
A24 (3/32")	200
A28 (7/64")	250
A32 (1/8")	300



P-Type (LPG) Nozzle for Cutogen 5



NOZZLE SIZE	PLATE THICKNESS (mm)
P8 (1/32")	6
P12 (3/64")	12
P16 (1/16")	25,50,75
P20 (5/64")	100
P24 (3/32")	150
P28 (7/64")	200
P32 (1/8")	250

Operating Data for Mild Steel cutting with ESAB Cutting Blowpipe (Injector & Nozzle Mix type) comply with ISI & ISO Standards

Material Thickness		Nozzle size	Gas pressure Oxygen		Gas Pressure Fuel				
					Acetyline		Propane		
mm	inch			bar	psi	bar	psi		
6.0	1/4"	1/32"	(3-6)	1.5	20	0.15	2.0	0.20	3.0
12.0	1/2"	3/64"	(5-12)	2.0	30	0.15	2.0	0.20	3.0
25.0	1"	1/16"	(10-75)	2.5	35	0.15	2.0	0.30	4.0
50.0	2"	1/16"	(10-75)	3.0	45	0.15	2.0	0.30	4.0
75.0	3"	1/16"	(10-75)	3.5	50	0.15	2.0	0.30	4.0
100.0	4"	5/64"	(70-100)	4.0	60	0.20	3.0	0.35	5.0
150.0	6"	3/32"	(90-150)	4.0	60	0.20	3.0	0.40	6.0
200.0	8"	7/64"	(140-200)	4.0	60	0.20	3.0	0.40	6.0
250.0	10"	1/8"	(190-250)	4.0	60	0.20	3.0	0.45	6.5
300.0	12"	1/8"	(250-300)	4.5	65	0.20	3.0	0.50	7.0

Welding Tips

TIPS

- Tips are manufactured from copper tubes which have swaged interior
 - Gas passages are mirror smooth with internal angles rounded, non-turbulent
 - More efficient gas flow.
- Wide range of Tips of different sizes
 - Optimum consumption of gas with use of correct size of tips.

Saffire 2 HP (swaged)

TIP SIZE (mm)	PLATE THICKNESS (mm)
1	0.9
2	1.2
3	2.0
6	3.0
7	3.2
10	4.0
13	5.0
20	8.0
30	8.5
35	10.0
45	13.0
55	16.0
70	20.0
90	25.0



TIPS

Light weight - LWHP (swaged)

TIP SIZE (mm)	PLATE THICKNESS (mm)
2	1.9
3	2.0
6	3.0
10	4.0
18	5.0
25	6.5
13	8.2



Model 'O' Tips

TIP SIZE (mm)	PLATE THICKNESS (mm)
1	2-3
2	4.5
3	6-8
4	10-20
5	18-30



Operating Data for Mild Steel welding with ESAB Welding Blowpipe (High pressure & Low pressure type) comply with ISI & ISO Standards

Material Thickness		Tips size	Gas pressure Oxygen		Gas Pressure Fuel Acetyline	
mm	inch		bar	psi	bar	psi
1.2	3/64"	2.0	1.5	20	0.14	2.0
2.0	5/64"	3.0	1.5	20	0.14	2.0
3.0	1/8"	6.0	2.5	35	0.21	3.0
5.0	3/16"	13.0	2.5	35	0.21	3.0
8.0	5/16"	20.0	3.0	45	0.28	4.0
10.0	3/8"	30.0	3.0	45	0.28	4.0
12.0	13/32"	35.0	3.5	50	0.42	6.0
14.0	9/16"	45.0	3.5	50	0.42	6.0
16.0	5/8"	55.0	4.0	60	0.56	8.0
20.0	13/16"	70.0	4.0	60	0.70	10.0
25.0	1"	90.0	4.5	65	0.70	10.0

Flashback Arrestors

ESAB FR - 18

ESAB FR-18 are torch mounted Flashback Arrestors, which comes in a pair of both Oxygen & Acetylene, designed to arrest the flame and avoid the reverse flow of gases.



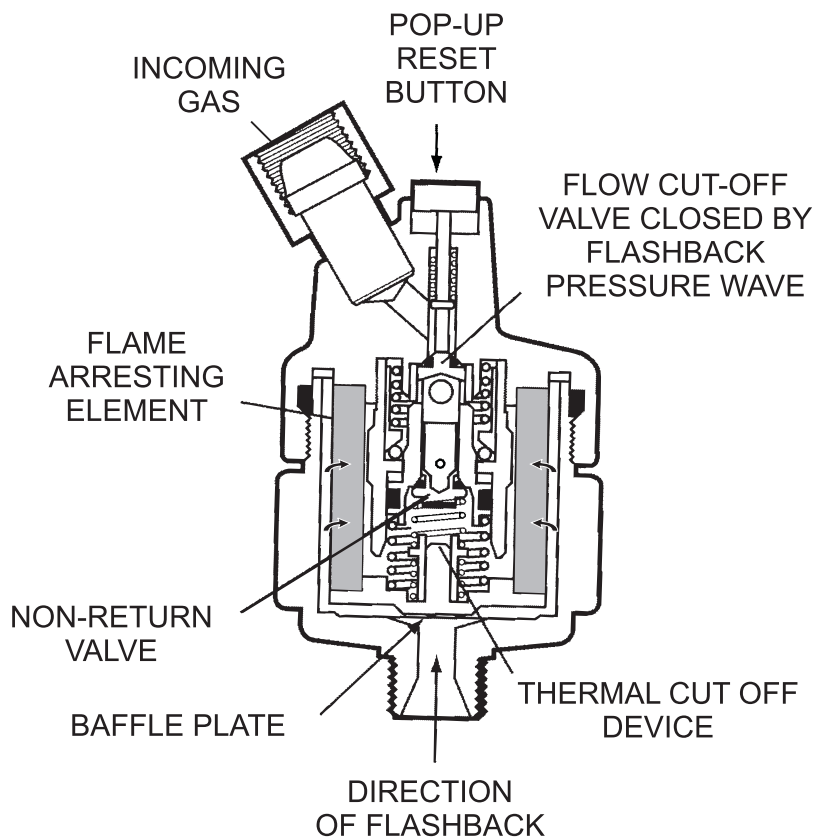
ESAB FRT

The ESAB cylindrical flashback arrestors, are of advanced design giving a higher flow rate. The FRT model is designed to be connected to the regulator or tapping point, model is equipped with a large cylindrical flame arresting element, an automatic reset non-return valve and a heat sensitive thermal cut-off.



ESAB PROTEX

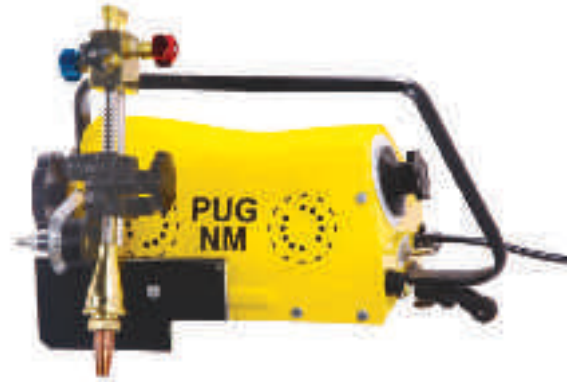
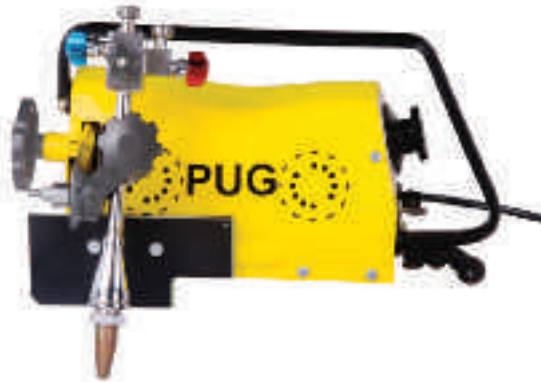
- FLAME ARRESTOR - Flame arrestor shall quench flashbacks
- NON-RETURN VALVE - Flame arrestor with non-return valve shall quench flashbacks & shall not allow the reverse flow of gases.
- TEMPERATURE SENSITIVE CUT-OFF VALVE - Flame arrestor with temperature sensitive cut-off valve shall quench flashbacks & shall stop the gas flow before the upstream gas is ignited.
- PRESSURE SENSITIVE CUT-OFF VALVE - Flame arrestor with pressure sensitive cut-off valve shall quench flashbacks & the pressure sensitive cut-off function shall active at each flashback. The pressure-sensitive cut-off valve shall remain closed until it is manually reset.



In view of the fact that flashback can occur in any of the cylinders ESAB PROTEX comes in two versions

- PROTEX - RO (For Oxygen)
- PROTEX-RA (For Acetylene)

Small / Portable Cutting Machines



ESAB PUG, PUG - NM

Small / Portable Gas Cutting Machines

ESAB-straight line and circle cutting machines.

Special Features:

- **Easy to handle**

The Machines are light weight and they have a wrap round handle for easy portability and protection.

- **Body**

Made of pressed steel with wrap round handle and fibre glass heat deflector.

- **Versatile**

Using extendable tracks, these machines can produce straight cuts on any length, square or bevel edge. With the same precision these machines can cut circles and also shape with gradual curves, when hand-guided.

- **Circle Cutting**

Can be done with the use of circle cutting attachments, supplied as optional extra. This can be easily attached to the machines by two screws.

Specifications:

MODEL NAME	ESAB PUG	ESAB PUG-NM
Cutting Capacity:		
Square Cuts	Upto 75mm thick MS	Upto 100mm thick MS
Bevel cuts (Upto 45)	Upto 50mm thick MS	Upto 75mm thick MS
Circles	75-1140mm diameter	75-1140mm diameter
(Using standard circle attachments, which can be supplied as an optional extra.)		
Cutting Speed	190-800mm/min	190/800mm/min
Cutter	IMC-3 Injector type	NM-type
Speed Control	Rotary resistance	Rotary resistance
Gas Hose Connections (for 5 mm Hose)	1/4" BSP RH & LH	1/4" BSP RH & LH

- **Cutter**

PUG: Injector type, specially designed to prevent backfire.

PUG NM: Nozzle mixing type, latest technology, much safer.

- **Cutter adjustment**

Can be Swivelled to cut levels up to 45° with Rack and Pinion.

- **Fuel Gas**

Acetylene or LPG can be used by selecting the appropriate nozzles. Two nozzles for use with Acetylene for cutting MS from 6 mm to 75 mm thickness supplied along with the machine. Cutter types and sizes are available as optional extras.

- **Motor**

Machine are fitted with 200 volts Fractional Horse Power geared reversible motors. Power is fed through a Forward-Reverse toggle Switch.

- **Track**

1.8 meter long Aluminium Track (for PUG & PUG NM) or Steel Track can be supplied as optional extra. The PUG/PUG NM Machines may be set to follow the edge of any straight piece of metal, 8 x 20 mm.

Optional: i) Circle cutting attachments ii) Extra for torches iii) Aluminium tracks

Gas Saver for Welding Blowpipes

Where welding operations are intermittent and the operator needs to frequently adjust the work place, considerable Gas and as well as Time (in re-setting the torch) is wasted.

Considerable saving in both gas and re-set up time can be achieved by fitting a Gas Saver upstream of the blowpipe. The torch can be hung on an arm which activates two valves, which cuts-off the gas supplies. When the operator is ready to re-commence the welding, he removes the torch from an arm which releases the gas supply. He is then able to re-light the flame from a pilot flame on the unit without operating the blowpipe control valves.

Gas Saver is a very effective accessory that will quickly pay in Gas and labour savings.

Design Features

- Bunsen type pilot flame evenly at all pressures without soot.
- Pilot flame can be adjusted or turned off by separate valve.
- The Acetylene valve is always closed first to eliminate soot in the air or the blowpipe.
- Reliable valves.
- No leaks glands





Welding & Cutting Hose

Technical Details

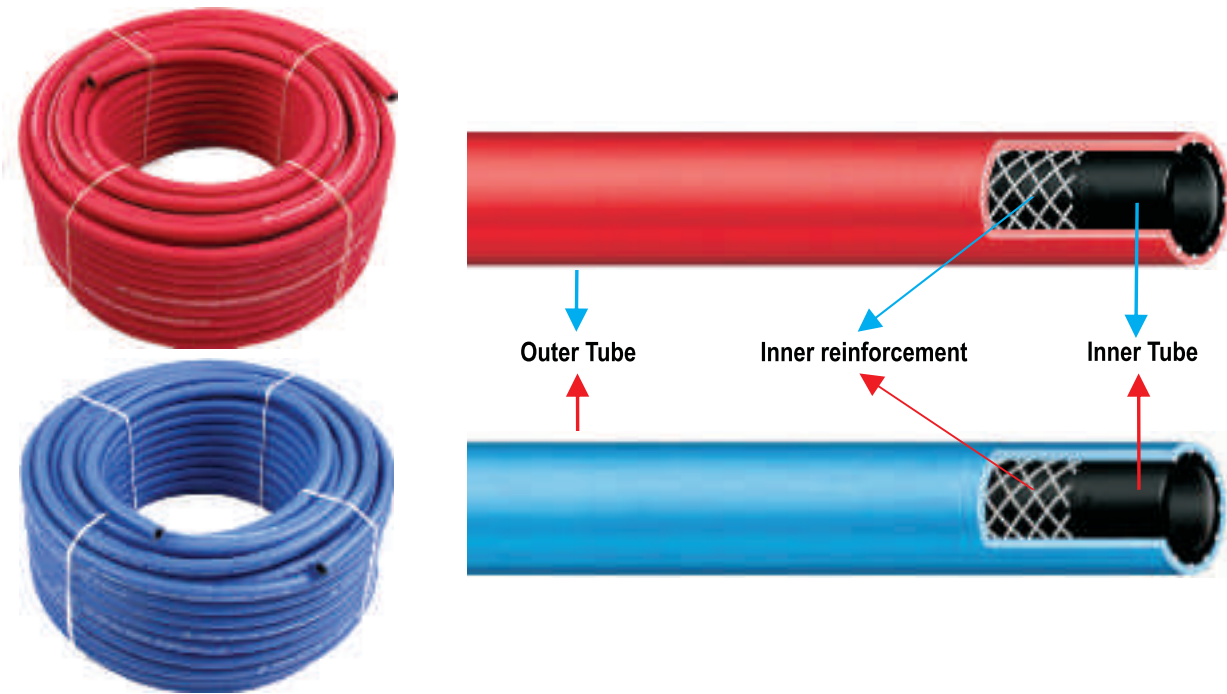
- **Core** : Black Synthetic Elastomer
- **Reinforcement** : High Tensile Polyester Yarn
- **Cover** : Hiper Flame Retardant Thermo-compound
- **Temperature Range** : -40°C to +55°C
- **Standard** : Manufactured according to IS:447

Features

- Highly Flexible
- Excellent Electrical Resistant
- Light in Weight
- High Abrasion Resistant
- Standard 50 mtr. length supplied in a box

Application

- Specially designed for Oxy-acetylene welding and cutting equipment



Specifications

Description	Dash Size	DN	Hose I.D. (Nom.)		Hose O.D. (Nom.)		Working Pressure		Min. Burst Pressure		Min. Bend Radius	
			(in.)	(mm)	(in.)	(mm)	(psi)	(bar)	(psi)	(bar)	(mm)	(in.)
Dura Hose	-3	5	3/16	5.0	0.43	11	220	15	800	55	18	0.71
Dura Hose	-5	8	5/16	8.0	0.63	16.0	220	15	800	55	25	1.00
Dura Hose	-6	10	3/8	10.0	0.71	18.0	220	15	800	55	38	1.52



Welding Tools and Accessories

A range of quality tools and accessories for welding, cutting and general engineering applications. All our welding tools and accessories conform to the relevant EU legislation and IS standards.

WELDING CABLES

Technical Data

- Harmonised Welding Cable with general purpose Rubber Sheathing as Type SE 1
NBR-PVC HOFr Sheathing as Type SE 3 to IS : 6380/84
- Conductor resistance in accordance to IS : 8130/84.
- Conductor resistance factor at +20°C - see technical catalogue
- Admissible working temperature at the conductor
General Purpose: + 80°C
HOFr/NBR-PVC Type: +100°C



Cable Structure

- Plain / Tinned annealed Copper / Plain Aluminium conductor extra fine stranded & bunched in accordance to IS : 8130/84.
- Melinex tape used as separator over the conductor for better electric conductivity.
- Rubber/NBR jacketing as per IS : 6380/84.
- With marking of brand name & cross section on each mtr.
- Testing of cable carried out as per IS : 9857/90 at our in house facility
- Standard 100 mtr. length supplied in a eco-friendly fibre drum

Application

- Rubber insulated flexible welding cable are used to connect Welding Machine & for better welding proficiency.
- Used in Automobile industries, Shipbuilding, Transport, Steel Plants, Railways, Refineries, Oil fields, Automatic Welding Robots, Construction, Coal Mines etc.
- The robust construction makes these cables highly durable.



Safety Requirements

- Coiled welding cable must always be spread out before using to avoid overheating in use.
- Cables must not be spliced within 10 feet of the holder.
- Welding cable must never be coiled or looped around the body of the worker
- Cables with damaged insulation must be replaced.

Sizes / Types available

Cable Welding CU (sq.mm)	35/50/70/95/120
Cable Welding CU (sq.mm) HOFr	35/50/70/95/120
Cable Welding AL (sq.mm)	35/50/70/95/120
Cable Welding AL (sq.mm) HOFr	35/50/70/95/120



Holder Handycool HC 600

This is crocodile style type 'B' electrode holder, which is made from black phenolic resin insulated jaws and black DMC handle. This holder is fully insulated for extra safety and brass jaws ensures good contact. It is suitable for cables up to Al 120 sq. mm./Cu 70 sq. mm. and used in heavy duty welding application.



Holder Confort 600

An open head style type 'B' electrode holder with fully insulated head to resist spatter and sturdy handle, made of fibre glass poly amide 66 – 33 for heavy duty application. Insulation resistant above 1 M Ω & Dielectric strength up to 3000 volts. This holder is suitable for cables up to Al 120 sq. mm./Cu 70 sq. mm. and CE certified as per European standard EN 60974-11.



Heavy Duty Earth Clamp 600

An earth clamp made of zinc coated steel with copper plated jaws and suitable copper mesh that provides good contact with the work piece. Jaw opening is up to 60mm. and is suitable for heavy duty application.



Magnetic Earth Clamp 600

Magnetic earth clamp with strong gripping power that permits attachment to any ferrous object. These clamps provide a large contact area with less overheating – thanks to fewer junctions. Flat edges ensure perfect grip on the job and strong handle to pull it out easily. Magnetic earth clamp is very convenient to place anywhere and start welding instantly.



Personal Protection

ESAB offer a comprehensive range of Personal Protection Equipment, covering everything from head to foot, for both welding and cutting and general engineering applications. All ESAB products conform to all relevant EU legislation and standards.

As Health and Safety Standards improve year on year, so does ESAB's commitment to providing a product portfolio capable of meeting the ever increasing demands of the markets we serve. As you would expect from a leading supplier of welding and cutting solutions, the ESAB product range is second to none for quality and reliability.

Origo™ - Tech 9-13

The new stylish high-tech helmet design from ESAB. The new shell is available in striking high gloss colour, 'Yellow'. The helmet features the ESABcomfort headgear, whilst the light weight shell offers superior face, head, ear & neck protection, which allows for welding in all positions. The ESAB variable shade ADF uses the latest technology and has proven reliability. The ADF is screw retained and sits in a fully moulded light seal cradle, which also creates a slight convex curve on the front spatter lens for extra security and strength. The Helmet is delivered in an ESAB display box, fully assembled and ready to use.



Origo™ -Tech 9-13 Helmet

The Origo™-Tech 9-13 features an external shade adjustment between DIN 9 and DIN 13. The delay and sensitivity can be adjusted from inside. The Origo™-Tech 9-13 is suitable for MIG/MAG, MMA and TIG (over 20 amps).



Eco-Arc Welding Helmets

The new Eco-Arc is the latest design in flip front passive welding helmets. With a light weight Poly Propylene shell and outstanding facial protection, the helmet is suitable for all position welding. The helmet also adopts the new Eco Headgear with 4 rake positions and 3 longitudinal adjustment positions for precise nose to shell adjustment. The helmet is supplied complete with outer protection lens, shade 11 mineral glass and the unique large internal protection glass.



Hand Shield Armour

Flat fronted, flame retardant hand shield made from glass filled nylon having 1.8 mm shell thickness, weighing only 480 gms. This hand shield have a concealed handle with good thumb grip facility to protect hand. Lens aperture 83 x 108mm (4¼" x 3¼").

RESPIRATORY EQUIPMENT

ESAB Air

ESAB always recommend the use of a full respiratory system for maximum protection against welding fume. For the ultimate protection and for use in the most aggressive of welding environments, ESAB offer Origo™ Air.



Origo™ Air

The Origo Air is a battery powered respiratory unit is designed to fit the Origo-Tech welding helmets. The unit provides clean/filtered air to increase the comfort and safety for the welder. The Origo Air is delivered complete with an 8-hour battery, P3 filter, comfort pad, waist belt and an air hose with a Proban hose cover fitted. This unit is supplied with an intelligent charger, which ensures a prolonged life time of the battery, by reducing the risk of over charging. The Origo Air is equipped with a low flow alarm, which will give an audible signal when the filter is blocked or the battery power is running low. The complete system is comfortable, lightweight and durable.



Origo™-Tech 9-13 Helmet for Air

The Origo™-Tech 9-13 features an external shade adjustment between DIN 9 and DIN 13. The delay and sensitivity can be adjusted from the inside. The Origo™-Tech 9-13 is suitable for MIG/MAG, MMA and TIG (over 20 amps). Now this helmet is ready to fit in Origo Air Unit.

Filtair Disposable Masks

The ESAB Filtair series has been developed to improve the comfort of disposable respirators whilst maintaining an excellent face fit. Colour coding the range makes identification simple when varying levels of protection may be required. The mesh shell supports the filter media and prevents collapse onto the face and the preformed nose bridge provides comfortable fit eliminating constant adjustment. The filters use the latest filter technology to promote low breathing resistance and are approved to EN149:2001(meeting the 120mg load testing). The Filtair is available as a pre-moulded and flat version. Depending on the protection level needed and the breathing resistance some models are equipped with a valve. All the masks are fitted with buckle fastening which also allows the wearer to adjust the straps accordingly



ESAB Filtair Flat A-1

This mask provide P1 protection and is suitable to wear during general dusty duties.

ESAB Filtair Flat P1 'White'



ESAB Filtair Flat A-2CV

This mask provide P2 protection and is equipped with a valve to reduce heat and moisture build up inside the respirator. The carbon layer takes out bad odours. Suitable to wear during welding, brazing,soldering, painting (brush applied), gluing (brush applied) and polyester resins (hand mix).

ESAB Filtair Flat P2CV 'Grey'

SPECTACLES, GOGGLES & VISORS

ESAB Eco Safety Spectacles

These stylish spectacles are used for drilling, chipping and metalworking, they have a sporty style and are extremely lightweight. Available in two different lens configurations. All lens configurations provide protection against dangerous UV radiation. CE approved according to EN 166-F.



ESAB Eco Smoked

The smoked lens is suitable when working in strong ambient light.

ESAB Eco Smoked



ESAB Eco Amber

The Amber (yellow lens) enhances the light. This is suitable when the ambient light is not sufficient

ESAB Eco Amber



ESAB Eco Clear

The clear lens is suitable when working indoors, providing general eye protection.

ESAB Eco Clear

ESAB Goggles & Visors



ESAB Face Shield

Safety face shield is made of 1.8 mm thick, 7" long & 14" wide colourless, transparent acrylic. This tilting visor is to protect forehead, eyes, cheeks, nose and mouth from flying particles, sprays or splashes of hazardous liquids.

Face Shield



ESAB Welding Goggle

New snugfit PVC make one piece Bocal type protective goggle with ventilators, holding rings with clear lense for gas welding, brazing and gas cutting.

Welders Goggle FG2

WELDING CURTAINS

Welding Curtains



Three colour types are available and all three can be supplied as standard curtains. The self-extinguishing material provides good protection from dangerous welding radiation. The curtains are equipped with press-studs for easy, strong fastening and they are folded at the top and the bottom to withstand harsh use. All approved according to EN 1598. The mounting rings come in a package of seven, which is enough to mount any of the curtains (supplied in a standard length of 1.8m x 1.4m). Rings are included when ordering any of the curtains.

Welding curtain, Dark Red (Single / Strip)

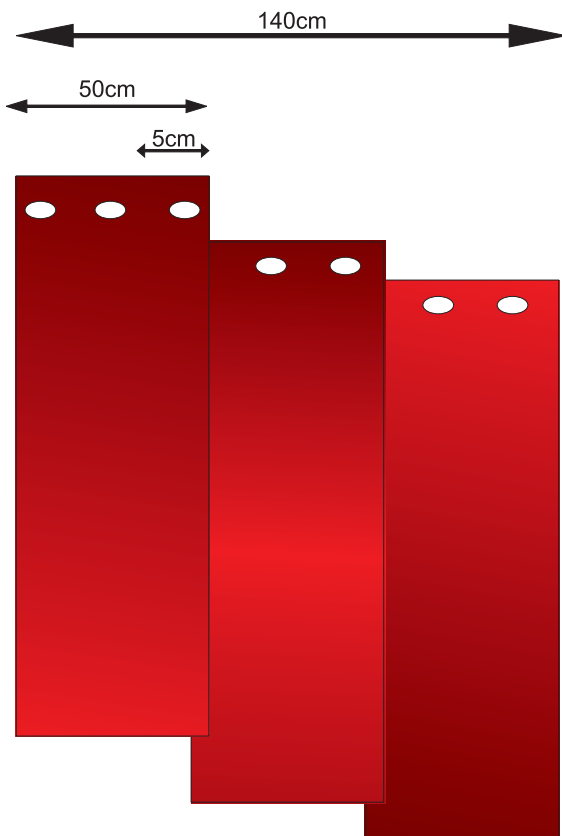
Welding curtain, Green Transparent (Single / Strip)

Welding curtain, Dark Green (DIN 9) (Single / Strip)

Welding strip curtain,
dark red, 1.8 x 1.4m

Welding strip curtain,
green transparent (DIN 6), 1.8 x 1.4m

Welding strip curtain,
dark green (DIN 9), 1.8 x 1.4m



Welding Gloves MIG/MAG/MMA & General Handling



Test against mechanical stress such as abrasion, cut, tear and puncture.



Test for thermal performance such as exposure to an open flame, contact heat, convective heat, radiant heat, small and large splashes of molten metal.



Welding Hand Gloves

A welding glove made of hard-wearing, heat resisting chrome leather, fully lined and KEVLAR stitched. This glove is used for MIG/ MAG/MMA welding.

Welding Hand Gloves



Heavy Duty Hand Gloves

A hard wearing working glove made of heavy duty chrome leather with comfort lining and rubberised cuff. This glove is used for general working and handling purpose.

Heavy Duty Hand Gloves



TIG Professional Hand Gloves

High dexterity, gunn cut, soft nappa grain leather TIG welders gauntlet, with 15 cm heat resisting chrome leather cuff. KEVLAR stitched.

TIG Professional Hand Gloves

WELDING CLOTHING

Welding Aprons

Esab protective aprons are made of superior quality split leather and distribute the weight effectively. They are KEVLAR stitched and re-inforced with rivets. Leather straps are provided for strength.



Welding Apron



Welding Sleeve

Split leather sleeves are KEVLAR stitched and with a total length of 47 cm. Equipped with elasticated cuff, comfortable knitted wrist and velcro arm fastener.

Welding sleeve

Welding Leg Guard

Esab welding leg guards are made of high quality split leather to protect the footwear during welding. The leg guards are KEVLAR stitched, fastened using velcro and 15 cm long.

Welding Leg Guard



Welding Blankets

The ESAB Welding blankets are produced using heat and flame resistant fabrics. The blankets provide excellent protection from grinding/welding sparks, slag and drops of molten metal. ESAB offer a wide range of blankets with different characteristics and in many different sizes. The blankets are colour coded.

When selecting the most suitable blanket for the application, the following factors should be considered:

Positioning of the blanket – Sparks hitting a blanket, which is positioned horizontally, will put extra stress on the material and a stronger and more heat resistant blanket should be used.

Work application – For light duty welding or cutting a thinner and less heat resistant blanket can be used. For heavy duty welding or cutting when the blanket is exposed to drops of molten metal then a more durable blanket should be used.

Flexibility – The weight of the blanket indicates how flexible the fabric is. A blanket of less weight makes it easier to protect small pipes and components where it's necessary to wrap the blanket.






SAFETY FOOTWEAR

ESAB Safety Shoe

EN compliant Safety Footwear for General Engineering, Chemical, Cement, Construction & Service Industry. Breathable Full Grain Leather Upper, Comfortable, Elegant. Light Weight. Imported Mesh Lining. Imported 200 joules Steel Toe cap EN 12568. Moulded full socks. Direct Injected lightweight PU Sole. Penetration Resistant steel Mid Sole. Antistatic. Slip Resistant (SRA Compliant). Meet EN 345 / IS 15298 (II) which gives the following guidelines:

Key to symbols:

-  Safety Basic to EN345 200 joules toe protection
-  Safety Basic, antistatic and energy absorbing heel
-  Antistatic



Features:

- EN complaint Safety Footwear for General Engineering, Chemical, Cement, Construction, Catering & Safety Industry
- Breathable Full Grain Leather Upper, Comfortable, Elegant
- Light Weight
- Imported Mesh Lining
- Imported 200 joules Steel Toe cap EN 12568
- Moulded full socks
- Direct Injected lightweight PU Sole
- Antistatic
- Slip Resistant (SRA Complaint)
- Meet En 345/IS 15298 (II)
- Value for money
- Size 5-12

ESAB safety shoe, size 5
ESAB safety shoe, size 6
ESAB safety shoe, size 7
ESAB safety shoe, size 8
ESAB safety shoe, size 9
ESAB safety shoe, size 10
ESAB safety shoe, size 11
ESAB safety shoe, size 12





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World leader in welding and cutting technology and 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 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 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 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



ESAB INDIA LIMITED

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Tel: 044-42281100, Fax: 044-42281150, Email: info@esab.co.in, www.esabindia.com

Factories: Ambattur & Irungattukottai (Chennai), Kalmeshwar (Nagpur) and Taratala & Khardah (Kolkata).

Eastern Regional Office

CONSUMABLES DIVISION:
B.T. Road, P.O.: B.D. Sopan,
Khardah, 24 Parganas (N), Kolkata - 700 116.
Tel: (033) 25532897 / 25838005

EQUIPMENTS DIVISION:
P41 Taratala Road, Kolkata 700 088.
Tel: (033) 24019671

Western Regional Office

501/502, 5th Floor, Sagar Tech-B
Andheri Kurla Road, Saki Naka, Andheri East,
Mumbai 400072. Tel: (022) 2851 7386

Central Regional Office

No. 218, Ashirvad, South Ambazari Road
Bajaj Nagar, Nagpur - 440010
Tel: (0712) 222 9547 / 48

Northern Regional Office

239 & 240, DLF Tower,
Shivaji Marg, Opp. Audi showroom
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Southern Regional Office

Karamuttu Centre, 6th Floor
New No. 634, Anna Salai, Nandanam,
Chennai - 600035. Tel: (044) 4295 7894 / 95