MUREX

Arc & Gas
Welding Consumables

“At the HEART of every good weld”

Murex Welding Products are today part of one of the world’s leading manufacturers of welding products and have a highly successful history extending over a period of time.

At its UK headquarters in Waltham Cross Hertfordshire, Murex Welding Products have a team of highly experienced and qualified staff who are always available to offer help and advice on all aspects of welding and cutting.

The name Murex is the generic name of a large group of attractive tropical shells which have an ancient and distinguished history.

Murex started in 1909 in Rainham, Essex and were refining metallurgists. Among the products which were produced were metal alloys in powder form which were suitable for inclusion in the coatings of welding electrodes. It was natural therefore that Murex showed an interest in firms who were producing welding electrodes and in due course they acquired two companies. These companies were amalgamated into one in the early 1930’s under the name of Murex Welding Processes.

In 1937 the Hertford Road, Waltham Cross factory was built and in 1938 Murex Welding Processes moved in and commenced manufacture of large amounts of welding electrodes at the factory.

Murex continued to grow and in 1956 the Saffire revolution started with its safety first principle – “Make it safe – Keep it Saffire”.

In 1982 ESAB purchased what was now Murex Welding Products and for the first time in very many years Murex became part of a company whose only interest was welding thus becoming part of a leading player in a global market.

Today, still based in Waltham Cross, Murex Welding Products offer a comprehensive range of arc and gas welding and cutting products, welding consumables and personal protective equipment and welding accessories.

Murex has and still remains “At the HEART of every good weld”.

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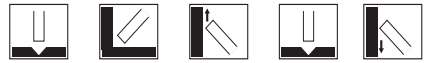
Although certain products are not listed in the Murex range an ESAB Group equivalent may be available. For details contact our Technical Information Officer, tony.johnson@esab.co.uk.

Guide to Using Your Murex Consumables Catalogue

Welding Symbols
The following symbols are intended as a guide only.



downhand | horizontal vertical | vertical up | overhead | vertical down

Recommended welding positions are printed in black. Acceptable positions are printed in grey.

All Weld Mechanical Properties
The mechanical properties of the deposited weld metal shown in this catalogue refer to all weld metal properties when deposited in the flat position. These may have little relevance to the properties of a real joint achieved in practice, since this will depend on the dilution from the base material, welding position, bead sequence and heat input. Apart from their use for quality control purposes, the mechanical properties of the all weld metal test provide the designer with an initial guide to the selection of welding consumables.

This is particularly important with regard to Charpy impact grading. Thus, consumables which have the highest grade are more likely to offer better Charpy properties when used in practice. They will not necessarily give the same level of Charpy results in a welded joint as they do in an all weld metal test piece.

Shielding Gases
For optimum performance of gas sheilded wire, careful control of electrode extension (stickout) and of shielding gas flow rate are recommended in order to avoid nitrogen entrainment from the air. The use of low nitrogen shielding gas is also recommended. Consult your gas supplier for information on the nitrogen levels of shielding gas.

Storage and handling

Recommendations for the storage, re-drying and handling of Murex 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 in the following climatic conditions:

Temperature	Relative humidity
5-15°C	< 60%
15-25°C	< 50%
above 25°C	< 40%

During the winter, it is possible to have low relative humidity by keeping the temperature in the store room 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 de-humidification.

If the electrodes have been stored in a cold place, allow them to reach ambient temperature before breaking the package.

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

Acid rutile stainless electrodes and all types of basic electrode may produce pores in the weld if they have not been stored in sufficiently dry conditions. Redrying the electrodes 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 with first class results. 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 oven 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.

Discoloration in the coating
If the colour of the electrodes changes during storage, they should be scrapped or the electrode manufacturer should be contacted.

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, re-dry 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. Tuck the flap back in the plastic capsule.

Discard or re-dry electrodes that have been exposed to the atmosphere in an opened Vac-Pac™ for more than 12 hours.

Storage and handling recommendations for 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.

MMA Electrodes Chemical Composition

Table 1 Fume analysis for MMA Electrodes where control of total welding fume to 5mg/m^3 will ensure that no constituent of the fume will exceed its own recommendation limit.

Fume Analysis (wt %)							
Electrode	**Fe**	**Mn**	**Ni**	**Cr**	**Cu**	**Pb**	**F**
Celtian	40	3.5	0.1	<0.1	0.2	0.1	-
Ferex 7016	12	5	<0.1	0.1	<0.1	0.1	13
Ferex 7018LT	20	5	0.1	<0.1	<0.1	0.4	18
Fortex 7018	13	6	0.2	<0.1	0.1	0.4	16
Mirrospeed	30	7	0.1	<0.1	0.1	0.1	-
Satinex	27	7	<0.1	<0.1	0.1	<0.1	-
Super Fastex	21	5	<0.1	<0.1	<0.1	<0.1	-
Vodex	35	5	<0.1	<0.1	0.1	0.1	-
Vortic Marine	40	5	0.1	0.1	0.1	0.1	-
Zodian Universal	30	7	0.1	<0.1	0.1	0.1	-

Table 2 Fume analysis for MMA Electrodes where the fume contains hexavalent chromium compounds for which a long term exposure limit of 0.05mg/m^3 is included in Guidance Note EH40.

Fume Analysis (wt %)							
Electrode	**Fe**	**Mn**	**Ni**	**Cr**	**Cu**	**Pb**	**F**
Armoid 1	12	6	1	4	0.1	0.1	11
Nicrex E308L	6	3	0.4	5	<0.1	0.1	4
Nicrex E312	12	12	1.5	12.5	<0.1	0.1	10
Nicrex E316L	6	3	0.6	4	<0.1	0.1	7

Health and Safety Information

Welding Fume
Welding fume consists of various airborne substances (fine particles and gases) which may increase hazards to health when they are inhaled or swallowed. The degree of hazard to the welder depends upon the composition of the fume, the concentration in the air that he is breathing and the time for which he is exposed to it.

No fumes or gases are evolved by MMA, MIG or TIG, SAW or gas welding consumables at normal ambient temperatures, but in use (welding), fumes can be evolved. The tables in this section give the chemical composition of the particulate fume evolved during the use of the range of welding consumables, analysis being of fume generated in an enclosed Swedish box type apparatus and using a compatible base plate.

The chemical composition of the fume is expressed as weight percent of elements, as is conventional, rather than as oxides and silicates and the other complex forms they actually exist in, in the fume. The analysis is not a complete analysis, the balance of the fume from the MMA process, for example, consisting of complex oxides and silicates of some or all the slag-forming constituents of the electrode coating such as sodium, potassium, calcium, magnesium, aluminium, titanium, which are usually treated together as a residual fraction of inert inorganic fume.

The gases nitric oxide, nitrogen dioxide and ozone may sometimes be produced by the action of the electric arc or the radiation from it on the surrounding air. These gases do not arise from the welding consumable and are not usually a problem in MMA welding under conditions of normal ventilation. MIG welding is more likely to give rise to these gases, particularly at high current levels, and ozone generation may be increased by the presence of argon in the atmosphere around the arc. Carbon monoxide may be produced by the decomposition of carbon dioxide in the shielding gas or of carbonates in flux cored wires.

Occupational Exposure Limits
The recommended limit on the concentration of welding fume (or any other atmospheric contaminant) in the air breathed by any person is defined by the Health & Safety Executive in a list of Occupational Exposure Limits (guidance note EH40). This guidance note is revised annually and reference should always be the most recent edition. A long term exposure limit (8 hr TWA value) of 5 mg/m^3 for particulate welding fume is included in the current list.

It is the responsibility of the user/employer under the Health & Safety at Work Act and the Control of Substances Hazardous to Health (COSHH) regulations that limits are not exceeded. The fume analysis cannot be used to assess the concentration of total welding fume to which a welder is exposed. Assessment of the possible exposure of the welder must be carried out by a competent person.

The analysis of fume from electrodes and wires for welding mild and some low alloy steels and aluminium alloys indicates that at a total particulate fume concentration of $5mg/m^3$ no individual constituent of the fume will exceed its own recommended limit.

These consumables can be found in table 1. There are, however, consumables which give fume containing elements such as chromium, nickel, manganese and copper in sufficient quantities that even at 5mg/m^3 their own limits would be exceeded. In these cases a greater degree of fume control or protection is required to ensure that welders and others are not exposed to excessive amounts of these elements. Consumables giving fume of this nature are listed in table 2, which also include guidance on the maximum concentration of total particulate fume allowable in order to protect workers from the main constituent (e.g. chromium) present in the fume.

The figures quoted in these tables are theoretical maximum concentrations, but at very low values, for accuracy with gravimetric determinations, sampling would have to be carried out for long periods, perhaps even over a complete working day. In these instances it is suggested that chemical analysis for the main constituent elements of concern might be a more practical approach.

Hazards of Excessive Exposure
Effects from excessive exposure to fume arising from inadequate ventilation may become apparent at the time of welding or shortly afterwards or at some later date. Some of the effects are summarised below, and here it is important to note that workers other than welders may also come into contact with the products of welding fume:-

(a) Irritation of the Respiratory Tract
This is the effect of dust or fume on the lining of the respiratory tract and can cause dryness of the throat, tickling, coughing, chest tightness, wheezing and difficulty in breathing. In its most acute form it can cause the lungs to become full of fluid. The effects will vary with exposure, concentration and type of irritant.

(b) Metal Fume Fever
The inhalation of freshly formed metallic oxides such as those of zinc, chromium, nickel, copper, manganese may lead to an acute influenza like illness termed metal fume fever.

(c) Systemic Poisoning
This can result from the inhalation or swallowing of substances such as fluorides, hexavalent chromium, lead and barium.

(d) Long Term Effects
It is possible that certain constituents of welding fume such as hexavalent chromium and nickel may be carcinogenic and until there is definite information about this it is wise to treat them as such.

(e) Fibrosis
This is the formation of fibrous or scar tissue in the lungs. It is the result of a reaction between dust or fume with the lung tissue. There are various types depending on the nature of the substance involved and duration of exposure.

In all cases of doubt concerning physiological response to welding pollutants, medical advice should be sought promptly.

Composition

(a) Manual Metal Arc Consumables
Manual Metal Arc welding electrodes consist of a metal core wire coated with a flux covering. The coating of rutile mild steel electrodes contains approximately 50% rutile sand; ferro-manganese; carbonates in the form of magnesite or chalk;the coating may contain mineral aluminium silicates, such as china clay, talc, felspar or mica.

About 10-15% (wet weight) of a silicate binder (water glass) is used to produce a paste which is extruded onto a mild steel core wire and dried.

Iron powder rutile types contain similar materials and approximately 50% iron powder with a corresponding reduction in the other constituents.

In basic mild steel electrodes the mineral silicates and rutile sand are replaced wholly or in part by calcium fluoride and calcium carbonate or similar materials.

Rutile and basic electrodes for the deposition of alloyed weld metal are formulated similarly to the above with the addition of appropriate alloying elements to the coating and/or core wire.

In cellulosic electrodes the rutile sand is replaced wholly or in part by cellulose material and an increased quantity of water glass, similar carbonates, mineral silicates and ferro-manganese form the balance.

Handling and Storage
With regard to storage and handling we do not consider that any special safety precautions are required, although obviously electrode coatings should not be ingested or allowed to come into contact with food. Hands should be washed thoroughly before all meal breaks.

Skin contact does not normally present a hazard, though it is always possible that occasional individuals may be found who are allergic to substances normally regarded as inert (e.g. cases of allergy to nickel have been reported arising from the wearing of nickel bracelets). However we do not know of any such cases in which welding consumables have been identified as the cause of an allergic response.

Consumables are dense materials and even small packets are relatively heavy. They should not be left in positions where physical injury or accidents could result.

Fire/Explosion Hazard
Welding consumables are non inflammable under ordinary conditions and do not present a fire or explosion risk. Welding consumables should not be allowed to come into contact with acids or other corrosive substances or with oxidising agents, nor with any other chemical substance with which a reaction may occur.

Personal Protection/Ventilation
Welders should wear the normal protective clothing and eye protection appropriate to electric arc welding. Under certain circumstances particularly with some high alloyed electrodes, the slag formed on the weld bead can detach and fly off in pieces,presenting a burn hazard to eyes and skin. Those in close proximity to welds should protect themselves from the danger of flying slag.

Ventilation and/or fume extraction must be adequate to keep fume concentration within safe limits.

Note on Other Atmospheric Pollutants
In any welding operation other possible sources of atmospheric contamination may be present, for example, coatings, paint or traces of oil or of degreasing agents on work being welded, or substances arising from other operations in the vicinity, in addition to any fume arising from the welding consumables. Advice regarding the nature and extent of any possible hazard which might arise directly or indirectly from such substances or sources should always be obtained from the manufacturer of each product. Occupational exposure limits for a large number of substances are listed in “Guidance Note EH40”.

Further Information
Additional information and technical advice on products included in this book may be obtained from:

Murex Welding Products
Hanover House,
Queensgate,
Britannia Road,
Waltham Cross,
Herts EN8 7TF

Tel: 01992 710000
Email: info@murexwelding.co.uk
www.murexwelding.co.uk

Welding Manufacturers Association leaflet 236 “Hazards from Welding Fume”, which gives some more general information about welding fume, is also available on request.

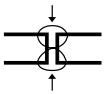
Guidance Note EH40 (Occupational Exposure Limits), EH54 (Assessment of exposure to fume from welding and allied processes) and EH55 (Control of exposure to fume from welding, brazing and similar processes) are available from HMSO bookshops.

General Information

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

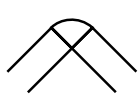
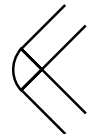
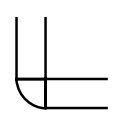
Plate thick-ness mm	Gap mm	 Flat			 Flat			 Vertical			 Overhead			 Horizontal-Vertical		
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
4	1	11.5	11	0.09	13	12.5	0.10	15	16.5	0.13	17.5	18	0.14	13	14.5	0.11
5	1	16.5	16	0.13	19.5	19	0.15	22.5	24.5	0.19	26	28	0.22	19.5	21	0.16
6	1	23	21.5	0.17	27	25.5	0.20	31	37	0.29	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 cm^3/m
2 Actual joint volume cm^3/m (taking account of transverse shrinkage)
3 Deposited weld metal kg/m

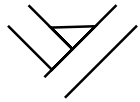
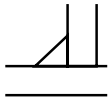
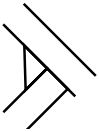
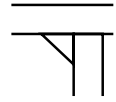
The first run and backing run V-joints: Weld metal weights

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	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	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

Hardness Scales

STATIC INDENTATION METHODS

Vickers or Diamond Pyramid Hardness HV,	Rockwell C Scale HRC, Rc	Hardness B Scale HRB, R_B	Brinell HB, HBr Steel Ball	Hardness BHN Tungsten Carbide Ball
1000	69	-	-	-
950	68	-	-	-
900	67	-	-	-
850	66	-	-	-
800	64	-	-	722
750	62	-	-	691
700	60	-	-	656
650	58	-	-	611
600	55	-	-	564
580	54	-	-	545
560	53	-	-	525
540	52	-	496	507
520	51	-	480	488
500	49	-	465	471
480	48	-	448	452
460	46	-	433	433
440	45	-	415	415
420	43	-	397	397
400	41	-	379	379
380	39	-	360	360
360	37	-	341	341
340	34	-	322	322
320	32	-	303	303
300	30	-	284	284
280	27	-	265	265
260	24	-	247	247
240	20	98	228	228
220	-	95	209	209
200	-	92	190	190
180	-	87	171	171
160	-	82	152	152
140	-	75	133	133
120	-	67	114	114
100	-	56	95	95

This table must be regarded as giving no more than a general indication of the hardness relationships for steels.

Celtian

EN 499 E 38 0 C 11

Description and applications
Celtian has a cellulosic coating, and is designed for welding using the vertical down technique. It is also recommended for carrying out positional general mild steel fabrication work.

Approvals
ABS : 2 DNV : 2 LR : 2 MOD : MS<25mm, (Navy)

All-weld metal properties			**Mechanical**	**As-welded**	
Chemical Composition					
	All weld metal %		YS	380 min	N/mm²
	Min	**Max**	UTS	470-600	N/mm²
C		0.20	Elongation	22 min	%
Si	0.05	0.25	Charpy V impact values	at 0°C	47 min ave J
Mn	0.15	0.60			
S		0.035			
P		0.035			
Cr		0.10			
Ni		0.10			
Mo		0.10			

Current range	AC (min OCV 90) or DC +		
Size (mm)	3.2	4.0	5.0
Current (amps)	90-120	120-160	135-200

Satinex

EN 499 E 42 A R 12
EN ISO 2560-A E 42 A R 12

Description and applications
A general purpose mild steel electrode for welding light and medium fabrications. It is a touch welding electrode, easily identified by the green colouring of the coating.

All-weld metal properties			**Mechanical**	**As-welded**		
Composition wt%						
			YS	420	N/mm²	
	Min	**Max**	UTS	500-640	N/mm²	
C		0.10	Elongation	20	%	
Si	0.3	0.60				
Mn	0.25	0.90	Charpy V impact values	at +20°C	47	J
S		0.03				
P		0.03				

Current range	AC (min OCV 50) or DC +		
Size (mm)	2.5	3.2	4.0
Current (amps)	70-100	90-140	120-180

Mirrospeed

SFA/AWS A5.1 E6013
EN ISO 2560-A E 42 0 RR 12

Description and applications
Easy-to-weld type electrode for welding in the flat position. The good flowing properties of the weld metal give a good finish of the weld beads both on butt and fillet welds (good slag detachability). The stable arc, also on low welding currents, makes the electrode very suitable for sheet metal welding.

All-weld metal properties
Chemical Composition
All weld metal %

	Min	Max
C		0.12
Si	0.35	0.75
Mn	0.25	0.75
P		0.03
S		0.03

All-weld metal ISO
As-welded

Properties		Min	Max
ReL (MPa)		420	460
Rm (MPa)		510	550
A5 (%)		25	26
Charpy V impact values	at 20°C (J)	47	65
	at 0°C (J)	47	

Comments: Elongation = A5

Current range	AC (min OCV 40) or DC + (-) -	
Size (mm)	2.5	3.2
Current (amps)	50-110	80-140

Vodex

AWS A/SFA 5.1-91 E6013
EN 499 E 35 2 R 12
EN ISO 2560-A E 35 2 R 12

Description and applications
Vodex is a high quality rutile electrode, specially designed for horizontal, vertical and overhead welding of mild steel plate and pipe.

Approvals

ABS : 3	LR : 3, 3Y	MOD : MS<25mm,
BV : 3	CE EN 13479	(Navy) B & BX <12mm
GL : 3		

All-weld metal properties
Composition wt%

	Min	Max
C		0.10
Si	0.10	0.20
Mn	0.30	0.60
S		0.035
P		0.035

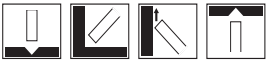
Mechanical **As-welded**

YS	375 min	N/mm^2	
UTS	460-550	N/mm^2	
Elongation	24	%	
Charpy V impact values	at -10°C	61 min ave	J
	at -20°C	47 min ave	J

Current range AC (min OCV 50) or DC +/-

Size (mm)	2.0	2.5	3.2	4.0	5.0	6.0
Current (amps)	40-70	75-100	95-125	135-180	155-230	185-300

Vortic Marine



AWS A/SFA 5.1-91 E6013
EN 499 E 35 2 R 12

Description and applications
Vortic Marine is a high quality rutile-coated electrode for general fabrication and shipyard work in the downhand, vertical and overhead positions.

Approvals

ABS : 3	LR : 3, 3Y	MOD : MS<25mm,
BV : 3	CE EN 13479	(Navy) B & BX <12mm
VdTÜV : 01698		

All-weld metal properties
Composition wt%

	Min	Max
C		0.10
Si	0.10	0.20
Mn	0.30	0.60
S		0.035
P		0.035

Mechanical	**As-welded**		
YS	375 min	N/mm^2	
UTS	460-550	N/mm^2	
Elongation	24	%	
Charpy V impact values	at -10°C	61 min ave	J
	at -20°C	47 min ave	J

Current range	AC (min OCV 50) or DC +/-			
Size (mm)	2.5	3.2	4.0	5.0
Current (amps)	75-100	95-125	135-180	155-230

Zodian Universal

AWS A/SFA 5.1-91 E6013
EN 499 E 38 0 RC 11
EN ISO 2560-A E 38 0 RC 11

Description and applications
A versatile rutile-cellulosic electrode for welding in all positions, including vertical down.

Approvals

ABS : 2	DNV : 2	MOD : MS<25mm,
BV : 2	LR : 2	CE EN 13479

All-weld metal properties
Composition wt%

	Min	Max
C	0.04	0.10
Si	0.20	0.40
Mn	0.30	0.60
S		0.03
P		0.03

Mechanical	**As-welded**		
YS	380 min	N/mm^2	
UTS	470-600	N/mm^2	
Elongation	24 min	%	
Charpy V impact values	at 0°C	47 min ave	J

Current range	AC (min OCV 50) or DC +/-				
Size (mm)	2.5	3.2	4.0	5.0	6.0
Current (amps)	70-95	90-120	130-190	180-230	220-300

Super Fastex

AWS A/SFA 5.1-91 E7024
EN 499 E 42 0 RR 73
EN ISO 2560-A E 42 0 RR 73

Description and applications
Super Fastex is a rutile iron powder electrode which combines a recovery of approximately 160% with a fast burn off to give extremely good deposition rates. The electrode was designed for touch welding, giving maximum ease of use and a high level of welder appeal.

Approvals
CE EN 13479 MOD : MS < 25mm

All-weld metal properties
Composition wt%

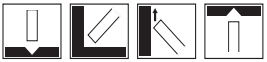
	Min	Max
C		0.10
Si	0.25	0.50
Mn	0.70	1.25
S		0.04
P		0.04

Mechanical **As-welded**

YS	420 min	N/mm^2	
UTS	510-640	N/mm^2	
Elongation	22 min	%	
Charpy V impact values	at 0°C	47 min ave	J
	at -20°C	35 min ave	J

Current range	AC (min OCV 50) or DC +/-		
Size (mm)	3.2	4.0	5.0
Current (amps)	120-180	170-220	220-320

Fortrex 7018



AWS A/SFA 5.1-91 E7018
EN 499 E 42 3 B 32 H5
EN ISO 2560-A E 42 3 B 32 H5

Description and applications
Fortrex 7018 is a basic-coated, hydrogen controlled electrode designed for all-positional (except vertical-down) welding of carbon and medium tensile steels, and of mild steels under conditions of high restraint.

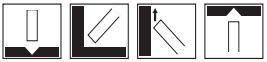
Approvals
ABS : 3H, 3Y DNV : 3YH10 MOD : MS>25mm,
BV : 3, 3YH LR : 3, 3Y, H15 (Navy) B & BX >12mm
CE EN 13479

All-weld metal properties			**Mechanical**	**As-welded**		
Chemical Composition						
	All weld metal %		YS	420 min	N/mm^2	
	Min	**Max**	UTS	510-640	N/mm^2	
C		0.10	Elongation	22 min	%	
Si	0.30	0.70				
Mn	0.85	1.35	Charpy V impact values	at -30°C	54 min ave	J
S		0.03				
P		0.03				
Cr		0.19				
Ni		0.29				
Mo		0.19				
V		0.049				
Nb		0.049				
Cu		0.29				

Comments
Mn+Ni+Cr+Mo+V < 1.75%

Current range	AC (min OCV 60) or DC +/-				
Size (mm)	2.5	3.2	4.0	5.0	6.0
Current (amps)	75-90	90-130	120-180	160-220	250-300

Ferex 7018LT



AWS A/SFA 5.1-91 E7018
EN 499 E 42 4 B 32 H5
EN ISO 2560-A E 42 4 B 32 H5

Description and applications
Ferex 7018LT is a basic-coated hydrogen controlled electrode for welding mild and medium tensile steels, particularly under conditions of high restraint.

Approvals

ABS : 3H10, 3Y	DNV : 3 YH10	MOD : MS >25mm,
BV : 3H	LR : 3, 3Y H15	(Navy) B & BX >12mm
Vd TÜV : 03862	GL : 3YH10	UXW frames to QT28 hulls.
CE EN 13479		

All-weld metal properties
Chemical Composition

	All weld metal %	
	Min	**Max**
C		0.10
Si	0.25	0.75
Mn	0.90	1.60
S		0.03
P		0.03
Cr		0.1
Ni		0.1
Mo		0.1
V		0.04

Comments
Mn+Ni+Cr+Mo+V < 1.75%

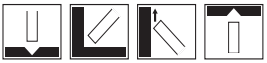
Mechanical Properties of Weld Metal

	All weld metal AWS As welded	
Properties	**Min**	**Max**
ReL (MPa)	430	
Rm (MPa)	540	650
A4-A5 (%)	22	
Charpy V at -20°C (J)	54	
Charpy V at -30°C (J)	47	
Charpy V at -40°C (J)	35	

Current range AC (min OCV 60) or DC +/- (DC-VE preferred)

Size (mm)	2.5	3.2	4.0	5.0
Current (amps)	70-110	110-150	150-200	190-260

Ferex 7016



AWS A/SFA 5.5-96 E7016-G-H8
EN 499 E 42 5 B 12 H5
EN ISO 2560-A E 42 5 B 12 H5

Description and applications
Ferex 7016 is an all-positional, thinly coated, basic electrode. It has been designed to give excellent Charpy toughness down to -40°C as well as good COD test values.

Approvals
ABS : 3H10, 3Y
BV : 3, 3YH
TÜV : 03861
CE EN 13479
DNV : 3 YH10
LR : 3, 3Y H15
DB : 10.040.01
MOD : MS >25mm,
(Navy) B & BX >12mm

All-weld metal properties
Chemical Composition

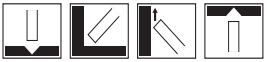
	All weld metal %	
	Min	**Max**
C	0.03	0.08
Si	0.25	0.50
Mn	1.40	1.80
S		0.02
P		0.02
Cr		0.10
Ni		0.10
Mo		0.10
V		0.08

Comments
Sulphur + Phosphorus < 0.035%

Mechanical	**As-welded**		
YS	420 min	N/mm^2	
UTS	530-640	N/mm^2	
Elongation	25 min	%	
Charpy V impact values	at -50°C	47 min ave	J

Current range	AC (min OCV 60) or DC +/- (DC preferred)			
Size (mm)	2.5	3.2	4.0	5.0
Current (amps)	60-90	70-140	110-180	160-250

Hi-Trex 8016G



AWS A/SFA 5.5-96 E8016-G
EN 499 E 50 6 Mn1Ni B 12 H5
EN ISO 2560-A E 50 6 Mn1Ni B 12 H5

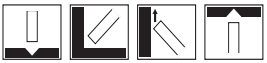
Description and applications
Hi-Trex 8016G is a basic, thinly coated electrode giving a weld metal deposit with less than 1% nickel content. The weld deposit combines a minimum tensile strength of 600 N/mm^2 with excellent low temperature toughness down to -50°C.

Approvals
LR : 5Y 40H15

All-weld metal properties			**Mechanical**	**As-welded**		
Chemical Composition						
	All weld metal %		YS	540 min	N/mm^2	
	Min	**Max**	UTS	600-720	N/mm^2	
C	0.04	0.08	Elongation	22 min	%	
Si	0.25	0.50				
Mn	1.40	1.80	Charpy V impact values	at -50°C	70 min ave	J
S		0.025		at -60°C	47 min ave	J
P		0.025				
Cr		0.10				
Ni	0.60	0.99				
Mo		0.20				
V		0.05				
Nb		0.05				
Cu		0.3				

Current range	AC (min OCV 55) or DC +/- (DC preferred)			
Size (mm)	2.5	3.2	4.0	5.0
Current (amps)	75-90	70-140	110-180	160-250

Fortrex NQ1



AWS A/SFA 5.5-81 E9016G

Description and applications
Fortrex NQ1 is a basic, thinly coated electrode designed to weld HY80 and equivalent grade steels in all positions except vertical down. This was the first electrode to gain MOD(N) NES 769 approval for the welding of Q1(N) steel. Also suitable for welding RQT 501 steel.

Approvals
MOD (Navy): Q1N
DEFSTAN 02-769 Q1(N)

All-weld metal properties			**Mechanical**	**As-welded**	
Chemical Composition					
	All weld metal %		YS	600 min	N/mm^2
	Min	**Max**	UTS	620 min	N/mm^2
C		0.07	Elongation	20 min	%
Si	0.20	0.60			
Mn	1.30	1.70	Charpy V impact values	at -50°C	50 min ave J
S		0.02			
P		0.02			
Cr		0.05			
Ni	0.60	1.30			
Mo	0.10	0.60			
V		0.01			
Cu		0.05			
Al		0.025			
Ti		0.04			

Current range	AC (min OCV 55) or DC +/- (DC Preferred)		
Size (mm)	3.2	4.0	5.0
Current (amps)	70-140	110-180	160-250

Nicrex E308L

SFA/AWS A5.4-92 E308L-17
EN 1600 E 19 9 LR 12

Description and applications
An acid-rutile coated electrode for the high quality welding of stainless steels of the 19% chromium, 9% nickel type. Emphasis on welder appeal has resulted in an electrode which strikes and re-strikes easily. A smooth, quiet arc offers excellent manipulation and a neat, finely rippled weld profile.

Approvals
CE EN 13479

All-weld metal properties

	Composition wt %	
	Min	**Max**
C		0.03
Si	0.50	1.00
Mn	0.50	1.20
S		0.02
P		0.025
Cr	18.5	20.5
Ni	9.0	11.0
Mo		0.05
Cu		0.05

AWS Mechanical	**As-welded**		
0.2% PS	320 min	N/mm^2	
UTS	520-700	N/mm^2	
Elongation	33 min	%	
Charpy V impact values	at +20°C	47 min ave	J
Ferrite level	FN 3-10		

Current range	AC (min OCV 50) or DC +	
Size (mm)	2.5	3.2
Current (amps)	50-90	70-130

Nicrex E316L

AWS A/SFA 5.4-92 E316L-17
EN 1600 E 19 12 3 LR 12

Description and applications
This is an extra low carbon, acid-rutile coated electrode for welding molybdenum bearing stainless steels of the 316 and 316L type. Nicrex E316L combines very high quality weld metal with good welder appeal. Features include first time striking and re-striking, and a smooth arc with very little spatter.

All-weld metal properties			**AWS**			
	Composition wt %		**Mechanical**	**As-welded**		
	Min	**Max**				
C		0.03	0.2% PS	320 min	N/mm^2	
Si		0.90	UTS	510	N/mm^2	
Mn	0.50	1.20	Elongation	33 min	%	
S		0.02				
P		0.025	Charpy V impact values	at +20°C	47 min ave	J
Cr	17.0	19.0	Ferrite level	FN 3-10		
Ni	11.0	13.0				
Mo	2.5	3.0				
Cu		0.20				

Current range	AC (min OCV 50) or DC +					
Size (mm)	1.6	2.0	2.5	3.2	4.0	5.0
Current (amps)	30-45	45-65	45-90	60-125	70-190	100-280

Nicrex E312

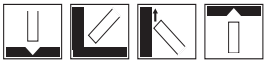
SFA/AWS A 5.4-92 E316L-17
EN 1600 E 19 12 3 LR 12

Description and applications
This is a highly alloyed stainless steel electrode of unusual versatility. It deposits a ferritic/austenitic duplex weld metal with about FN60 ferrite content. Typical applications include the welding of dissimilar steel combinations such as mild or low alloy steel to stainless steel, and the welding of spring steels, nickel steels, other hardenable steels.

All-weld metal properties			**AWS**		
	Composition wt %		**Mechanical**	**As-welded**	
	Min	**Max**			
C		0.15	0.2% PS	450 min	N/mm^2
Si	0.70	1.20	UTS	660 min	N/mm^2
Mn	0.50	1.20	Elongation	22 min	%
S		0.02			
P		0.030	Charpy V impact values	at +20°C	40 J Typical
Cr	28.0	30.0	Ferrite level	FN 50-80	
Ni	9.0	10.5	Hardness	220-240HV	
Mo		0.5	Interpass Temp.	< 150°C	
Cu		0.3			

Current range	AC (min OCV 55) or DC +		
Size (mm)	2.5	3.2	4.0
Current (amps)	50-85	55-120	75-170

Armoid 1



EN 1600 E 20 10 3R

Description and applications
Armoid 1 is a rutile-coated stainless steel electrode specially designed for welding hardenable high tensile strength steels, and for dissimilar steel welding. Armoid 1 was originally developed for welding armour plate.

Approvals
MOD: MVEE 1050: 1A, 1B

Alloy Type: Austenitic CrNiMoMn
Coatin Type: Rutile
Ferrite Content: 10-25

All-weld metal properties
Chemical Composition

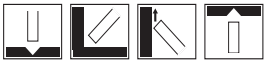
	All weld metal %	
	Min	**Max**
C		0.10
Si	0.30	1.00
Mn	0.80	1.50
S		0.030
P		0.020
Cr	19.0	21.0
Ni	9.0	11.0
Mo	2.5	3.5
Cu		0.50

Mechanical Properties of Weld Metal

	All Weld Metal ISO As Welded	
Properties	**Min**	**Typ**
Rm (MPa)	620	690
A5 (%)	20	28
Charpy V at -20°C (J)		45

Current range	AC (min OCV 65) or DC +		
Size (mm)	2.5	3.2	4.0
Current (amps)	60-80	80-110	90-160

Bostrand BW1



EN 440	G38 2 C G3Si1
EN 440	G42 3 M G3Si1
SFA/AWS A5.18	ER70S-6

Description and applications

A bare manganese-silicon alloyed wire for GMAW using Ar/20CO_2 mixtures or CO_2 as the gas shield. Bostrand BW1 is a general purpose mild steel non copper coated solid wire. It produces excellent quality welds with good radiographic and mechanical properties. The Bostrand BW1 is ideal for welding most mild and carbon- manganese steels.

Approvals

ABS : 3YSA (M21)	BV : SA3YM (M21)
CE EN 13479	LR : 3S, 3YS (M21)

Typical all-weld mechanical properties – as welded using Ar/20%CO_2

Yield Strength		470	MPa
Tensile Strength		560	MPa
Elongation		26	%
Charpy V impact value,	- 20°C	90	J
	- 30°C	70	J

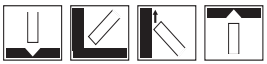
Chemical Composition (wire)

	Min	Max
C	0.06	0.14
Si	0.80	1.00
Mn		0.025
P		0.025
S		0.15

Welding Parameters

Size (mm)	0.8	1.0	1.2
Current (amps)	60-200	80-300	120-380

Bostrand LW1



Classification Weld Metal

EN ISO 14341-A G 38 2 C G3Si1
EN ISO 14341-A G 42 3 M G3Si1

Classification Wire Electrode

EN ISO 14341-A G3Si1
SFA/AWS A5.18 ER70S-6

Description and applications

Bostrand LW1 is the general purpose mild steel copper coated MAG (metal active gas) wire. De-oxidised with manganese and silicon, it produces quality welds with excellent radiographic and mechanical properties. Bostrand LW1 is ideal for welding most mild and carbon-manganese steels e.g. Lloyds grades A to EH (up to EH32).

Approvals

ABS : 3YSA (M21)	BV : SA3YM (M21)	CE EN 13479
LR : 3S, 3YS	DNV : 111 YMS	

Typical all-weld mechanical properties – as welded using Ar/20%CO_2

Yield Stress		480	MPa
Tensile Strength		560	MPa
Elongation		26	%
Charpy V impact value, Typical	- 20°C	90	J
	- 30°C	70	J

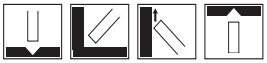
Chemical Composition (wire)

	Min	Max
C	0.06	0.14
Si	0.80	1.00
Mn	1.40	1.60
S		0.025
P		0.025
Cu		0.35

Welding Parameters

Size (mm)	0.6	0.8	1.0	1.2	1.6
Current (amps)	30-100	60-200	80-300	120-380	225-550

Bostrand LW3



Classification Weld Metal

EN ISO 14341-A G 42 2 C G4Si1
EN ISO 14341-A G 46 3 M G4Si1

Classification Wire Electrode

EN ISO 14341-A G4Si1
SFA/AWS A5.18 ER70S-6

Description and applications

Bostrand LW3 is a general purpose mild steel copper coated MAG wire. De-oxidised with manganese and silicon, it produces quality welds with excellent radiographic and mechanical properties. Bostrand LW3 is ideal for welding most mild and carbon-manganese where an increased strength over LW1 is required.

Chemical Composition

	All Weld Metal (%) EN 80Ar/20CO_2 (M21)	CO_2 (C1)	**Wire/Strip (%)**	
	Nom	**Nom**	**Min**	**Max**
C	0.10	0.09	0.06	0.14
Si	0.80	0.70	0.80	1.15
Mn	1.28	1.08	1.60	1.85
P	0.013	0.013		0.025
S	0.013	0.013		0.025

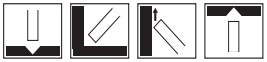
Mechanical Properties of Weld Metal

	AWS CO2 (C1)	EN 80Ar/ 20CO2 (M21)			EN 80/Ar/ 20CO2 (M21)	EN 80/Ar/ 20CO2 (M21)	EN 80/Ar/ 20CO2 (M21)	EN 80/Ar/ 20CO2 (M21)	EN CO2 (M21)		
	As welded	As welded 920°C 0.5h			Normalized 920°C 0.5h	Normalized 620°C 15h	Strell relieved 620°C 15h	Strell relieved	As welded		
Properties	Min	Min	Max	Typ	Typ	Typ	Typ	Typ	Min	Max	Typ
Rp0.2 (MPa)	400	-	-	-	-	-	-	-	-	-	-
ReL (MPa)	-	460	525	320	320	385	385	385	420	-	475
ReH (MPa)	-	-	-	535	330	330	395	395	485	-	-
Rm (MPa)	480	530	680	595	465	465	520	520	500	640	570
A4-A5 (%)	22	20	-	26	32	32	28	28	20	-	25
Z (%)	-	-	-	68	71	71	73	73	-	-	70
Charpy V at -20°C (J)	-	-	-	130	100	100	120	120	-	-	110
Charpy V at -20°C (J)	-	90	-	-	75	75	90	90	47	-	70
Charpy V at -29°C (J)	27	-	-	-	-	-	-	-	-	-	-
Charpy V at -30°C (J)	-	47	-	70	-	-	-	-	-	-	-

Welding Parameters

Size (mm)	0.8	1.0	1.2
Current (amps)	60-200	80-300	120-380

Bostrand 308LSi



AWS A/SFA 5.9-93 ER308LSi
EN 12072 G 19 9 LSi

Description and applications

Bostrand 308LSi is a corrosion-resisting chromium-nickel stainless steel solid wire for welding austenitic chromium-nickel alloys of the 18%Cr/8%Ni type with low carbon content. The wire has a low carbon content which gives good resistance to intergranular corrosion of the weld. The silicon content is elevated in order to improve weldability. Bostrand 308LSi is also suitable for joining niobium-stabilised steels of the 18Cr/8Ni type if the service temperature will not exceed 400°C. It can also be used for welding ferritic stainless steels except in sulphur-rich environments.

The wire is suitable for joining grades such as AISI 304 and 304L and Werkstoff Nrs 1.4550 (X6 CrNiNb 18 10) and 1.6905 (X10 CrNiNb 18 10).

Typical all-weld mechanical properties – as welded using Ar/He or Ar/20%CO_2

Yield Stress		205 min	MPa
Tensile Strength		500-750	MPa
Elongation		40 min	%
Charpy V impact values	at +20%	110	J
	at -60°C	90	J
	at -196°C	60	J

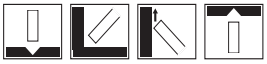
Chemical Composition (wire)

	Min	Max
C		0.025
Si	0.65	1.00
Mn	1.5	20.0
P		0.030
S		0.025
Cr	19.5	21.0
Ni	9.5	11.0
Mo		0.50

Welding Parameters

Size (mm)	0.8	1.0	1.2
Current (amps)	50-140	80-190	180-280

Bostrand 309LSi



AWS A/SFA 5.9-93 ER309LSi
EN 12072 G 23 12 LSi

Description and applications
Bostrand 309LSi is a corrosion-resisting 24% chromium -13% nickel stainless steel solid wire for welding austenitic chromium-nickel alloys of the 23Cr/12Ni type, and for joining dissimilar steels e.g. stainless steel to mild steel. The silicon content of the wire is elevated in order to improve weldability.

Bostrand 309LSi is also suitable for use as a buttering layer when cladding ferritic steels with stainless steels. It may also be used for joining high carbon equivalent ferritic steels to themselves with reduced preheat requirements.

The gas shield should be an Ar/He mixture, or Ar/1%O2 or Ar/2%O2. CO_2 may also be used if a weld metal carbon level above 0.03% is acceptable.

Typical all-weld mechanical properties – as welded using Ar/He or Ar/20%CO_2

Yield Stress		440 min	MPa
Tensile Strength		600	MPa
Elongation		41 min	%
Charpy V impact values	at +20%	160	J
	at -60°C	130	J
	at -110°C	90	J

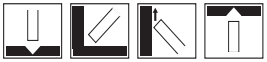
Chemical Composition (wire)

	Min	Max
C		0.025
Si	0.65	1.00
Mn	1.0	2.0
P		0.030
S		0.025
Cr	23.0	25.0
Ni	12.0	14.0
Mo		0.50

Welding Parameters

Size (mm)	0.8	1.0	1.2
Current (amps)	50-140	80-190	180-280

Bostrand 316LSi



AWS A/SFA 5.9-93 ER316LSi
EN 12072 G 19 12 3 LSi

Description and applications
Bostrand 316LSi is a corrosion-resisting chromium-nickel-molybdenum stainless steel solid wire for welding austenitic stainless steel alloys of the 18%Cr/8%Ni and 18%Cr/8%Ni/3%Mo types with low carbon content. The wire has a low carbon content which gives good resistance to intergranular corrosion of the weld. The silicon content is elevated in order to improve weldability. Bostrand 316LSi is also suitable for joining niobium-stabilised steels of the same type if the service temperature will not exceed 400°C. It can also be used for welding ferritic stainless steels except in sulphur-rich environments, and for lower alloyed stainless steels except when attacked by nitric acid.

The wire is suitable for joining grades such as AISI 316, 316L and 318, and Werkstoff Nr 1.4583 (X10 CrNiMoNb 18 12).

Typical all-weld mechanical properties – as welded using Ar/He or Ar/20%CO_2

Yield Stress		205 min	MPa
Tensile Strength		500-750	MPa
Elongation		40 min	%
Charpy V impact values	at +20%	120	J
	at -60°C	95	J
	at -196°C	55	J

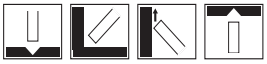
Chemical Composition (wire)

	Min	Max
C		0.025
Si	0.65	1.00
Mn	1.5	2.0
P		0.030
S		0.025
Cr	18.0	20.0
Ni	11.0	13.0
Mo	2.5	3.0

Welding Parameters

Size (mm)	0.8	1.0	1.2
Current (amps)	50-140	80-190	180-280

Bostrand 281



AWS A/SFA 5.10-92 ER4043

Description and applications

Bostrand 281 is an aluminium/5% silicon solid MIG wire which is used to weld aluminium alloys of the AlMgSi type, and AlSi types with up to 7% Si. Bostrand 281 may also be used to join wrought to cast materials eg BS 1490 LM2 and LM6. The resistance of the weld metal to hot cracking is high.

Typical all-weld mechanical properties – as welded using Argon or Argon Helium

Yield Stress	50 min	MPa
Tensile Strength	150 min	MPa
Elongation	15 min	%

Chemical Composition (wire)

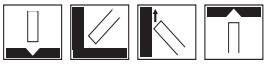
	Min	Max
Si	4.5	5.5
Mn		0.05
Cr		0.05
Ti		0.15
Al	Balance	

Welding Parameters

Size (mm)	1.2	1.6
Current (amps)	130-220	170-320

Group equivalent for 0.8mm and 1.0mm – OK Autrod 4043.

Bostrand 286



BS 2901: Part 4 1990 5356
AWS A/SFA 5.10-92 ER5356
DIN 1732 (1988) SG-AlMg5

Description and applications

Bostrand 286 is an aluminium/5% magnesium solid MIG wire for welding similar parent materials as shown in the above table. It may also be used to weld cast materials such as BS 1490 LM5.

Typical all-weld mechanical properties – as welded using Argon or Argon Helium

Yield Stress	110 min	MPa
Tensile Strength	235 min	MPa
Elongation	17 min	%

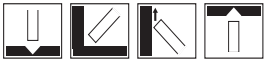
Chemical Composition (wire)

	Min	Max
Si		0.25
Mn	0.10	0.20
Cr	0.05	0.20
Mg	4.5	5.5
Fe		0.40
Ti	0.06	0.15
Al	Balance	

Welding Parameters

Size (mm)	0.8	1.0	1.2	1.6
Current (amps)	80-120	90-180	130-200	170-300

Bostrand 2861



AWS A/SFA 5.10-92 ER5556

Description and applications

Bostrand 2861 is an aluminium 5.3% magnesium solid MIG wire for welding parent materials of similar composition (as shown in the above table). The corrosion resistance of the weld metal in a marine environment is high. Preheating is not required for welds in sections up to 20mm thick, but the risk of porosity can be reduced by preheating sections over 10mm thick. Recommended preheat temperature is usually 150-200°C. Appropriate for welding AlMg4.5Mn, AlMg3, AlMg2Mn0.8, AlMg2.7Mn parent materials.

Typical all-weld mechanical properties – as welded using Argon or Argon Helium

Yield Stress	125 min	MPa
Tensile Strength	275 min	MPa
Elongation	17 min	%

Chemical Composition (wire)

	Min	Max
Si		0.25
Mn	0.60	1.0
Mg	5.0	5.5
Cr	0.05	0.20
Fe		0.40
Ti	0.05	0.20
Al	Balance	

Welding Parameters

Size (mm)	1.2
Current (amps)	130-200

Saffire Copper Coated Mild Steel (CCMS)

BS 1453: 1972 (1987) A1

Description and applications
Saffire Copper Coated Mild Steel is a general purpose low carbon steel rod for high grade oxy-acetylene welding of mild steel and wrought iron. It is widely used in the automobile, heating and ventilation, and chemical plant industries. No flux is required. The rods melt at 1490°C. The rod ends are not stamped or colour coded.

Chemical Composition (wire)

	Min	Max
C		0.10
Si		0.07
Mn		0.60
S		0.040
P		0.040
Ni		0.25
Cu		0.45 (includes Coating)

Saffire Silicon Bronze

BS 1453: 1972 (1987) C2

Description and applications
Saffire Silicon Bronze is a deoxidised 60/40 copper/zinc alloy, suitable for general purpose bronze-welding and brazing of sheet, tube and extruded sections. The rod may also be used for TIG welding of brass using an AC supply. Saffire Silicon Bronze has a melting point of 875°C.

Composition
Wire Analysis Wt %

	Min	Max
Si		0.07
Cu	58.5	61.5
Al		0.03
Pb		0.03
Sn		0.50
Zn	Balance	

Saffire Fluxobronze K

BS 1453: 1972 (1987) C2
Flux colour: white in a knurled yellow rod

Description and applications
Saffire Fluxobronze K is a ready-fluxed silicon bronze rod with similar composition to that of Saffire Fluxobronze S, but with less flux. The filler is 'impregnated' with flux via the knurls of the core rod. It is suitable for welding brass and general purpose brazing of copper and steel. Saffire Fluxobronze K is a fast flowing rod, with a melting point of 875°C.

Composition
Wire Analysis Wt %

	Min	Max
Si	0.20	0.40
Cu	58.5	61.5
Al		0.01
Pb		0.02
Sn	0.20	0.50
Zn	Balance	

Saffire Fluxobronze S

BS 1453: 1972 (1987) C2
Flux colour : white

Description and applications
Saffire Fluxobronze S is a fully flux-coated silicon bronze brazing rod, recommended for bronze-welding copper sheet and tubes, deep-drawn steels and brass. It is used in the automobile industry to braze high pressure steel joints, and to braze carbide tips to drill bits. The rod is tolerant to varying flame conditions, and may be used without additional flux. The melting point of the rod is 875°C.

Composition
Wire Analysis Wt %

	Min	Max
Si	0.20	0.40
Cu	58.5	61.5
Al		0.01
Pb		0.02
Sn	0.20	0.50
Zn	Balance	

Saffire Nickel Bronze

BS 1453: 1972 (1987) C5

Description and applications
Saffire Nickel Bronze is a 10% nickel alloy rod which is particularly suitable for bronze welding or brazing steel and malleable iron. The deposit work hardens and is suitable for building up worn gear teeth, valve seats and bearings. Saffire Nickel Bronze should be used in conjunction with Saffire Unibronze flux. The melting point of the rod is 910°C. The ends of rods are colour coded green.

Composition
Wire Analysis Wt %

	Min	Max
Si	0.15	0.50
Mn		0.50
Ni	8.0	11.0
Cu	46.0	50.0
Al		0.03
Fe		0.50
Pb		0.03
Sn		0.50
Zn	Balance	

Saffire Copper Phosphorus 93/7

To be used in conjunction with Saffire Copper Silver flux.

Description and applications
Copper Phosphorus is a low melting point copper alloy rod which is used as an alternative to low silver content brazing alloys. When used for welding or brazing copper to copper, no flux is required. The deposit has good electrical conductivity and is corrosion resistant, but is not recommended for direct application to steel, cast iron or nickel. Melting point 705°C. Crimson rod ends.

Composition
Wire Analysis Wt %

	Min	Max
P	7.0	7.8
Al		0.01
Pb		0.02
Zn		0.05
Cd		0.025
Cu	Balance	

Saffire Silver Braze 2

Description and applications
Saffire Silver Braze 2 is an inexpensive silver bearing copper-phosphorus alloy for brazing joints on copper, brass and bronze where a thin-flowing low temperature ductile alloy is required. It is widely used in maintenance and production line applications, and is recommended for intricate assemblies and capillary work as experienced in the electrical industry. It should not be used on nickel or ferrous metals, or for applications exposed to sulphurous gases or oxidising conditions where temperatures exceed 200°C. It should be used with Saffire Copper Silver flux. The melting point of the rod is 740°C. The rod ends are colour coded yellow.

Composition
Wire Analysis Wt %

	Min	Max
P	6.1	6.9
Al		0.01
Pb		0.02
Zn		0.05
Ag	1.8	2.2
Cd		0.025
Cu	Balance	

Saffire Super Steel

Classification Weld Metal
EN 1668 W 46 4 W 2 Ti

Classification Wire Electrode
EN 1668 W 2 Ti
AWS A/SFA 5.18 ER70S-2

Description and applications
Saffire Super Steel is a triple-deoxidised copper-coated mild steel filler rod particularly suited to TIG welding (with argon shielding gas) root runs in pipes. The rods may also be used without flux for oxy-acetylene welding. Typical all-weld metal ultimate tensile strength is 630 N/mmÇ.

Composition
Wire Analysis Wt %

	Min	Max
C	0.04	0.07
Si	0.40	0.70
Mn	0.90	1.40
P		0.025
S		0.025
Cr		0.15
Ni		0.15
Mo		0.15
V		0.03
Cu		0.35
Al	0.05	0.15
Ti	0.05	0.15
Zr	0.02	0.12
Ti+Zr	0.07	0.25

Mechanical Properties of weld Metal

	All Weld Metal			
	Ar (I1)			Ar (I1)
	EN			AWS
	As welded			As welded
Properties	**Min**	**Max**	**Typ**	**Min**
Rp 0.2 (MPa)	460		570	400
Rm (MPa)	530	680	625	480
A4 (%)				22
A5 (%)	20		26	
Charpy V At -29°C (J)				27
Charpy V At -40°C (J)	47		180	

Saffire Low Carbon Steel

EN 1668 W 42 3 WO (Tigrod)

Description and applications
Saffire Low Carbon Steel is a copper-coated low carbon double-deoxidised filler wire for TIG (with argon shielding gas) or oxy-acetylene (without flux) welding mild steels.

Composition
Wire Analysis Wt %

	Min	Max
C	0.07	0.12
Si	0.15	0.40
Mn	0.85	1.20
P		0.025
S		0.025
Cr		0.15
Ni		0.15
Cu		0.45

Mechanical Properties of weld Metal

	All Weld Metal	
	Ar (I1)	
	EN	
	As welded	
Properties	**Min**	**Max**
ReL (MPa)	420	
Rm (MPa)	500	640
A4-A5 (%)	20	
Charpy V At -30°C (J)	47	

Saffire 18/8-308L

BS 2901: Part 2 1990	308S92	
AWS A/SFA 5.9-93	ER308L	
DIN 8556 (1986)	SGX2 CrNi 19 9	Werkstoff Nr.1.4316

Description and applications
Saffire 18/8-308L is a low carbon austenitic stainless steel filler rod for welding steels of similar composition (18% chromium, 8% nickel) e.g. AISI 304L, Werkstoff Nrs 1.4550 (X6 CrNiNb 18 10) and 1.6905 (X10 CrNiNb 18 10). The recommended shielding gas is argon or argon/5% hydrogen.

Composition
Wire Analysis Wt %

	Min	Max
C		0.025
Si	0.30	0.65
Mn	0.90	1.40
P		0.030
S		0.025
Cr	19.5	21.0
Ni	9.0	11.0
Mo		0.50
Cu		0.50
P+S		0.050

Saffire 23/12-309

BS 2901: Part 2 1990 309S94
AWS A/SFA 5.9-81 ER309

Description and applications
Saffire 23/12-309 is a nominal 23% chromium, 12% nickel austenitic stainless steel filler rod suitable for TIG welding steels of similar composition. The rod is also ideal for joining dissimilar steel combinations such as mild or low alloy steel to stainless or manganese steel. It may also be used for 'difficult to weld' steels where cold cracking is a danger. Shielding gas is argon or argon/5% hydrogen. Do not use Ar/5%H2 on steels susceptible to cold cracking.

Composition
Wire Analysis Wt %

	Min	Max
C		0.12
Si	0.30	0.60
Mn	1.0	2.50
P		0.030
S		0.030
Cr	23.0	25.0
Ni	12.0	14.0
Mo		0.50
Cu		0.50

Saffire 18/8-308L

BS 2901: Part 2 1990	316S92	
AWS A/SFA 5.9-93	ER316L	
DIN 8556 (1986)	SGX2 CrNiMo 19 12	Werkstoff Nr. 1.4430

Description and applications
Saffire 18/8/3Mo-316L is a low carbon austenitic stainless steel filler rod for welding steels of similar composition (19% chromium, 12% nickel, 3% molybdenum) e.g. AISI 316L, Werkstoff Nr 1.4583 (X10 CrNiMoNb 18 12). The recommended shielding gas is argon or argon/5% hydrogen.

Approvals
VdTÜV : 09738

Composition
Wire Analysis Wt %
Wire/Strip (%)

	Min	Max
C		0.03
Si	0.30	0.65
Mn	1.30	2.0
P		0.030
S		0.020
Cr	18.0	20.0
Ni	11.0	13.0
Mo	2.50	3.0
Cu		0.30
N		0.08
Others Total		0.50

Saffire Aluminium 5% Silicon

BS 2901: Part 4 1990	4043A (TIG rods)
BS 1453: 1972 (1987)	4043A (Gas rods)
AWS A/SFA 5.10-88	ER4043
DIN 1732 (1988)	SG-AlSi5

Description and applications
Saffire Aluminium 5% Silicon is suitable for welding a wide range of aluminium alloys except for those with magnesium as a main addition. The recommended shielding gas for TIG welding is argon, and the recommended flux for oxy-acetylene welding is Saffire Aluminium Welding flux.

Composition
Wire Analysis Wt %

	Min	**Max**
Si	4.5	5.5
Mn		0.05
Cr		0.05
Cu		0.05
Ti		0.15
Zn		0.10
Mg		0.05
Fe		0.40
Be		0.0008
Others Total		0.15
Al		Balance

Saffire Aluminium 5% Magnesium

BS 2901: Part 4 1990	5356 (TIG rods)
BS 1453: 1972 (1987)	5356 (Gas rods)
AWS A/SFA 5.10-88	ER5356
DIN 1732 (1988)	SG-AlMg5

Description and applications
Saffire Aluminium 5% Magnesium is suitable for welding wrought and cast aluminium alloys containing up to 5% magnesium. The recommended shielding gas for TIG welding is argon, and the recommended flux for oxy-acetylene welding is Saffire Aluminium Welding flux.

Composition
Wire Analysis Wt %

	Min	Max
Si		0.25
Mn	0.10	0.20
Cr	0.05	0.20
Cu		0.05
Ti	0.06	0.15
Zn		0.10
Mg	4.5	5.5
Fe		0.40
Be		0.0008
Others Total		0.15
Al		Balance

Saffire Argofil

BS 2901: Part 3 1990 C7
AWS A/SFA 5.7-77 ER Cu

Description and applications
Saffire Argofil is a high quality 98.5% copper filler rod for TIG welding copper, using argon as the shielding gas.

Composition
Wire Analysis Wt %

	Min	Max
Si	0.10	0.50
Mn	0.10	0.50
P		0.015
Ni		0.10
Cu	98.0	
Sn		1.0
Pb		0.01
Al		0.01
Fe		0.03
As		0.05
Sb		0.005
Bi		0.003

Aluminium Flux

Description and applications
Aluminium flux is a general purpose white flux powder with a melting point of approx. 570°C. It is intended for welding aluminium alloys with Aluminium 5% Silicon or Aluminium 10% Silicon rods. The flux may be used with Saffire Aluminium 5% rods to weld aluminium magnesium alloys. The flux may be mixed with water to form a paste.

Copper Silver Flux

Description and applications
Copper Silver flux is a white powder with a melting point of approx. 850°C. It is suitable for use with Copper Silver rods for the welding and brazing of copper alloys. The flux may be mixed with water to form a paste.

Sifbronze Flux

Description and applications
Sifbronze flux is a general purpose light blue flux powder with a melting point of approx 875°C. It is recommended for use when bronzewelding copper and when welding copper alloys (including brass) using Saffire Silicon Bronze rods. It may be used with Saffire Nickel Bronze rods to bronzeweld stainless steel.

Cast Iron Flux

Description and applications
Cast Iron flux is a white powder with a melting point of 850°C. It is recommended for use when welding cast iron with Silicon Cast Iron rods. The flux may be mixed with water in order to form a paste.

Coromig 58

Classifications Weld Metal

SFA/AWS A5.18	E70C-6C
SFA/AWS A5.18	E70C-6M
EN ISO 17632-A	T 42 2 M C 1 H10
EN ISO 17632-A	T 42 2 M M 1 H10

Description and applications

Coromig 58 is a metal-cored wire which has been developed for use with both CO_2 and Ar/CO_2 shielding gases. The wire is suitable for general mild steel welding applications for parent material thicknesses over 5mm.

With CO_2 shielding gas, the wire is particularly recommended for single run fillets using spray transfer in the flat, horizontal-vertical and vertical-down positions. Ar/CO_2 mixed gas is preferred for multi-run fillets and butts in the flat and horizontal-vertical positions, and for overhead. Dip transfer conditions must be used for vertical-up welding. Low slag levels and minimal spatter make Coromig 58 ideal for robotic welding.

Approvals

CE EN 13479

Typical all-weld mechanical properties under shielding gas of 80 Ar/20 CO_2

Composition Wt %

	Min	Max
C	0.04	0.11
Si	0.35	0.85
Mn	1.05	1.65
S		0.025
P		0.025
Hydrogen		< 10ml/100g

Mechanical	**As welded**
YS	420 min N/mm²
UTS	510-640 N/mm²
Elongation	22 min %
CVN at -20°C	54 min ave J

Current range	DC + or - with 15-20 l/min Ar/20%CO_2	DC - with 15-20 l/min CO_2
Size (mm)	1.2	1.6
Current (amps)	100-320	140-450

Corofil R56XL

Classifications Weld Metal

SFA/AWS A5.20	E71T-1C
SFA/AWS A5.20	E71T-1M
EN ISO 17632-A	T 46 2 P C 2 H5
EN ISO 17632-A	T 46 2 P M 2 H5

Description and applications

Corofil R56XL is an all-positional rutile flux-cored wire which gives spray transfer characteristics in the vertical and overhead positions. The wire may also be used for horizontal/vertical fillet welds and for downhand butt work. It is ideal for the general purpose welding of mild and carbon-manganese steels in all positions.

Approvals

ABS : 3YSA H10 (M21) DNV : IIIYMS (M21) LR 3YS (M21)
BV : SA3YM (M21)
CE EN 13479

Typical all-weld mechanical properties under shielding gas of 80 Ar/20 CO_2

Composition Wt %

	Min	Max
C	0.02	0.08
Si	0.30	0.80
Mn	1.19	1.50
S		0.025
P		0.025

Mechanical	As welded	
YS	460 min	N/mm^2
UTS	530-660	N/mm^2
Elongation	22 min	%
CVN at -20°C	54 min ave	J

Current range	DC + with shielding gas 15-20 l/min Ar/20%CO_2 or CO_2
Size (mm)	1.2
Current (amps)	110-300

Corofil R59Ni

Classifications Weld Metal

SFA/AWS A5.29	E81T1-Ni1M
EN ISO 17632-A	T 46 3 1Ni P C 2 H5
EN ISO 17632-A	T 46 4 1Ni P M 2 H5

Description and applications

Corofil R59Ni is a rutile flux-cored wire designed to give spray transfer, all-positional welding for both single and multi-run welds. The nominal 1% nickel weld metal has excellent toughness down to -40°C.

Approvals

ABS : 3YSA (M21) DNV : IV YMS H10 (M21) MOD : MS>25mm
BV : SA3YM (M21) MOD : MS>25mm (Navy): B&BX>12mm
CE : EN 13479

Typical all-weld mechanical properties under shielding gas of 80 Ar/20 CO_2

Chemical Composition
All Weld Metal %
M21 Shielding gas

	Min	Max
C	0.04	0.08
Si	0.20	0.50
Mn	0.90	1.40
P		0.020
S		0.020
Cr		0.10
Ni	0.80	1.10
Mo		0.05
V		0.05
Nb		0.03
Cu		0.10
Al		0.05
Sn		0.02
Ti	0.02	0.06
Pb		0.010
As		0.010
Sb		0.010
B	0.003	0.007
N		0.008
O	0.30	0.10

Mechanical Properties of Weld Metal
All Weld Metal (%)
M21 shielding gas
As Welded

Properties	Min	Max	Typ
ReL (MPa)	470		560
Rm (MPa)	560	650	600
A5 (%)	22		25
Charpy V At -20°C (J)	54		130
Charpy V At -30°C (J)			120
Charpy V At -40°C (J)	75		110

Current range DC + with shielding gas 15-20 l/min Ar/20%CO_2

Size (mm)	1.2	1.6
Current (amps)	110-300	150-360

Corofil B55

Classifications Weld Metal

SFA/AWS A5.20	E71T1-5C H4
SFA/AWS A5.20	E71T1-5M H4
EN ISO 17632-A	T 42 3 B C 2 H5
EN ISO 17632-A	T 42 3 B M 2 H5

Description and applications

Corofil B55 is an easy to use basic flux-cored wire which deposits weld metal with a very low hydrogen content and with high resistance to cracking. Iron powder within the flux core results in high deposition rates and deposition efficiency of up to 90%. The slag is thin and easily removed. The 1.2mm diameter wire can be used in all positions. Corofil B55 is suitable for applications where good low temperature impact properties are required down to -30°C.

Approvals

CE EN13479	DB : 42.040.01 (M21 and C1)
LR : 3YS (M21)	VdTÜV : 04442

Typical all-weld mechanical properties under shielding gas of 80 Ar/20 CO_2

Composition Wt %

	Min	Max
C	0.03	0.10
Si	0.40	0.90
Mn	1.15	1.65
S		0.025
P		0.025

Mechanical	**As welded**	
YS	420 min	N/mm^2
UTS	530-640	N/mm^2
Elongation	22 min	%
CVN at -20°C	47 min ave	J
CVN at -30°C	47 min ave	J

Hydrogen < 10ml/100g

1.6mm diameter wire M21, 350 amps, 31 Volts DCEN

Current range	DC - with shielding gas of 15-20 l/min Ar/20%CO_2 or CO_2	
Size (mm)	1.2	1.6
Current (amps)	120-300	140-400

Corofil 20/9/3

SFA/AWS A5.22.95 E308L Mo T0-4

Description and applications
Corofil 20/9/3 is a rutile stainless flux-cored wire designed for welding hardenable steels and dissimilar steel combinations. The 1.2mm diameter wire is intended for positional welding applications, and the 1.6mm diameter for higher deposition rate downhand welding. The wire is intended for applications such as welding armour plate. It is also recommended for joining hardenable low alloy, high tensile strength steels, spring steels and other 'difficult to weld' steels. The use of Corofil 20/9/3 may allow a reduction in the preheat needed to weld certain hardenable steels.

Approvals
(May Vary with gas)
MOD: DEF STAN 34-7 : 2Ab, 2B

Typical all-weld mechanical properties under shielding gas of 80 Ar/20 CO_2

Composition Wt %

	Min	Max
C		0.04
Si		1.0
Mn	0.50	2.50
S		0.03
P		0.04
Cr	18.0	21.0
Ni	9.0	12.0
Mo	2.0	3.0
Cu		0.50

Mechanical Properties of Weld Metal

	All Weld Metal (%) M21 shielding gas As Welded	
Properties	**Min**	**Typ**
Rm (MPa)	520	
A4-A5 (%)	35	40

Current range DC + with shielding gas of 15-25 l/min Ar/20%CO_2 or CO_2

Size (mm)	1.2	1.6
Current (amps)	150-300	200-350

Your Local Distributor

Contact Details

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