OERLIKON

Welding Consumables

Product Data





3rd edition

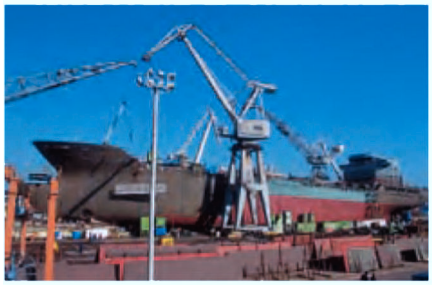
www.oerlikon-welding.com

AIR LIQUIDE WELDING

OERLIKON

Welding Consumables

About OERLIKON



A Leader in Global Welding

OERLIKON is part of the Air Liquide Welding Group, an Air Liquide company. With a sales turnover in excess of €600 million and a workforce of more than 3000 employees, Air Liquide Welding is one of the global market leaders in welding technology.

Our Mission

The design, manufacture and sale of products, processes, system solutions and related services, adapted to the needs of industrial companies for the welding and cutting of materials.

Our Vision

Performance and innovation to offer customers the best with regards to products, solutions and services and to be the European reference for welding.

Welding and Cutting Competence

Experience is the necessary precondition for our competence. For decades OERLIKON has played a crucial role in the development of welding and cutting technology.
Wherever arc welding processes are being used, you will find OERLIKON products and know-how.

Serving the most diverse industries

A comprehensive range of high-quality products for welding and cutting, combined with a flexible range of services, forward-looking research and development and the reliability only a competent partner can ensure.

General Advice

MMA Electrodes

Solid Wires

Each product data sheet contains a comprehensive description of the welding consumable.
Each data sheet is sub divided as follows:

Standard Designation
The order of classifications is as follows:
- EN ISO, relating to published International-Standards
- EN relating to current standards for information during the interim period
- AWS/ASME
- DIN

Applications and Properties
Description of the most important applications and characteristic properties of the welding consumable.

Materials
The most important base metals according to EN are listed in tables to allow comparison. It is not possible to list all base metals according to EN. For further information consult a "Key to Steels".

Qualification Tests, Approvals
Each product data sheet gives details of the Technical Inspection and Classification Society Approvals, for the welding consumable. The most important data referring to the approvals issued at the time of printing are compiled in the table in the appendix. It should be noted, however, that the extent of the approval may vary due to technical progress (e.g. extended approval tests). Therefore, we recommend an enquiry to ascertain the most recent approval details for the welding consumable selected.

Weld Metal Analysis
The chemical composition of the weld metal is indicated by typical values. These values refer to the all-weld metal and were determined from results generated during our continuous routine quality control procedures. For making the analysis, a weld pad according to EN ISO 6847 or an all-weld metal test piece according to EN 1597-1 is used.

Mechanical Properties
The mechanical properties are given as typical values and refer to the all-weld metal, with the exception of aluminium and its alloys, the values of which refer to welded joints. Data referring to preheat and interpass temperature, as well as heat treatment, are available in the relevant standard for welding consumables. It should be noted, that the mechanical properties of welded joints depend upon the base metal, dimensions of the component, welding position and weld parameters, so the properties of a welded joint can deviate from those of the all-weld metal.

Terms and Conditions of Delivery
The terms and conditions of delivery are indicated in our latest price list.

Storage Recommendations for OERLIKON Welding Consumables

Welding consumables should be stored in dry conditions and at a constant temperature, in order to minimise any effects of atmospheric moisture. The characteristics of MMA electrodes, SAW fluxes and folded flux-cored wires, in particular, are detrimentally affected by moisture pick up.

A warehouse suitable for the storage of Oerlikon welding consumables should have the following characteristics :

- Fully weatherproof and well ventilated with heating available to ensure the storage temperature is maintained at higher than the dew point and above freezing.
- Ceiling, floor and walls are dry.
- No open water surfaces.

The packaging of the welding-consumables must not be stored in direct contact with the floor or walls and storage should be on pallets or shelves.

There are no additional recommendations for the storage conditions for special packaging systems, such as tins, drums or vacuum packaging.

Welding consumables should be stored in their original packaging until use.
Stored products should be selected using a first-in-first-out (FIFO) system.

Standard choices for welding consumables DIN EN/DIN EN ISO

Symbols	E	G	T	W	S	O
Product	Covered electrode	Solid wire electrode	Flux cored	Rod, Wire	Wire, Wire/Flux	Rod
Process Nr. DIN EN ISO 4063:2000	E-Hand 111	MIG/MAG 131/135	MAG 135	WIG 141	UP 121, 123, 125 (ED), (MD), (FD)	311, 312, 313
For welding of unalloyed and fine grain structural steels (Minimum yield strength up to 500 MPa)						
Norm	DIN EN ISO 2560:2005	DIN EN ISO 14341	DIN EN ISO 17632:2008	DIN EN ISO 636:2008	DIN EN 756:2004/ pr EN ISO 14171	DIN EN 12536:2000
For welding of high-strength steels						
Norm	DIN EN 757:1997	DIN EN ISO 16834:2007	DIN EN ISO 18276:2006	DIN EN ISO 16834:2007	DIN EN 14295:2003/ pr EN ISO 26304	
For welding of creep resistant steels						
Norm	DIN EN ISO 3580:2008	DIN EN ISO 21952:2007	DIN EN ISO 17634:2006	DIN EN ISO 21952:2007	DIN EN ISO 24598:2007	DIN EN 12536:2000
For welding of austenitic stainless and heat resisting steels						
Norm	DIN EN 1600:1997	DIN EN ISO 14343:2007	DIN EN ISO 17633:2006	DIN EN ISO 14343:2007	DIN EN ISO 14343:2007	
For welding of aluminium and aluminium alloys						
Norm		DIN EN ISO 18273:2004		DIN EN ISO 18273:2004		
For welding of nickel and nickel-base alloys						
Norm	DIN EN ISO 14172:2004	DIN EN ISO 18274:2004		DIN EN ISO 18274:2004	DIN EN ISO 18274:2004	
Welding consumables for hardsurfacing Welding consumables for fusion welding of cast iron Shielding gases for arc welding and related processes Fluxes for submerged arc welding			DIN EN 14700:2005 EN ISO 1071:2003 DIN EN ISO 14175:2008 DIN EN 760:1996 / pr EN ISO 14174:2007			

Standard choices for welding consumables ASME II Part C 2007

Symbols	E	G	T	W	S	O
Product	Covered electrode	Solid wire electrode	Flux cored	Rod, Wire	Wire, Wire/Flux	Rod
Process Nr. DIN EN ISO 4063:2000	E-Hand 111	MIG/MAG 131/135	MAG 135	WIG 141	UP 121, 122, 123, 125 (Band), (MD), (FD)	311, 312, 313
For carbon steel						
specification	SFA-5.1 / SFA-5.1M	SFA-5.18 / SFA-5.18M	SFA-5.20 / SFA-5.20M (1) SFA-5.18 / SFA-5.18M(2)	SFA-5.18 / SFA-5.18M	SFA-5.17 / SFA-5.17M	SFA-5.2 / SFA-5.2M
For low-alloy steel						
specification	SFA-5.5 / SFA-5.5M	SFA-5.28 / SFA-5.28M	SFA-5.29 / SFA-5.29M(1)	SFA-5.28 / SFA-5.28M	SFA-5.23 / SFA-5.23M	SFA-5.2 / SFA-5.2M
For stainless steel						
specification	SFA-5.4 / SFA-5.4M	SFA-5.9 / SFA-5.9M	SFA-5.22 / SFA-5.22M (1) SFA-5.9 / SFA-5.9M(2)	SFA-5.9 / SFA-5.9M	SFA-5.9 / SFA-5.9M	
For aluminium and aluminium alloy						
specification	SFA-5.3 / SFA-5.3M	SFA-5.10 / SFA-5.10M		SFA-5.10 / SFA-5.10M		SFA-5.10 / SFA-5.10M
For nickel and nickel alloy						
specification	SFA-5.11 / SFA-5.11M	SFA-5.14 / SFA-5.14M		SFA-5.14 / SFA-5.14M	SFA-5.14 / SFA-5.14M	
for cast iron						
specification	SFA-5.15	SFA-5.15	SFA-5.15	SFA-5.15		SFA-5.15
For surfacing						
specification	SFA-5.13	SFA-5.21 / SFA-5.21M	SFA-5.21 / SFA-5.21M	SFA-5.21 / SFA-5.21M		
Shielding gases for arc welding SFA-5.32/SFA-5.32M (1) Flux cored wire (2) Metal cored wire						

General Advice
Certificate on testing of materials

If required, welding consumables can be certified by means of certificates on testing of materials according to DIN EN 10 204. This standard defines the different types of certificates. The following table lists the most requested types of certificates.

Type of certificate	Document validated by	Document content
Test report Type 2.2	The manufacturer	Statement of compliance with the order, with indication of results of non-specific inspection
Inspection certificates 3.1 Type 3.1	The manufacturer's authorized inspection representative independent of manufacturing department	Statement of compliance with the order, with indication of results of specific inspection
Inspection certificate 3.2 Type 3.2	The manufacturer's authorized inspection representative independent of the manufacturing department and either the purchaser's authorized inspection representative or the inspector designated by the official regulations	Statement of compliance with the order, with indication of results of specific inspection

1) Non-specific test

Test carried out by the manufacturer, applying a suitable procedure, in which the results are not-necessarily determined on the products of the delivery or test unit.

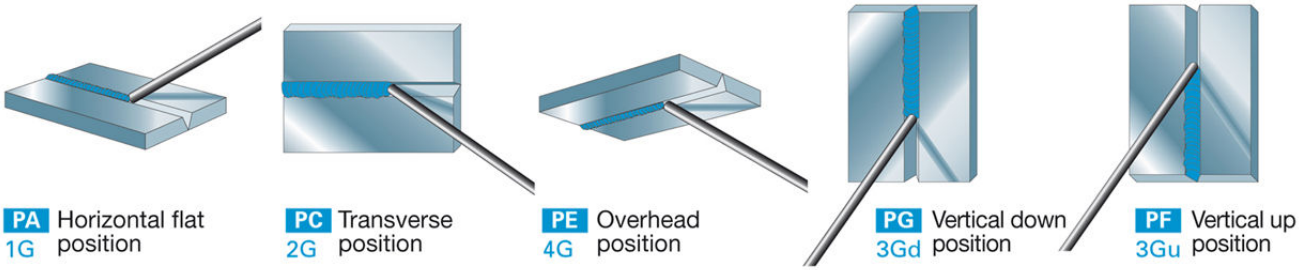
2) Specific test

Certificates on testing of materials have to be requested when placing the order.

If certificates according to DIN EN 10 204 are required, the exact type should be specified. General designations such as“works certificate” are not sufficient. In the case of acceptance test certificates, the customer should establish the exact extent of testing. Generally, the all-weld metal will be tested. The following should also be specified: whether the weld metal has to be heat treated, what test specimens have to be taken, and at what temperatures they shall be tested.

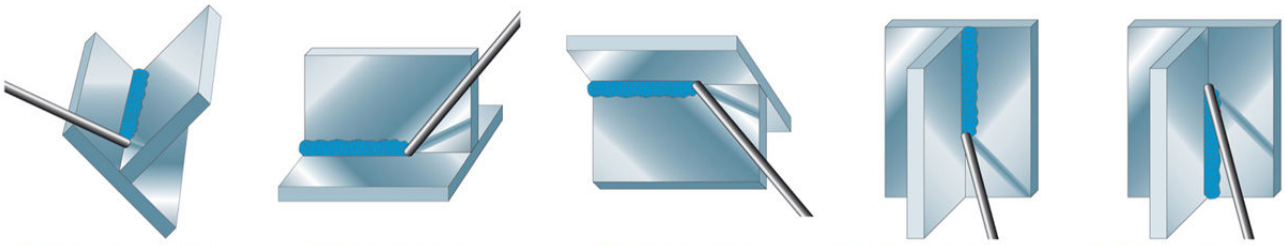
Welding positions according to DIN EN ISO 6947:1997-05

Butt welds



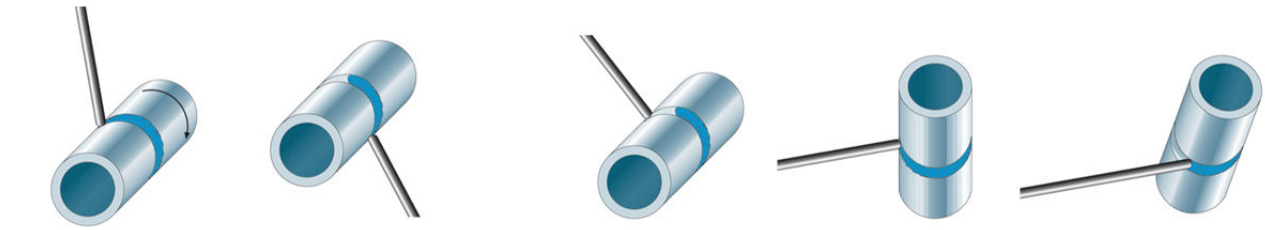
PA 1G Horizontal flat position
PC 2G Transverse position
PE 4G Overhead position
PG 3Gd Vertical down position
PF 3Gu Vertical up position

Fillet welds



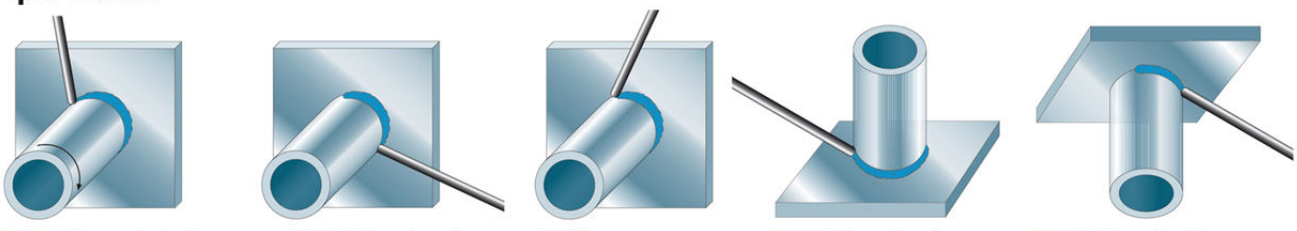
PA 1F Horizontal flat position
PB 2F Horizontal downhand position
PD 4F Horizontal overhead position
PG 3F Vertical down position
PF 3Fu Vertical up position

Pipe welds



PA 1G Pipe: rotated Axis: horizontal ASME: 1G
PG 5Gd Pipe: fixed Axis: horizontal ASME: 5Gd
PF 5Gu Pipe: fixed Axis: horizontal ASME: 5Gu
PC 2G Pipe: fixed Axis: vertical ASME: 2G
H-LO45 6G Pipe: fixed Axis: e.g. 45° ASME: 6G

Pipe welds



PB 2F Pipe: rotated Axis: horizontal ASME: 2F
PG 5Fd Pipe: fixed Axis: horizontal ASME: 5fd
PF 5Fu Pipe: fixed Axis: horizontal ASME: 5Fu
PB 2F Pipe: fixed Axis: vertical ASME: 2F
PD 4F Pipe: fixed Axis: vertical ASME: 4F

Gases for welding, cutting & reforming - Comparison of standards DIN EN / DIN EN ISO

DIN EN 439 (May 1995)							
Short name 1)		Components in percent by volume (vol%)					
Group	Index	Oxidizing		Inert		Reducing	Unreactive
		CO2	O2	Ar	He	H2	N2
R	1	-	-	Rest 2)	-	> 0 to 15	-
	2	-	-	Rest 2)	-	>15 to 35	-
I	1	-	-	100	-	-	-
	2	-	-	-	100	-	-
	3	-	-	Rest	> 0 to 95	-	-
M1	1	> 0 to 5	-	Rest 2)	-	> 0 to 15	-
	2	> 0 to 5	-	Rest 2)	-	-	-
	3	-	> 0 to 3	Rest 2)	-	-	-
	4	> 5 to 25	> 0 to 3	Rest 2)	-	-	-
M2	1	> 5 to 25	-	Rest 2)	-	-	-
	2	-	> 3 to 10	Rest 2)	-	-	-
	3	> 0 to 5	> 3 to 10	Rest 2)	-	-	-
M3	4	> 5 to 25	> 0 to 8	Rest 2)	-	-	-
	1	> 25 to 50	-	Rest 2)	-	-	-
	2	-	> 10 to 15	Rest 2)	-	-	-
	3	> 5 to 50	> 8 to 15	Rest 2)	-	-	-
C	1	100	-	-	-	-	-
	2	Rest	> 0 to 30	-	-	-	-
F	1	-	-	-	-	-	100
	2	-	-	-	-	> 0 to 50	Rest

1) Mixed with components that are not listed in the table, then the mixed gas is called a special gas with the letter S. The name is made up with this acronym for the S + Basisgas fraction in% and chem. Designation for the additional gas. For example, protective EN 439 - S M24 + 2.5 Ne.

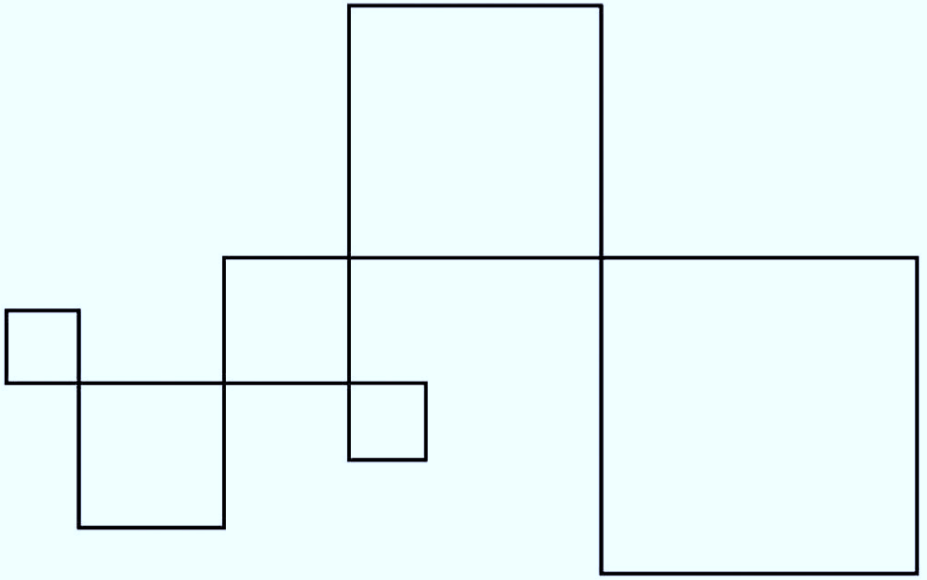
2) Argon may be replaced, up to 95% with helium. The helium content is specified by an additional figure in brackets. The following applies: (1)> 0 to 33% helium, (2)> 33 to 66% helium, (3)> 66 to 95% helium. For example, protective EN 439 - M12 (1).

Gases for welding, cutting & reforming - Comparison of standards DIN EN / DIN EN ISO

DIN EN ISO 14175 (June 2008)							
Symbol		Components in percent by volume (nominal)					
Main group	Under group	Oxidizing		Inert		Reducing	Unreactive
		CO2	O2	Ar	He	H2	N2
I	1	-	-	100	-	-	-
	2	-	-	-	100	-	-
	3	-	-	Rest	0.5 ≤ He ≤ 95	-	-
M1	1	0.5 ≤ CO2 ≤ 5	-	Rest (a)	-	0.5 ≤ H2 ≤ 5	-
	2	0.5 ≤ CO2 ≤ 5	-	Rest (a)	-	-	-
	3	-	0.5 ≤ O2 ≤ 3	Rest (a)	-	-	-
	4	0.5 ≤ CO2 ≤ 5	0.5 ≤ O2 ≤ 3	Rest (a)	-	-	-
M2	0	5 < CO2 ≤ 15	-	Rest (a)	-	-	-
	1	15 < CO2 ≤ 25	-	Rest (a))	-	-	-
	2	-	3 < O2 ≤ 3	Rest (a)	-	-	-
	3	0.5 ≤ CO2 ≤ 5	3 < O2 ≤ 10	Rest (a)	-	-	-
	4	5<CO2 ≤ 15	0.5 ≤ O2 ≤ 3	Rest (a)	-	-	-
	5	5 < CO2 ≤ 15	3 < O2 ≤ 10	Rest (a)	-	-	-
	6	15 < CO2 ≤ 25	0.5 ≤ O2 ≤ 3	Rest (a)	-	-	-
	7	15 < CO2 ≤ 25	3< O2 ≤ 10	Rest (a)	-	-	-
M3	1	25 < CO2 ≤ 50	-	Rest (a)	-	-	-
	2	-	10 ≤ O2 ≤ 15	Rest (a)	-	-	-
	3	25 < CO2 ≤ 50	2 < O2 ≤ 10	Rest (a)	-	-	-
	4	5 < CO2 ≤ 25	10 < O2 ≤ 15	Rest (a)	-	-	-
	5	25 < CO2 ≤ 50	10 < O2 ≤ 15	Rest (a)	-	-	-
C	1	100	-	-	-	-	-
	2	Rest	0.5 ≤ O2 ≤ 30	-	-	-	-
R	1	-	-	Rest (a)	-	0.5 ≤ H2 ≤ 15	-
	2	-	-	Rest (a)	-	15 < H2 ≤ 50	-
N	1	-	-	-	-	-	100
	2	-	-	Rest (a)	-	-	0.5 ≤ N2 ≤ 5
	3	-	-	Rest (a)	-	-	5 < N2 ≤ 50
	4	-	-	Rest (a)	-	0.5 ≤ H2 ≤ 10	0.5 ≤ N2 ≤ 5
	5	-	-	-	-	0.5 ≤ H2 ≤ 50	Rest
O	1	-	100	-	-	-	-
Z	Mixed gases with components not listed in the table, or mixed gases with a composition outside the specified areas.(b)						

(a) For a schedule may be partially or fully replace argon with helium.
(b) Two mixed gases with the same Z-division may not be exchanged against each other.

MMA ELECTRODES



OERLIKON

Overview of MMA electrodes

Product list with classification according to standards

MMA electrodes / C-Mn and low-alloy steels			
Product name	AWS	EN / EN ISO / DIN	Page
FINCORD M	A5.1: E 6013	2560-A: E 38 0 R 12	33
OVERCORD E	A5.1: E 6013	2560-A: E 38 0 R 12	34
SUPERCORD	A5.1: E 6013	2560-A: E 38 0 R 12	35
OVERCORD S	A5.1: E 6013	2560-A: E 38 2 R 1 2	36
SUPERCORD 42	A5.1: E 6013	2560-A: E 42 A R 12	37
SUPERCORD 45	A5.1: E 6013	2560-A: E 42 0 R 12	38
OVERCORD R92	A5.1: E 6013	2560-A: E 35 0 RC 1 1	39
OVERCORD	A5.1: E 6013	2560-A: E 38 0 RC 11	40
OVERCORD R10	A5.1: E 6013	2560-A: E 38 0 RC 1 1	41
OVERCORD R12	A5.1: E 6013	2560-A: E 38 0 RC 1 1	42
OVERCORD Z	A5.1: E 6013	2560-A: E 38 0 RC 1 1	43
CITOCORD	A5.1: E 6013	2560-A: E 42 0 RC 11	44
FLEXAL 60	A5.1: E 6010	2560-A: E 38 3 C 21	45
FLEXAL 70	A5.5: E 7010-P1	2560-A: E 42 2 Mo C 21	46
FLEXAL 80	A5.5: E 8010-G	2560-A: E 46 3 1Ni C21	47
FLEXAL 90	A5.5: E 9010-G	2560-A: E 50 2 1Ni C 21	48
FINCORD S	A5.1: E 6013	2560-A: E 42 A RR 12	49
FINCORD	A5.1: E 6013	2560-A: E 42 0 RR 12	50
FINCORD DB	A5.1: E 6013	2560-A: E 42 0 RR 1 2	52
SUPERCORD R14	A5.1: E 6013	2560-A: E 42 0 RR 1 2	53
FERROMATIC 130	A5.1: E 7024	2560-A: E 42 0 RR 53	54
FERROMATIC 160	A5.1: E 7024	2560-A: E 42 0 RR 73	55
FERROMATIC 180	A5.1: E 7024	2560-A: E 42 0 RR 73	56
FERROMATIC 200	A5.1: E 7024	2560-A: E 42 0 RR 73	57
CITOREX	A5.1: E 6013	2560-A: E 38 2 RB 12	58
CITORAPID	A5.1: E 6020	2560-A: E 38 2 RA 13	59
CITORAPID 160W	A5.1: E 6027	2560-A: E 38 2 RA 73	60
EXTRA	A5.1: E 7016-H8	2560-A: E 42 4 B 32 H10	61
SPEZIAL	A5.1: E 7016-H8	2560-A: E 38 3 B 12 H10	62
TENAX 56S	A5.1: E 7016-1 H4	2560-A: E 42 5 B 12 H5	63
ULTRACITO	A5.1: E 7018	2560-A: E 42 2 RB 32 H10	64
SUPERCITO A	A5.1: E 7018	2560-A: E 42 4 B 42 H5	65
SUPERCITO E	A5.1: E 7018	2560-A: E 42 4 B 3 2 H5	66
TENACITO R	A5.1: E 7018-1 H4	2560-A: E 42 6 B 4 2 H5	67
UNIVERS	-	2560-A: E 38 6 B 42 H5	68
FEBAMATIC 160S	A5.1: E 7028	2560-A: E 42 4 B 54 H5	69
TENAX CY17	A5.1: E 7018-1	2560-A: E 42 5 B 32 H5	70
SUPERCITO	A5.1: E 7018-1-H4	2560-A: E 42 5 B 3 2 H5	71
SUPERCITO 7018 S	A5.1: E 7018-1 H4	2560-A: E 42 5 B 3 2 H5	72
TENAX 35S	A5.1: E 7018-1 H4	2560-A: E 42 5 B 32 H5	73
TENAX 55H	A5.1: E 7018-1 H4	2560-A: E 42 5 B 32 H5	75
BOR SP6	-	2560-A: E 46 6 B 34 H10	76
TENAX 76S	A5.5: E 7018-G	2560-A: E 46 6 1Ni B 32 H5	77
TENACITO 38R	A5.5: E 7018-G H4	2560-A: E 46 6 1Ni B 4 2 H5	78
OE-CRYO 87	A5.5: E 7016-C2L	2560-A: E 42 6 3Ni B 12 H5	79
OE-CRYO 75 H	A5.5: E 7018-C1L	2560-A: E 42 6 2Ni B 32 H5	80
OE-CRYO 55	A5.5: E 8018-C1	2560-A: E 46 6 2Ni B 4 2 H5	81
TENAX 88S	A5.5: E 8016-G	2560-A: E 50 6 Mn1Ni B 12 H5	82
TENAX 88S HR	A5.5: E 8018-G H4	2560-A: E 50 6 Mn1Ni B 32 H5	83
TENACITO 70B	A5.5: E 8018-C1 H4	2560-A: E 46 6 2Ni B 4 2 H5	84
TENACITO 70	A5.5: E 8018-G H4	2560-A: E 50 6 Mn1Ni B 4 2 H5	85
FREEZAL ENi3	A5.5: E 8018-C2	2560-A: E 46 6 3Ni B 3 2 H5	86
VERTICORD 80	A5.5: E 8018 G	2560-A: E 46 4 B 4 5 H5	87
VERTICORD 90	A5.5: E 9018-G	757: E 55 4 Z B 45 H5	88

Overview of MMA electrodes

Product list with classification according to standards

MMA electrodes / Weathering steels			
Product name	AWS	EN / EN ISO / DIN	Page
TENCORD Kb	A5.5: E 7018-G-H4	2560-A: E 42 4 ZNiCu1 B 4 2 H5	89
TENCORD 85 CP	A5.5: E 8018-G	2560-A: E 46 4 Z B 32 H5	90

MMA electrodes / High-strength steels			
Product name	AWS	EN / EN ISO / DIN	Page
TENAX 98M	A5.5: E 9018-M H4	757: E 55 5 Z B 32 H 5	91
TENACITO 65R	A5.5: E 9018-G H4	757: E 55 6 Mn1NiMo B T 4 2 H5	92
TENAX 118-D2	A5.5: E 10018-D2	757: E 62 4 Mn1NiMo B T 32 H5	93
TENACITO 75	A5.5: E 10018-G H4	757: E 69 6 Mn2NiCrMo B 4 2 H5	94
TENAX 118	A5.5: E 11018-G H4	757: ~E 69 4 Mn2NiCrMo B 32 H5	95
TENAX 118-M	A5.5: E 11018-M H4	757: E 69 5 Z B 32 H5	96
TENACITO 80	A5.5: E 11018-G H4	757: E 69 6 Mn2NiCrMo B 4 2 H5	97
TENACITO 80 CL	A5.5: E 11018-G H4	757: E 69 6 Mn2NiMo B 4 2 H5	98
TENAX 128-M	A5.5: E 12018 M H4	757: E 79 5 Mn2NiCrMo B 32 H5	99
TENAX 128	A5.5: E 12018-G H4	757: ~ E 89 2 Mn2Ni1CrMo B 32 H5	100
TENACITO 100	A5.5: E 12018-G H4	757: E 89 4 Mn2Ni1CrMo B 4 2 H5	101
TENAX 140	A5.5: ~ E 14018 M-H4	-	102

MMA electrodes / Chromium-Molybdenum steels			
Product name	AWS	EN / EN ISO / DIN	Page
MOLYCORD Ti	A5.5: E 8013-G	3580-A: E Mo R 1 2	103
MOLYCORD Kb	A5.5: ~E 7018-A1-H4	3580-A: E Mo B 4 2 H5	104
OE-KV2HR	A5.5: E 7018-A1 H4R	1599: E Mo B 32 H5	105
CROMOCORD 55	A5.5: E 8018-B1	3580-A: E CrMo0.5 B 1 2 H5	106
CROMOCORD Kb	A5.5: E 8018-B2-H4	3580-A: E CrMo1 B 4 2 H5	107
OE-KV5L	A5.5: E 7015-B2L	1599: E CrMo1L B 22 H5	108
OE-KV5HR	A5.5: E 8018-B2 H4R	1599: E CrMo1 B 32 H5	109
CROMOCORD 2 STC	A5.5: E 9018-B3-H4	3580-A: E CrMo2 B 4 2 H5	110
OE-KV3L	A5.5: E 8015-B3L-H4	1599: E CrMo2L B 22 H5	111
OE-KV3HR	A5.5: E 9018-B3 H4R	1599: E CrMo2 B 3 2 H5	112
CROMO E225	A5.5: E 9015-B3 H4	3580-A: E CrMo2 B 2 2 H5	113
CROMO E225V	A5.5: E 9015-G	3580-A: E Z CrMoV 2 B 2 2 H5	114
CROMOCORD E223	A5.5: E 8015-G	-	115
CROMOCORD 5L	A5.5: E 8015-B6L	1599: E CrMo5 B 2 2 H5	116
CROMOCORD 5	A5.5: E 8015-B6-H4	3580-A: E CrMo5 B 2 2 H5	117
CROMOCORD 9	A5.5: E 8015-B8	1599: ~E CrMo9 B 2 2 H5	118
CROMOCORD 9M	A5.5: E 9018-B9-H4	3580-A: ~E CrMo9 B 4 2 H5	119
CROMOCORD 91	A5.5: E 9018-B9-H4	3580-A: E CrMo91 B 4 2 H5	120
CROMOCORD 92	A5.5: E 9018-G	3580-A: E Z CrMoWVNb 9 0.5 2 B 4 2 H5	121
CROMOCORD 10M	A5.5: ~E 9018-G	3580-A: E Z CrMoWV10 B 4 2 H5	122
CROMOCORD N125	A5.5: E 9015-G-H4	3580-A: ~E CrMoV1 B 4 2 H5	123

Overview of MMA electrodes

Product list with classification according to standards

MMA electrodes / Stainless and Heat resistant steels			
Product name	AWS	EN / EN ISO / DIN	Page
BASINOX 410 S	A5.4: ~E 410-15	1600: E Z 13 1 B 22	124
BASINOX 410 NiMo S	A5.4: E 410NiMo-15	1600: E 13 4 B 22	125
BASINOX 430 S	A5.4: E 430-15	1600: ~E 17 B 32	126
SUPRANOX 308L	A5.4: E 308L-17	1600: E 19 9 L R 1 2	127
SUPRANOX RS 308L	A5.4: E 308L-16	1600: E 19 9 L R 12	128
SUPRANOX 308L P	A5.4: E 308L-16	1600: E 19 9 L R 1 2	129
CRISTAL E308L	A5.4: E 308L-17	1600: E 19 9 L R 22	130
BASINOX 308L	A5.4: E 308L-15	1600: E 19 9 L B 42	131
BASINOX 308L T	A5.4: E 308L-15	1600: E 19 9 L B 12	132
SUPRANOX 347	A5.4: E 347-16	1600: E 19 9 Nb R 1 2	133
SUPRANOX RS 347	A5.4: E 347-16	1600: E 19 9 Nb R 12	134
BASINOX 347	A5.4: E 347-15	1600: E 19 9 Nb B 42	135
SUPRANOX 316L	A5.4: E 316L-17	1600: E 19 12 3 L R 1 2	136
SUPRANOX RS 316L	A5.4: E 316L-16	1600: E 19 12 3 L R12	137
CRISTAL E316L	A5.4: E 316L-17	1600: E 19 12 3 L R 22	138
SUPRANOX 316L P	A5.4: E 316L-16	1600: E 19 12 3 L R 1 2	139
BASINOX 316L	A5.4: E 316L-15	1600: E 19 12 3 L B 42	140
BASINOX 316L T	A5.4: E 316L-15	1600: E 19 12 2 B 12	141
SUPRANOX 317	A5.4: E 317-16	1600: E 19 13 4 N L R 12	142
SUPRANOX 318	A5.4: E 318-16	1600: E 19 12 3 Nb R 1 2	143
BASINOX 318	A5.4: E 318-15	1600: E 19 12 3Nb B 42	144
SUPRANOX E 22 9 3 N	A5.4: ~E 2209-16	1600: E 22 9 3 N L R 1 2	145
SUPRANOX RS 22 9 3 L	A5.4: E 2209-16	1600: E 22 9 3 N L R 12	146
BASINOX 22 9 3 N	A5.4: E 2209-15	1600: E 22 9 3 N L B 42	147
BASINOX EB 25 10 4 N	A5.9: E 2594-15	1600: E 25 9 4 N L B 42	148
SUPRANOX 904L	A5.4: E 385-16	1600: E 20 25 5 Cu N L R 5 3	149
BASINOX 904L	A5.4: E 385-15	1600: E Z 20 25 5 CuL B 12	150
SUPRANOX 308H	A5.4: E 308H-16	1600: E 19 9 R 12	151
SUPRANOX RS 308H	A5.4: E 308H-16	1600: E 19 9 R 12	152
BASINOX 308H	A5.4: E 308H-15	1600: E 19 9 H B 42	153
SUPRANOX 310	A5.4: E 310-16	1600: E 25 20 R 1 2	154
SUPRANOX RS 310	A5.4: E 310-16 (nearest)	1600: E 25 20 R 22	155
BASINOX 310	A5.4: E 310-15	1600: E 25 20 B 12	156
BASINOX 310Mo	A5.4: E 310Mo-15	-	157
SUPRANOX 309L	A5.4: E 309L-17	1600: E 23 12 L R 1 2	158
SUPRANOX RS 309L	A5.4: E 309L-16	1600: E 23 12 L R 12	159
CRISTAL E309L	A5.4: E 309L-17	1600: E 23 12 L R 22	160
SUPRANOX 309MoL	A5.4: E 309LMo-17	1600: E 23 12 2 L R 1 2	161
SUPRANOX RS 309Mo	A5.4: E 309MoL-16	1600: E 23 12 2 L R 12	162
FERINOX	A5.4: E 309LMo-26	1600: E 23 12 2 L R 53	163
DW RSP	-	-	164
BASINOX 309L	A5.4: E 309L-15	1600: E 23 12 L B 12	165
BASINOX 309Mo	A5.4: E 309MoL-15	1600: E 23 12 2 L B 12	166
BASINOX 309Nb	A5.4: E 309Nb-15	1600: E 23 12 Nb B 12	167
BASINOX 22 12 H	A5.4: ~E 309-15	1600: E 22 12 B 42	168
SUPERCHROMAX R	A5.4: ~E 307-16	1600: E 18 8 Mn R 1 2 14700 : E Fe10	169
SUPERCHROMAX RS	A5.4: ~E 307-16	1600: E 18 8 Mn R 7 3 14700 : E Fe10	170
SUPERCHROMAX N	A5.4: ~E 307-15	1600: E 18 8 Mn B 2 2 14700 : E Fe10	171
BASINOX 307	A5.4: E 307-15	1600: E 18 9 MnMo B 12	172
DW 312	A5.4: ~E 312-16	1600: ~E 29 9 R 12	173

Overview of MMA electrodes

Product list with classification according to standards

MMA electrodes / Nickel and Copper alloys			
Product name	AWS	EN / EN ISO / DIN	Page
SUPRANEL Ni1	A5.11: E Ni-1	14172: E Ni 2061	174
SUPRANEL SR	A5.11: E NiCrFe-2	14172: E Ni 6092 (NiCr16Fe12NbMo)	175
SUPRANEL	A5.11: E NiCrFe-3	14172: E Ni 6182	176
SUPRANEL 600	A5.11: E NiCrFe-3	14172: E Ni 6182	177
SUPRANEL 625	A5.11: E NiCrMo-3	14172: E Ni 6625	178
SUPRANEL C276	A5.11: E NiCrMo-4	14172: E Ni 6276	179
FREEZAL ENi9	A5.11: E NiCrMo-6	14172: E Ni 6620	180
SUPRANEL 690	A5.11: E NiCrFe-7	14172: E Ni 6152 (nearest)	181
SUPRANEL NiCu7	A5.11: E NiCu-7	14172: E Ni 4060 (NiCu30Mn3Ti)	182
CUPRONIC 70	A5.6: E CuNi	-	183
CITOBRONZE Sn	A5.6: E CuSn-C	-	184

MMA electrodes / Cast-iron			
Product name	AWS	EN / EN ISO / DIN	Page
SUPERFONTE Ni	A5.15: E Ni-CI	1071: E C Ni-CI 1	185
SUPERFONTE NiFe	A5.15: E NiFe-CI	1071: E C NiFe-CI 1	186
SUPERFONTE BM	A5.15: E NiFe-CI	1071: E C NiFe CI 1	187

MMA electrodes / Aluminum alloys			
Product name	AWS	EN / EN ISO / DIN	Page
ALCORD Al	A5.3: ~E1100	1732: EL-Al 99.8	188
ALCORD 5Si	A5.3: E4043	1732: EL-AlSi 5	189
ALCORD 12Si	-	1732: EL-AlSi 12	190

MMA electrodes / Hardfacing			
Product name	AWS	EN / EN ISO / DIN	Page
SUPRAMANGAN	-	14700: ~E Fe9	191
CITORAIL	-	14700: E Fe1	192
SUPRADUR 2015	-	14700: ~E Fe1	193
SUPRADUR 345B	-	14700: E Fe13	194
SUPRADUR 400	-	14700: E Fe1	195
SUPRADUR 400B	-	14700: E Fe1	196
SUPRADUR 600	-	14700: E Fe2	197
SUPRADUR 600B	-	14700: E Fe2	198
SUPRADUR 600RB	-	14700: E Fe2	199
SUPRADUR V1000	-	14700: E Fe14	200
SUPRADUR VF1000	-	14700: E Fe14	201
TOOLCORD	-	14700: E Fe4	202
SUPRANEL C95	A5.11: E NiCrMo-5	14172: E Ni 6275	203
ABRACITO 62	-	14700: ~E Fe14	204
ABRACITO 62S	-	14700: E Fe16	205
ABRACITO 65	-	14700: E Fe16	206
CITOLIT 6	A5.13: E CoCr-A	8555: E-20-UM-45-CTZ	207
CITOLIT 12	A5.13: E CoCr-B	8555: E-20-UM-50-CTZ	208
CITOLIT 21	A5.13: E CoCr-E	8555: E-20-UM-35-CKTZ	209
CITOLIT 25	-	8555: E 20-UM-250-CPTZ	210

MMA electrodes / Cutting			
Product name	AWS	EN / EN ISO / DIN	Page
CITOCUT	-	-	211
SUPERCUT	-	-	212

MMA electrodes for metal-arc welding of unalloyed and fine grain structural steels.

EN ISO 2560-A

E	46	6	1 Ni	B	4	2	H5
MMA electrode	Table 1	Table 2	Table 3	Table 4	Table 5	Table 6	Table 7

Table 1

Code digits for tensile strength and elongation properties of the weld metal			
Code digit	Minimum yield strength(1) [MPa]	Tensile strength [MPa]	Minimum elongation(2) [%]
35	355	440–570	22
38	380	470–600	20
42	420	500–640	20
46	460	530–680	20
50	500	560–720	18
1) For yield strength the lower yield (ReL) shall be used if yielding occurs, otherwise the 0,2% proof strength (Rp0,2) shall be applied. 2) Gauge length is equal to five times the test specimen diameter.			

Table 2

Symbols for impact energy of all-weld metal	
Symbols	Temperature for minimum average impact energy of 47 J [°C]
Z	no requirements
A	+20
0	0
2	–20
3	–30
4	–40
5	–50
6	–60

Table 3

Symbols for chemical composition of all-weld metal			
Symbols	Chemical composition (1)(2)(3) [%]		
	Mn	Mo	Ni
No symbol	2,0	–	–
Mo	1,4	0,3–0,6	–
MnMo	> 1,4–2,0	0,3–0,6	–
1Ni	1,4	–	0,6–1,2
2Ni	1,4	–	1,8–2,6
3Ni	1,4	–	> 2,6–3,8
Mn1Ni	> 1,4–2,0	–	0,6–1,2
1NiMo	1,4	0,3–0,6	0,6–1,2
Z	any other chemical composition agreed upon		
1) If not specified: Mo<0,2%; Ni<0,3%;Cr<0,2%; V<0,05%; Nb<0,05; Cu<0,3%. 2) Single values shown in the table are maximum values. 3) The results shall be rounded to the same decimal place as the specified values using the rules of ISO 31-0 : 1992, Appendic B, Rule A.			

Table 4

Symbols for type of coating	
A	acid coating
C	cellulosic coating
R	rutile coating
RR	thick rutile coating
RC	rutile-cellulosic coating
RA	rutile-acid coating
RB	rutile-basic coating
B	basic coating

Table 5

Code digit for weld metal recovery and type of current		
Code digit	Weld metal recovery [%]	Type of current (1)
1	≤105	alternating and direct current
2	≤105	direct current
3	>105 ≤125	alternating and direct current
4	>105 ≤125	direct current
5	>125 ≤160	alternating and direct current
6	>125 ≤160	direct current
7	>160	alternating and direct current
8	>160	direct current
1) In order to demonstrate operability on a.c., test shall be carried out with an open circuit voltage not higher than 65 Volts.		

Table 6

Code digits for welding positions	
Code digit	Welding positions
1	all positions
2	all positions, except vertical-down
3	flat butt weld, flat fillet weld, horizontal vertical fillet weld
4	flat butt weld, flat fillet weld
5	vertical down and positions according to digit 3

Table 7

Symbols for hydrogen content of all-weld metal	
Symbols	Hydrogen content ml/100 grams deposited weld metal, max.
H5	5
H10	10
H15	15

MMA electrodes for metal-arc welding of high-strength steels.

EN 757

E	55	5	Mn1NiMo	B	T	4	2	H5
MMA electrode	Table 1	Table 2	Table 3	Table 4	Table 5	Table 6	Table 7	Table 8

Table 1

Code digits for tensile strength and elongation properties of the weld metal			
Code digit	Minimum yield strength(1) [MPa]	Tensile strength [N/MPa]	Minimum elongation(2) [%]
55	550	610–780	18
62	620	690–890	18
69	690	760–960	17
79	790	880–1080	16
89	890	980–1180	15
1) For yield strength the lower yield (ReL) shall be used if yielding occurs, otherwise the 0,2% proof strength (Rp0,2) shall be applied. 2) Gauge length is equal to five times the test specimen diameter.			

Table 2

Symbols for impact energy of all-weld metal	
Symbols	Temperature for minimum average impact energy of 47 J [°C]
Z	no requirements
A	20
0	0
2	-20
3	-30
4	-40
5	-50
6	-60
7	-70
8	-80

Table 3

Symbols for chemical composition of all-weld metal				
Symbols	Chemical composition of all-weld metal(1)(2)(3) [%] (m/m)			
	Mn	Ni	Cr	Mo
MnMo	1,4–2,0	–	–	0,3–0,6
Mn1Ni	1,4–2,0	0,6–1,2	–	–
1NiMo	1,4	0,6–1,2	–	0,3–0,6
1,5NiMo	1,4	1,2–1,8	–	0,3–0,6
2NiMo	1,4	1,8–2,6	–	0,3–0,6
Mn1NiMo	1,4–2,0	0,6–1,2	–	0,3–0,6
Mn2NiMo	1,4–2,0	1,8–2,6	–	0,3–0,6
Mn2NiCrMo	1,4–2,0	1,8–2,6	0,3–0,6	0,3–0,6
Mn2Ni1CrMo	1,4–2,0	1,8–2,6	0,6–1,0	0,3–0,6
Z	any other chemical composition agreed upon			

1) If not specified: C 0,03%-0,10%, Ni<0,3%, Cr<0,2%, Mo<0,2%, V<0,05%, Nb<0,05%, Cu<0,3%, P<0,025%, S<0,020%.
2) Single values shown in the table are maximum values.
3) The results shall be rounded to the same decimal place as the specified values using the rules of ISO 31-0 : 1992, Appendix B, Rule A.

Table 4

Symbol for type of coating	
Symbol	Meaning
B	these electrodes have a basic coating, other types of coating, see DIN 499

Table 5

Symbol for the stress-relieved condition	
Symbol	Meaning.
T	Properties of the all-weld metal apply to the stress- relieved condition of 1 hr. between 560 °C and 600 °C, then furnace cooling to 300 °C.

Table 6

Code digit for metal recovery and type of current		
Code digit	Metal recovery [%]	Type of current (1)
1	≤105	alternating and direct current
2	≤105	direct current
3	>105 ≤125	alternating and direct current
4	>105 ≤125	direct current
5	>125 ≤160	alternating and direct current
6	>125 ≤160	direct current
7	>160	alternating and direct current
8	>160	direct current

1) In order to demonstrate operability on a.c., test shall be carried out with an open circuit voltage not higher than 65 Volts.

Table 7

Code digits for welding positions	
Code digit	Welding positions
1	all positions
2	all positions, except vertical-down
3	flat butt weld, flat fillet weld, horizontal vertical fillet weld
4	flat butt weld, flat fillet weld
5	vertical-down and positions according to digit 3

Table 8

Symbols for hydrogen content of all-weld metal	
Symbols	Hydrogen content ml/100 grams weld metal max.
H5	5
H10	10

MMA electrodes for metal-arc welding of creep resistant steels.

EN ISO 3580-A

E	CrMo1	B	4	2	H5
MMA electrode	Table 1/2	Table 3	Table 4	Table 5	Table 6

Table 1

Symbols for chemical composition of all-weld metal									
Symbols	Chemical composition of all-weld metal [%] (m/m) (1)(2)(3)								
	C	Si	Mn	P	S	Cr	Mo	V	Other elements
Mo	0,10	0,80	0,40-1,5(4)	0,030	0,025	0,2	0,40-0,70	0,03	--
MoV	0,03-0,12	0,80	0,40-1,50	0,030	0,025	0,30-0,60	0,80-1,20	0,25-0,60	--
CrMo0,5	0,05-0,12	0,80	0,40-1,50	0,030	0,025	0,40-0,65	0,40-0,65	--	--
CrMo1	0,05-0,12	0,80	0,40-1,5(4)	0,030	0,025	0,90-1,40	0,45-0,70	--	--
CrMo1L	0,05	0,80	0,40-1,5(4)	0,030	0,025	0,90-1,40	0,45-0,70	--	--
CrMoV1	0,05-0,15	0,80	0,70-1,50	0,030	0,025	0,90-1,30	0,90-1,30	0,10-0,35	--
CrMo2	0,05-0,12	0,80	0,40-1,30	0,030	0,025	2,0-2,6	0,90-1,30	--	--
CrMo2L	0,05	0,80	0,40-1,30	0,030	0,025	2,0-2,6	0,90-1,30	--	--
CrMo5	0,03-0,12	0,80	0,40-1,50	0,025	0,025	4,0-6,0	0,40-0,70	--	--
CrMo9	0,03-0,12	0,60	0,40-1,30	0,025	0,025	8,0-10,0	0,90-1,20	0,15	Ni 1,0
CrMo91	0,06-0,12	0,60	0,40-1,50	0,025	0,025	8,0-10,5	0,80-1,20	0,15-0,30	Ni0,40-1,0 Nb0,03-0,1 N0,02-0,07
CrMoWV12	0,15-0,22	0,80	0,40-1,30	0,025	0,025	10,-12,0	0,80-1,20	0,20-0,40	Ni0,8 W0,4-0,6
Z	any other chemical composition agreed upon								

1) If not specified: Ni<0,3%, Cu<0,3%, Nb<0,01%.
2) Single values shown in the table are maximum values.
3) The results shall be rounded to the same decimal place as the specified values using the rules of ISO 31-0 : 1992, Appendix B, Rule A.

Table 2

Symbols for the mechanical properties of all-weld metal								
Symbols	Yield strength (1) [MPa]	Tensile strength Rm [MPa]	Elongation(2) A [%]	Impact energy [J] KV at +20°C		Weld metal Heat treatment /test piece		
				Minimum average value from 3 specimens	Minimum single value(3)	Preheat and interpass temperature [°C]	Temperature (4) [°C]	Time in minutes(5)
Mo	355	510	22	47	38	<200	570-620	60
MoV	355	510	18	47	38	200-300	690-730	60
CrMo0,5	355	510	22	47	38	100-200	600-650	60
CrMo1	355	510	20	47	38	150-250	660-700	60
CrMo1L	355	510	20	47	38	150-250	660-700	60
CrMoV1	435	590	15	24	19	200-300	680-730	60
CrMo2	400	500	18	47	38	200-300	690-750	60
CrMo2L	400	500	18	47	38	200-300	690-750	60
CrMo5	400	590	17	47	38	200-300	730-760	60
CrMo9	435	590	18	34	27	200-300	740-780	60
CrMo91	415	585	17	47	38	200-300	750-770	120-180
CrMoWV12	550	690	15	34	27	250-350(6) or 400-500(6)	740-780	120

1) For yield strength the lower yield (ReL). shall be used if yielding occurs, otherwise the 0,2%-proof strength (Rp0,2) shall be applied.
2) Gauge length is equal to five times the test specimen diameter.
3) Only one single value lower than minmum average is permitted.
4) The test piece shall be cooled in the furnace to 300°C, at a rate not exceeding 200°C/hr.
5) Tolerance ±10 min.
6) Immediately after welding the test piece is to be cooled down to 120°C to 100°C and kept at this temperature for at least 1 hr.

Table 3

Symbols for type of coating	
Symbols	Type of coating
R	rutile coating
B	basic coating

Table 4

Code digit for weld metal recovery and type of current		
Code digit	Weld metal recovery [%]	Type of current(1)
1	≤105	alternating and direct current
2	≤105	direct current
3	>105 ≤125	alternating and direct current
4	>105 ≤125	direct current

1) In order to demonstrate operability on a.c., test shall be carried out with an open circuit voltage not higher than 65 volts.

Table 5

Code digits for welding positions	
Code digit	Welding positions
1	all positions
2	all positions, except vertical-down
3	flat butt weld, flat fillet weld, horizontal vertical fillet weld
4	flat butt weld, flat fillet weld, horizontal vertical fillet weld, vertical down

Table 6

Symbols for hydrogen content of all-weld metal	
Symbols	Hydrogen content ml/100 grams deposited weld metal, max.
H5	5
H10	10
H15	15

MMA electrodes for metal-arc welding of austenitic stainless and heat resisting steels.

EN 1600

E	19 12 3 L	R	1	2
coated electrode	Table 1/5	Table 2	Table 3	Table 4

Table 1

Mechanical properties of all-weld metal				
Alloy symbol	Minimum yield strength Rp0.2 [MPa]	Minimum tensile strength Rm [MPa]	Minimum elongation(1) A [%]	Heat treatment
13	250	450	15	(2)
13 4 17 19 9	500 300 350	750 450 550	15 15 30	(3) (4) none
19 9 L	320	510	30	none
19 9 Nb	350	550	25	none
19 12 2	350	550	25	none
19 12 3 L	320	510	25	none
19 12 3 Nb 19 13 4 N L 22 9 3 N L	350 350 450	550 550 550	25 25 20	none none none
25 7 2 N L	500	700	15	none
25 9 3 Cu N L 25 9 4 N L 18 15 3 L	550 550 300	620 620 480	18 18 25	none none none
18 16 5 N L	300	480	25	none
20 25 5 Cu N L	320	510	25	none
20 16 3 Mn N L	320	510	25	none
25 22 2 N L 27 31 4 Cu L 18 8 Mn	320 240 350	510 500 500	25 25 25	none none none
18 9 MnMo	350	500	25	none
20 10 3	400	620	20	none
23 12 L	320	510	25	none
23 12 Nb	350	550	25	none
23 12 2 L 29 9 16 8 2	350 450 320	550 650 510	25 15 25	none none none
19 9 H	350	550	30	none
25 4	400	600	15	none
22 12	350	550	25	none
25 20	350	550	20	none
25 20 H	350	550	10(5)	none
18 36	350	550	10(5)	none

1) Gauge length is equal to five times the test specimen diameter.
2) 840°C–870°C for 2 h – furnace-cooling to 600°C, then air-cooling.
3) 580°C–620°C for 2 h – air-cooling.
4) 760°C–790°C for 2 h – furnace-cooling to 600°C, then air-cooling.
5) These electrodes have high carbon in the weld metal for service at high temperatures. Room temperature elongation has little relevance to such applications.

Table 2

Symbols for type of coating	
Symbols	Type of coating
R	rutile coating
B	basic coating

Table 3

Code digit for weld metal recovery and type of current		
Code digit	Weld metal recovery [%]	Type of current(1)
1	≤105	alternating and direct current
2	≤105	direct current
3	>105 ≤125	alternating and direct current
4	>105 ≤125	direct current
5	>125 ≤160	alternating and direct current
6	>125 ≤160	direct current
7	>160	alternating and direct current
8	>160	direct current
1) Maximum a.c. open circuit voltage shall be 65 volts.		

Table 4

Code digits for welding positions	
Code digit	Welding positions
1	all positions
2	all positions, except vertical-down
3	flat butt weld, flat fillet weld, horizontal vertical fillet weld
4	flat butt weld, flat fillet weld

Table 5 (1/2)

Symbols for chemical composition of all-weld metal									
Alloy symbol	Chemical composition(%), (m/m), (1)(2)(3)								
	C	Si	Mn	P(4)	S(4)	Cr	Ni(5)	Mo(5)	Other Elements (5)
Martensitic / ferritic 13	0,12	1,0	1,5	0,030	0,025	11,0–14,0	–	–	–
13 4	0,06	1,0	1,5	0,030	0,025	11,0–14,5	3,0–5,0	0,4 to1,0	–
17	0,12	1,0	1,5	0,030	0,0250,025	16,0–18,0	–	–	–
Austenitic 19 9	0,08	1,2	2,0	0,030	0,025	18,0–21,0	9,0–11,0	–	–
19 9 L	0,04	1,2	2,0	0,030	0,025	18,0–21,0	9,0–11,0	–	–
19 9 Nb	0,08	1,2	2,0	0,030	0,025	18,0–21,0	9,0–11,0	–	Nb(6)
19 12 2	0,08	1,2	2,0	0,030	0,025	17,0–20,0	10,0–13,0	2,0–3,0	–
19 12 3 L	0,04	1,2	2,0	0,030	0,025	17,0–20,0	10,0–13,0	2,5–3,0	–
19 12 3 Nb	0,08	1,2	2,0	0,030	0,025	17,0–20,0	10,0–13,0	2,5–3,0	Nb(6)
19 13 4 N	0,04	1,2	1,0–5,0	0,030	0,025	17,0–20,0	12,0–15,0	3,0–4,5	N 0,20
Austenitic-ferritic. High corrosion resistance 22 9 3 N L (8)	0,04	1,2	2,5	0,030	0,025	21,0–24,0	7,5–10,5	2,5–4,0	N 0,08–0,20
25 7 2 N L	0,04	1,2	2,0	0,035	0,025	24,0–28,0	6,0–8,0	1,0–3,0	N 0,20
25 9 3 Cu N L (8)	0,04	1,2	2,5	0,030	0,025	24,0–27,0	7,5–10,5	2,5–4,0	N0,1–0,25 Cu 1,5–3,5
25 9 4 N L (8)	0,04	1,2	2,5	0,030	0,025	24,0–27,0	8,0–10,5	2,5–4,5	N0,2-0,3 Cu1,5;W1
Fully austenitic. High corrosion	0,04	1,2	1,0–4,0	0,030	0,025	16,5–19,5	14,0–17,0	2,5–3,5	–
18 16 5 N	0,04	1,2	1,0–4,0	0,035	0,025	17,0–20,0	15,5–19,0	3,5–5,0	N 0,20
20 25 5 Cu N L(7)	0,04	1,2	1,0–4,0	0,030	0,025	19,0–22,0	24,0–27,0	4,0–7,0	Cu 1,0–2,0 N 0,25
20 16 3 Mn	0,04	1,2	5,0–8,0	0,035	0,025	18,0–21,0	15,0–18,0	2,5–3,5	N 0,20
25 22 2 N	0,04	1,2	1,0–5,0	0,030	0,025	24,0–27,0	20,0–23,0	2,0–3,0	N 0,20
27 31 4 Cu	0,04	1,2	2,5	0,030	0,025	26,0–29,0	30,0–33,0	3,0–4,5	Cu 0,6–1,5
Special grades 18 8 Mn(7)	0,20	1,2	4,5–7,5	0,035	0,025	17,0–20,0	7,0–10,0	–	–
18 9 MnMo	0,04–0,14	1,2	3,0–5,0	0,035	0,025	18,0–21,5	9,0–11,0	0,5–1,5	–
20 10 3	0,10	1,2	2,5	0,030	0,025	18,0–21,0	9,0–12,0	1,5–3,5	–
23 12 L	0,04	1,2	2,5	0,030	0,025	22,0–25,0	11,0–14,0	–	–
23 12 Nb	0,10	1,2	2,5	0,030	0,025	22,0–25,0	11,0–14,0	–	Nb(6)
23 12 2 L	0,04	1,2	2,5	0,030	0,025	22,0–25,0	11,0–14,0	2,0–3,0	–
29 9	0,15	1,2	2,5	0,035	0,025	27,0–31,0	8,0–12,0	–	–

Table 5 (2/2)

Symbols for chemical composition of all-weld metal									
Alloy symbol	Chemical composition(%), (m/m), (1)(2)(3)								
	C	Si	Mn	P(4)	S(4)	Cr	Ni(5)	Mo(5)	Other Elements (5)
Heat resisting grades 16 8 2	0,08	1,0	2,5	0,030	0,025	14,5–16,5	7,5–9,5	1,5–2,5	–
19 9 H	0,04–0,08	1,2	2,0	0,030	0,025	18,0–21,0	9,0–11,0	–	–
25 4	0,15	1,2	2,5	0,030	0,025	24,0–27,0	4,0–6,0	–	–
22 12	0,15	1,2	2,5	0,030	0,025	20,0–23,0	10,0–13,0	–	–
25 20(7)	0,06–0,20	1,2	1,0–5,0	0,030	0,025	23,0–27,0	18,0–22,0	–	–
25 20 H(7)	0,35–0,45	1,2	2,5	0,030	0,025	23,0–27,0	18,0–22,0	–	–
18 36(7)	0,25	1,2	2,5	0,030	0,025	14,0–18,0	33,0–37,0	–	–

1) Single values in this table are maximum values.
2) MMA electrodes not listed in this table shall be symbolised similarly and prefixed by the letter Z.
3) The results shall be rounded to the same decimal place as the specified values using the rules of ISO 31-0 : 1992, Appendix B, Rule A..
4) The sum of P and S shall not exceed 0,050%, except for 25 7 2 N L / 18 16 5 N L / 20 16 3 Mn N L / 18 8 Mn /18 9 MnMo / 29 9.
5) If not specified: Mo < 0,75%, Cu < 0,75% und Ni < 0,60%.
6) Nb min. 8 x% C, max. 1,1%; up to 20% of the amount of Nb can be replaced by Ta.
7) The all-weld metal is in most cases fully austenitic and therefore can be susceptible to microfissuring and solidification cracks. The occurence of cracking is reduced by increasing the weld metal manganese level and because of this, the manganese range is extended for a number of the grades.
8) Electrodes under this symbol are usually selected for specific properties and may not be directly interchangeable.

Notes on MMA electrodes
Re-drying

In general, MMA electrodes should be used in the dry condition. In the course of time, electrode coatings will absorb moisture from the humidity of the ambient air.

Therefore, it is recommended that MMA electrodes are stored in a dry location with undamaged packaging until use.

Depending on the coating type and the base metal to be welded the moisture absorbed is either not harmful or must be removed from the coating by re-drying.

In order to avoid damage to the coating, the total re-drying time shall not exceed 10 hours.
Re-dried electrodes should be stored in drying cabinets and/or heated quivers at 100 °C to 200 °C to avoid subsequent moisture absorption.

Re-drying recommendations for the respective OERLIKON-types of electrodes are shown in the following Tables 1 and 2.

An alternative: No re-drying due to special packaging materials.
By using special moisture-tight materials, the absorption of humidity is effectively prevented. The electrodes will stay as dry as after packaging.

Advantages:
- electrodes welded straight from these packages need not be re-dried before use
- no special storage conditions are necessary
- complete protection of the electrodes during transport under difficult climatic conditions

OERLIKON offers two special packaging systems: Vacuum packaging and aluminium cans.

The vacuum packaging VacuPack medium contains about 2.5 kg corresponding to approx. half a standard packet.
DRYF is the smallest vacuum packaging and contains about 15 to 30 pieces.

MMA electrodes for corrosion resistant steels and nickel alloys are also available in the aluminium can packaging Gaspack.

Notes on MMA electrodes
Re-drying

Table 1

Electrodes suitable for ...	Type of electrode coating symbols used for standard classification	Example	Notes on redrying, see Table 2
C-Mn and low-alloy steels	cellulosic (C)	FLEXAL-Range	1
C-Mn and low-alloy steels	rutile (R, RR)	FINCORD	2
C-Mn and low-alloy steels	rutile-cellulosic (RC)	OVERCORD	2
C-Mn and low-alloy steels	rutile-acid (RA)	CITORAPID 160W	2
C-Mn and low-alloy steels	rutile-basic (RB)	CITOREX	2
C-Mn and low-alloy steels	basic (B)	TENAX 56S	3
high strength steels and special steels (e.g. for low temperature)	basic (B)	TENACITO-Range	3
Chromium-Molybdenum steels	rutile (R)	MOLYCORD Ti	2
Chromium-Molybdenum steels	basic (B)	CROMOCORD Kb	3
austenitic stainless and heat resistant steels, dissimilar joints	rutile (R)	SUPRANOX 316L	4
austenitic stainless and heat resistant steels, dissimilar joints	basic (B)	BASINOX 316L	5
stainless ferritic and martensitic chromium steels, Duplex-steels	rutile (R)	SUPRANOX E 22.9.3 N	6
stainless ferritic and martensitic chromium steels, Duplex-steels	basic (B)	BASINOX 410 NiMo S	6
nickel and nickel alloys	basic (B)	SUPRANEL 625	7
hardfacing	rutile (R)	SUPRADUR 600RB	2
hardfacing	basic (B)	CITORAIL	3

Table 2

Re-drying conditions	
Code number in Table 1	Interpretation of re-drying conditions
1	As these electrodes require a high moisture content in their coating, these types are exclusively supplied in metal cans. Re-drying must not be carried out.
2	Porosity in the weld metal, enhanced spatter and a more or less erratic weld behaviour point to an increased moisture content. Such electrodes can be re-dried for 1 hour at 100–110 °C. However, if closed or opened packages are properly stored, re-drying is required only under very unfavourable conditions.
3	High metallurgical requirements must be met by the weld metal of basic electrodes. Since humidity in the covering will cause porosity and diffusible hydrogen (“HD”), responsible for cold cracking, such electrodes shall be re-dried for 1-2 hours at 300–420°C(¤).
4	Comparatively, rutile-covered high-alloy electrodes react more sensitively to humid coverings. Since absorption of humidity cannot entirely be excluded, not even with unopened packaging. Pre-drying for 1-2 hours at 250 °C - 370 °C(¤) for avoiding weld metal porosity is recommended.
5	Basic covered high-alloy electrodes are practically not prone to porosity caused by humidity. Therefore, re-drying is not mandatory. But re-drying of 1-2 hours / 250°C-350°C(¤) is recommended.
6	In order to avoid cold-cracking, re-drying for 2 hours at 300–350°C(¤) is required.
7	In order to avoid porosity, re-drying for 2 hours at 300°C – 350°C(¤) is required.
(¤)Note concerning temperatures and times: The product-specific indications on the labels or data sheets are applicable.	

FINCORD M

MMA Electrodes
C-Mn and low-alloy steels

FINCORD M is a rutile medium coated MMA electrode for a wide variety of mild steel fabrication applications. It has exceptional overall operability and welder appeal, resulting in high quality weld deposits . Excellent in the overhead position and for fillet welding in the horizontal-vertical position. Smooth metal transfer, low spatter and self-releasing slag. Smooth weld bead appearance.

Classification	
EN ISO	2560-A: E 38 0 R 12
EN	499: E 38 0 R 12
AWS	A5.1: E 6013

Approvals	Grade
DB	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.05-0.09	0.3-0.6	0.2-0.5	≤0.02	≤0.02

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation	Impact Energy ISO - V (J)
				0 °C
As Welded	≥ 380	470-600	≥ 22	≥ 50

Materials

S(P)235 to S(P)355; GP240; GP280

Storage

Keep dry and avoid condensation. Re-drying not generally required. If necessary: 100-110 °C for 1 hour.

Current condition and welding position

AC; DC-; DC+

PA PB PC PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
2.0	300	40-60	11.0	340	●
2.5	300	45-85	14.6	240	●
2.5	350	55-90	17.2	240	●
3.2	350	80-130	30.5	140	●
4.0	450	120-180	60.0	85	●
5.0	450	160-240	102.7	50	●
6.0	450	220-290	146.7	35	●

OVERCORD E

MMA Electrodes
C-Mn and low-alloy steels

OVERCORD E is a medium coated rutile MMA electrode, specially designed for welding mild steels for light metallic constructions and thin sheets. Suitable for use in structural engineering, shipbuilding and vehicle, boiler and tank construction.

Classification	
EN ISO	2560-A: E 38 0 R 12
EN	499: E 38 0 R 12
AWS	A5.1: E 6013

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.05-0.11	0.4-0.7	0.2-0.4	≤0.03	≤0.02

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation	Impact Energy ISO - V (J)
				0 °C
As Welded	≥ 430	490-550	≥ 24	≥ 47

Materials

S(P)235 to S(P)355; GP240; GP280

Storage

Keep dry and avoid condensation. Re-drying not generally required. If necessary: 100-110 °C for 1 hour.

Current condition and welding position

AC; DC-

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
2.0	300	40-60	10.3	365	●
2.5	350	60-90	19.1	235	●
3.2	350	110-135	30.8	146	●
4.0	350	160-180	45.9	98	●
5.0	450	180-210	97.2	62	●

MMA Electrodes
C-Mn and low-alloy steels

SUPERCORD is a medium-coated rutile MMA electrode with a fast freezing slag. Universal all-positional electrode which is very easy to weld, for all light constructional work, including pipework. Suitable for vertical down welding of thin plates. Operates on low open circuit voltage, recommended for tack welding. Good slag detachability and excellent bead appearance. Efficiency 100%.

Classification	
EN ISO	2560-A: E 38 0 R 12
AWS	A5.1: E 6013
GOST	9467-75:?50-E51 1

Approvals	Grade
ABS	2

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.05-0.11	0.4-0.7	0.2-0.4	≤ 0.03	≤ 0.02

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 0 °C
As Welded	≥ 430	510-640	≥ 24	≥ 47

Materials

S(P)235 to S(P)355; GP240; GP280

Storage

Keep dry and avoid condensation. Re-drying not generally required. If necessary: 100-110 °C for 1 hour.

Current condition and welding position

AC; DC-

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX PC	CBOX Code
2.0	300	40-60	10.5	360	●
2.5	350	65-90	20.1	220	●
3.2	350	100-140	32.4	140	●
3.2	450	100-140	42.0	140	●
4.0	350	140-180	47.4	95	●
4.0	450	140-180	62.1	95	●
5.0	350	170-230	71.4	70	●
5.0	450	170-230	92.9	70	●

OVERCORD S

CE

MMA Electrodes
C-Mn and low-alloy steels

Rutile coated MMA electrode, used for the welding of large structures and process pipe work in the shipbuilding and construction industries where precise fit-ups are difficult to achieve. OVERCORD S is a high quality electrode designed to deposit weld metal with high impact toughness properties at -20 °C. The forceful arc ensures sound fusion and is tolerant to variations in welding current, which are important considerations when welding under site conditions.

Classification	
EN ISO	2560-A: E 38 2 R 1 2
EN	499: E 38 2 R 1 2
AWS	A5.1: E 6013

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.06	0.5	0.2	≤0.03	≤0.02

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation	Impact Energy ISO - V (J)
				-20 °C
As Welded	≥ 380	510-610	≥ 22	≥ 47

Materials

S(P)235 to S(P)355; GP240; GP280

Storage

Keep dry and avoid condensation. Re-drying not generally required. If necessary: 100-110 °C for 1 hour.

Current condition and welding position

AC; DC-; DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
2.5	300	50-90	15.2	280	●
3.2	350	100-130	28.7	170	●
4.0	450	130-180	55.7	115	●
5.0	450	200-260	90.2	65	●

SUPERCORD 42

OERLIKON

CE

MMA Electrodes
C-Mn and low-alloy steels

SUPERCORD 42 is a rutile coated MMA electrode with easily detachable slag, suitable for welding in the downhand position. Smaller diameters are also suitable for positional welding. Spatter free welding with a very smooth bead appearance. Excellent mechanical properties. Efficiency 100%.

Classification	
EN ISO	2560-A: E 42 A R 12
EN	499: E 42 A R 12
AWS	A5.1: E 6013
GOST	9467-75:?50-E51 1

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.05-0.11	0.4	0.4	≤ 0.03	≤ 0.03

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 20 °C
As Welded	≥ 420	500 - 600	≥ 24	≥ 47

Materials

S(P)235 to S(P)355; GP240; GP280

Storage

Keep dry and avoid condensation. Re-drying not generally required. If necessary: 100-110 °C for 1 hour.

Current condition and welding position

AC; DC-

PA PB PC PF PG

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX PC	CBOX Code
1.6	250	30-45	5.7	600	●
2.0	300	40-65	10.6	360	●
2.5	300	60-100	17.4	220	●
3.2	450	70-130	43.4	135	●
4.0	450	120-160	60.4	95	●
5.0	450	160-200	95.5	65	●

SUPERCORD 45

OERLIKON

CE

MMA Electrodes
C-Mn and low-alloy steels

SUPERCORD 45 is a medium-coated rutile MMA electrode, suitable for all positional welding, except vertically down. The arc is stable even on low open circuit voltage. Applications include tack welding and welding on dirty or primed plate. Efficiency 100%.

Classification	
EN ISO	2560-A: E 42 0 R 12
EN	499: E 42 0 R 12
AWS	A5.1: E 6013
GOST	9467-75:?50-E51 2

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.06-0.1	0.4-0.7	0.2-0.5	≤0.03	≤0.02

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 0 °C
As Welded	≥ 420	500 - 640	≥ 24	≥ 47

Materials

S(P)235 to S(P)355; GP240; GP280

Storage

Keep dry and avoid condensation. Re-drying not generally required. If necessary: 100-110 °C for 1 hour.

Current condition and welding position

AC; DC-

PA PB PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX PC	CBOX Code
1.6	250	20-50	5.7	600	●
2.0	300	40-70	10.8	360	●
2.5	300	60-90	17.7	215	●
3.2	450	90-130	43.8	130	●

AIR LIQUIDE WELDING

OVERCORD R92

OERLIKON

MMA Electrodes
C-Mn and low-alloy steels

OVERCORD R92 is a rutile coated MMA electrode for welding in all positions. Excellent fusion and good bead aspect. Used with all types of welding equipment even with low OCV. Efficiency 100%.

Classification	
EN ISO	2560-A: E 35 0 RC 1 1
EN	499: E 35 0 RC 1 1
AWS	A5.1: E 6013

Approvals	Grade
BV	2Y

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.07	0.55	0.4	≤ 0.03	≤ 0.03

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)
				0 °C
As Welded	≥ 355	440-570	≥ 24	≥ 47

Materials

S(P)235 to S(P)355; GP240; GP280

Storage

Keep dry and avoid condensation. Re-drying not generally required. If necessary: 100-110 °C for 1 hour.

Current condition and welding position

DC-

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOH		CBOX	
				PC	Code	PC	Code
1.6	300	35-50	7.1	220	●		
2.0	350	50-65	11.3			355	●
2.5	350	70-95	18.2			230	●
3.2	350	90-125	29.1			165	●
3.2	450	90-125	38.0			165	●
4.0	350	130-175	42.8			110	●
4.0	450	130-175	55.0			110	●
5.0	450	160-230	87.4			70	●

OVERCORD

OERLIKON

MMA Electrodes
C-Mn and low-alloy steels

Medium-thick rutile-cellulosic coated MMA electrode for structural steelwork, workshop and maintenance applications, welding can be carried out with the same current setting in all positions. Excellent all positional operating characteristics, especially vertically-down and the arc characteristic ensures reliable penetration. Welding in the vertical-down position produces flat, slightly concave weld beads. Good gap bridging and easy striking and restriking. Used on primer painted and slightly rusted parts, as there is a high tolerance to impurities. The strong and stable arc makes OVERCORD suitable for welding galvanised steel components. Used on mains transformers. If a softer arc is required OVERCORD Z is recommended.

Classification	
EN ISO	2560-A: E 38 0 RC 11
EN	499: E 38 0 RC 11
AWS	A5.1: E 6013

Approvals	Grade
ABS	1 (P)
BV	1
DB	●
DNV	1
GL	1
LRS	1m
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si
0.08	0.5	0.3

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	0 °C
As Welded	≥ 380	470-600	≥ 22	≥ 60	≥ 47

Materials

S(P)235 - S(P)355; GP240; GP280

Storage

Keep dry and avoid condensation. Re-drying not generally required. If necessary: 100-110 °C for 1 hour.

Current condition and welding position

AC; DC-

PA PB PC PD PE PF PG

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOH		CBOX	
				PC	Code	PC	Code
2.0	250	50-60	7.8	205	●		
2.5	350	60-85	16.2			275	●
3.2	350	90-130	28.0			160	●
3.2	450	120-140	41.8			139	●
4.0	350	140-180	43.0			105	●
4.0	450	170-190	64.5			90	●
5.0	350	180-240	67.5			70	●

AIR LIQUIDE WELDING

OVERCORD R10

OERLIKON

MMA Electrodes
C-Mn and low-alloy steels

OVERCORD R10 is a rutile coated MMA electrode for welding in all positions. Used for a wide variety of applications.. Efficiency 100%.

Classification	
EN ISO	2560-A: E 38 0 RC 1 1
EN	499: E 38 0 RC 1 1
AWS	A5.1: E 6013

Approvals	Grade
ABS	2
BV	2
DNV	2
LRS	2

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.07	0.5	0.4	≤0.03	≤ 0.03

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -20 °C
As Welded	≥ 380	480-550	≥ 24	≥ 28

Materials

S(P)235 to S(P)355; GP240; GP280

Storage

Keep dry and avoid condensation. Re-drying not generally required. If necessary: 100-110 °C for 1 hour.

Current condition and welding position

DC-

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
2.0	350	45-65	13.0	310	●
2.5	350	65-90	18.4	230	●
3.2	350	90-125	27.6	165	●
3.2	450	90-125	36.6	165	●
4.0	350	120-175	43.8	110	●
4.0	450	120-175	56.8	110	●
5.0	450	160-230	87.4	70	●

OVERCORD R12

OERLIKON

MMA Electrodes
C-Mn and low-alloy steels

OVERCORD R12 is a rutile coated MMA electrode for all positional welding. Easy to use and toleranrt of dirty or poorly prepared base plates. Efficiency 100%.

Classification	
EN ISO	2560-A: E 38 0 RC 1 1
EN	499: E 38 0 RC 1 1
AWS	A5.1: E 6013

Approvals	Grade
ABS	2
BV	2
DB	●
DNV	2
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.07	0.6	0.4	≤ 0.03	≤ 0.03

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 0 °C
As Welded	≥ 380	470-580	≥ 20	≥ 47

Materials

S(P)235 to S(P)355; GP240; GP280

Storage

Keep dry and avoid condensation. Re-drying not generally required. If necessary: 100-110 °C for 1 hour.

Current condition and welding position

DC-

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		SMPA	
				PC	Code	PC	Code
2.0	350	50-65	11.3	355	●		
2.5	350	75-95	17.3	250	●	38	●
3.2	350	95-125	26.9	155	●	24	●
3.2	450	95-125	35.0	155	●		
4.0	350	140-190	43.0	100	●		
4.0	450	140-190	55.4	100	●		
5.0	450	160-230	87.4	70	●		

AIR LIQUIDE WELDING

OVERCORD Z

OERLIKON

MMA Electrodes
C-Mn and low-alloy steels

Medium-thick rutile-cellulosic general-purpose MMA electrode for structural steelwork, workshop and maintenance welding in all positions. Good gap bridging, easy striking and restriking. The slag is generally self-releasing, the weld beads are smooth and slightly concave, blending into the base plate without undercut. Used for welding galvanised steels, there is a tolerance to impurities in the welding zone. OVERCORD Z has a softer arc than OVERCORD.

Classification	
EN ISO	2560-A: E 38 0 RC 1 1
EN	499: E 38 0 RC 1 1
AWS	A5.1: E 6013

Approvals	Grade
ABS	2
BV	2
DB	●
DNV	2
GL	2
LRS	2
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si
0.08	0.5	0.3

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	0 °C
As Welded	≥ 380	470-600	≥ 22	≥ 60	≥ 47

Materials

S(P)235 - S(P)355; GP240; GP280

Storage

Keep dry and avoid condensation. Re-drying not generally required. If necessary: 100-110 °C for 1 hour.

Current condition and welding position

AC; DC-

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOH		CBOX	
				PC	Code	PC	Code
2.0	300	50-60	9.6			390	●
2.5	350	55-85	17.5	115	●	250	●
3.2	350	90-140	29.6	65	●	155	●
4.0	350	130-180	44.6	45	●	100	●

CITOCORD

MMA Electrodes
C-Mn and low-alloy steels

Thick rutile coated general-purpose MMA electrode for construction welding and assembly. The welding characteristics of CITOCORD are between FINCORD and OVERCORD. 3.2mm and smaller diameters are suitable for welding vertically-down without restrictions. Ideal for tack welding and short beads with a generally self-releasing slag. Applications include mains transformers.

Classification	
EN ISO	2560-A: E 42 0 RC 11
EN	499: E 42 0 RC 11
AWS	A5.1: E 6013

Approvals	Grade
ABS	3
BV	3
DB	●
DNV	3
LRS	3
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si
0.08	0.6	0.4

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-10 °C
As Welded	≥ 420	500-600	≥ 24	≥ 60	≥ 47

Materials

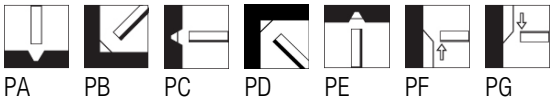
S(P)235 - S(P)355; GP240; GP280

Storage

Keep dry and avoid condensation. Re-drying not generally required. If necessary: 100-110 °C for 1 hour.

Current condition and welding position

AC; DC-



Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
2.5	350	70-95	18.1	230	●
3.2	350	100-135	30.8	150	●
4.0	350	130-190	45.5	100	●

FLEXAL 60

OERLIKON

MMA Electrodes
C-Mn and low-alloy steels

Cellulosic coated MMA electrode for welding large-diameter pipe lines in the vertical-down position. Used for root and hot passes as well as filling and capping. When root pass welding, negative polarity is recommended. FLEXAL 60 is also used for root passes on higher-strength pipe steels, up to X 80. Note: Power source must be suitable for cellulosic-coated MMA electrodes.

Classification	
EN ISO	2560-A: E 38 3 C 21
EN	499: E 38 3 C 21
AWS	A5.1: E 6010
GOST	9467-75: 46-E43 2

Approvals	Grade
ABS	3
DNV	3
LRS	3m
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si
0.1	0.6	0.2

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-30 °C
As Welded	≥ 380	470-560	≥ 24	≥ 60	≥ 47

Materials

L210-L360; X42-X52; root pass in X80

Storage
Do not re-dry

Current condition and welding position
DC-; DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	MCAN	
				PC	Code
2.5	350	40-80	16.2	555	●
3.2	350	60-110	26.7	355	●
4.0	350	90-140	40.0	237	●
5.0	350	110-170	60.0	158	●

FLEXAL 70

OERLIKON

MMA Electrodes
C-Mn and low-alloy steels

FLEXAL 70 is a cellulosic coated MMA electrode for welding large-diameter pipe lines in the vertical-down position. Used for root and hot passes as well as filling and capping. When root pass welding, negative polarity is recommended. Note: Power source must be suitable for cellulosic-coated MMA electrodes.

Classification	
EN ISO	2560-A: E 42 2 Mo C 21
EN	499: E 42 2 Mo C 21
AWS	A5.5: E 7010-P1
GOST	9467-75: 50- E 51 3

Approvals	Grade
ABS	3
DNV	3
LRS	3m 3Ym
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	Mo
0.1	0.7	0.2	0.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-20 °C
As Welded	≥ 420	500-640	≥ 22	≥ 60	≥ 47

Materials

L210-L415, X42-X60

Storage
Do not re-dry

Current condition and welding position
DC-; DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	MCAN	
				PC	Code
2.5	350	40-80	16.2	555	●
3.2	350	60-110	26.7	355	●
4.0	350	90-140	40.0	237	●
5.0	350	110-170	60.0	158	●

AIR LIQUIDE WELDING

FLEXAL 80

MMA Electrodes
C-Mn and low-alloy steels

FLEXAL 80 is a cellulosic coated MMA electrode for welding large-diameter pipe lines in the vertical-down position. Used for root and hot passes as well as filling and capping. Note: Power source must be suitable for cellulosic-coated MMA electrodes.

Classification	
EN ISO	2560-A: E 46 3 1NiMo C21
AWS	A5.5: E 8010-G
GOST	9467-75: 55-E51 3

Approvals	Grade
ABS	3
DNV	3
LRS	3m 3Ym
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	Ni	Mo
0.1	0.8	0.2	0.7	0.3

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-30 °C
As Welded	≥ 460	550-680	≥ 22	≥ 60	≥ 47

Materials

L360-L450, X52-X65

Storage
Do not re-dry

Current condition and welding position
DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	MCAN	
				PC	Code
2.5	350	40-80	15.9	565	●
3.2	350	60-110	26.7	355	●
4.0	350	90-140	39.9	238	●
5.0	350	110-170	60.9	156	●

FLEXAL 90

MMA Electrodes
C-Mn and low-alloy steels

FLEXAL 90 is a cellulosic coated MMA electrode for welding large-diameter pipe lines in the vertical-down position. Used for root and hot passes as well as filling and capping. Note: Power source must be suitable for cellulosic-coated MMA electrodes.

Classification	
EN ISO	2560-A: E 50 2 1Ni C 21
EN	499: E 50 2 1Ni C21
AWS	A5.5: E 9010-G
GOST	9467-75: 55-E55 3

Chemical analysis (Typical values in %)

C	Mn	Si	Ni	Mo
0.15	0.8	0.2	0.8	0.3

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-25 °C
As Welded	≥ 530	580-680	≥ 22	≥ 60	≥ 47

Materials

L450-L555, X65-X80

Storage
Do not re-dry

Current condition and welding position
DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	MCAN	
				PC	Code
2.5	350	50-70	15.9	565	●
3.2	350	80-120	26.7	355	●
4.0	350	110-150	39.9	238	●
5.0	350	140-220	60.9	156	●

FINCORD S

MMA Electrodes
C-Mn and low-alloy steels

FINCORD S is a thick rutile coated MMA electrode particularly suited for the welding of horizontal fillets, producing an outstanding fillet shape. Easy striking and restriking with fine droplet metal transfer with a mostly self-releasing slag, producing very smooth welds blending into the base plate without undercut at the toes. Suitable for use with mains transformers. FINCORD also produces an excellent fillet weld shape, but with increased weld metal toughness. For butt welding, FINCORD or FINCORD DB are recommended.

Classification	
EN ISO	2560-A: E 42 A RR 12
EN	499: E 42 A RR 12
AWS	A5.1: E 6013

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si
0.08	0.6	0.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C
As Welded	≥ 420	500-640	≥ 20	≥ 47

Materials

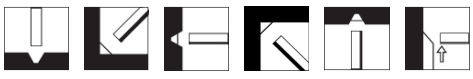
S(P)235 - S(P)355; GP240; GP280

Storage

Keep dry and avoid condensation. Re-drying not generally required. If necessary: 100-110 °C for 1 hour.

Current condition and welding position

AC; DC-



Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOH		CBOX	
				PC	Code	PC	Code
2.0	300	50-70	11.7	150	●		
2.5	350	65-90	21.0			210	●
3.2	350	100-140	35.9			115	●
3.2	450	100-140	47.0			115	●
4.0	450	140-180	69.8			85	●
5.0	450	190-240	107.8			45	●

FINCORD

MMA Electrodes
C-Mn and low-alloy steels

FINCORD is a thick rutile coated multi-purpose MMA electrode with outstanding welding characteristics. Exceptionally easy operability makes it suitable for use by lower skilled welders. Easy striking and restriking and used for touch-welding, the arc is stable with very low spatter and the slag is generally self-releasing. The weld beads are finely-rippled and clean, blending into the base plate without undercut, Increased current-carrying capacity of the larger diameters >3.2mm. Suitable for use with mains transformers. For X-ray quality welds in combination with MAG filler layers, Fincord DB is recommended. In horizontal fillet welds, FINCORD S produces an excellent weld bead shape.

Classification	
EN ISO	2560-A: E 42 0 RR 12
EN	499: E 42 0 RR 12
AWS	A5.1: E 6013

Approvals	Grade
ABS	2 (P)
BV	2
DB	●
DNV	2
GL	2Y
LRS	2m
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si
0.08	0.6	0.45

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	0 °C
As Welded	≥ 420	500-640	≥ 22	≥ 60	≥ 47

Materials

S(P)235 - S(P)355; GP240; GP280

Storage

Keep dry and avoid condensation. Re-drying not generally required. If necessary: 100-110 °C for 1 hour.

Current condition and welding position

AC; DC-

PA PB PC PD PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOH		CBOX	
				PC	Code	PC	Code
1.6	250	30-60	5.9	220	●		
2.0	250	50-70	8.9	170	●		
2.0	350	50-70	12.8			340	●
2.5	350	65-90	20.1			210	●
3.2	350	100-140	34.5			125	●
3.2	450	100-150	44.4			125	●
4.0	350	140-210	50.3			80	●
4.0	450	140-210	66.0			80	●
5.0	450	190-280	102.8			50	●
6.0	450	240-320	146.3			33	●

FINCORD DB

MMA Electrodes
C-Mn and low-alloy steels

Thicker rutile coated MMA electrode for welding plates and pipes, FINCORD DB has a slightly thinner coating than FINCORD. Easy weldability, easy striking and restriking and used extensively for tack-welding. Mostly self-releasing slag, leaving a smooth weld bead surface. Welds are of X-ray quality, also in combination with MAG layers.

Classification	
EN ISO	2560-A: E 42 0 RR 1 2
EN	499: E 42 0 RR 1 2
AWS	A5.1: E 6013

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si
0.08	0.5	0.35

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-10 °C
As Welded	≥ 420	500-640	≥ 22	≥ 60	≥ 47

Materials

S(P)235 - S(P)355; GP240; GP280

Storage

Keep dry and avoid condensation. Re-drying not generally required. If necessary: 100-110 °C for 1 hour.

Current condition and welding position

AC; DC-

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
2.5	350	60-100	19.4	215	●
3.2	350	95-140	32.9	135	●
4.0	450	130-190	64.3	85	●
5.0	450	170-240	102.5	55	●

SUPERCORD R14

OERLIKON

MMA Electrodes
C-Mn and low-alloy steels

SUPERCORD R14 is a rutile MMA electrode with a good bead aspect, used for a wide variety of applications. Suitable for all positional welding, except vertical down. Efficiency 100%.

Classification	
EN ISO	2560-A: E 42 0 RR 1 2
EN	499: E 42 0 RR 1 2
AWS	A5.1: E 6013

Approvals	Grade
ABS	2
BV	2Y
LRS	2

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.7	0.6	0.5	≤ 0.03	≤ 0.03

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 0 °C
As Welded	≥ 420	500-640	≥ 24	≥ 27

Materials

S(P)235 to S(P)355; GP240; GP280

Storage

Keep dry and avoid condensation. Re-drying not generally required. If necessary: 100-110 °C for 1 hour.

Current condition and welding position

DC-

PA PB PC PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX PC	CBOX Code
2.0	350	60-80	12.7	330	●
2.5	350	75-100	19.5	215	●
3.2	350	100-130	31.1	140	●
3.2	450	100-130	39.6	140	●
4.0	350	140-195	49.9	85	●
4.0	450	140-195	64.8	85	●
5.0	450	180-250	103.5	50	●

FERROMATIC 130

OERLIKON

MMA Electrodes
C-Mn and low-alloy steels

FERROMATIC 130 is a thick rutile coated high-efficiency MMA electrode with a recovery of ~130% for welding butt and fillet joints. Easy striking and restriking, low spatter loss and self-releasing slag. The weld bead is smooth with well blended toes, without undercut into the base plate.

Classification	
EN ISO	2560-A:E 42 0 RR 53
EN	499: E 42 0 RR 53
AWS	A5.1: E 7024

Approvals	Grade
ABS	2
BV	2Y
DNV	2
LRS	2m

CE

Chemical analysis (Typical values in %)

C	Mn	Si
0.1	0.8	0.4

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	0 °C
As Welded	≥ 420	510-610	≥ 22	≥ 60	≥ 47

Materials

S(P)235-S(P)420, GP240-GP280

Storage
Keep dry and avoid condensation. Re-drying not generally required. If necessary: 100-110 °C for 1 hour.

Current condition and welding position
AC; DC-; DC+

PA PB

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
3.2	450	110-150	63.7	86	●
4.0	450	150-205	89.6	61	●
5.0	450	230-305	137.5	40	●

AIR LIQUIDE WELDING

FERROMATIC 160

OERLIKON

MMA Electrodes
C-Mn and low-alloy steels

FERROMATIC 160 is a thick rutile coated high-efficiency MMA electrode with a recovery of ~160% for welding butt and fillet joints. Used for the cost effective filling of thicker weld sections and the welding of long fillet welds. Easy striking and restriking, low spatter and mostly self-releasing slag. The weld bead is very smooth and clean with well blended toes, without undercut into the base plate. For applications requiring higher levels of sub zero ISO-V toughness, basic coated FEBAMATIC 160S is recommended.

Classification	
EN ISO	2560-A: E 42 0 RR 73
EN	499: E 42 0 RR 73
AWS	A5.1: E 7024

Approvals	Grade
ABS	2
BV	2Y
DB	●
DNV	2
GL	2
LRS	2m
RINA	2
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si
0.1	0.9	0.45

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	0 °C
As Welded	≥ 420	510-610	≥ 22	≥ 60	≥ 47

Materials

S(P)235-S(P)420, GP240-GP280

Storage

Keep dry and avoid condensation. Re-drying not generally required. If necessary: 100-110 °C for 1 hour.

Current condition and welding position

AC; DC-; DC+

PA PB

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
3.2	450	105-140	71.1	76	●
4.0	450	160-220	107.8	51	●
5.0	450	240-320	148.1	39	●

FERROMATIC 180

OERLIKON

MMA Electrodes
C-Mn and low-alloy steels

FERROMATIC 180 is a thick rutile coated high-efficiency MMA electrode with a recovery of ~180% and long run-out length. Used for the cost effective filling of thicker weld sections and the welding of long fillet welds. Easy striking and restriking, low spatter, mostly self-releasing slag. The weld bead is very smooth and clean with well blended toes, without undercut into the base plate.

Classification	
EN ISO	2560-A: E 42 0 RR 73
EN	499: E 42 0 RR 73
AWS	A5.1: E 7024

Approvals	Grade
ABS	2
BV	2Y
DB	●
DNV	2
GL	2
LRS	3Ym
RMRS	2
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si
0.1	0.9	0.4

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	0 °C
As Welded	≥ 420	510-610	≥ 22	≥ 60	≥ 47

Materials

S(P)235-S(P)420, GP240-GP280

Storage
Keep dry and avoid condensation. Re-drying not generally required. If necessary: 100-110 °C for 1 hour.

Current condition and welding position
AC; DC-; DC+
 PA PB

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
4.0	450	160-220	105.2	51	●
5.0	450	225-310	159.0	33	●

AIR LIQUIDE WELDING

FERROMATIC 200

OERLIKON

MMA Electrodes
C-Mn and low-alloy steels

FERROMATIC 200 is a rutile coated high-efficiency MMA electrode with a recovery of ~200% and long run-out length. Used for the cost effective filling of thicker weld sections and the welding of long fillet welds. Easy striking and restriking, low spatter, mostly self-releasing slag. The weld bead is very smooth and clean with well blended toes, without undercut into the base plate.

Classification	
EN ISO	2560-A: E 42 0 RR 73
EN	499: E 42 0 RR 73
AWS	A5.1: E 7024

Approvals	Grade
BV	3Y
DNV	3
LRS	3Ym

CE

Chemical analysis (Typical values in %)

C	Mn	Si
≤0.1	0.6-1.2	0.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation	Impact Energy ISO - V (J)	
				+20 °C	0 °C
As Welded	≥ 420	510-610	≥ 22	≥ 60	≥ 47

Materials

S(P)235-S(P)420, GP240-GP280

Storage

Keep dry and avoid condensation. Re-drying not generally required. If necessary: 100-110 °C for 1 hour.

Current condition and welding position

AC; DC-; DC+

PA PB

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
3.2	450	110-150	81.3	68	●
3.2	600	180-230	108.4	68	●
4.0	450	130-170	108.0	54	●
5.0	450	210-270	166.0	33	●

MMA Electrodes
C-Mn and low-alloy steels

Rutile-basic coated MMA electrode which is particularly suitable for welding root, fill and capping passes with X-ray quality for pipes, boilers and tanks. The welding current can be decreased to low values while maintaining a stable arc, good for gap-bridging . The excellent positional welding characteristics have established CITOREX as a first choice for welder training. Due to the low silicon content of the weld deposit, CITOREX is used to weld components for subsequent galvanising or enamelling. In order to obtain a finely-rippled weld bead, the use of FINCORD DB for capping passes is recommended.

Classification	
EN ISO	2560-A: E 38 2 RB 12
EN	499: E 38 2 RB 12
AWS	A5.1: E 6013

Approvals	Grade
ABS	3
BV	3
DB	●
DNV	3
GL	3
LRS	3m
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si
0.08	0.6	0.2

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-20 °C
As Welded	≥ 380	470-600	≥ 22	≥ 80	≥ 47

Materials

S(P)235 - S(P)355; GP240; GP280; L210 - L360

Storage

Keep dry and avoid condensation. Re-drying not generally required. If necessary: 100-110 °C for 1 hour.

Current condition and welding position

AC; DC-

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOH		CBOX	
				PC	Code	PC	Code
2.0	250	40-60	9.3	150	●		
2.5	350	50-90	19.7			200	●
3.2	350	100-150	33.4			125	●
4.0	350	140-190	50.5			85	●
4.0	450	140-190	63.6			85	●
5.0	450	220-260	97.9			55	●

CITORAPID

MMA Electrodes
C-Mn and low-alloy steels

CITORAPID is a acid-rutile coated MMA electrode featuring a high burn-off rate and a very high current carrying capacity. Therefore, it is particularly suited for piece-work applications. The slag is porous and very easily released even from narrow joints leaving a smooth, slightly concave weld bead. Suitable for welding primer painted and slightly rusted parts. Due to the low Si-content, welded components are suitable for subsequent galvanising, enamelling and rubber cladding. Weld joints are of X-ray quality.

Classification	
EN ISO	2560-A: E 38 2 RA 13
EN	499: E 38 2 RA 13
AWS	A5.1: E 6020

Approvals	Grade
ABS	3
BV	3
DB	●
DNV	3
GL	3
LRS	3m
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si
0.08	0.6	0.2

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-20 °C
As Welded	≥ 380	470-600	≥ 20	≥ 80	≥ 47

Materials

S(P)235 - S(P)355; GP240; GP280

Storage
Keep dry and avoid condensation. Re-drying not generally required. If necessary: 100-110 °C for 1 hour.

Current condition and welding position
AC; DC-

PA PB

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
3.2	450	90-160	42.3	125	●
4.0	450	130-220	64.0	80	●
5.0	450	180-300	99.6	50	●

CITORAPID 160W

OERLIKON

MMA Electrodes
C-Mn and low-alloy steels

CITORAPID 160W is a acid-rutile coated MMA electrode featuring a high burn-off rate and a very high current carrying capacity, suitable for rapid piece-work applications. The solid slag is porous and very easily released even from narrow joints to leave smooth, slightly concave weld beads. Suitable for welding on primer painted and slightly rusted parts. Due to the low silicon content of the weld deposit, applications include parts to be galvanised, enamelled and rubber clad. Weld joints are of X-ray quality.

Classification	
EN ISO	2560-A: E 38 2 RA 73
EN	499: E 38 2 RA 73
AWS	A5.1: E 6027

Approvals	Grade
DB	●
GL	
LRS	
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si
0.06	0.8	0.25

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-20 °C
As Welded	≥ 380	470-600	≥ 20	≥ 80	≥ 47

Materials

S(P)235 - S(P)355; GP240; GP280

Storage

Keep dry and avoid condensation. Re-drying not generally required. If necessary: 100-110 °C for 1 hour.

Current condition and welding position

AC; DC-

PA PB

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
4.0	450	170-220	97.0	53	●
5.0	450	220-250	153.0	28	●

AIR LIQUIDE WELDING

MMA Electrodes
C-Mn and low-alloy steels

Basic-coated multi-purpose double-coated MMA electrode for metal construction, workshop and maintenance welding. The double coating of this electrode confers a stable and concentrated arc with good gap bridging characteristics, excellent for root pass and positional welding. The glassy slag is easily detached from the smooth weld beads, which are of X-ray quality. Approved for rail joint welding by DB, tensile strength < 685 MPa.

Classification	
EN ISO	2560-A: E 42 4 B 32 H10
EN	499: E 42 4 B 32 H10
AWS	A5.1: E 7016-H8

Approvals	Grade
ABS	3H10
BV	3YHH
DB	●
DNV	3Y H10 (P)
GL	3Y H10
LRS	3m 3Ym H10 (P)
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.08	1.3	0.45	≤ 0.025	≤ 0.015

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-40 °C
As Welded	≥ 420	500-640	≥ 25	≥ 150	≥ 80

Materials

S(P)235-S(P)420, GP240-GP280

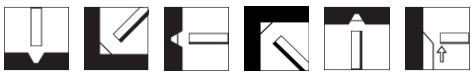
Storage

Keep dry and avoid condensation.

HD ≤ 10: Re-dry at 300-350 °C for 2 hours, 5 times max

Current condition and welding position

AC; DC+



Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
2.5	350	60-90	19.7	200	●
3.2	350	90-140	32.8	125	●
4.0	450	135-190	64.2	80	●
5.0	450	180-260	100.0	50	●

MMA Electrodes
C-Mn and low-alloy steels

SPEZIAL is a basic, double-coated multi-purpose MMA electrode. The composition of the double coating confers exceptionally good welding characteristics and a highly stable and directional arc. Very good gap bridging and ideally suited for root passes and positional welding. The glassy slag is easily removed from the finely-rippled weld seams, the excellent welding characteristics and ISO-V toughness to -30°C have made SPEZIAL a renowned and reliable electrode for welding structural steelwork, production and assembly jobs in industry and for pipeline construction for decades. Welds are of X-ray quality. Optimum AC weldability requires an OCV > 65V.

Classification	
EN ISO	2560-A: E 38 3 B 12 H10
AWS	A5.1: E 7016-H8

Approvals	Grade
ABS	3H10
BV	3YHH
DB	●
DNV	3Y40H10

Approvals	Grade
GL	3YH10
LRS	3YmH15
RMRS	3YHH
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.06	0.9	0.7	≤ 0.020	≤ 0.015

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-30 °C
As Welded	≥ 380	470-600	≥ 25	≥ 150	≥ 60

Materials

S(P)235-S(P)355; GP240-GP280; L245-L360

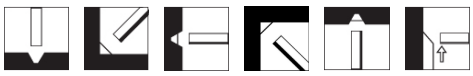
Storage

Keep dry and avoid condensation.

HD ≤ 10: Re-dry at 300-350 °C for 2 hours, 5 times max

Current condition and welding position

AC; DC+



PA PB PC PD PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
2.0	350	55-65	12.6	330	●	160	●
2.5	350	60-90	19.7	200	●	100	●
3.2	350	95-150	33.0	125	●	55	●
3.2	450	95-150	42.7	125	●	55	●
4.0	450	140-190	65.0	80	●	40	●
5.0	450	190-250	100.4	50	●	25	●

TENAX 56S

OERLIKON

MMA Electrodes
C-Mn and low-alloy steels

TENAX 56S is a basic coated low hydrogen MMA electrode with a very thin coating to improve joint access when root pass welding. The principal applications are related to the all positional welding of steels to BS 4360-50D or equivalent. Designed for pipe welding in position. The main applications are in the following industries, offshore oil and gas, petrochemical and power engineering. Efficiency 100%.

Classification	
EN ISO	2560-A: E 42 5 B 12 H5
EN	499: E 42 5 B 12 H5
AWS	A5.1: E 7016-1 H4
GOST	9467-75:?50A-E51 6

Approvals	Grade
ABS	4H5-4Y
BV	3-3YHHH
DB	●
DNV	4YH5
GL	3Y H5
LRS	3m 4Ym H5
RINA	4YH5
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.06	1.2	0.5	≤ 0.02	≤ 0.02

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -50 °C
As Welded	≥ 420	500-640	≥ 22	≥ 110
620 °C x 1h	≥ 390	500-620	≥ 22	≥ 110

Materials

S(P)235-S(P)420, GP240-GP280

Storage

Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 400-420 °C for 1 hour, 5 times max

HD ≤ 10: Re-dry at 350-370 °C for 1 hour, 5 times max

Current condition and welding position

AC; DC-; DC+

PA PB PC PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
2.0	300	60-75	10.5	320	●		
2.5	300	60-90	16.7			110	●
2.5	350	60-90	19.5	215	●	110	●
3.2	350	80-130	31.2	140	●	65	●
3.2	450	80-120	39.8	140	●	65	●
4.0	350	125-170	46.1			45	●
4.0	450	125-170	58.4	95	●	45	●
5.0	450	170-240	89.1	65	●	30	●

ULTRACITO

MMA Electrodes
C-Mn and low-alloy steels

ULTRACITO is a basic coated low hydrogen MMA electrode for welding a wide range of mild and carbon-manganese steels and is particularly suitable for fillet welding where excellent mitre finish beads are obtained. Depositing a C-1,2%Mn weld metal, the addition of metal powder to the coating gives a nominal efficiency of 110%. ULTRACITO is a versatile all-positional electrode exhibiting a very stable arc with good control of the molten weld pool, for welding both thin plate and heavy sections, especially in deep or restricted configurations.

Classification	
EN ISO	2560-A: E 42 2 RB 32 H10
EN	499: E 42 2 RB 32 H10
AWS	A5.1: E 7018

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.05	1.25	0.4	≤0.02	≤0.02

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -20 °C
As Welded	≥ 420	500-640	≥ 24	≥ 80

Materials

S(P)235-S(P)420, GP240-GP280

Storage

Keep dry and avoid condensation.

HD ≤ 10: Re-dry at 300-350 °C for 2 hours, 5 times max

Current condition and welding position

AC; DC-; DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX PC	CBOX Code
2.5	300	60-90	19.9	180	●
3.2	350	95-150	36.2	120	●
4.0	450	140-190	67.9	85	●
5.0	450	170-260	106.4	55	●

SUPERCITO A

CE

MMA Electrodes
C-Mn and low-alloy steels

SUPERCITO A is thick coated basic MMA electrode, used for welding highly strained components with both static and dynamic loading. Structural engineering applications include, boilers, tanks, vehicle construction, bridges and shipbuilding. SUPERCITO A welds with a stable arc and very low spatter, the slag is easy to remove. It deposits low hydrogen weld metal for service temperatures down to -40°C. The weld metal diffusible hydrogen content conforms to low hydrogen, < 5mlH2/100g deposited weld metal. Weld metal recovery: ~116%

Classification	
EN ISO	2560-A: E 42 4 B 42 H5
AWS	A5.1: E 7018

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.05-0.9	0.80-1.20	0.25-0.65	≤0.025	≤0.015

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -40 °C
620°Cx1h	≥ 420	500-620	≥ 22	≥ 47
As Welded	≥ 430	510-640	≥ 24	≥ 47

Materials

S185, S235, S275, S355
P235, P265, P295, P335
S275; S355; S420

Storage

Keep dry and avoid condensation.
HD ≤ 5: Re-dry at 340-360 °C for 2 hours, 5 times max.
HD ≤ 10: Re-dry at 300-350 °C for 2 hours, 5 times max

Current condition and welding position

AC; DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX PC	CBOX Code
2.0	300	50-80	12.4	282	●
2.5	350	65-90	22.3	180	●
3.2	350	120-140	35.7	112	●
3.2	450	120-140	46.7	117	●
4.0	450	160-190	67.8	81	●
5.0	450	210-230	100.9	55	●

SUPERCITO E

MMA Electrodes
C-Mn and low-alloy steels

SUPERCITO E is a low hydrogen MMA electrode with iron powder coating additions, suitable for welding C-Mn steels. High deposition rate, ideal for ship-building applications and general construction. Welds deposited with this electrode have excellent x-ray quality and very good impact toughness. Efficiency 120%.

Classification	
EN ISO	2560-A: E 42 4 B 3 2 H5
AWS	A5.1: E 7018

Approvals	Grade
ABS	3YH5
BV	3Y HHH
DNV	3 YH5
GL	3YH10
LRS	3YmH5
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.05-0.08	1.0-1.5	≤0.55	≤ 0.02	≤ 0.02

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -30 °C
As Welded	≥ 420	≥ 510	≥ 24	≥ 80

Materials

S(P)235-S(P)420; GP240-GP280; L245-L360

Storage

Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

HD ≤ 10: Re-dry at 300-350 °C for 2 hours, 5 times max

Current condition and welding position

DC+

PA PB PC PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
2.5	350	65-90	22.3	185	●	90	●
3.2	350	100-140	35.2	120	●	55	●
3.2	450	120-140	46.0	120	●	55	●
4.0	450	160-190	68.0	85	●	40	●
5.0	450	210-230	100.5	55	●	25	●

TENACITO R

OERLIKON

MMA Electrodes
C-Mn and low-alloy steels

Basic coated MMA electrode for reliable, crack-free and tough welded joints on steels with a yield strength <420MPa.The weld metal is of extremely high metallurgical purity, is ageing-resistant, retaining ISO-V toughness to -60°C and CTOD tested. Very low hydrogen content. Due to the double coating of the 2.5 mm and 3.2 mm sizes, the arc is both stable and concentrated, even at lower welding currents when positional welding, with good gap bridging characteristics. Welds are of X-ray quality. TENACITO R is also suited for critical applications when welding steels with a carbon content <0.6 %, e.g. C45, C60. DB approved for rail welding.

Classification	
EN ISO	2560-A: E 42 6 B 4 2 H5
EN	499: E 42 6 B 4 2 H5
AWS	A5.1: E 7018-1 H4

Approvals	Grade
ABS	4H5-4Y
BV	3Y HH
DB	●
DNV	5Y H5
GL	4Y H5
LRS	4m 4Ym H5
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.06	1.45	0.3	≤ 0.012	≤ 0.012

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-60 °C
As Welded	≥ 420	500-640	≥ 25	≥ 180	≥ 90
580 °C x 15 h	≥ 420	500-640	≥ 25	≥ 160	≥ 90

Materials

S(P)235-S(P)420, GP240-GP280; L245-L415

Storage

Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

HD ≤ 10: Re-dry at 300-350 °C for 2 hours, 5 times max

Current condition and welding position

DC+

PA PB PC PD PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
2.5	350	65-95	19.2	225	●	110	●
3.2	350	90-140	34.4	125	●	60	●
3.2	450	90-140	46.1	125	●	60	●
4.0	450	140-185	68.6	80	●	35	●
5.0	450	180-240	109.6	45	●	20	●

MMA Electrodes
C-Mn and low-alloy steels

UNIVERS is a basic coated MMA electrode depositing comparatively low tensile strength and high toughness weld metal. Recommended for avoiding cracking when welding highly restrained structural members with large weld cross sections or when stress relieving is not possible.

Classification	
EN ISO	2560-A: E 38 6 B 42 H5
EN	499: E 38 6 B 42 H 5

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.07	0.9	0.4	≤ 0.020	≤ 0.015

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				-40 °C	-60 °C
As Welded	355-430	440-550	≥ 28	≥ 120	≥ 100

Materials

S(P)235-S(P)355, GP240-GP280; L245-L290

Storage

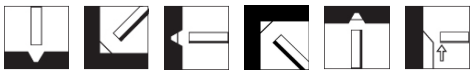
Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 340-360 °C for 2 hours, 5 times max

HD ≤ 10: Re-dry at 300-350 °C for 2 hours, 5 times max

Current condition and welding position

AC; DC+



Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
2.5	350	60-85	19.5	220	●	110	●
3.2	350	90-140	34.2	125	●	60	●
4.0	450	140-190	67.0	80	●	40	●
5.0	450	170-260	107.9	50	●	25	●

FEBAMATIC 160S

OERLIKON

MMA Electrodes
C-Mn and low-alloy steels

Basic coated high-efficiency MMA electrode with a recovery of ~165%, used for cost effective fillet welding and for filling thicker sections. The weld metal is free of cracks and is of X-ray quality, with ISO-V toughness down to -40°C. Easy slag removal, leaving smooth and clean welds blending into the base plate without undercut. FEBAMATIC 160S is used when the application is unsuitable for welding with rutile coated high efficiency MMA electrodes. Suitable for welding primer painted components

Classification	
EN ISO	2560-A: E 42 4 B 54 H5
EN	499: E 42 4 B 54 H5
AWS	A5.1: E 7028

Approvals	Grade
ABS	3YHH
BV	3YHHH
DB	●
DNV	3YH5
GL	3Y H5
LRS	3Ym-4Y40m H5
RMRS	3YHHH
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.1	1.1	0.6	≤ 0.025	≤ 0.015

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-40 °C
As Welded	≥ 420	510-610	≥ 26	≥ 150	≥ 80
600ºC x 2h	≥ 420	500-600	≥ 26	≥ 150	≥ 80

Materials

S(P)235-S(P)420, GP240-GP280

Storage

Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

HD ≤ 10: Re-dry at 300-350 °C for 2 hours, 5 times max.

Current condition and welding position

AC; DC+

PA PB

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
4.0	450	175-240	101.5	55	●	26	●
5.0	450	230-320	145.0	39	●	18	●

TENAX CY17

MMA Electrodes
C-Mn and low-alloy steels

TENAX CY17 is a basic coated MMA electrode with very low diffusible hydrogen content for welding steels with a tensile strength <600 MPa. Recommended for welding very thick section or fully restrained assemblies. Very high impact toughness down to - 40 °C and CTOD tested. Applications include offshore drilling, boiler work, construction and repair of pressurised equipment.

Classification	
EN ISO	2560-A: E 42 5 B 32 H5
EN	499: E 42 5 B 3 2 H5
AWS	A5.1: E 7018-1

Approvals	Grade
ABS	3H10-3Y
BV	33YHHH
DB	●
DNV	4Y40H5
LRS	33YH5
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.07	1.4	0.3	≤ 0.025	≤ 0.02

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation	Impact Energy ISO - V (J)
				-50 °C
As Welded	≥ 420	530-640	≥ 22	≥ 47

Materials

S(P)235-S(P)420, GP240-GP280

Storage

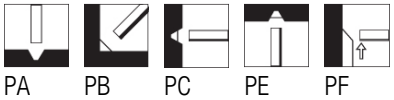
Keep dry and avoid condensation.

HD = 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

HD = 10: Re-dry at 300-350 °C for 2 hours, 5 times max

Current condition and welding position

AC; DC+



Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		DRYF	
				PC	Code	PC	Code
2.5	350	70-95	21.4	185	●	28	●
3.2	350	95-130	35.4	115	●	22	●
3.2	450	95-130	46.0	55	●	22	●
4.0	450	130-180	65.0	85	●	18	●
5.0	450	170-230	102.0	55	●		
6.0	450	220-300	154.8	40	●		

SUPERCITO

MMA Electrodes
C-Mn and low-alloy steels

SUPERCITO is a heavy basic coated MMA electrode, designed for highly restrained work with static and dynamic loadings. Used in structural engineering, boilers, tanks and vehicle construction and also bridge building and shipbuilding. Recommended for service temperatures down to -50°C. Good CTOD at -10ºC.

Classification	
EN ISO	2560-A: E 42 5 B 3 2 H5
AWS	A5.1: E 7018-1-H4

Approvals	Grade
ABS	3YH5
BV	3YHHH
DB	●
DNV	3YH5

Approvals	Grade
GL	3YH5
LRS	3YmH5
RMRS	3YHH
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.05-0.08	1.0-1.5	≤0.55	≤ 0.020	≤ 0.020

All-weld metal Mechanical Properties

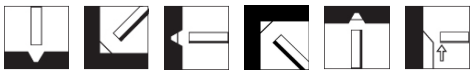
Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -50 °C
As Welded	≥ 430	≥ 510	≥ 24	≥ 47

Materials

S(P)235-S(P)420; GP240-GP280; L245-L360

Storage
Keep dry and avoid condensation.
HD ≤ 5: Re-dry at 340-360 °C for 2 hours, 5 times max.
HD ≤ 10: Re-dry at 300-350 °C for 2 hours, 5 times max

Current condition and welding position
AC; DC+



Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
2.5	350	65-90	22.3	185	●	90	●
3.2	350	100-140	35.2	120	●	55	●
3.2	450	100-140	46.0	120	●	55	●
4.0	450	140-190	68.0	85	●	40	●
5.0	450	190-250	100.5	55	●	25	●

SUPERCITO 7018 S

OERLIKON

MMA Electrodes
C-Mn and low-alloy steels

SUPERCITO 7018 S is a basic coated MMA electrode for producing crack-free and tough welded joints Good welding characteristics, suitable for root passes and positional welding, welds are of X-ray quality. The weld metal has good ISO-V toughness to -50°C. Suitable for unalloyed steels with low purity or higher carbon content, <0.4%C, and for buffer layers. Very low hydrogen content after re-drying.

Classification	
EN ISO	2560-A: E 42 5 B 3 2 H5
EN	499: E 42 5 B 3 2 H5
AWS	A5.1: E 7018-1 H4

Approvals	Grade
ABS	3H10-3Y
BV	33YHHH
DB	●
DNV	4Y40 H5
GL	4Y40H5
LRS	33Y H5
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.05	1.2	0.4	≤ 0.020	≤ 0.015

All-weld metal Mechanical Properties

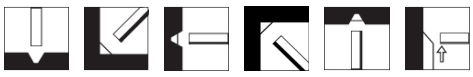
Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)		
				-20 °C	-30 °C	-50 °C
As Welded	≥ 420	510-640	≥ 24	≥ 150	≥ 120	≥ 70

Materials

S(P)235-S(P)420; GP240-GP280; L245-L360

Storage
Keep dry and avoid condensation.
HD ≤ 5: Re-dry at 340-360 °C for 2 hours, 5 times max.
HD ≤ 10: Re-dry at 300-350 °C for 2 hours, 5 times max

Current condition and welding position
AC; DC+



Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		DRYF		VPMD	
				PC	Code	PC	Code	PC	Code
2.5	350	70-95	21.4	185	●	28	●	85	●
3.2	350	100-135	34.2	115	●	22	●	55	●
3.2	450	100-135	44.4	115	●	22	●	55	●
4.0	450	130-180	66.5	80	●	18	●	40	●
5.0	450	170-240	103.8	55	●			25	●

AIR LIQUIDE WELDING

TENAX 35S

OERLIKON

MMA Electrodes
C-Mn and low-alloy steels

TENAX 35S is a general purpose basic coated low hydrogen MMA electrode containing iron powder additions, suitable for positional welding. The weld appearance is very good and spatter levels minimal. The excellent mechanical properties make this electrode suitable for critical applications in industries including offshore oil and gas, nuclear and pressure vessels and the general construction industry. Conformance to E7018.1 H4R is available on request. Very good X ray quality. Efficiency 120%.

Classification	
EN ISO	2560-A: E 42 5 B 32 H5
EN	499: E 42 5 B 32 H5
AWS	A5.1: E 7018-1 H4
GOST	9467-75:?50A-E51 6

Approvals	Grade
ABS	4H5 4Y
BV	3YHHH
DB	●
DNV	4YH5
GL	4Y40 H5
LRS	3YMH5
RINA	4D/4YDH5
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.075	1.35	0.35	≤ 0.02	≤ 0.015

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -50 °C
As Welded	≥ 420	510 - 640	≥ 22	≥ 100
620 °C x 1h	≥ 400	490 - 560	≥ 22	≥ 100

Materials

S(P)235-S(P)420, GP240-GP280

SA 516 gr.60; SA 516 gr.70; SA 106 gr.B

Storage

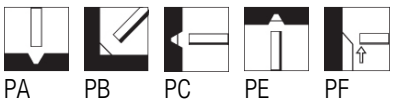
Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 400-420 °C for 1 hour, 3 times max.

HD ≤ 10: Re-dry at 350-370 °C for 1 hour, 3 times max

Current condition and welding position

AC; DC+



PA PB PC PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD PC	VPMD Code
2.5	350	70-100	23.5	90	●
3.2	350	90-130	39.0	55	●
3.2	450	90-130	49.5	55	●
4.0	450	110-170	70.9	40	●
5.0	450	175-220	106.5	25	●

TENAX 55H

OERLIKON

MMA Electrodes
C-Mn and low-alloy steels

TENAX 55H is a basic coated MMA electrode depositing 1.5%Mn weld metal with very good weldability. Low hydrogen content weld deposit, excellent mechanical properties and easy positional welding. Suitable for high yield strength steels. Efficiency 120%.

Classification	
EN ISO	2560-A: E 42 5 B 32 H5
EN	499: E 42 5 B 32 H 5
AWS	A5.1: E 7018-1 H4
GOST	9467-75:?46A-E43 6 2

Approvals	Grade
ABS	3H5-3Y
DNV	4YH5
LRS	3m 3Ym H5
RINA	4YDH5

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.06	1.5	0.35	≤ 0.03	≤ 0.03

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -50 °C
As Welded	≥ 420	500 - 640	≥ 22	≥ 80

Materials

S(P)235-S(P)420, GP240-GP280

Storage

Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 400-420 °C for 1 hour, 3 times max.

HD ≤ 10: Re-dry at 350-370 °C for 1 hour, 3 times max

Current condition and welding position

AC; DC+

PA PB PC PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
2.5	300	70-100	20.1	180	●	90	●
3.2	450	90-130	49.5	115	●	55	●
4.0	450	110-170	70.9	80	●	40	●
5.0	450	175-220	106.5	55	●	25	●
6.0	450	210-280	150.3	40	●		

BOR SP6

MMA Electrodes
C-Mn and low-alloy steels

Basic double-coated special MMA electrode for the welding of rails using a copper backing. Continuous welding of the rail joint is possible without intermediate slag removal. For these special applications, BOR SP6 is only available in 550 mm length.

Classification	
EN ISO	2560-A: E 46 6 B 34 H10
EN	499: E 46 6 B 34 H10

Approvals	Grade
DB	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.06	1.8	0.7	≤ 0.025	≤ 0.015

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-60 °C
As Welded	≥ 460	530-680	≥ 24	≥ 160	≥ 60

Materials

Schienenstähle bis Zugfestigkeit 1080 N/mm²

Storage
Keep dry and avoid condensation.
HD ≤ 10: Re-dry at 300-350 °C for 2 hours, 5 times max

Current condition and welding position
DC+
 PA PB

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
4.0	550	160-210	86.2	40	●
5.0	550	180-220	131.7	25	●
6.0	550	210-260	182.7	18	●

TENAX 76S

OERLIKON

MMA Electrodes
C-Mn and low-alloy steels

TENAX 76S is used for welding steels to BS 4360 50D and similar steel grades particularly for joints in thicker sections. Very good weld metal ISO-V and CTOD toughness in the as welded condition. There are many approved welding procedures for the offshore oil and gas and construction industries, where TENAX 76S is used extensively for welding higher yield steels with absolute confidence. Efficiency 120%.

Classification	
EN ISO	2560-A: E 46 6 1Ni B 32 H5
EN	499: E 46 6 1Ni B 32 H5
AWS	A5.5: E 7018-G
GOST	9467-75:?55-E51 7

Approvals	Grade
ABS	3YH5
BV	3YHHH
DNV	5Y H5
GL	6Y H5
LRS	5Y40m H5
RINA	4YH5

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni
0.07	1.4	0.3	≤ 0.02	≤ 0.01	0.9

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -60 °C
As Welded	≥ 460	530 - 680	≥ 22	≥ 90
620 °C x 1h	≥ 390	490 - 560	≥ 22	≥ 110

Materials

SA 516 gr.60; SA 516 gr.70; SA 106 gr.B; SA333 gr1/6.

S(P)235 to S(P)360; GP240-GP280

Storage

Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 400-420 °C for 1 hour, 5 times max.

HD ≤ 10: Re-dry at 350-370 °C for 1 hour, 5 times max

Current condition and welding position

AC; DC+

PA PB PC PE PF PG

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
2.5	300	80-100	18.3	215	●	90	●
2.5	350	80-100	21.4	215	●	90	●
3.2	350	100-140	36.6	115	●	55	●
3.2	450	100-130	47.1	115	●	55	●
4.0	450	120-180	67.4	85	●	40	●
5.0	450	180-270	102.0	55	●	25	●

TENACITO 38R

OERLIKON

MMA Electrodes
C-Mn and low-alloy steels

Basic coated MMA electrode for reliable, crack-free and tough welded joints on steels with a yield strength <460MPa. The weld metal is of extremely high metallurgical purity, is ageing-resistant, retaining ISO-V toughness down to -60°C and CTOD tested. Very low hydrogen content. Due to the double coating of the 2.5 mm and 3.2 mm sizes, the arc is both stable and concentrated, even at lower welding currents when positional welding. Good gap bridging characteristics. Welds are of X-ray quality. On request, TENACITO 38R can be supplied to special quality assurance requirements.

Classification	
EN ISO	2560-A: E 46 6 1Ni B 4 2 H5
EN	499: E 46 6 1Ni B 4 2 H5
AWS	A5.5: E 7018-G H4

Approvals	Grade
ABS	3Y
BV	5Y
DB	●
DNV	5Y H5
GL	6Y42 H5
LRS	5Y40m H5
RMRS	5Y46HHH
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni
0.06	1.3	0.4	≤ 0.012	≤ 0.015	0.95

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-60 °C
As Welded	≥ 460	530-650	≥ 25	≥ 180	≥ 110
580 °C x 15 h	≥ 420	500-650	≥ 25	≥ 180	≥ 90

Materials

S(P)235-S(P)460; GP240-GP280; L245-L450

Storage

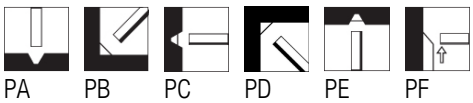
Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

HD ≤ 10: Re-dry at 300-350 °C for 2 hours, 5 times max

Current condition and welding position

DC+



PA PB PC PD PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
2.5	350	65-95	18.7	225	●	110	●
3.2	350	90-140	34.7	125	●	60	●
4.0	450	140-185	68.2	80	●	35	●
5.0	450	180-250	111.3	45	●	20	●

OE-CRYO 87

OERLIKON

MMA Electrodes
C-Mn and low-alloy steels

OE CRYO 87 deposits weld metal containing 3,5%Ni and is suitable for welding fine grain steels. Used for welding steels operating at temperatures down to -101°C. Suitable for welding pipes, tanks, containers. Efficiency 100%.

Classification	
EN ISO	2560-A: E 42 6 3Ni B 12 H5
EN	499: E 42 6 3 Ni B 12 H5
AWS	A5.5: E 7016-C2L
GOST	9467-75:?50A-E51 7

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni
0.03	0.5	0.2	≤ 0.02	≤ 0.02	3.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -101 °C
As Welded	≥ 420	500-640	≥ 25	≥ 47
620 °C x 1h	≥ 420	≥ 460	≥ 25	≥ 60

Materials

ASTM A203 gr. B; A333/ A334 gr. 3; 12Ni14

Storage

Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 400-420 °C for 1 hour, 5 times max

HD ≤10: Re-dry at 350-370 °C for 1 hour, 5 times max

Current condition and welding position

AC; DC+

PA PB PC PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
2.5	300	60-90	18.5	90	●
3.2	350	90-140	34.9	60	●
4.0	350	120-180	53.5	40	●
5.0	450	190-250	94.9	25	●

OE-CRYO 75 H

OERLIKON

MMA Electrodes
C-Mn and low-alloy steels

OE CRYO 75H is a low hydrogen Ni alloyed electrode, depositing high toughness weld metal. Used for the construction of tanks, etc. Use a short arc and low travel speed. Efficiency 120%.

Classification	
EN ISO	2560-A: E 42 6 2Ni B 32 H5
EN	499: E 42 6 2Ni B 32 H5
AWS	A5.5: E 7018-C1L
GOST	9467-75:?50A-E51 7

Approvals	Grade
DNV	5Y H5
RINA	5YDH5

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni
0.04	0.5	0.3	≤ 0.015	≤ 0.015	2.3

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -60 °C
As Welded	≥ 420	510 - 660	≥ 26	≥ 80
620 °C x 1h	≥ 420	≥ 460	≥ 26	≥ 110

Materials

12Ni14, S275-S420, P275-P460

Storage

Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 400-420 °C for 1 hour, 3 times max.

HD ≤ 10: Re-dry at 350-370 °C for 1 hour, 3 times max

Current condition and welding position

AC; DC+

PA PB PC PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
2.5	300	60-120	16.8	100	●
3.2	450	100-140	47.0	60	●
4.0	450	120-190	67.4	40	●
5.0	450	180-250	103.1	25	●

OE-CRYO 55

OERLIKON

MMA Electrodes
C-Mn and low-alloy steels

OE-CRYO 55 is a basic coated MMA electrode for welding of 0,5% - 2%Ni steels for use at low temperatures. Excellent weld metal mechanical properties in both the as welded and stress relieved conditions. CTOD tested.

Classification	
EN ISO	2560-A: E 46 6 2Ni B 4 2 H5
EN	499: E 46 6 2Ni B 4 2 H5
AWS	A5.5: E 8018-C1

Approvals	Grade
ABS	8018 C1
BV	UP
DNV	H10
LRS	3YYH5 5Y40

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni
0.04	1	0.4	≤ 0.02	≤ 0.015	2.3

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation	Impact Energy ISO - V (J)
				-60 °C
As Welded	≥ 460	550-680	≥ 22	≥ 110

Materials

12Ni14, S275-S460, P275-P460

A333 Gr 7, A203 Gr A,B.

Storage

Keep dry and avoid condensation.

HD = 5: Re-dry at 400-420 °C for 2 hours, once only.

HD = 10: Re-dry at 340-360 °C for 2 hours, 5 times max

Current condition and welding position

DC+

PA PB PC PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	DRYF	
				PC	Code
2.5	350	70-90	20.3	30	●
3.2	350	95-130	32.0	22	●
4.0	450	130-180	64.9	18	●
5.0	450	170-230	99.7	8	●

TENAX 88S

OERLIKON

MMA Electrodes
C-Mn and low-alloy steels

TENAX 88S is a low-alloyed MMA electrode for welding higher yield steels >450N/mm², BS 4360-55 E/F a nd E 450 EMZ, used for topside facilities of oil and gas production platforms. This electrode produces high impact and fracture (CTOD) tough weld metal in the as-welded and stress relieved conditions. Excellent operability in all welding positions. TENAX 88S is used extensively in offshore oil and gas applications for the all positional welding of higher yield strength steels. Efficiency 100%.

Classification	
EN ISO	2560-A: E 50 6 Mn1Ni B 12 H5
EN	499: E 50 6 Mn1Ni B 12 H5
AWS	A5.5: E 8016-G
GOST	9467-75:?60-06?2H1-7

Approvals	Grade
ABS	3YH5
DNV	5Y H5
LRS	DXVuO-BF-5Y40m-H5

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni
0.06	1.7	0.4	≤ 0.02	≤ 0.02	0.8

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -60 °C
As Welded	≥ 500	560-720	≥ 24	≥ 60
620 °C x 1h	≥ 460	560-640	≥ 26	≥ 60

Materials

S(P)420-S(P)500

Storage

Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 400-420 °C for 1 hours, 5 times max.

Current condition and welding position

AC; DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
2.5	350	55-85	19.5	215	●	100	●
3.2	350	80-140	30.8	140	●	65	●
3.2	450	80-130	39.6	140	●	65	●
4.0	450	110-180	59.0	95	●	45	●
5.0	450	180-230	91.2	65	●	30	●

TENAX 88S HR

OERLIKON

MMA Electrodes
C-Mn and low-alloy steels

TENAX 88S HR is an iron-powder low-alloy MMA electrode, Mn/Ni type, used extensively for welding higher yield steels >450N/mm², usually BS 4360-55 E/F and E 450EMZ, for topside facilities of oil and gas product ion platforms. This electrode deposits high impact and fracture (CTOD) tough weld metal in the as-welded and stress relieved conditions. Efficiency 120%.

Classification	
EN ISO	2560-A: E 50 6 Mn1Ni B 32 H5
EN	499: E 50 6 Mn1Ni B 32 H5
AWS	A5.5: E 8018-G H4
GOST	9467-75:?60-06?2H1-7

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni	Mo
0.06	1.5	0.3	≤ 0.015	≤ 0.015	0.9	0.2

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -60 °C
As Welded	≥ 500	560-720	≥ 24	≥ 60
620 °C x 1h	≥ 460	560-640	≥ 26	≥ 60

Materials

S(P)420-S(P)500

Storage

Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 400-420 °C for 1 hours, 5 times max.

Current condition and welding position

AC; DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
2.5	300	60-100	19.3	180	●	90	●
3.2	350	80-140	35.2	115	●	55	●
3.2	450	80-130	47.0	115	●	55	●
4.0	450	120-180	67.4	85	●	40	●
5.0	450	180-270	103	55	●	25	●

TENACITO 70B

OERLIKON

MMA Electrodes
C-Mn and low-alloy steels

TENACITO 70B is a basic coated MMA electrode for welding nickel-alloyed structural steels for low temperature service. The weld metal is of extremely high metallurgical purity, is ageing-resistant and deposits high ISO-V toughness weld metal to -80°C. Very low hydrogen content. Due to the double coating of the 2.5 mm and 3.2 mm sizes, the arc is both stable and concentrated, even at lower welding currents when positional welding. Good gap bridging characteristics. Welds are of X-ray quality.

Classification	
EN ISO	2560-A: E 46 6 2Ni B 4 2 H5
EN	499: E 46 6 2Ni B 4 2 H5
AWS	A5.5: E 8018-C1 H4

Approvals	Grade
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni
0.06	1.1	0.3	≤ 0.012	≤ 0.012	2.4

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)		
				+20 °C	-60 °C	-80 °C
As Welded	≥ 480	550-700	≥ 22	≥ 170	≥ 110	≥ 70
580°C x 15 h	≥ 420	520-640	≥ 20	≥ 170	≥ 80	≥ 47

Materials

12Ni14, S(P)275-S(P)460, 13 MnNi 6-3

Storage

Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

HD ≤ 10: Re-dry at 300-350 °C for 2 hours, 5 times max

Current condition and welding position

DC+

PA PB PC PD PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
2.5	350	65-95	19.1	225	●	110	●
3.2	350	90-130	34.4	125	●	60	●
4.0	450	140-185	69.5	80	●	35	●
5.0	450	180-240	112.2	45	●	20	●

TENACITO 70

OERLIKON

MMA Electrodes
C-Mn and low-alloy steels

TENACITO 70 is a basic coated MMA electrode for reliable, crack-free and tough welded joints on steels with a yield strength <500MPa. The weld metal is of extremely high metallurgical purity, is ageing-resistant, retaining ISO-V toughness to -60°C. Very low hydrogen content. For applications with higher strength steels up to S(P) 500 and 16Mo3, MOLYCORD Kb could be used.

Classification	
EN	2560-A: E 50 6 Mn1Ni B 4 2 H5
EN	499: E 50 6 Mn1Ni B 4 2 H 5
AWS	A5.5: E 8018-G H4

Approvals	Grade
ABS	3H5-3Y
DB	●
DNV	4Y50 H5
GL	3Y H5
LRS	3m 5Y40m H5
RMRS	3YHHH
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni
0.06	1.6	0.3	≤ 0.020	≤ 0.015	0.75

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-60 °C
As Welded	≥ 510	590-680	≥ 24	≥ 150	≥ 80
580°C x 15h	≥ 510	590-680	≥ 24	≥ 150	≥ 80

Materials

S(P)420-S(P)500; L245-L485

Storage
Keep dry and avoid condensation.
HD ≤ 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

Current condition and welding position
DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
2.5	350	65-90	23.9	170	●	80	●
3.2	350	95-130	35.5	115	●	55	●
4.0	450	130-180	68.0	80	●	40	●
5.0	450	170-230	108.9	50	●	25	●

AIR LIQUIDE WELDING

FREEZAL ENi3

CE

MMA Electrodes
C-Mn and low-alloy steels

FREEZAL ENi3 is a basic coated MMA electrode for welding cryogenic steels containing 3.5%Ni. Good weld deposit fracture toughness down to -105 °C. This electrode operates well on AC polarity, thus minimising magnetic arc blow, which is typical for this type of material.

Classification	
EN ISO	2560-A: E 46 6 3Ni B 3 2 H5
EN	499: E 46 6 3Ni B 3 2 H5
AWS	A5.5: E 8018-C2

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni
0.04	0.75	0.3	≤ 0.015	≤ 0.015	3.3

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				-75 °C	-105 °C
As Welded	≥ 460	≥ 550	≥ 24	≥ 50	≥ 40
620 °C x 1 h	≥ 450	≥ 540	≥ 24	≥ 60	≥ 50

Materials

12Ni14

A352LC3; ASTM A203 D,E ; A300 D,E ; A333 Gr 3 ; A 334 Gr 3

Storage

Keep dry and avoid condensation.

HD = 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

Current condition and welding position

AC; DC+

PA PB PC PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	DRYF	
				PC	Code
2.5	350	70-95	21.8	28	●
3.2	350	100-135	35.7	22	●
4.0	350	130-180	53.9	18	●
5.0	450	185-230	98.1	8	●

VERTICORD 80

OERLIKON

MMA Electrodes
C-Mn and low-alloy steels

VERTICORD 80 is a basic coated MMA electrode with very low hydrogen content for welding vertically down during pipeline construction. Improved efficiency compared to vertical welding with basic MMA electrodes. Suitable for welding steel type X70 with high ISO-V weld metal toughness at -40°C. Welds are of X-ray quality.

Classification	
EN ISO	2560-A: E 46 4 B 4 5 H5
EN	499: E 46 4 B 35 H5
AWS	A5.5: E 8018 G
GOST	9467-75:⊠ 55-E51 5

Approvals	Grade
TÜV	●

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.07	1.5	0.5	≤ 0.020	≤ 0.015

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-50 °C
As Welded	≥ 460	560-650	≥ 27	≥ 120	≥ 45

Materials

API 5LX 50-70; L210-L415

Storage

Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 280-300 °C for 1 hour, 5 times max.

Current condition and welding position

DC+

PA PB PC PD PE PG

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	MCAN	
				PC	Code
3.2	350	130-170	34.0	200	●
4.0	350	160-210	49.8	175	●
4.5	350	200-240	62.3	150	●

VERTICORD 90

OERLIKON

MMA Electrodes
C-Mn and low-alloy steels

VERTICORD 90 is a basic coated MMA electrode with very low hydrogen content for welding vertically down during pipeline construction. Improved efficiency compared to vertical welding with basic MMA electrodes. Suitable for welding steel type X80 with high ISO-V weld metal toughness at -40°C. Welds are of X-ray quality.

Classification	
EN	757 : E 55 4 Z B 45 H5
AWS	A5.5: E 9018-G

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni	Mo
0.06	1.4	0.5	≤ 0.02	≤ 0.02	0.9	0.3

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)		
				-20 °C	-30 °C	-40 °C
As Welded	≥ 570	620-690	≥ 25	≥ 100	≥ 90	≥ 80

Materials

API 5LX 80; L415-L555

Storage

Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 280-300 °C for 1 hour, 5 times max.

Current condition and welding position

DC+

PA PB PC PE PG

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	MCAN	
				PC	Code
3.2	350	130-170	34.0	150	●
4.0	350	160-210	47.5	175	●
4.5	350	200-240	62.3	150	●

TENCORD Kb

OERLIKON

MMA Electrodes
Weathering steels

Basic coated MMA electrode for tough and crack resistant welded joints on weathering steels, e.g. Patinax or Cor-ten, the weld metal corrosion characteristics are compatible with these steel types. Due to the double coating of the 2.5 mm and 3.2 mm sizes, the arc is both stable and concentrated, even at lower welding currents when positional welding, with good gap bridging characteristics. Welds are of X-ray quality.

Classification	
EN ISO	2560-A: E 42 4 ZNiCu1 B 4 2 H5
EN	499: E 42 4 ZNiCu1 B 4 2 H5
AWS	A5.5: E 7018-G-H4

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni	Cu
0.06	1	0.4	≤ 0.02	≤ 0.015	1	0.45

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-40 °C
As Welded	≥ 420	500-600	≥ 25	≥ 150	≥ 80

Materials

S235J0W; S235J2W; S355J0W; S355J2W; S355K2W

Storage

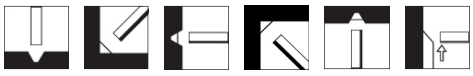
Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

HD ≤ 10: Re-dry at 300-350 °C for 2 hours, 5 times max

Current condition and welding position

DC+



PA PB PC PD PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
2.5	350	65-95	20.3	225	●
3.2	350	90-140	35.0	125	●
4.0	450	140-185	70.0	80	●

TENCORD 85 CP

OERLIKON

MMA Electrodes
Weathering steels

TENCORD 85 CP is a low Hydrogen MMA electrode suitable for the welding of steels with high atmospheric corrosion resistance and high contents of P and Cu, used for Cor-Ten A steel applications. Compared with a C-Mn steel, Cor-Ten is particularly suitable for movable structures, such as lorries, trailers, etc. Cor-Ten is also used in the bridge and construction industries because of the surface patina which does not require painting. The weld deposit has a very similar appearance to Cor-Ten A steel. Suitable for welding with an inverter generator. Efficiency 115%.

Classification	
EN ISO	2560-A: E 50 4 Z B 32 H5
EN	499: E 46 4 Z B 3 2 H5
AWS	A5.5: E 8018-G
GOST	9467-75:?50-E51 3

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Cu
0.06	1.3	0.4	≤ 0.02	≤ 0.02	0.5	0.45	0.45

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -40 °C
As Welded	≥ 500	560-720	≥ 23	≥ 47
620 °C x 1h	≥ 460	530-680	≥ 23	≥ 47

Materials

CORTEN A-B-C; PATINAX; S235J0W; S235J2W; S355J0W; S355J2W; S355K2W

Storage

Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

Current condition and welding position

AC; DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX PC	CBOX Code	VPMD PC	VPMD Code
2.5	300	60-90	18.7	180	●	90	●
3.2	450	80-140	49.8	120	●	55	●
4.0	450	110-180	65.0	85	●	45	●
5.0	450	160-240	97.8	60	●	25	●

TENAX 98M

OERLIKON

MMA Electrodes
High-strength steels

TENAX 98M is a basic coated MMA electrode depositing low hydrogen weld metal with an efficiency of 110-120%. It is generally used for the welding of high strength steels with tensile strength >600N/mm². The main applications include the welding of root runs and standing fillets in higher strength steels.

Classification	
EN	757: E 55 5 Z B 32 H 5
AWS	A5.5: E 9018-M H4
GOST	9467-75:?60-06?H1-6

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni	Mo
0.07	1.2	0.4	≤ 0.02	≤ 0.02	1.6	0.3

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -51 °C
As Welded	≥ 550	610-780	≥ 24	≥ 47

Materials

S(P)355-S(P)500; A508 Cl.2, A533 Cl.1Gr. B

Storage

Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 400-420 °C for 1 hours, 3 times max.

Current condition and welding position

AC; DC+

PA PB PC PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
2.5	300	55-105	16.0	90	●
3.2	350	90-140	36.0	55	●
4.0	350	110-180	53.1	40	●
5.0	450	170-240	110.7	20	●

TENACITO 65R

OERLIKON

MMA Electrodes
High-strength steels

Basic coated MMA electrode for reliable, crack-free and tough welded joints on steels with a yield strength <555 MPa. The weld metal is of extremely high metallurgical purity, is ageing-resistant, retaining good CVN toughness to -60°C and CTOD tested. Very low hydrogen content. Due to the double coating of the 2.5 mm and 3.2 mm sizes, the arc is both stable and concentrated, even at lower welding currents when positional welding, with good gap bridging characteristics. Welds are of X-ray quality. For sour gas applications, the nickel content is restricted to <1.0% max. On request, TENACITO 65R can be supplied to special quality assurance requirements, including KTA 1408.2.

Classification	
EN	757: E 55 6 Mn1NiMo B T 4 2 H5
AWS	A5.5: E 9018-G H4

Approvals	Grade
ABS	E9018G
DB	●
RMRS	5Y50HHH
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni	Mo
0.05	1.6	0.3	≤ 0.012	≤ 0.012	0.9	0.35

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-60 °C
As Welded	≥ 560	630-750	≥ 20	≥ 150	≥ 47
605 °C x 40 h	≥ 500	630-700	≥ 20	≥ 150	≥ 50

Materials

S(P)355-S(P)555, 20MnMoNi5-5, 15NiCuMoNb5, 22NiMoCr3-7

A508 Cl.2, A533 Cl.1Gr. B, 13MnNiMo5-4, 17MnMoV6-4; L245-L555

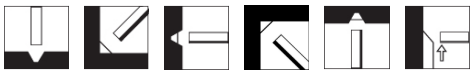
Storage

Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

Current condition and welding position

DC+



PA PB PC PD PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
2.5	350	65-95	20.6	225	●	110	●
3.2	350	90-140	34.1	125	●	60	●
4.0	450	140-185	68.7	80	●	35	●
5.0	450	180-240	111.7	45	●	20	●

TENAX 118-D2

CE

MMA Electrodes
High-strength steels

TENAX 118-D2 is a basic coated MMA electrode for welding high yield strength steels, >600N/mm², when good impact toughness at low temperatures is required.

Classification	
EN	757: E 62 4 Mn1NiMo B T 32 H5
AWS	A5.5: E 10018-D2

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni	Mo
0.08	1.8	0.3	0.025	0.02	0.8	0.35

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation	Impact Energy ISO - V (J)	
				-40 °C	-50 °C
620°Cx1h	≥ 620	690-890	≥ 18	≥ 47	-
As Welded	≥ 620	690-890	≥ 20	≥ 47	≥ 27

Materials

S(P)500

Storage

Keep dry and avoid condensation.

HD = 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

Current condition and welding position

AC; DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
2.5	350	65-90	20.3	95	●
3.2	350	95-130	34.9	55	●
4.0	450	130-180	69.0	35	●
5.0	450	170-230	107.0	20	●

TENACITO 75

OERLIKON

MMA Electrodes
High-strength steels

TENACITO 75 is a basic coated MMA electrode for reliable, crack-free and tough welded joints on steels with a yield strength <700 MPa. The weld metal is of extremely high metallurgical purity, is ageing-resistant, retaining good ISO-V toughness to -60°C. Very low hydrogen content. Due to the double coating of the 2.5 mm and 3.2 mm sizes, the arc is both stable and concentrated, even at lower welding currents when positional welding, with good gap bridging characteristics. Welds are of X-ray quality.

Classification	
EN	757: E 69 6 Mn2NiCrMo B 4 2 H5
AWS	A5.5: E 10018-G H4

Approvals	Grade
DB	●
DNV	3Y69 H5
GL	3Y69 H5
RMRS	3Y69HHH
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo
0.05	1.4	0.5	≤ 0.020	≤ 0.012	0.4	2.4	0.4

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)		
				+20 °C	-40 °C	-60 °C
As Welded	≥ 720	760-900	≥ 17	≥ 120	≥ 80	≥ 60
580°C x 2h	≥ 650	700-850	≥ 17	≥ 120	≥ 60	≥ 47

Materials

S620-S690; P690; L415-L555

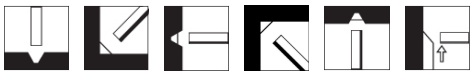
Storage

Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

Current condition and welding position

DC+



Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
2.5	350	65-95	19.7	225	●	110	●
3.2	350	90-140	33.8	125	●	50	●
4.0	450	140-185	70.3	80	●	80	●
5.0	450	180-240	110.5	45	●	20	●

TENAX 118

CE

MMA Electrodes
High-strength steels

TENAX 118 is a basic coated MMA electrode for welding steels with a yield strength >700 MPa. The weld metal is of extremely high metallurgical purity, retaining good ISO-V toughness to -40°C. Very low hydrogen content.

Classification	
EN	757: ~E 69 4 Mn2NiCrMo B 32 H5
AWS	A5.5: E 11018-G H4

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo
0.06	1.7	0.4	≤ 0.020	≤ 0.012	0.4	1.7	0.4

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -40 °C
As Welded	≥ 700	780-960	≥ 18	≥ 47

Materials

Welding of steels with a high yield strength (0.2% proof stress ≥ 700 MPa).

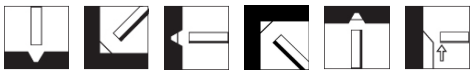
Storage

Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

Current condition and welding position

AC; DC+



PA PB PC PD PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	DRYF PC	DRYF Code
2.5	350	75-95	21.5	28	●
3.2	450	100-135	46.0	22	●
4.0	450	130-190	67.9	18	●
5.0	450	180-240	103.5	7	●

TENAX 118-M

OERLIKON

MMA Electrodes
High-strength steels

TENAX 118-M is an all-positional low-hydrogen MMA electrode for welding high strength steels in the tensile strength range, 760-870 N/mm² e.g. T1, HY80, etc. The shortest possible arc and a low travel speed s hould be used as a low heat input is recommended. The low hydrogen weld metal minimises the risk of cold cracking. Efficiency 120%.

Classification	
EN	757: E 69 5 Z B 32 H5
AWS	A5.5: E 11018-M H4
GOST	9467-75:?70-06?H2-6

Approvals	Grade
ABS	E11018-M
DNV	4Y69H5

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni	Mo
0.07	1.6	0.3	≤ 0.02	≤ 0.02	2.3	0.4

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -60 °C
As Welded	≥ 690	760-960	≥ 20	≥ 70

Materials

T1; HY80; S(P)690

Storage

Keep dry and avoid condensation.

HD = 5: Re-dry at 400-420 °C for 1 hours, 3 times max.

Current condition and welding position

AC; DC+

PA PB PC PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD PC	VPMD Code
2.5	300	55-105	16.6	90	●
3.2	350	90-140	34.3	55	●
4.0	350	110-180	52.7	40	●
5.0	450	150-210	108.1	20	●

TENACITO 80

OERLIKON

MMA Electrodes
High-strength steels

TENACITO 80 is a basic coated MMA electrode for reliable, crack-free and tough welded joints on steels with a yield strength <700 MPa. The weld metal is of extremely high metallurgical purity, is ageing-resistant, retaining good ISO-V toughness to -60°C. Very low hydrogen content. Due to the double coating of the 2.5 mm and 3.2 mm sizes, the arc is both stable and concentrated, even at lower welding currents when positional welding, with good gap bridging characteristics. Welds are of X-ray quality.

Classification	
EN	757: E 69 6 Mn2NiCrMo B 4 2 H5
AWS	A5.5: E 11018-G H4

Approvals	Grade
ABS	E 11018-G
DNV	4Y69H5
GL	3Y69 H5
RMRS	3Y69HHH
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo
0.06	1.8	0.4	≤ 0.020	≤ 0.012	0.4	2.3	0.45

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)		
				+20 °C	-20 °C	-60 °C
As Welded	≥ 790	850-960	≥ 16	≥ 100	≥ 60	≥ 47

Materials

S(P)690; L415-L555

Storage

Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

Current condition and welding position

DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
2.5	350	65-95	19.8	225	●	110	●
3.2	350	90-135	34.3	125	●	60	●
4.0	450	140-185	68.3	80	●	35	●
5.0	450	180-240	110.5	45	●	20	●

AIR LIQUIDE WELDING

TENACITO 80 CL

OERLIKON

MMA Electrodes
High-strength steels

TENACITO 80 CL is a basic coated MMA electrode for reliable, crack-free and tough welded joints on steels with a yield strength <700MPa.The weld metal is of extremely high metallurgical purity, is ageing-resistant, retaining ISO-V toughness to -60°C. Very low hydrogen content. Due to the double coating of the 2.5 mm and 3.2 mm sizes, the arc is both stable and concentrated, even at lower welding currents when positional welding, with good gap bridging characteristics. Welds are of X-ray quality.

Classification	
EN	757: E 69 6 Mn2NiCrMo B 4 2 H5
AWS	A5.5: E 11018-G H4

Approvals	Grade
ABS	E 11018-G

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo
0.06	1.6	0.4	≤ 0.020	≤ 0.012	0.35	2.4	0.4

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)		
				+20 °C	-40 °C	-60 °C
As Welded	≥ 720	760-900	≥ 17		≥ 80	≥ 60
580ºC x 2h	≥ 650	700-850	≥ 17	≥ 120	≥ 60	

Materials

S(P)690

Storage

Keep dry and avoid condensation.

HD = 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

Current condition and welding position

DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
2.5	350	65-95	19.7	225	●	110	●
3.2	350	90-135	33.8	125	●	60	●
4.0	450	140-185	70.3	80	●	35	●
5.0	450	180-240	110.5	45	●	20	●

TENAX 128-M

OERLIKON

MMA Electrodes
High-strength steels

TENAX 128-M is an all-positional low-hydrogen MMA electrode for the welding of high strength steels with yield strength <850 N/mm². Use the shortest possible arc and low travel speed as a low heat input is recom mended. The low hydrogen weld metal minimises the risk of cold cracking. Efficiency 110-120%

Classification	
EN	757: E 79 5 Mn2NiCrMo B 32 H5
AWS	A5.5: E 12018 – M
GOST	9467-75:?85-08?2H2-6

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo
0.08	1.6	0.35	≤ 0.015	≤ 0.015	0.45	1.9	0.4

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -51 °C
As Welded	≥ 740	880-1080	≥ 18	≥ 47
580 °C x 4 h	≥ 700	790-900	≥ 19	≥ 27

Storage

Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 400-420 °C for 1 hours, 3 times max.

Current condition and welding position

AC; DC+

PA PB PC PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD PC	VPMD Code
2.5	300	55-105	16.7	115	●
3.2	350	90-140	34.3	60	●
4.0	350	110-180	51.7	40	●

TENAX 128

CE

MMA Electrodes
High-strength steels

TENAX 128 is a basic coated MMA electrode for welding high-strength steels, with a yield strength <890 MPa, retaining ISO-V toughness down to -20°C. Very low hydrogen content.

Classification	
EN	757: ~ E 89 2 Mn2Ni1CrMo B 32 H5
AWS	A5.5: E 12018-G H4

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo
0.08	1.7	0.4	≤ 0.020	≤ 0.010	0.6	1.9	0.8

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -20 °C
As Welded	≥ 950	1000-1180	≥ 15	≥ 47

Materials

Welding of steels with a high yield strength YS ≥ 900 MPa.

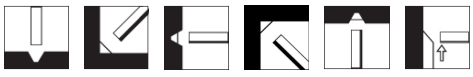
Storage

Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

Current condition and welding position

AC; DC+



PA PB PC PD PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	DRYF PC	DRYF Code
3.2	450	100-135	45.8	22	●
4.0	450	140-190	67.5	18	●

TENACITO 100

OERLIKON

MMA Electrodes
High-strength steels

TENACITO 100 is a basic coated MMA electrode for reliable, crack-free and tough welded joints on high-strength steels, with a yield strength <890MPa, retaining ISO-V toughness down to -40°C. Very low hydrogen content, welds are of X-ray quality. Due to the double coating of the 2.5 mm and 3.2 mm sizes, the arc is both stable and concentrated, even at lower welding currents when positional welding, with good gap bridging characteristics.

Classification	
EN	757: E 89 4 Mn2Ni1CrMo B 4 2 H5
AWS	A5.5: E 12018-G H4

Approvals	Grade
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo
0.07	1.7	0.4	≤ 0.012	≤ 0.012	0.8	2.45	0.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-40 °C
As Welded	≥ 890	980-1080	≥ 15	≥ 60	≥ 47

Materials

S890

Storage

Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

Current condition and welding position

DC+

PA PB PC PD PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
2.5	350	65-95	20.7	105	●
3.2	350	90-135	34.4	60	●
4.0	450	140-185	69.6	35	●
5.0	450	180-240	110.8	20	●

AIR LIQUIDE WELDING

TENAX 140

OERLIKON

MMA Electrodes
High-strength steels

TENAX 140 is a basic coated MMA electrode for tough, high-strength welded joints. The weld metal is of extremely high metallurgical purity and has a very low hydrogen content. Despite the very high yield strength <960MPa, the weld metal has good elongation and ISO-V toughness to -40°C, typically 40-60 J.

Classification	
AWS	A5.5: ~ E 14018 M-H4

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo
0.08	1.3	0.3	≤ 0.012	≤ 0.012	0.7	3.7	1.1

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				-20 °C	-50 °C
As Welded	≥ 960	1000-1100	≥ 15	≥ 47	≥ 27

Materials

Fine grain steels with yield strength > 900 N/mm², S960QL

Storage

Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

Current condition and welding position

DC+

PA PB PC PD PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
2.5	350	65-95	20.0	110	●
3.2	350	90-135	34.1	60	●
4.0	450	140-185	67.1	40	●
5.0	450	180-240	110.5	25	●

MOLYCORD Ti

OERLIKON

MMA Electrodes
Chromium-Molybdenum steels

MOLYCORD Ti is a rutile coated MMA electrode for welding creep resistant steels in the construction of vessels, boilers and pipes, particularly suitable for 16Mo3. Very smooth and clean welds blending into the base plate without undercut. Root passes are free of porosity even in narrow weld preparations. Creep resistant to <530°C.

Classification	
EN ISO	3580-A : E Mo R 1 2
AWS	A5.5: E 8013-G

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Mo
0.08	0.6	0.3	≤0.025	≤0.025	0.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C
620 °C x 1 h	≥ 470	560-720	≥ 22	≥ 50

Materials

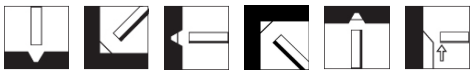
16Mo3, S(P)235-S(P)460

Storage

Keep dry and avoid condensation. Re-drying not generally required. If necessary: 100-110 °C for 1 hour

Current condition and welding position

AC; DC-



Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX PC	CBOX Code
2.5	300	65-90	16.3	220	●
3.2	300	90-130	27.7	135	●
4.0	450	140-180	66.7	80	●

AIR LIQUIDE WELDING

MOLYCORD Kb

OERLIKON

MMA Electrodes
Chromium-Molybdenum steels

MOLYCORD Kb is a basic coated MMA electrode with a wide range of applications in the fabrication of vessels, boilers, pipes and for metal construction. Suitable for welding creep resistant steels, e.g.16Mo3 as well as higher strength steels, yield strength <500 MPa. Creep resistant <530 °C, with good weld metal toughness down to -40°C. Very low hydrogen content. The double coating, 2.5 mm and 3.2 mm, confers a stable and concentrated arc even at low current intensity, well suited for root passes and positional welding. Welds are of X-ray quality.

Classification	
EN ISO	2560-A : E 50 4 Mo B 4 2 H5
EN ISO	3580-A: E Mo B 4 2 H5
AWS	A5.5: ~E 7018-A1-H4

Approvals	Grade
ABS	
DB	●
DNV	H10, NV0 3Mo (P)
RMRS	1Y (P)
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Mo
0.06	1	0.4	≤0.020	≤0.015	0.6

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-40 °C
As Welded	≥ 500	560-720	≥ 22	≥ 120	≥ 60
620 °C x 1 h	≥ 500	560-720	≥ 22	≥ 120	≥ 60

Materials

16Mo3, S(P)235-S(P)500

Storage

Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

HD ≤ 10: Re-dry at 300-350 °C for 2 hours, 5 times max

Current condition and welding position

DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
2.5	350	65-90	20.7	200	●	95	●
3.2	350	90-130	34.9	125	●	60	●
4.0	450	140-180	68.5	80	●	35	●
5.0	450	190-230	111.9	45	●	20	●

OE-KV2HR

OERLIKON

MMA Electrodes
Chromium-Molybdenum steels

OE-KV2HR is a low hydrogen iron-powder MMA electrode for the all-positional welding of steels containing 0.5%Mo and high tensile steels. Excellent weldability and arc stability, depositing weld metal with good X-ray quality and a high resistance to solidification cracking. Pre-heat and interpass temperatures between 100-150°C are recommended. Efficiency 120%.

Classification	
EN	1599: E Mo B 32 H5
AWS	A5.5: E 7018-A1 H4R
GOST	9467-75:⊠ 09M

Approvals	Grade
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Mo
0.08	0.8	0.45	≤ 0.015	≤ 0.015	0.53

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -40 °C
620 °C x 1h	≥ 390	510-600	≥ 25	≥ 60

Materials

ASTM A355 Gr. P1; A182M Gr. F1

16Mo3; S(P)235-S(P)420

Storage

Keep dry and avoid condensation.

HD = 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

Current condition and welding position

AC; DC+

PA PB PC PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
2.5	300	65-95	19.3	165	●	80	●
3.2	350	90-130	36.2	115	●	55	●
4.0	350	125-165	51.4	80	●	40	●
5.0	450	170-220	106.8	50	●	20	●

AIR LIQUIDE WELDING

CROMOCORD 55

CE

MMA Electrodes
Chromium-Molybdenum steels

CROMOCORD 55 is a basic coated MMA electrode for the welding of creep resistant steels with 0,5%Cr - 0,5%Mo.

Classification	
EN ISO	3580-A: E CrMo0,5 B 1 2 H5
AWS	A5.5: E 8018-B1
EN 1599	E CrMo0,5 B 1 2 H5

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Mo
0.05	0.7	0.4	≤ 0.025	≤ 0.020	0.55	0.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation	Impact Energy ISO - V (J)	
				0 °C	-20 °C
650°C x 1 h	≥ 460	≥ 550	≥ 20	≥ 100	≥ 47

Materials

A387 gr. 2

Storage

Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

Current condition and welding position

AC; DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
2.5	350	70-95	20.4	195	●
3.2	350	95-130	34.9	115	●
4.0	450	130-175	63.4	85	●
5.0	450	165-220	94.2	60	●

CROMOCORD Kb

MMA Electrodes
Chromium-Molybdenum steels

CROMOCORD Kb is a basic coated MMA electrode for welding creep resistant steels of similar composition, used for the fabrication of pressure vessels, boilers and pipes, preferably for 13CrMo4-5. Creep resistant <570 °C. The smaller diameters <3,2 mm are double coated, conferring a stable and concentrated arc even at lower welding currents, resulting in excellent positional welding characteristics. X-factor <15ppm, J-factor <150. Welds are of X-ray quality.

Classification	
EN ISO	3580-A: E CrMo1 B 4 2 H5
AWS	A5.5: E 8018-B2-H4

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Mo
0.07	0.7	0.3	≤ 0.012	≤ 0.010	1.20	0.55

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-30 °C
690 °C x 2 h	≥ 490	560-720	≥ 22	≥ 120	≥ 80
920 °Cx0,5 h/air+700 °Cx0,5h	≥ 300	450-550	≥ 26	≥ 130	≥ 80

Materials

13CrMo4-5, 13CrMoSi5-5; G17CrMo5-5

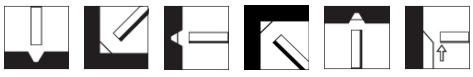
Storage

Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

Current condition and welding position

DC+



PA PB PC PD PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
2.5	350	60-85	20.7	215	●	105	●
3.2	350	100-130	34.3	125	●	50	●
4.0	350	140-180	52.8	80	●	35	●
5.0	450	190-230	110.9	45	●	20	●

OE-KV5L

OERLIKON

MMA Electrodes
Chromium-Molybdenum steels

Basic coated MMA electrode, <0.05%C, for the all-positional welding of creep resistant steels alloyed with 1.25%Cr 0.5%Mo. OE KV5L is also recommended for welding 0.9 Cr 0.5 Mo steel. The chemical composition of the weld metal results in a high resistance to solidification cracking. Efficiency 100%.

Classification	
EN	1599: E CrMo1L B 22 H5
AWS	A5.5: E 7015-B2L

Approvals	Grade
RINA	C1M H5
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Mo
0.04	0.7	0.27	≤ 0.015	≤ 0.015	1.25	0.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -40 °C
690 °C x 1h	≥ 390	520 - 650	≥ 20	≥ 47

Materials

13CrMo4-5, 13CrMoSi5-5; G17CrMo5-5

Storage

Keep dry and avoid condensation.

HD = 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

Current condition and welding position

DC+

PA PB PC PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
2.5	300	65-95	19.1	180	●	80	●
3.2	350	90-130	35.2	120	●	55	●
4.0	350	125-165	50.0	85	●	40	●
5.0	450	170-220	97.3	60	●	25	●
6.0	450	240-290	133.0	45	●		

OE-KV5HR

OERLIKON

MMA Electrodes
Chromium-Molybdenum steels

Basic coated MMA electrode depositing 1.25% Cr 0.5% Mo weld metal for the all-positional welding of creep resistant steels. OE-KV5HR is also recommended for welding 0.9%Cr 0.5%Mo steel. The chemical composition of the weld metal results in a high resistance to solidification cracking. Preheat and interpass temperatures 150-200°C are recommended. 120% recovery. X Factor <15ppm and J Factor <150ppm.

Classification	
EN	1599: E CrMo1 B 32 H5
AWS	A5.5: E 8018-B2 H4R
GOST	9467-75:?09X1M similar

Approvals	Grade
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Mo
0.08	0.75	0.25	≤ 0.01	≤ 0.01	1.25	0.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -40 °C
690 °C x 1h	≥ 460	550 - 690	≥ 20	≥ 47

Materials

A335 Gr P11; 13CrMo4-5; 13CrMoSi5-5

Storage

Keep dry and avoid condensation.

HD = 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

Current condition and welding position

AC; DC+

PA PB PC PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
2.5	300	65-95	19.7	165	●	80	●
3.2	350	90-130	35.9	115	●	55	●
4.0	350	125-165	52.7	80	●	40	●
5.0	450	170-220	104.6	50	●	20	●

AIR LIQUIDE WELDING

CROMOCORD 2 STC

OERLIKON

MMA Electrodes
Chromium-Molybdenum steels

CROMOCORD 2 STC is a basic coated MMA electrode for welding creep resistant and high-pressure hydrogen resistant steels in the fabrication of pressure vessels, boilers and pipes, for operating temperatures <600 °C. The weld metal deposited is low in residual and impurity elements and therefore largely insensitive to in-service embrittlement, demonstrated by simulated heat treatment: STC = step cooling. X-factor <15 ppm and J-factor <150.

Classification	
EN ISO	3580-A: E CrMo2 B 4 2 H5
AWS	A5.5: E 9018-B3-H4

Approvals	Grade
TÜV	●
TÜV	●

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Mo
0.09	0.5	0.3	≤ 0.012	≤ 0.010	2.4	1

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-30 °C
	≥ 400	550-650	≥ 22	≥ 150	≥ 70
690 °C x 17 h/air	≥ 400	550-650	≥ 22	≥ 150	≥ 100

Materials

10CrMo9-10, 12CrMo9-10; A387 Gr.22, Cl1, Cl2, A 182 Gr.F 22, A 336 Gr.F22

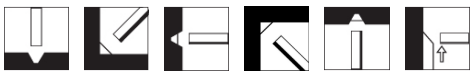
Storage

Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

Current condition and welding position

DC+



PA PB PC PD PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
2.5	300	65-95	19.7	165	●	80	●
3.2	350	85-130	37.5	115	●	55	●
4.0	350	140-180	53.0	80	●	40	●
5.0	450	180-230	109.7	50	●	20	●

OE-KV3L

MMA Electrodes
Chromium-Molybdenum steels

OE-KV3L is a basic coated low hydrogen MMA electrode for the all positional welding of 2.25% Cr 1% Mo creep resisting steels. The low carbon content reduces the risk of cracking. In order to achieve the desired level of heat affected zone properties it is recommended that preheat and interpass temperatures of between 200-250°C are used. Efficiency 100%.

Classification	
EN	1599: E CrMo2L B 22 H5
AWS	A5.5: E 8015-B3L-H4

Approvals	Grade
RINA	C2M1 H5
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Mo
0.04	0.75	0.35	≤ 0.02	≤ 0.015	2.25	1

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -20 °C
700 °C x 1h	≥ 460	630-720	≥ 18	≥ 47

Materials

10CrMo9-10, 12CrMo9-10; A 387 Gr.22, Cl 1and 2, A 182 Gr.F 22, A 336 Gr.F22

Storage

Keep dry and avoid condensation.

HD = 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

Current condition and welding position

DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
2.5	300	65-95	19.3	165	●	80	●
3.2	350	90-130	35.0	115	●	55	●
4.0	350	125-165	51.4	80	●	40	●
5.0	450	170-220	98.2	60	●	25	●

OE-KV3HR

MMA Electrodes
Chromium-Molybdenum steels

OE-KV3HR is a basic coated MMA electrode for the all-positional welding of creep resisting steels alloyed with 2.25%Cr 1.0%Mo. The chemical composition of the weld metal ensures a low sensitivity to solidification cracking. Preheat and interpass temperatures 200-250°C are recommended. Efficiency 120%. X Factor <15ppm and J Factor <150ppm.

Classification	
EN	1599: E CrMo2 B 3 2 H5
AWS	A5.5: E 9018-B3 H4R
GOST	9467-75:?09X2M1

Approvals	Grade
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Mo
0.1	0.75	0.3	≤ 0.01	≤ 0.01	2.25	1

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -30 °C
690 °C x 17 h/air	≥ 400	550-650	≥ 22	≥ 100
690 °C x 17 h/air + STC	≥ 400	550-650	≥ 22	≥ 70
700 °C x 1h	≥ 530	630-720	≥ 18	≥ 47

Materials

10CrMo9-10, 12CrMo9-10; A 387 Gr.22, Cl 1and 2, A 182 Gr.F 22, A 336 Gr.F22

Storage

Keep dry and avoid condensation.

HD = 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

Current condition and welding position

AC; DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
2.5	300	65-95	19.7	165	●	80	●
3.2	350	90-130	37.5	115	●	55	●
4.0	350	125-165	53.0	80	●	40	●
5.0	450	170-220	109.7	50	●	20	●

CROMO E225

OERLIKON

MMA Electrodes
Chromium-Molybdenum steels

CROMO E225 is a basic coated MMA electrode for welding creep resistant and high-pressure, hydrogen resistant steels used in the fabrication of pressure vessels, boilers and pipework with operating temperatures <600 °C. The weld metal deposited is low in residual and impurity elements and therefore largely insensitive to in-service embrittlement, demonstrated by simulated heat treatment: STC = step cooling. X-factor <15 ppm and J-factor <120.

Classification	
EN ISO	3580-A: E CrMo2 B 2 2 H5
AWS	A5.5: E 9015-B3 H4
EN 1599	E CrMo2 B 2 2 H5

Approvals	Grade
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Mo
0.1	0.7	0.25	≤ 0.010	≤ 0.010	2.3	1.1

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-40 °C
690 °C x 8 h	≥ 400	550-650	≥ 22	≥ 150	≥ 80
690 °C x 8 h + STC	≥ 400	550-650	≥ 22	≥ 150	≥ 60

Materials

10CrMo9-10, 12CrMo9-10; A387 Gr.22, Cl 1, Cl2, A 182 Gr.F 22, A 336 Gr.F22

Storage

Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 340-360 °C for 2 hour, 5 times max.

Current condition and welding position

DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
2.5	300	65-95	17.3	170	●
3.2	350	85-130	33.5	120	●
4.0	450	110-160	60.2	90	●
5.0	450	150-220	94.9	55	●

AIR LIQUIDE WELDING

CROMO E225V

OERLIKON

MMA Electrodes
Chromium-Molybdenum steels

CROMO E225V is a basic coated MMA electrode for welding creep resistant steels of type 2.25%Cr - 1%Mo - V. The weld metal deposited is low in residual and impurity elements, which induce embrittlement, and therefore largely insensitive to in-service embrittlement, demonstrated by simulated heat treatment: STC = step cooling. X-factor <15ppm and J-factor <120.

Classification	
EN ISO	3580-A: E Z CrMoV 2 B 2 2 H5
AWS	A5.5: E 9015-G

Approvals	Grade
ABS	E9015-G

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Mo	Nb	V
0.09	0.6	0.2	≤ 0.010	≤ 0.010	2.3	1	0.020	0.25

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-18 °C
710°C x 8h	≥ 420	620 - 750	≥ 18	≥ 120	≥ 54

Materials

12 CrMoV9-10; SA 336 F22V; SA 541 Gr 22V

Storage

Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

Current condition and welding position

DC+

PA PB PC PD PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
3.2	350	85-130	33.7	120	●	55	●
4.0	450	130-170	61.4	90	●	40	●
5.0	450	170-220	92.8	55	●	25	●

CROMOCORD E223

OERLIKON

MMA Electrodes
Chromium-Molybdenum steels

Basic coated MMA electrode for welding pipe steel of type P/T 23, particularly for applications in thermal power generation plants. Excellent weldability in all positions except vertical down. X Factor <15ppm and J Factor <120.

Classification
AWS A5.5: E 8015-G

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	V	W
0.04	0.5	0.3	≤ 0.015	≤ 0.015	2	0.5	0.25	1.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-20 °C
740°C x 2h	≥ 460	550-640	≥ 20	≥ 100	≥ 27

Materials

A335 P23 - A213 T23

Storage
Keep dry and avoid condensation. HD ≤ 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

Current condition and welding position
DC+

PA PB PC PD PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
2.5	350	50-80	20.6	200	●	95	●
3.2	350	65-100	33.7	120	●	55	●
4.0	450	130-170	62.2	90	●	40	●

CROMOCORD 5L

OERLIKON

MMA Electrodes
Chromium-Molybdenum steels

CROMOCORD 5L is a basic-coated all-positional MMA electrode (max. 0.05%C) for welding creep resisting steels containing 4-6%Cr and 0.45-0.65%Mo, such as 12Cr Mo 19 5. Applications in the oil industry, include components for high pressure hydrogenation vessels requiring good resistance to corrosion. Pre-heat and interpass temperatures of 250°C to 300°C are recommended. Efficiency 100%.

Classification	
EN	1599: E CrMo5 B 2 2 H5
AWS	A5.5: E 8015-B6L

Approvals	Grade
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Mo
0.04	0.75	0.4	≤ 0.015	≤ 0.015	5	0.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 20 °C
740 °C x 2h	≥ 460	550-640	≥ 20	≥ 70

Materials

12CrMo19-5, X12CrMo5; A182 Gr. F5, A199 Gr. T5, A213 Gr.T5, A335 Gr.P5

A 336 Cl. F5, A 369 Gr. FP5, A 387 Gr.5, Cl 1 and 2

Storage

Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

Current condition and welding position

DC+

PA PB PC PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD PC	VPMD Code
2.5	300	65-95	20.1	80	●
3.2	350	90-130	35.8	55	●
4.0	350	125-165	53.2	40	●
5.0	450	170-220	98.8	25	●

CROMOCORD 5

OERLIKON

MMA Electrodes
Chromium-Molybdenum steels

CROMOCORD 5 is a basic coated MMA electrode for creep resistant steels of type 5%Cr - 0.5%Mo. Applications include the welding of boilers, pressure vessels, pipework etc., with operating temperatures <650°C.

Classification	
EN ISO	3580-A: E CrMo5 B 2 2 H5
AWS	A5.5: E 8015-B6-H4
EN 1599	E CrMo5 B 2 2 H5

Approvals	Grade
TÜV	●

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Mo
0.07	0.8	0.3	≤ 0.012	≤ 0.010	5	0.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-10 °C
	≥ 460	600-700	≥ 19	≥ 100	≥ 80
960 °C x 0.5h/air + 710 x 2h	≥ 580	650-750	≥ 17	≥ 100	≥ 80

Materials

A 336 Cl. F5, A 369 Gr. FP5, A 387 Gr.5, Cl 1, Cl 2

12CrMo19-5, X12CrMo5; A182 Gr. F5, A199 Gr. T5, A213 Gr.T5, A335 Gr.P5

Storage

Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

Current condition and welding position

DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
2.5	300	65-95	18.9	90	●
3.2	350	90-130	36.5	55	●
4.0	350	125-165	52.4	40	●
5.0	450	170-220	97.2	25	●

CROMOCORD 9

OERLIKON

MMA Electrodes
Chromium-Molybdenum steels

CROMOCORD 9 is a basic coated, low hydrogen MMA electrode for the welding of creep resistant steels containing 9%Cr -1%Mo. During welding pre-heat and interpass temperatures of 250°C - 300°C are recommended. Efficiency 100%.

Classification	
EN	1599: ~E CrMo9 B 2 2 H5
AWS	A5.5: E 8015-B8

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo
0.08	0.7	0.4	≤ 0.015	≤ 0.015	9	0.06	1

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 20 °C
750 °C x 2h	≥ 460	≥ 590	≥ 20	≥ 47

Materials

A335 Gr. P9

Storage

Keep dry and avoid condensation.

HD = 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

Current condition and welding position

DC+

PA PB PC PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
2.5	300	65-95	20.3	85	●
3.2	350	90-130	36.4	55	●
4.0	350	135-165	52.2	40	●

CROMOCORD 9M

MMA Electrodes
Chromium-Molybdenum steels

CROMOCORD 9M is a basic coated MMA electrode for welding high-temperature creep resistant steels of type 9%Cr-1%Mo -V - Nb - N for operating temperatures <650 °C. Applications include the welding of thick walled cast steel components, with a post weld a tempering treatment at 740 °C for 8h.

Classification	
EN ISO	3580-A: ~E CrMo9 B 4 2 H5
AWS	A5.5: E 9018-B9-H4

Approvals	Grade
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Mo	Nb	V	N
0.09	0.95	0.2	≤ 0.015	≤ 0.010	9	1	0.07	0.20	0.04

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C
740 °C x 8h/furnace	≥ 540	≥ 720	≥ 17	≥ 50

Materials

T 91 (ASTM A 213); F 91 (ASTM A 182); GX12CrMoVNbN9-1

X10CrMoVNb9-1; grade 91 (ASTM A 387); P 91 (ASTM A 335)

Storage

Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

Current condition and welding position

DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
2.5	300	60-90	19.0	185	●		
2.5	350	70-95	19.0			90	●
3.2	350	85-130	38.1	105	●	50	●
4.0	450	130-160	75.3	70	●	30	●
5.0	450	180-230	118.2	45	●	20	●

CROMOCORD 91

OERLIKON

MMA Electrodes
Chromium-Molybdenum steels

CROMOCORD 91 is a basic coated MMA electrode for welding high-temperature creep resistant steels of type 9%Cr-1%Mo - V - Nb - N with operating temperatures of <650 °C. Applications include thick-walled castings with a post weld tempering treatment at 740°C for 8h, also for thin-walled components (e.g. pipework) with a postweld heat treatment at higher temperatures and shorter times (e.g. 760°C for 2 h).

Classification	
EN ISO	3580-A: E CrMo91 B 4 2 H5
AWS	A5.5: E 9018-B9-H4
EN 1599	E CrMo91 B 4 2 H5

Approvals	Grade
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	Nb	V	N
0.1	0.7	0.3	≤ 0.012	≤ 0.010	9	0.4	1	0.05	0.20	0.04

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-20 °C
760 °C x 2h/furnace	≥ 530	620-850	≥ 17	≥ 70	≥ 27

Materials

X10CrMoVNb9-1, grade 91 (ASTM A 387), P 91 (ASTM A 335)

T 91 (ASTM A 213), F 91 (ASTM A 182)

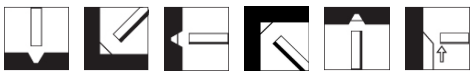
Storage

Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 340-360 °C for 2 hour, 5 times max.

Current condition and welding position

DC+



Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
2.5	350	70-95	20.9	100	●
3.2	350	90-120	35.6	60	●
4.0	350	135-165	53	35	●
5.0	450	170-220	108	20	●

CROMOCORD 92

CE

MMA Electrodes
Chromium-Molybdenum steels

Basic coated MMA electrode for welding high-temperature creep resistant steels of type 9Cr-0.5Mo-W-V-Nb-N with operating temperatures <650°C. CROMOCORD 92 is particularly suitable for welding components with a post weld tempering treatment at 760°C.

Classification	
EN ISO	3580-A: E Z CrMoWVNb 9 0.5 2 B 4 2 H5
AWS	A5.5: E 9018-G

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Mo	Nb	Co	V	W	N
0.095	1.1	0.2	≤0.012	≤0.012	9	0.5	0.05	1.0	0.20	1.7	0.04

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C
760°C x 4h/furnace	≥530	≥ 700	≥16	≥50

Materials

X10CrMoWVNb9-2, A 213 T92, A 335 P92

A 387 Gr.92, A 182 F92, A 369 FP 92F

Storage

Keep dry and avoid condensation.

HD = 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

Current condition and welding position

DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
2.5	350	65-95	21.7	185	●	90	●
3.2	350	85-135	37.1	105	●	50	●
4.0	350	140-180	55.6	70	●	30	●

CROMOCORD 10M

CE

MMA Electrodes
Chromium-Molybdenum steels

CROMOCORD 10M is a basic coated MMA electrode for welding high-temperature creep resistant steels of type 10Cr-1Mo-1W-V-Nb. Particularly suited for thick-walled steel castings with a post weld tempering treatment of 12 hours at 730°C.

Classification	
EN ISO	3580-A : E Z CrMoWV10 B 4 2 H5
AWS	A5.5: ~E 9018-G
DIN	8575: ~E CrMoW10 B 20+

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	Nb	V	W	N
0.1	1	0.25	≤ 0.015	≤ 0.010	9.5	0.7	1	0.05	0.2	1	0.05

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C
730 °C x 12h/furnace	≥ 550	700-820	≥ 17	≥ 60

Materials

G X 12 CrMoVWNbN 10 1 1

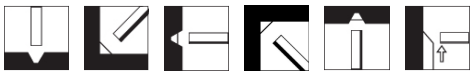
Storage

Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 340-360 °C for 2 hours, 5 times max.

Current condition and welding position

DC+



Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD PC	VPMD Code
2.5	350	60-90	22.4	90	●
3.2	350	80-130	38.4	50	●
4.0	450	140-180	76.5	30	●
5.0	450	180-230	116.7	20	●

CROMOCORD N125

CE

MMA Electrodes
Chromium-Molybdenum steels

CROMOCORD N125 is a basic coated MMA electrode depositing 1.5%Cr-1%Mo-0.25%V weld metal for welding cast steels of similar composition. Applications include the welding of steam turbines and valve boxes with operating temperatures <600 °C. Tough, crack resistant weld metal, suitable for tempering and normalising. Very low hydrogen content.

Classification	
EN ISO	3580-A : ~E CrMoV1 B 4 2 H5
AWS	A5.5: E 9015-G-H4

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Mo	V
0.12	0.9	0.4	≤ 0.020	≤ 0.015	1.4	1	0.25

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C
690 °C x 8 h/air	≥ 600	650-850	≥ 17	≥ 60

Materials

G17CrMoV5-11

Storage

Keep dry and avoid condensation.

HD ≤ 5: Re-dry at 340-360 °C for 2 hours, 5 times max

Current condition and welding position

DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX PC	CBOX Code
2.5	350	60-90	20.4	200	●
3.2	450	90-130	45.8	115	●
4.0	450	140-180	69.7	80	●
5.0	450	190-230	112	45	●

BASINOX 410 S

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

Basic-coated MMA electrode for welding ferritic and martensitic chromium steels with 11- 13.5%Cr, AISI 410. These steel are air hardening, therefore depending on the steel type and material thickness, pre-heating between 200°C - 400°C and stress relieving treatments are required. BASINOX 410 S is also used for stainless wear resistant surfacing on unalloyed or low-alloy steels for the sealing surfaces of water, gas or steam fittings.

Classification	
EN	1600: E Z 13 1 B 22
AWS	A5.4: ~E 410-15

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni
0.05	0.4	0.3	0	≤ 0.025	12	1.50

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C	Hardness
680 °C x 8h	≥ 440	590-800	≥ 15	≥ 47	180-240 HB

Materials

1.4000 (X6Cr13); 1.4006 (X12Cr13)

AISI 410

Storage

Keep dry and avoid condensation.

Re-dry at 280-300 °C for 1 hour, 5 times max

Current condition and welding position

DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
2.5	300	65-95	18.2	100	●
3.2	350	85-140	38.8	50	●
4.0	350	120-190	55.0	40	●
5.0	350	190-240	87.2	20	●

BASINOX 410 NiMo S

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

BASINOX 410 NiMo S is a basic coated MMA electrode for welding martensitic 13% chromium-nickel steels or cast steels. Despite the high strength, the weld metal has excellent toughness. For wall thicknesses >10mm, preheating <150 °C is recommended. After welding a tempering or a normalising and tempering treatment is required.

Classification	
EN	1600: E 13 4 B 42
AWS	A5.4: E 410NiMo-15

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo
≤ 0.05	0.8	0.5	≤ 0.025	≤ 0.02	11.5	4.5	0.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-60 °C
610 °C x 1h/air or 610°C x 5h	≥ 600	≥ 850	≥ 15	≥ 60	≥ 50

Materials

1.4313 (X4CrNi13-4); 1.4413 (X3CrNiMo13-4)

1.4407 (G-X5CrNiMo13-4); 1.4414 (G-X4CrNiMo13-4)

Storage

Keep dry and avoid condensation.

Re-dry 280-300 °C for 2 hours, 5 times max.

Current condition and welding position

DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
2.5	300	65-95	18.5	100	●
3.2	350	85-140	38.4	55	●
4.0	350	120-190	56.8	40	●
5.0	350	190-240	82.8	25	●

BASINOX 430 S

Basic-coated MMA electrode for welding ferritic and martensitic chromium steels with 15 -17%Cr, AISI 430. These steel are air hardening, therefore, depending on the steel type and material thickness, pre-heating between 150°C -300°C and stress relieving treatments are required. BASINOX 430S can be used for joining heat-resistant steels containing <18% Cr. Welding with a low heat input is recommended.

Classification	
EN	1600: ~E 17 B 32
AWS	A5.4: E 430-15
WR	1.4016

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr
0.04	0.6	0.4	≤ 0.03	≤ 0.03	16.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)
				20 °C
760 °C x 2h	≥ 300	≥ 450	≥ 20	≥ 47

Materials

AISI 430

Storage

Keep dry and avoid condensation.

Re-dry at 280-300 °C for 1 hour, 5 times max

Current condition and welding position

AC; DC+

PA PB PC PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
2.5	300	65-95	19.3	110	●
3.2	350	85-140	40.3	65	●
4.0	350	120-190	53.0	45	●
5.0	350	190-240	83.5	25	●

SUPRANOX 308L

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

SUPRANOX 308L is a rutile coated MMA electrode for welding similar austenitic stainless Cr-Ni steels, also suitable for ferritic stainless Cr-steels. Metal transfer in fine droplets and nearly spatter free, the slag is generally self releasing from finely-rippled concave fillet welds with an excellent bead surface appearance. Good striking and restriking. Under wet corrosive conditions, suitable for operating temperatures <350°C, non-scaling <800°C.

Classification	
EN	1600: E 19 9 L R 1 2
AWS	A5.4: E 308L-17

Approvals	Grade
ABS	308L
BV	UP
DB	●
DNV	308L
GL	4550
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Ferrite
≤ 0.03	0.8	0.9	19	10	5-10

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-120 °C
As Welded	≥ 350	≥ 520	≥ 30	≥ 50	≥ 32

Materials

1.4541 (X6CrNiTi18-10); 1.4301 (X4CrNi18-10); 1.4311 (X2CrNiN18-10)

AISI 304 - 304L - 302

Storage

Keep dry and avoid condensation.

Re-drying not generally required.

If necessary: 300-350 °C for 2 hours, 5 times max

Current condition and welding position

AC; DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		DRYF		VPMD	
				PC	Code	PC	Code	PC	Code
2.0	300	35-60	11.0	310	●	36	●	145	●
2.5	300	45-80	17.4	195	●	28	●	90	●
3.2	350	70-120	35.1	115	●	22	●	55	●
4.0	350	100-150	53.0	75	●	18	●	35	●
5.0	450	160-220	107.1	45	●	7	●	20	●

AIR LIQUIDE WELDING

SUPRANOX RS 308L

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

SUPRANOX RS 308L is a semi-basic MMA electrode suitable for the welding of austenitic steels containing 16-20%Cr and 8-12%Ni, i.e. AISI 304, AISI 304L. The weld deposit has a carbon content <0,04%. Used for nuclear, chemical and associated applications with service temperatures <300°C. Excellent weldability with a spatter free arc and self-releasing slag, producing a very smooth bead appearance. Efficiency 100%.

Classification	
EN	1600: E 19 9 L R 12
AWS	A5.4: E 308L-16
GOST	10052-75: ?04X20H9

Approvals	Grade
ABS	E308L-16
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Ferrite
0.025	0.9	0.8	≤ 0.03	≤ 0.025	19.8	9.5	5-10

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 20 °C
As Welded	≥ 320	≥ 520	≥ 35	≥ 60

Materials

1.4541 (X6CrNiTi18-10); 1.4301 (X4CrNi18-10); 1.4311 (X2CrNiN18-10)

AISI 304 - 304L - 302

Storage

Keep dry and avoid condensation.

Re-drying not generally required

If necessary: 350-370 °C for 1 hour, 3 times max

Current condition and welding position

AC; DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	GASP PC	GASP Code
2.0	300	30-60	11.2	310	●
2.5	300	50-80	18.7	190	●
3.2	350	60-120	35.0	120	●
4.0	350	100-140	52.8	80	●
5.0	350	130-180	81.6	50	●

SUPRANOX 308L P

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

SUPRANOX 308L P is a semi-basic MMA electrode for welding austenitic stainless steels, such as AISI 304 and AISI 304L. A good compromise between bead appearance, ease of use and mechanical characteristics, especially when welding pipework in position. Efficiency 100%.

Classification	
EN	1600: E 19 9 L R 1 2
AWS	A5.4: E 308L-16

Approvals	Grade
ABS	308L
BV	UP
DNV	308L
LRS	308L
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Ferrite
0.025	0.6	0.6	≤ 0.03	≤ 0.03	19.5	9.5	4-10

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 20 °C
As Welded	≥ 320	≥ 520	≥ 30	≥ 50

Materials

1.4541 (X6CrNiTi18-10); 1.4301 (X4CrNi18-10); 1.4311 (X2CrNiN18-10)

AISI 304 - 304L - 302

Storage

Keep dry and avoid condensation.

Re-drying recommended at 300-350 °C for 2 hours, 5 times max

Current condition and welding position

AC; DC+

PA PB PC PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		DRYF	
				PC	Code	PC	Code
2.0	300	40-55	10.9	320	●	36	●
2.5	300	60-80	16.3	215	●	30	●
3.2	350	80-110	31.7	135	●	22	●
4.0	350	100-150	53.0	75	●	18	●

AIR LIQUIDE WELDING

CRISTAL E308L

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

CRISTAL E308L is a rutile coated MMA electrode for welding similar austenitic Cr-Ni steels. The reduced fume formation and the lower chromium VI content of the fume contribute to an improved working environment for welders and in workshops. Advantageous in confined spaces and with restricted fume extraction systems. Excellent striking and re-striking. Metal transfer is in fine droplets with good wetting of the joint faces, finely-rippled bead surface, easy slag removal. Applications include wet-corrosive conditions for operating temperatures <350 °C, non-scaling <800 °C.

Classification	
EN	1600: E 19 9 L R 22
AWS	A5.4: E 308L-17

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Ferrite
≤ 0.03	0.8	0.9	19	9	5-10

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C
As Welded	≥ 350	≥ 520	≥ 30	≥ 50

Materials

1.4541 (X6CrNiTi18-10); 1.4301 (X4CrNi18-10); 1.4311 (X2CrNiN18-10)

AISI 304 - 304L - 302

Storage

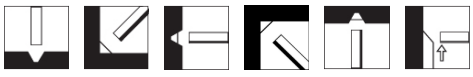
Keep dry and avoid condensation.

Re-drying not generally required

If necessary: 250-300 °C for 2 hours, 5 times max

Current condition and welding position

DC+



Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	DRYF	
				PC	Code
2.5	300	65-85	18.6	28	●
3.2	350	80-105	35.4	22	●
4.0	350	100-135	53.6	18	●

BASINOX 308L

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

Basic coated MMA electrode for welding similar austenitic Cr-Ni steels or cast steels. With the correct welding procedure, applications include the joining of ferritic and stainless Cr-steels. The weld metal has high ductility and BASINOX 308L is recommended for welding thicker section components. Easy slag release and well-suited for positional welding. Applications include wet-corrosive conditions for operating temperatures <350 °C, non-scaling <800 °C.

Classification	
EN	1600: E 19 9 L B 42
AWS	A5.4: E 308L-15
WR	1.4316

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Ferrite
≤ 0.03	1.5	0.3	≤ 0.025	≤ 0.025	19	10	5-10

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-120 °C
As Welded	≥ 350	≥ 520	≥ 30	≥ 60	≥ 32

Materials

1.4541 (X6CrNiTi18-10)

1.4301 (X4CrNi18-10) - 1.431 (X2CrNiN18-10)

Storage

Keep dry and avoid condensation.

Re-drying not generally required

If necessary: 280-300 °C for 1 hour, 5 times max

Current condition and welding position

DC+

PA PB PC PD PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
2.5	300	45-70	17.5	100	●
3.2	350	65-120	32.8	65	●
4.0	350	100-140	49.5	40	●
5.0	350	130-170	72.1	25	●

BASINOX 308L T

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

BASINOX 308L T is a low hydrogen MMA electrode suitable for the welding of austenitic stainless steels. Low carbon content and very good weld metal toughness at -196°C. Efficiency 100%.

Classification	
EN	1600: E 19 9 L B 12
AWS	A5.4: E 308L-15
GOST	10052-75: ?04X20H9

Approvals	Grade
ABS	

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Ferrite
0.025	1.5	0.3	0	0	19	10	1-5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-196 °C
As Welded	≥ 320	≥ 520	≥ 35	≥ 60	≥ 32

Materials

AISI 304 - 304L - 302

1.4541 (X6CrNiTi18-10); 1.4301 (X4CrNi18-10); 1.4311 (X2CrNiN18-10)

Storage

Keep dry and avoid condensation.

Re-drying not generally required.

If necessary: 280-300 °C for 1 hour, 5 times max.

Current condition and welding position

AC; DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
2.5	300	45-70	15.9	105	●
3.2	350	65-120	32.0	65	●
4.0	350	100-140	47.8	45	●

SUPRANOX 347

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

SUPRANOX 347 is a rutile coated MMA electrode for welding similar stabilised austenitic Cr-Ni steels, also suited for ferritic stainless and heat resistant Cr-steels .The weld metal transfer is in fine droplets, nearly spatter free with a generally self-releasing slag, producing finely rippled concave fillet welds with an outstanding weld bead aspect. Good striking and restriking. Under wet corrosive conditions, suitable for operating temperatures <400°C, non-scaling <800°C.

Classification	
EN	1600: E 19 9 Nb R 1 2
AWS	A5.4: E 347-16

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Nb	Ferrite
≤ 0.03	0.8	0.9	19	10	0.4	5-10

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-60 °C
As Welded	≥ 350	≥ 550	≥ 25	≥ 50	≥ 32

Materials

1.4541 (X6CrNiTi18-10); 1.4301 (X4CrNi18-10); 1.4550 (X6CrNiNb18-10);

AISI 347 - 321

Storage

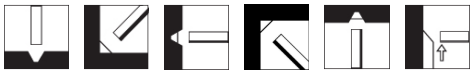
Keep dry and avoid condensation.

Re-drying not generally required.

If necessary: 300-350 °C for 2 hours, 5 times max.

Current condition and welding position

AC; DC+



PA PB PC PD PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		DRYF		VPMD	
				PC	Code	PC	Code	PC	Code
2.0	300	40-55	11.2	310	●	36	●	150	●
2.5	300	50-70	17.9	195	●	28	●	95	●
3.2	350	75-105	36.6	115	●	22	●	55	●
4.0	350	100-130	52.5	80	●	18	●	35	●

SUPRANOX RS 347

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

SUPRANOX RS 347 is a semi-basic MMA electrode suitable for welding stabilised austenitic stainless steels, AISI 321 and AISI 347. The Nb+Ta in the weld metal is due to the sublimation of titanium at the liquidus temperature of the weld pool. The weld metal mechanical properties are excellent at high temperatures. Outstanding weldability, spatter free and a self-releasing slag, resulting in a very smooth bead appearance. Efficiency 100%.

Classification	
EN	1600: E 19 9 Nb R 12
AWS	A5.4: E 347-16
GOST	10052-75: ?08X20H10? 2? similar

Approvals	Grade
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Nb	Ferrite
0.05	0.8	0.6	≤ 0.03	≤ 0.02	19.5	10	0.4	5-10

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 20 °C
As Welded	≥ 350	≥ 550	≥ 30	≥ 47

Materials

1.4541 (X6CrNiTi18-10); 1.4301 (X4CrNi18-10); 1.4550 (X6CrNiNb18-10);

AISI 347 - 321

Storage

Keep dry and avoid condensation.

Re-drying not generally required.

If necessary: 350-370 °C for 1 hour, 3 times max.

Current condition and welding position

AC; DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	GASP	
				PC	Code
2.0	300	30-60	11.1	310	●
2.5	300	50-80	18.7	190	●
3.2	350	60-120	35.0	120	●
4.0	350	100-140	52.5	80	●
5.0	350	130-180	82.6	50	●

BASINOX 347

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

Basic coated MMA electrode for welding similar stabilised austenitic stainless, Cr-Ni steels or cast steels. With the correct welding procedure, also suitable for stainless or heat-resistant ferritic Cr steels. The weld metal has high ductility and BASINOX 347 is recommended for the welding of thicker section components in all positions. Easy slag removal. Applications include wet-corrosive conditions for operating temperatures <350°C, non-scaling <800°C.

Classification	
EN	1600: E 19 9 Nb B 42
AWS	A5.4: E 347-15
WR	1.4551

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Nb	Ferrite
≤ 0.04	1.6	0.4	≤ 0.025	≤ 0.023	19	10	0.5	5-10

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-60 °C
As Welded	≥ 420	≥ 600	≥ 25	≥ 70	≥ 40

Materials

AISI 347 - 321

1.4541 (X6CrNiTi18-10); 1.4301 (X4CrNi18-10); 1.4550 (X6CrNiNb18-10);

Storage

Keep dry and avoid condensation.

Re-drying not generally required.

If necessary: 280-300 °C for 1 hour, 5 times max.

Current condition and welding position

DC+

PA PB PC PD PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
2.5	300	45-70	17.7	110	●
3.2	350	65-120	33.2	65	●
4.0	350	115-140	48.2	45	●
5.0	350	130-170	76.0	25	●

AIR LIQUIDE WELDING

SUPRANOX 316L

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

SUPRANOX 316L is a rutile coated MMA electrode for welding similar austenitic Cr-Ni-Mo steels. The weld metal transfer is in fine droplets and nearly spatter free, depositing finely rippled concave fillet welds with an outstanding weld bead aspect and generally self-releasing slag. Good striking and restriking. Under wet corrosive conditions suitable for operating temperatures <400°C.

Classification	
EN	1600: E 19 12 3 L R 1 2
AWS	A5.4: E 316L-17

Approvals	Grade
ABS	316L
BV	UP
DB	●
DNV	316L

Approvals	Grade
GL	4571
LRS	316L
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo	Ferrite
≤ 0.03	0.7	0.9	18.5	12	2.7	5-10

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-60 °C
As Welded	≥ 400	≥ 520	≥ 30	≥ 50	≥ 32

Materials

1.4401 (X4CrNiMo17-12-2), 1.4435 (X2CrNiMo18-14-3)

1.4571 (X6CrNiMoTi17-12-2), 1.4583 (X10CrNiMoNb18-12)

AISI 316L

Storage

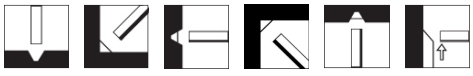
Keep dry and avoid condensation.

Re-drying not generally required

If necessary: 300-350 °C for 2 hours, 5 times max

Current condition and welding position

AC; DC+



PA PB PC PD PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOH		CBOX		DRYF		SMPA		VPMD	
				PC	Code	PC	Code	PC	Code	PC	Code	PC	Code
1.6	300	25-45	7.6	210	●								
2.0	300	35-60	11.3			320	●	36	●			145	●
2.5	300	45-80	18.0			190	●	28	●	30	●	85	●
3.2	350	70-120	35.2			115	●	22	●	15	●	55	●
4.0	350	100-150	53.4			75	●	18	●			35	●
5.0	450	155-220	108.3			45	●	7	●			20	●

SUPRANOX RS 316L

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

SUPRANOX RS 316L is a semi-basic MMA electrode suitable for the welding of austenitic stainless steels containing 16-20%Cr, 10-14%Ni and 2-3%Mo, AISI 316 and 316L, for maximum service temperatures <400°C. Good resistance to chemical corrosion. The low carbon content of the weld deposit ensures a high resistance to weld cracking. Excellent weldability with a spatter free arc and self-releasing slag, combined with a very smooth bead appearance. Efficiency 100%.

Classification	
EN	1600: E 19 12 3 L R12
AWS	A5.4: E 316L-16
GOST	10052-75: ?02X20N14?2 M 2?

Approvals	Grade
ABS	E316L-16
RINA	316L
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	Ferrite
0.03	0.85	0.8	≤ 0.025	≤ 0.02	19	12	2.5	4-10

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 20 °C
As Welded	≥ 350	≥ 510	≥ 30	≥ 47

Materials

AISI 316L

1.4571 (X6CrNiMoTi17-12-2), 1.4583 (X10CrNiMoNb18-12)

1.4401 (X4CrNiMo17-12-2), 1.4435 (X2CrNiMo18-14-3)

Storage

Keep dry and avoid condensation.

Re-drying not generally required

If necessary: 350-370 °C for 1 hour, 3 times max

Current condition and welding position

AC; DC+

PA PB PC PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	GASP PC	GASP Code
2.0	300	30-50	11.5	310	●
2.5	300	50-80	18.4	190	●
3.2	350	60-120	35.7	120	●
4.0	350	100-140	52.3	80	●
5.0	350	130-190	84.8	50	●

CRISTAL E316L

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

CRISTAL E316L is a rutile coated MMA electrode for welding similar austenitic Cr-Ni-Mo steels. The reduced fume formation and the lower content of chromium VI contribute to an improved working environment for welders and in workshops. Advantageous in confined spaces and with restricted fume extraction systems. Excellent striking and restriking. Weld metal transfer is in fine droplets with good fusion of joint faces, finely rippled bead surface, easy slag removal. Under wet corrosive conditions suitable for operating temperatures <400°C.

Classification	
EN	1600: E 19 12 3 L R 22
AWS	A5.4: E 316L-17

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo	Ferrite
0.03	0.8	0.9	19.1	11.5	2.8	5-10

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-60 °C
As Welded	≥ 320	≥ 520	≥ 30	≥ 50	≥ 32

Materials

1.4401 (X4CrNiMo17-12-2), 1.4435 (X2CrNiMo18-14-3)

1.4571 (X6CrNiMoTi17-12-2), 1.4583 (X10CrNiMoNb18-12)

AISI 316L

Storage

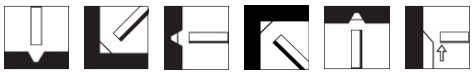
Keep dry and avoid condensation.

Re-drying not generally required

If necessary: 250-300 °C for 2 hours, 5 times max

Current condition and welding position

DC+



Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	DRYF	
				PC	Code
2.5	300	65-85	18.3	28	●
3.2	350	80-105	34.8	22	●
4.0	350	100-135	53.5	18	●

SUPRANOX 316L P

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

SUPRANOX 316LP is a thin basic-rutile coated MMA electrode for welding austenitic stainless Cr-Ni-Mo steels/ cast steels, with an extra low carbon content. For operating temperatures <400 °C. SUPRANOX 316LP is a good compromise between ease of use when positional welding and bead finish. Particularly recommended for welding pipe work.

Classification	
EN	1600: E 19 12 3 L R 1 2
AWS	A5.4: E 316L-16

Approvals	Grade
ABS	316L
BV	UP
DNV	316L
LRS	316L

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	Ferrite
≤ 0.03	0.7	0.6	≤ 0.025	≤ 0.02	18.2	11.3	2.6	4-8

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 20 °C
As Welded	≥ 320	≥ 510	≥ 30	≥ 50

Materials

1.4571 (X6CrNiMoTi17-12-2), 1.4583 (X10CrNiMoNb18-12)

1.4401 (X4CrNiMo17-12-2), 1.4435 (X2CrNiMo18-14-3)

AISI 316L

Storage

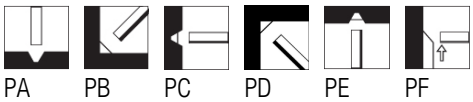
Keep dry and avoid condensation.

Re-drying not generally required

If necessary: 300-350 °C for 2 hours, 5 times max

Current condition and welding position

AC; DC+



Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		DRYF	
				PC	Code	PC	Code
2.0	300	40-55	11.1	320	●	36	●
2.5	300	60-80	17.0	215	●	30	●
3.2	350	80-110	33.2	135	●	24	●
4.0	350	100-150	53.4	75	●	18	●

AIR LIQUIDE WELDING

BASINOX 316L

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

Basic coated MMA electrode for welding similar austenitic stainless Cr-Ni-Mo steels and cast steels. The weld metal has high ductility and BASINOX 316L is recommended for welding thicker section components in all positions. Easy slag release. Applications include wet-corrosive conditions for operating temperatures <400 °C.

Classification	
EN	1600: E 19 12 3 L B 42
AWS	A5.4: E 316L-15
WR	1.4430

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	Ferrite
≤ 0.025	1	0.3	≤ 0.025	≤ 0.020	18.5	11.5	2.7	5-10

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-60 °C
As Welded	≥ 420	≥ 520	≥ 30	≥ 60	≥ 32

Materials

1.4571 (X6CrNiMoTi17-12-2), 1.4583 (X10CrNiMoNb18-12)

1.4401 (X4CrNiMo17-12-2), 1.4435 (X2CrNiMo18-14-3)

AISI 316L

Storage

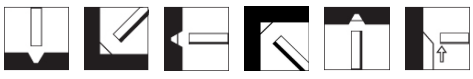
Keep dry and avoid condensation.

Re-drying not generally required

If necessary: 280-300 °C for 1 hour, 5 times max

Current condition and welding position

DC+



PA PB PC PD PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
2.5	300	45-70	16.8	115	●
3.2	350	65-120	33.3	60	●
4.0	350	115-140	47.5	40	●
5.0	350	130-170	71.3	30	●

BASINOX 316L T

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

BASINOX 316LT is a basic coated low hydrogen MMA electrode suitable for the welding of stainless steels, types AISI 316 and 316L. Excellent mechanical properties of the weld deposit to -196°C. Efficiency 100%.

Classification	
EN	1600: E 19 12 2 B 12
AWS	A5.4: E 316L-15

Approvals	Grade
ABS	

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	Ferrite
0.02	1.5	0.3	≤ 0.025	≤ 0.020	17.5	12	2.6	1-5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-196 °C
As Welded	≥ 350	≥ 550	≥ 35	≥ 60	≥ 40

Materials

1.4571 (X6CrNiMoTi17-12-2), 1.4583 (X10CrNiMoNb18-12)

AISI 316L

1.4401 (X4CrNiMo17-12-2), 1.4435 (X2CrNiMo18-14-3)

Storage

Keep dry and avoid condensation.

Re-drying not generally required.

If necessary: 280-300 °C for 1 hour, 5 times max.

Current condition and welding position

DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
2.5	300	45-70	16.1	110	●
3.2	350	65-120	31.5	60	●
4.0	350	115-140	48.1	40	●

AIR LIQUIDE WELDING

SUPRANOX 317

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

SUPRANOX 317 is a semi-basic MMA electrode suitable for the welding of austenitic stainless steels with 16-20%Cr, 10-14%Ni and 3-4%Mo (AISI 317). The use of these steels is limited to corrosion conditions in the presence of sulphuric and sulphurous acids and their salts. Excellent weldability with a spatter free arc and self-releasing slag to produce a very smooth bead appearance. Efficiency 100%.

Classification	
EN	1600: E 19 13 4 N L R 12
AWS	A5.4: E 317-16

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	Ferrite
0.025	0.9	0.8	≤ 0.03	≤ 0.03	20	13	3.4	5-10

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 20 °C
As Welded	≥ 350	≥ 550	≥ 30	≥ 27

Materials

1.4434 (X2CrNiMoN18-12-4); 1.4438 (X2CrNiMo18-15-4); 1.4429 (X2CrNiMoN17-13-3)

AISI 317L - 317LN

Storage

Keep dry and avoid condensation.

Re-drying not generally required

If necessary: 350-370 °C for 1 hour, 3 times max

Current condition and welding position

AC; DC+

PA PB PC PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD PC	VPMD Code
2.5	300	50-80	18.7	90	●
3.2	350	60-120	35.8	55	●
4.0	350	100-140	55.05	40	●

SUPRANOX 318

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

SUPRANOX 318 is a rutile coated MMA electrode for welding similar stabilised austenitic Cr-Ni-Mo steels. The weld metal transfer is in fine droplets, nearly spatter free with a generally self-releasing slag, producing finely rippled concave fillet welds with an outstanding weld bead aspect. Good striking and restriking. Under wet corrosive conditions suitable for operating temperatures <400°C.

Classification	
EN	1600: E 19 12 3 Nb R 1 2
AWS	A5.4: E 318-16

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo	Nb	Ferrite
≤ 0.03	0.8	0.9	19	11.5	2.7	0.4	5-15

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-60 °C
As Welded	≥ 350	≥ 550	≥ 30	≥ 50	≥ 32

Materials

1.4583 (X10CrNiMoNb18-12)

1.4580 (X6CrNiMoNb17-12-2) - 1.4408 (GX5CrNiMo19-11)

1.4571 (X6CrNiMoTi17-12-2) - 1.4401 (X4CrNiMo17-12-2)

1.4581 (GX5CrNiMoNb19-10) - 1.4436 (X4CrNiMo17-13-3)

Storage

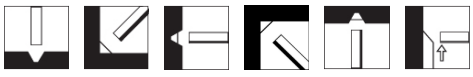
Keep dry and avoid condensation.

Re-drying not generally required.

If necessary: 300-350 °C for 2 hours, 5 times max.

Current condition and welding position

AC; DC+



Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
2.0	300	40-55	11.5	150	●
2.5	300	55-70	18.6	90	●
3.2	350	75-105	36.5	55	●
4.0	350	100-130	52.3	35	●

AIR LIQUIDE WELDING

BASINOX 318

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

Basic coated MMA electrode for welding similar stabilised austenitic stainless, Cr-Ni-Mo steels and cast steels. The weld metal has high ductility and BASINOX 318 is recommended for the welding of thicker section components in all positions. Easy slag release. Applications include wet-corrosive conditions for operating temperatures <400°C.

Classification	
EN	1600: E 19 12 3Nb B 42
AWS	A5.4: E 318-15

Approvals	Grade
TÜV	●

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	Nb	Ferrite
≤ 0.03	1.1	0.3	≤ 0.030	≤ 0.025	19	12	2.7	0.3	5-12

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-60 °C
As Welded	≥ 350	≥ 550	≥ 30	≥ 50	≥ 40

Materials

1.4581 (GX5CrNiMoNb19-10) - 1.4436 (X4CrNiMo17-13-3)

318C17; 316Ti; S31635

1.4580 (X6CrNiMoNb17-12-2) - 1.4408 (GX5CrNiMo19-11)

1.4583 (X10CrNiMoNb18-12)

Storage

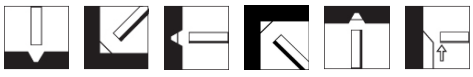
Keep dry and avoid condensation.

Re-drying not generally required.

If necessary: 280-300 °C for 1 hour, 5 times max.

Current condition and welding position

DC+



PA PB PC PD PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
2.5	300	50-80	17.4	110	●
3.2	350	70-120	33.6	65	●
4.0	350	110-140	49.1	45	●

SUPRANOX E 22 9 3 N

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

SUPRANOX E 22 9 3 N is a rutile coated MMA electrode for welding ferritic-austenitic duplex stainless steels, e.g.1.4462 and UNS S31803, also for joining duplex to standard austenitic or ferritic steels. The weld metal has high-strength, toughness and good resistance to pitting, crevice and stress-corrosion cracking in media containing chlorides and hydrosulphides. Weld metal transfer is in fine droplets, good fusion of the joint faces, easy slag removal and finely rippled bead surface. Maximum operating temperature <250 °C.

Classification	
EN	1600: E 22 9 3 N L R 1 2
AWS	A5.4: ~E 2209-16

Approvals	Grade
ABS	E2209
BV	UP
DNV	DUPLEX
GL	4462
LRS	S31803

CE

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo	N	Ferrite
≤0.030	1	1	22.5	9	3.2	0.15	35-50

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-40 °C
As Welded	≥ 690	800-900	≥ 24	≥ 50	≥ 27

Materials

UNS S31803 - S31500 - S31200 - S32304

1.4462 (X2CrNiMoN22-5-3)

Storage

Keep dry and avoid condensation.

Re-dry at 300-350 °C for 2 hours, 5 times max.

Current condition and welding position

AC; DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		DRYF		VPMD	
				PC	Code	PC	Code	PC	Code
2.5	300	60-85	17.1	210	●	30	●	100	●
3.2	350	80-110	32.9	140	●	24	●	65	●
4.0	350	95-130	50.8	80	●	18	●	40	●

AIR LIQUIDE WELDING

SUPRANOX RS 22 9 3 L

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

SUPRANOX RS 22.9.3L is particularly suitable for the welding of duplex stainless steels. High resistance to intergranular corrosion, pitting and stress corrosion conditions. Low carbon content. Excellent weldability with a spatter free arc, self-releasing slag combined with a very smooth bead appearance. Efficiency 100%.

Classification	
EN	1600: E 22 9 3 N L R 12
AWS	A5.4: E 2209-16

Approvals	Grade
BV	2209
DNV	DNV
RINA	2209

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	N	Ferrite
0.025	0.9	0.9	≤ 0.03	≤ 0.03	22.5	9.5	2.8	0.14	30-55

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 20 °C
As Welded	≥ 450	≥ 690	≥ 20	≥ 47

Materials

UNS S31803 - S31500 - S31200 - S32304

1.4462 (X2CrNiMoN22-5-3)

Storage

Keep dry and avoid condensation.

Re-drying not generally required.

If necessary: 350-370 °C for 1 hour, 3 times max.

Current condition and welding position

AC; DC+

PA PB PC PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	GASP	
				PC	Code
2.5	300	35-70	18.9	190	●
3.2	350	60-120	37.6	120	●
4.0	350	90-140	55.0	80	●
5.0	350	140-210	83.9	50	●

BASINOX 22 9 3 N

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

BASINOX 22 9 3 N is a basic coated MMA electrode, particularly suitable for welding duplex stainless steels, 22%Cr, 9%Ni, 3%Mo. Excellent resistance to intergranular corrosion. Low carbon content. Good weldability with a spatter free arc, self-releasing slag combined with a very smooth bead appearance.

Classification	
EN	1600: E 22 9 3 N L B 42
AWS	A5.4: E 2209-15

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	N	Ferrite
≤0.040	1.20	0.4	≤0.020	≤0.020	23.40	9	2.80	0.15	35-50

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-50 °C
As Welded	≥550	≥690	≥25	≥70	≥50

Materials

1.4462 (X2CrNiMoN 22-5-3)
UNS S31803-S31500-S31200S32304

Storage

Keep dry and avoid condensation.
Re-dry 280-300 °C / 2 h, max 5x.

Current condition and welding position

DC+

PA PB PC PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		GASP		VPMD	
				PC	Code	PC	Code	PC	Code
2.5	300	70-90	15.9	105	●	105	●	105	●
3.2	350	95-120	32.0	135	●	135	●	65	●
4.0	350	130-160	47.8	85	●	85	●	40	●

AIR LIQUIDE WELDING

BASINOX EB 25 10 4 N

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

Basic-coated MMA electrode for welding ferritic-austenitic duplex steels with PREN > 40, "Superduplex", such as e.g. UNS S32550 – UNS S32760. The deposited weld metal has high strength, toughness and very good resistance to pitting and stress corrosion cracking . Used to fabricate components and pipework in the off-shore oil and gas industry and more generally for vessels and pipework in the chemical industry.

Classification	
EN	1600: E 25 9 4 N L B 42
AWS	A5.9: E 2594-15

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	N	Ferrite
0.03	0.8	0.4	≤ 0.03	0.025	25	9.5	4	0.25	35-70

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-50 °C
As Welded	≥ 650	≥ 850	≥ 20	≥ 47	≥ 32

Materials

SAF 2507; Uranus 47N; UNS S32750; ASTM A182 F53

Storage

Keep dry and avoid condensation.

Re-drying 280-300 °C for 1 hour, 5 times max.

Current condition and welding position

DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
2.5	300	80-110	16.8	105	●
3.2	350	100-140	33.3	65	●
4.0	350	130-180	49.6	45	●

SUPRANOX 904L

CE

MMA Electrodes
Stainless and Heat resistant steels

SUPRANOX 904L is a rutile coated MMA electrode for welding identical or similar alloys, with high corrosion-resistance in reducing media, such as sulphuric and phosphoric acids. The weld metal microstructure is austenitic without delta-ferrite. High PREN, increased resistance to pitting and crevice corrosion in water and solutions containing chlorine. Typical applications in the off-shore oil and gas, chemical, pulp and paper industries and seawater desalination plant.

Classification	
EN	1600: E 20 25 5 Cu N L R 5 3
AWS	A5.4: E 385-16

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo	Cu
≤ 0.03	1.3	0.4	21	25	4.5	1.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C
As Welded	≥ 320	≥ 510	≥ 30	≥ 70

Materials

URANUS B6; AISI 904L; 1.4539 (X1NiCrMoCu25-20-5); 1.4439 (X2CrNiMoN17-13-5)

Storage

Keep dry and avoid condensation.

Re-drying not generally required.

If necessary: 300-350 °C for 2 hours, 5 times max.

Current condition and welding position

AC; DC+

PA PB

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		DRYF	
				PC	Code	PC	Code
2.5	300	50-75	20.9	190	●	28	●
3.2	350	80-105	41.7	115	●	22	●
4.0	350	100-135	60.2	80	●	18	●

BASINOX 904L

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

BASINOX 904L is a basic-coated MMA electrode for welding identical or similar alloyed steels with high corrosion resistance in reducing media, such as sulphuric or phosphoric acid. High PREN, increased resistance to pitting and crevice corrosion in water and solutions containing chlorine. Typical applications include seawater desalination plants and in the chemical and pulp and paper industries. The weld metal microstructure is austenitic without delta-ferrite.

Classification	
EN	1600: E Z 20 25 5 CuL B 12
AWS	A5.4: E 385-15

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	Cu
0.027	1.7	0.5	≤ 0.03	≤ 0.025	21	24.6	4.8	1.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-196 °C
As Welded	≥ 310	≥ 520	≥ 30	≥ 70	≥ 32

Materials

URANUS B6; AISI 904L; 1.4539 (X1NiCrMoCu25-20-5); 1.4439 (X2CrNiMoN17-13-5)

Storage

Keep dry and avoid condensation.

Re-drying not generally required.

If necessary: 280-300 °C for 1 hour, 5 times max.

Current condition and welding position

AC; DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
2.5	300	65-80	25.8	65	●
3.2	350	95-120	50.1	40	●
4.0	350	130-160	72.6	30	●
5.0	350	165-200	112.5	15	●

SUPRANOX 308H

SUPRANOX 308H is a semi-basic MMA electrode for welding type AISI 304H or Wr.1.4948 steels. Developed for high temperature applications in the petrochemical and nuclear industries. Efficiency 100%.

Classification	
EN	1600: E 19 9 R 12
AWS	A5.4: E 308H-16
GOST	10052-75: Э 07Х20Н9

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Ferrite
0.05	0.90	0.80	19.50	9.50	3-8

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C
As Welded	≥ 350	≥ 550	≥ 35	≥ 60

Materials

AISI 304H; 1.4948 (X6CrNi18-10); 1.4310 (X10CrNi18-8)

Storage

Keep dry and avoid condensation.
Re-drying not generally required
If necessary: 350-370 °C for 1 hour, 3 times max

Current condition and welding position

AC; DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
2.5	300	50-80	18.7	90	●
3.2	350	60-120	35.0	60	●
4.0	350	100-140	52.8	40	●
5.0	350	140-180	81.6	20	●

SUPRANOX RS 308H

Semi-basic MMA electrode for welding type AISI 304H or Wr.1.4948 steels. SUPRANOX RS 308H is used for high temperature applications in the petrochemical and nuclear industries.
Efficiency 100%.

Classification	
EN	1600: E 19 9 R 12
AWS	A5.4: E 308H-16
GOST	10052-75: ?07X20H9

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Ferrite
0.05	0.90	0.80	≤ 0.030	≤ 0.025	20	9.50	2-10

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 20 °C
As Welded	≥ 350	≥ 550	≥ 35	≥ 60

Materials

AISI 304H; 1.4948 (X6CrNi18-10); 1.4310 (X10CrNi18-8)

Storage

Keep dry and avoid condensation.
Re-drying not generally required
If necessary: 350-370 °C for 1 hour, 3 times max

Current condition and welding position

AC; DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	GASP PC	GASP Code
2.5	300	50-80	18.7	190	●
3.2	350	60-120	35.0	120	●
4.0	350	100-140	52.8	80	●
5.0	350	140-200	81.6	50	●

BASINOX 308H

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

BASINOX 308H is a basic coated MMA electrode for welding austenitic, creep resistant steels with higher carbon contents, type 18%Cr - 8%Ni, e.g. AISI 304H (1.4948). The controlled ferrite content in the weld metal confers a high resistance to hot cracking with little sensitivity to embrittlement. Good weldability in all positions, except vertically-down. Typical applications are in the petrochemical and nuclear industries.

Classification	
EN	1600: E 19 9 H B 42
AWS	A5.4: E 308H-15

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Ferrite
0.05	1.5	0.4	≤ 0.025	≤ 0.025	19	10	3-8

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C
As Welded	≥ 350	≥ 550	≥ 30	≥ 50

Materials

AISI 304H; 1.4948 (X6CrNi18-10); 1.4310 (X10CrNi18-8)

Storage

Keep dry and avoid condensation.

Re-drying not generally required

If necessary: 280-300 °C for 1 hour, 5 times max

Current condition and welding position

DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD PC	VPMD Code
2.5	300	50-80	17.5	105	●
3.2	350	70-120	32.8	65	●
4.0	350	110-140	49.5	45	●

AIR LIQUIDE WELDING

SUPRANOX 310

CE

MMA Electrodes
Stainless and Heat resistant steels

Rutile coated MMA electrode for welding identical or similar heat resistant steels. Fully austenitic microstructure, non-scaling <1150°C, but not resistant to sulphurous gases. SUPRANOX 310 is an optimum choice for weldability, weld bead profile and weld metal properties. For thick-walled components, the basic coated BASINOX 310 is recommended.

Classification	
EN	1600: E 25 20 R 1 2
AWS	A5.4: E 310-16

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni
0.1	1.7	0.6	27	21

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C
As Welded	≥ 350	≥ 550	≥ 30	≥ 60

Materials

AISI 310; 1.4845 (X8CrNi25-21); 1.4841 (X15CrNiSi25-21); 1.4828 (X15CrNiSi20-12)

Storage

Keep dry and avoid condensation.

Re-drying not generally required

If necessary: 300-350 °C for 2 hour, 5 times max

Current condition and welding position

AC; DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
2.5	300	60-80	18.7	185	●	85	●
3.2	350	80-110	36.1	115	●	55	●
4.0	350	100-130	47.2	100	●	45	●

SUPRANOX RS 310

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

SUPRANOX RS 310 is a rutile coated MMA electrode depositing fully austenitic weld metal containing 25%Cr and 20%Ni, suitable for the welding of AISI 310 and heat resistant alloys, <1150°C.
Excellent weldability with a spatter free arc and self-releasing slag, combined with a very smooth bead appearance. Efficiency 100%.

Classification	
EN	1600: E 25 20 R 12
AWS	A5.4: ~E 310-16

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo
0.08	2.2	1	≤ 0.03	≤ 0.02	26	21	0.4

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 20 °C
As Welded	≥ 350	≥ 550	≥ 30	≥ 60

Materials

AISI 310; 1.4845 (X8CrNi25-21); 1.4841 (X15CrNiSi25-21); 1.4828 (X15CrNiSi20-12)

Storage

Keep dry and avoid condensation.
Re-drying not generally required
If necessary: 350-370 °C for 1 hour, 3 times max

Current condition and welding position

AC; DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	GASP	
				PC	Code
2.5	300	45-70	18.3	190	●
3.2	350	70-120	34.5	120	●
4.0	350	110-140	53.5	80	●

BASINOX 310

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

BASINOX 310 is a basic-coated MMA electrode for welding identical/similar heat-resistant steels and cast steel. Fully austenitic microstructure, non-scaling <1150°C. In common with other similar high nickel base alloys, the weld metal is not corrosion resistant in sulphurous atmospheres.

Classification	
EN	1600: E 25 20 B 12
AWS	A5.4: E 310-15

Approvals	Grade
MMI	E-I32

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni
0.09	2	0.6	≤ 0.030	≤ 0.025	25.6	21

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C
As Welded	≥ 350	≥ 550	≥ 30	≥ 80

Materials

AISI 310; 1.4845 (X8CrNi25-21); 1.4841 (X15CrNiSi25-21); 1.4828 (X15CrNiSi20-12)

Storage

Keep dry and avoid condensation.

Re-drying not generally required.

If necessary: 280-300 °C for 1 hour, 5 times max.

Current condition and welding position

AC; DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
2.5	300	45-70	18.7	90	●
3.2	350	70-120	34.6	60	●
4.0	350	110-140	51.6	40	●
5.0	350	140-170	77.5	25	●

BASINOX 310Mo

BASINOX 310Mo is a basic coated MMA electrode depositing a fully austenitic weld metal containing 25%Cr and 20%Ni (AISI 310). Suitable for the welding of heat resisting alloys, <1150°C. Used for rebuilding on AISI 316L clad steels. Efficiency 100%.

Classification	
AWS	A5.4: E 310Mo-15

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo
0.1	1.45	0.6	≤ 0.03	≤ 0.02	26	20.7	2.8

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -196 °C
As Welded	≥ 400	≥ 550	≥ 30	≥ 27

Materials

AISI 310; cladding

Storage

Keep dry and avoid condensation.

Re-drying not generally required.

If necessary: 280-300 °C for 1 hour, 5 times max.

Current condition and welding position

AC; DC+

PA PB PC PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD PC	VPMD Code
2.5	300	45-70	18.3	100	●
3.2	350	70-120	33.0	65	●
4.0	350	110-140	50.0	45	●

SUPRANOX 309L

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

SUPRANOX 309L is a rutile coated MMA electrode for joining dissimilar steels, austenitic steels to ferritic steels, and for stainless cladding. The weld metal microstructure is austenite with ~15 % delta-ferrite. Cladding on unalloyed and low-alloy steels is corrosion resistant in the first layer. Metal transfer is in fine droplets, good wetting of the joint faces, finely-rippled weld bead surface, easy slag removal with good striking and restriking. The maximum operating temperature for dissimilar joints is 300 °C, for higher temperatures or postweld heat treatments use SUPRANEL 600.

Classification	
EN	1600: E 23 12 L R 1 2
AWS	A5.4: E 309L-17

Approvals	Grade
ABS	309L
BV	UP
DB	●
DNV	309L

Approvals	Grade
GL	4332
LRS	SS/CMn
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Ferrite
≤ 0.030	0.7	0.9	24	12.5	12-20

All-weld metal Mechanical Properties

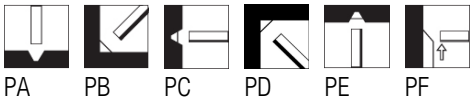
Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-60 °C
As Welded	≥ 320	≥ 520	≥ 30	≥ 50	≥ 40

Materials

A312 TP309S; Dissimilar steels (Ferritic to Austenitic steels), cladding.

Storage
Keep dry and avoid condensation.
Re-drying not generally required
If necessary: 300-350 °C for 2 hours, 5 times max

Current condition and welding position
AC; DC+



Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		DRYF		VPMD	
				PC	Code	PC	Code	PC	Code
2.5	300	50-70	18.5	190	●	28	●	85	●
3.2	350	75-105	36.3	115	●	22	●	55	●
4.0	350	100-130	54.0	80	●	18	●	35	●
5.0	450	150-190	108.8	45	●	7	●	20	●

SUPRANOX RS 309L

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

SUPRANOX RS 309L is a semi-basic MMA electrode suitable for the welding of stainless steels containing 22-25%Cr and 12-14%Ni, AISI 309, AISI 309L, for maximum service temperature <1000°C. Particularly suitable for the welding of dissimilar steels. Excellent weldability with a spatter free arc and self-releasing slag, combined with a very smooth bead appearance. Efficiency 100%.

Classification	
EN	1600: E 23 12 L R 12
AWS	A5.4: E 309L-16
GOST	10052-75: ?10X25H13?2 similar

Approvals	Grade
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Ferrite
0.03	0.9	0.8	≤ 0.03	≤ 0.03	23.5	12.3	5-15

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 20 °C
As Welded	≥ 320	≥ 520	≥ 30	≥ 60

Materials

A312 TP309S; carbon steel to stainless steels joint

Storage
Keep dry and avoid condensation.
Re-drying not generally required.
If necessary: 350-370 °C for 1 hour, 3 times max.

Current condition and welding position
AC; DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	GASP PC	GASP Code
2.0	300	30-50	11.8	310	●
2.5	300	45-70	19.3	190	●
3.2	350	65-120	36.2	120	●
4.0	350	115-140	54.1	80	●
5.0	350	130-180	86.6	50	●

CRISTAL E309L

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

CRISTAL E309L is a rutile coated MMA electrode for joining austenitic steels to ferritic steels, dissimilar steels, and for stainless cladding. The reduced fume formation and the lower chromium VI content of the fume contribute to an improved working environment for welders and in workshops. Advantageous in confined spaces and with restricted fume extraction systems. Cladding on unalloyed and low-alloy steels is already corrosion resistant in the first layer. Excellent striking and re-striking. Metal transfer is in fine droplets with good wetting of the joint faces, finely-rippled bead surface, easy slag removal. Highest operating temperature for joints between dissimilar steels is 300°C. In case of higher service temperatures or postweld heat treatments use SUPRANEL 600.

Classification	
EN	1600: E 23 12 L R 22
AWS	A5.4: E 309L-17

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Ferrite
≤ 0.030	0.8	0.9	23	12.5	10-20

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-60 °C
As Welded	≥ 320	≥ 520	≥ 30	≥ 40	≥ 32

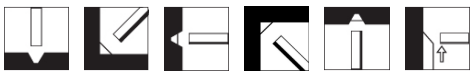
Materials

A312 TP309S;

Dissimilar steels (Ferritic to Austenitic steels), cladding.

Storage
Keep dry and avoid condensation.
Re-drying not generally required
If necessary: 250-300 °C for 2 hours, 5 times max

Current condition and welding position
DC+



Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	DRYF	
				PC	Code
2.5	300	65-85	18.9	28	●
3.2	350	80-105	35.3	22	●
4.0	350	100-135	55.2	18	●

SUPRANOX 309MoL

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

SUPRANOX 309MoL is a rutile coated MMA electrode for joining ferritic to austenitic steels, dissimilar joining and for stainless cladding. The weld metal microstructure consists of austenite with ~15% delta-ferrite. Surfacing on unalloyed and low-alloy steels is already corrosion resistant in the first layer. Metal transfer is in fine droplets, good wetting of the joint faces, finely-rippled weld bead surface, easy slag removal with good striking and restriking. The maximum operating temperature for joints between dissimilar steels is 300 °C, for higher temperatures or postweld heat treatments use SUPRANEL 600.

Classification	
EN	1600: E 23 12 2 L R 1 2
AWS	A5.4: E 309LMo-17

Approvals	Grade
DNV	309Mo

CE

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo	Ferrite
≤ 0.030	0.8	0.9	22.5	13.5	2.6	12-20

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-60 °C
As Welded	≥ 350	≥ 550	≥ 25	≥ 50	≥ 32

Materials

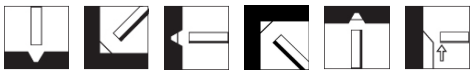
Dissimilar steels (Ferritic to Austenitic steels), cladding.

Storage

Keep dry and avoid condensation.
Re-drying not generally required
If necessary: 300-350 °C for 2 hours, 5 times max

Current condition and welding position

AC; DC+



Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		DRYF		VPMD	
				PC	Code	PC	Code	PC	Code
2.5	300	60-85	18.9	195	●	28	●	90	●
3.2	350	80-105	37.1	115	●	22	●	50	●
4.0	350	100-135	54.6	80	●	18	●	35	●
5.0	450	160-220	113.0	40	●	7	●	20	●

SUPRANOX RS 309Mo

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

SUPRANOX RS 309Mo is a rutile coated MMA electrode suitable for the welding of steels type AISI 309 and for the welding of dissimilar steels, buffer layers and cladding. Excellent weldability with a spatter free arc and self-releasing slag, combined with a very smooth bead appearance. Efficiency 100%.

Classification	
EN	1600: E 23 12 2 L R 12
AWS	A5.4: E 309MoL-16
GOST	10052-75: ?10X25H13?2 similar

Approvals	Grade
RINA	309Mo

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	Ferrite
0.03	0.9	0.9	≤ 0.02	≤ 0.02	22.7	12.5	2.3	10-25

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 20 °C
As Welded	≥ 350	≥ 550	≥ 30	≥ 60

Materials

Cladding of carbon steel and low alloy steel

Storage

Keep dry and avoid condensation.
Re-drying not generally required
If necessary: 350-370 °C for 1 hour, 3 times max

Current condition and welding position

AC; DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	GASP PC	GASP Code
2.0	300	30-50	11.9	310	●
2.5	300	45-70	19.2	190	●
3.2	350	65-120	37.0	120	●
4.0	350	115-140	55.2	80	●
5.0	350	130-180	87.2	50	●

MMA Electrodes
Stainless and Heat resistant steels

Rutile coated high-efficiency MMA electrode with a recovery of 160% for welding ferritic to austenitic steels or stainless cladding. Cladding on unalloyed steels is already corrosion resistant in the first layer. Highest operating temperature for dissimilar steel joints is <300 °C. Easy striking and restriking, metal transfer is in fine droplets, good fusion of the joint faces, with easy slag removal to leave a finely rippled bead surface.

Classification	
EN	1600: E 23 12 2 L R 53
AWS	A5.4: E 309LMo-26

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo	Ferrite
≤ 0.040	1	0.8	22	12	2.8	12-20

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-60 °C
As Welded	≥ 350	≥ 580	≥ 30	≥ 40	≥ 32

Materials

Dissimilar steels (Ferritic-Austenitic), cladding.

Storage
Keep dry and avoid condensation.
Re-drying not generally required
If necessary: 300-350 °C for 2 hours, 5 times max

Current condition and welding position
AC; DC+

PA PB

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
2.5	350	75-100	31.9	130	●
3.2	450	110-155	69.5	75	●

DW RSP

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

Semi-basic MMA electrode depositing austenitic-ferritic weld metal which is highly resistant to cracking. Particularly suitable for the welding of dissimilar steels (i.e. stainless steel to mild steel) where heat treatments are applicable. For hardfacing DW RSP may be used as a buffer layer. Excellent weldability with a spatter free arc, self-releasing slag combined with a very smooth bead appearance. Efficiency 100%. Packed in Gaspack system.

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	Ferrite
0.02	0.9	0.8	≤ 0.03	≤ 0.02	19	10	3	5-20

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 20 °C
As Welded	≥ 580	680 - 780	≥ 26	≥ 60

Materials

Dissimilar joints

Storage

Keep dry and avoid condensation.

If necessary Re-dry at 350-370 °C for 1 hour, 3 times max

Current condition and welding position

AC; DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	GASP PC	GASP Code
2.0	300	30-50	11.5	310	●
2.5	300	45-75	18.4	190	●
3.2	350	60-120	35.0	120	●
4.0	350	90-140	51.3	80	●
5.0	350	130-180	84.0	50	●

BASINOX 309L

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

BASINOX 309L is a low-hydrogen MMA electrode suitable for the welding of austenitic stainless steels containing 22-25%Cr and 12-14%Ni (AISI 309). The weld deposit carbon content is 0.04% max. Excellent weldability with a spatter free arc, self-releasing slag, combined with a very smooth bead appearance. Good corrosion resistance. Efficiency 100%. Suitable for welding of dissimilar steels, e.g. carbon steel to stainless steel, and for buffer layers and cladding.

Classification	
EN	1600: E 23 12 L B 12
AWS	A5.4: E 309L-15
WR	1.4332

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Ferrite
0.025	1.4	0.35	≤ 0.03	≤ 0.025	22.5	13	5-15

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 20 °C
As Welded	≥ 320	≥ 520	≥ 30	≥ 60

Materials

A312 TP309S; Dissimilar steels (Ferritic to Austenitic steels), cladding.

Storage

Keep dry and avoid condensation.

Re-drying not generally required.

If necessary: 280-300 °C for 1 hour, 5 times max.

Current condition and welding position

AC; DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
2.5	300	45-70	19.3	95	●
3.2	350	65-120	36.2	60	●
4.0	350	115-140	54.1	40	●
5.0	350	130-180	86.6	25	●

AIR LIQUIDE WELDING

BASINOX 309Mo

BASINOX 309Mo is a low hydrogen MMA electrode suitable for the welding of stainless steels, type AISI 309. Efficiency 100%. Particularly suitable for the welding of dissimilar steels, e.g. stainless steels to carbon steels. Service temperature <1000°C, at elevated temperatures the Mo content improves the creep properties.

Classification	
EN	1600: E 23 12 2 L B 12
AWS	A5.4: E 309MoL-15

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	Ferrite
≤0.04	1.4	0.3	≤ 0.03	≤ 0.025	23	12.7	2.5	5-15

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 20 °C
As Welded	≥ 350	≥ 550	≥ 30	≥ 60

Materials

Cladding of carbon steel and low alloy steel

Storage
Keep dry and avoid condensation.
Re-drying not generally required.
If necessary: 280-300 °C for 1 hour, 5 times max.

Current condition and welding position
AC; DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
2.5	300	45-70	18.0	100	●
3.2	350	65-120	36.0	60	●
4.0	350	115-140	51.8	40	●
5.0	350	130-180	77.5	25	●

BASINOX 309Nb

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

BASINOX 309Nb is a low hydrogen MMA electrode suitable for the welding of stainless steels type AISI 309. Efficiency 100%. Used for the welding of buffer layers on AISI 347 clad steels and dissimilar steels. The Nb content improves the resistance to intergranular corrosion and also the mechanical properties for high service temperature applications. Maximum service temperature: 1000°C.

Classification	
EN	1600: E 23 12 Nb B 12
AWS	A5.4: E 309Nb-15
GOST	10052-75: ?10 25H13?2 ?

Approvals	Grade
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Nb	Ferrite
≤0.04	1.6	0.45	≤ 0.03	≤ 0.025	23.5	12.5	0.9	5-15

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C
As Welded	≥ 350	≥ 550	≥ 30	≥ 60

Materials

Cladding of carbon steel and low alloy steel

Storage

Keep dry and avoid condensation.

Re-drying not generally required.

If necessary: 280-300 °C for 1 hour, 5 times max.

Current condition and welding position

AC; DC+

PA PB PC PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
2.5	300	45-70	18.5	100	●
3.2	350	65-120	36.3	60	●
4.0	350	115-140	50.0	40	●
5.0	350	130-180	77.4	25	●

AIR LIQUIDE WELDING

BASINOX 22 12 H

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

BASINOX 22 12 H is a basic coated MMA electrode depositing austenitic weld metal. Used for welding identical and similar heat resisting steels. Also suitable for welding heat resisting and non-scaling chromium steels, provided that corrosion from sulphur-bearing reducing combustion gases is not anticipated. Non-scaling <1000 °C.

Classification	
EN	1600: E 22 12 B 42
AWS	A5.4: ~E 309-15

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Ferrite
0.11	1.4	0.5	≤ 0.030	≤ 0.025	22	12	0-5 FN

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)
				+20 °C
As Welded	≥ 350	≥ 550	≥ 25	≥ 60

Materials

1.4828 (X15CrNiSi 20-12), AISI 309

Storage
Keep dry and avoid condensation.
Re-dry 280-300 °C / 2 h, max 5x.

Current condition and welding position
DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
2.5	300	45-70	18.0	100	●
3.2	350	65-120	34.5	65	●
4.0	350	115-140	76.6	40	●

SUPERCHROMAX R

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

SUPERCHROMAX R is a rutile coated MMA electrode for difficult-to-weld steels and austenitic-ferritic, dissimilar steels, joining as well as hard facing, buffer layers and for joining manganese hard steel, e.g. X120Mn12. Stainless, fully austenitic chromium-nickel-manganese weld metal, small amounts of delta-ferrite are possible. The weld metal is highly crack-resistant and non-scaling <850 °C. The hardness of the all-weld metal is ~180 HB, which work hardens to ~450 HB under impact load. Highest operating temperature for dissimilar steel joints is 300 °C. In case of higher temperatures, use SUPRANEL 600 electrodes.

Classification	
EN	14700 : E Fe10
EN	1600: E 18 8 Mn R 1 2
AWS	A5.4: ~E 307-16

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni
0.12	5	1	18	9

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-60 °C
As Welded	≥ 350	≥ 600	≥ 30	≥ 60	≥ 32

Materials

Dissimilar steels (Ferritic to Austenitic steels)

Joining difficult-to-weld steels; Manganese steels X120Mn12 (1.3401); Armor plates

Storage

Keep dry and avoid condensation.

Re-drying not generally required.

If necessary: 300-350 °C for 2 hours, 5 times max.

Current condition and welding position

AC; DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
2.5	300	50-80	15.6	105	●
3.2	300	80-130	26.8	60	●
4.0	350	120-160	51.0	40	●

AIR LIQUIDE WELDING

SUPERCHROMAX RS

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

SUPERCHROMAX RS is a rutile coated high-efficiency MMA electrode, ~160% recovery, for surfacing and joining ferritic to austenitic steels, dissimilar joining and difficult-to-weld steels. Also suitable for buffer layers when hardfacing. Stainless, fully austenitic chromium-nickel-manganese weld metal, small amounts of delta-ferrite are possible. The weld metal is highly crack-resistant and non-scaling <850 °C. The hardness of the all-weld metal is ~180 HB, which work hardens to ~450 HB under impact load. Highest operating temperature for dissimilar steel joints is 300 °C. In case of higher temperatures, use SUPRANEL 600 electrodes.

Classification	
EN	14700 : E Fe10
EN	1600: E 18 8 Mn R 7 3
AWS	A5.4: ~E 307-16

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni
0.07	6	0.5	18	8

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-60 °C
As Welded	≥ 350	≥ 600	≥ 30	≥ 60	≥ 32

Materials

Joining difficult-to-weld steels; Manganese steels X120Mn12 (1.3401); Armor plates

Dissimilar steels (Ferritic to Austenitic steels)

Storage

Keep dry and avoid condensation.

Re-drying not generally required.

If necessary: 300-350 °C for 2 hours, 5 times max.

Current condition and welding position

AC; DC+

PA PB

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
2.5	350	80-120	31.9	125	●	55	●
3.2	350	100-150	51.9	80	●	35	●
4.0	450	160-220	97.4	50	●	25	●

SUPERCHROMAX N

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

SUPERCHROMAX N is a basic coated MMA electrode for difficult-to-weld steels and austenitic-ferritic (dissimilar steels) joining as well as hard facing, buffer layer applications and suitable for joining manganese hard steel, e.g. X120Mn12. Stainless, fully austenitic chromium-nickel-manganese weld metal, small amounts of delta-ferrite are possible. The weld metal is highly crack-resistant and non-scaling <850 °C. Hardness of the all-weld metal is ~180 HB, which work hardens to ~450 HB under impact load. Highest operating temperature for dissimilar joints is 300 °C. In case of higher temperatures, use SUPRANEL 600 electrodes.

Classification	
EN	14700 : E Fe10
EN	1600: E 18 8 Mn B 2 2
AWS	A5.4: ~E 307-15

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni
0.09	6	0.4	≤ 0.025	≤ 0.020	18.5	9

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-60 °C
As Welded	≥ 350	≥ 600	≥ 30	≥ 80	≥ 60

Materials

Dissimilar steels (Ferritic to Austenitic steels)

Joining difficult-to-weld steels; Manganese steels X120Mn12 (1.3401); Armor plates.

Storage

Keep dry and avoid condensation.

Re-drying not generally required.

If necessary: 300-350 °C for 2 hours, 5 times max.

Current condition and welding position

DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
2.5	300	50-80	15.0	115	●
3.2	300	95-120	25.2	70	●
4.0	350	110-160	42.1	50	●

AIR LIQUIDE WELDING

BASINOX 307

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

Basic-coated MMA electrode suitable for the welding of dissimilar steels, quenched and tempered steels, 13%Mn and Cr steels. BASINOX 307 is also used to join difficult to weld steels. Good corrosion and wear resistance. Excellent mechanical properties and high crack resistance. Efficiency: 100%

Classification	
EN	1600: E 18 9 MnMo B 12
AWS	A5.4: E 307-15
GOST	10052-75: ?10X20H9?6C

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	Ferrite
0.08	4	≤0.9	≤ 0.03	≤ 0.03	19	10	1.3	≤ 8

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 20 °C
As Welded	≥ 350	≥ 590	≥ 30	≥ 80

Materials

Armour plate; Dissimilar Steels

X120Mn12 (1.3401)

Storage

Keep dry and avoid condensation.

Re-drying not generally required.

If necessary: 280-300 °C for 1 hour, 5 times max.

Current condition and welding position

AC; DC+

PA PB PC PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
2.5	300	50-75	18.1	100	●
3.2	350	70-120	34.8	60	●
4.0	350	90-120	49.6	40	●
5.0	350	100-145	75.0	25	●

DW 312

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

DW 312 is a rutile coated MMA electrode for joining difficult-to-weld steels, dissimilar steels and for wear-resistant surfacing and buffer layers, the deposit hardness is ~220 HB. Applications include repair and maintenance welding on machines, power transmission equipment and tools. The microstructure of the higher strength weld metal consists of ferritic-austenitic Cr-Ni steel, with ~50% delta-ferrite, and is highly crack resistant, rust-proof and non-scaling <1100 °C. Very good weldability, weld metal transfer is in fine droplets with easy slag removal, producing a good weld bead shape.

Classification	
EN	1600: ~E 29 9 R 12
AWS	A5.4: ~E 312-16

Approvals	Grade
DB	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Ferrite
0.8	1	1.2	28	12	25-50

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C	Hardness
As Welded	≥ 450	≥ 650	≥ 20	≥ 30	220 HB

Materials

Welding of steels which are difficult to weld: alloy steels, armor-plating steels. This electrode can also be used to weld dissimilar materials: non-alloyed steels or low alloy steels with stainless steel. Electrode particularly suitable for use in repair work.

Storage

Keep dry and avoid condensation.

Re-drying not generally required

If necessary: 300-350 °C for 2 hours, 5 times max

Current condition and welding position

AC; DC+

PA PB PC PD PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		DRYF		SMPA	
				PC	Code	PC	Code	PC	Code
2.5	300	60-85	18.3	195	●	28	●	28	●
3.2	350	80-115	37.1	115	●	22	●	15	●
4.0	350	105-160	54.1	80	●	18	●		

AIR LIQUIDE WELDING

SUPRANEL Ni1

OERLIKON

MMA Electrodes
Nickel and Copper alloys

SUPRANEL Ni1 is a basic-coated MMA electrode for welding pure nickel components and for joining these materials to unalloyed or low-alloyed steels, dissimilar joints. Suitable for buffer layers on corrosion-resistant, unalloyed or low alloy steels, before joining to nickel or copper alloys.

Classification	
EN ISO	14172: E Ni 2061
AWS	A5.11: E Ni-1

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni	Fe	Ti
0.01	0.3	0.8	0.005	0.005	Rem	0.2	1.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -196 °C
As Welded	≥ 200	≥ 410	≥ 35	≥ 100

Materials

UNS N02200; UNS N02201; UNS N02205

2.4066; 2.4068; 2.4061; 2.4060

Storage

Keep dry and avoid condensation.

Re-dry at 300-350 °C for 2 hours, 5 times max

Current condition and welding position

DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
2.5	300	50-70	18.0	90	●
3.2	350	65-100	33.5	60	●
4.0	350	85-120	50.9	40	●

SUPRANEL SR

OERLIKON

MMA Electrodes
Nickel and Copper alloys

SUPRANEL SR is a basic coated MMA electrode for the welding of heat and corrosion resistant nickel alloys. The weld metal retains ISO-V toughness down to -196°C and is creep-resistant <800°C. Due to the high toughness properties and resistance to cracking, applications include the joining of difficult-to-weld steels and maintenance welding of critical components. Even at higher temperatures, there is only limited carbon diffusion in the weld metal, thus avoiding the formation of crack-prone carbides at the weld interface of dissimilar joints. The coefficient of thermal expansion is between austenitic and ferritic steels, therefore applications include the joining of ferritic to austenitic steels, dissimilar welding, at operating temperatures or postweld heat treatment >300°C.

Classification	
EN ISO	14172: E Ni 6092 (NiCr16Fe12NbMo)
AWS	A5.11: E NiCrFe-2

Approvals	Grade
ABS	ENICrFe2
BV	UP
DNV	H10

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	Nb	Fe
≤ 0.05	2	0.2	≤ 0.020	≤ 0.015	16	Rem	1	1.8	8.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation	Impact Energy ISO - V (J)	
				+20 °C	-196 °C
As Welded	≥ 360	≥ 550	≥ 35	≥ 80	≥ 60

Materials

Cladding or buffer layer on steels.

2.4816 (NiCr15Fe); 1.4876 (X10NiCrAlTi32-20); 1.4958 (X5NiCrAlTi31-20)

UNS N06600; UNS N08800; UNS N08810

Storage
Keep dry and avoid condensation.
Re-dry at 300-350 °C for 2 hours, 5 times max

Current condition and welding position
DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		SMPA		VPMD	
				PC	Code	PC	Code	PC	Code
2.5	300	50-70	17.3	220	●			105	●
3.2	350	70-95	33.9	140	●	10	●	65	●
4.0	350	95-130	48.6	100	●	8	●	45	●

AIR LIQUIDE WELDING

SUPRANEL

OERLIKON

CE

MMA Electrodes
Nickel and Copper alloys

Basic-coated MMA electrode for welding high-temperature creep-resistant, heat resistant and corrosion resistant Ni-Cr alloys. Cryogenic toughness down to -196°C, creep resistant <800°C, non-scaling <1000°C. In a sulphurous atmosphere the weld metal can be used up to 500°C. Even at higher temperatures, there is only limited carbon diffusion in the weld metal thus avoiding crack-prone carbides at the weld interface of dissimilar joints. The weld metal coefficient of thermal expansion is between austenitic and ferritic steels, therefore SUPRANEL is used for joining ferritic to austenitic steels, dissimilar joints, with operating temperatures or postweld heat treatment >300°C.

Classification	
EN ISO	14172: E Ni 6182
AWS	A5.11: E NiCrFe-3

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Nb	Fe
0.05	7.8	0.3	≤ 0.020	≤ 0.015	16	Rem.	1.9	7.8

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -196 °C
As Welded	≥ 360	≥ 550	≥ 30	≥ 60

Materials

UNS N06600; UNS N08800; UNS N08810

2.4816; 1.4876; 1.4958

Storage

Keep dry and avoid condensation.

Re-dry at 300-350 °C for 2 hours, 5 times max

Current condition and welding position

DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
2.5	350	60-90	26.4	165	●	75	●
3.2	350	80-120	44.8	95	●	45	●
4.0	350	115-160	67.0	60	●	30	●
5.0	450	145-210	137.5	40	●	15	●

SUPRANEL 600

CE

MMA Electrodes
Nickel and Copper alloys

Basic-coated MMA electrode for welding high-temperature creep-resistant, heat resistant and corrosion resistant Ni-Cr alloys. Cryogenic toughness down to -196°C, creep resistant <800°C, non-scaling <1000°C. In a sulphurous atmosphere the weld metal can be used up to 500°C. Even at higher temperatures, there is only limited carbon diffusion in the weld metal thus avoiding crack-prone carbides at the weld interface of dissimilar joints. The weld metal coefficient of thermal expansion is between austenitic and ferritic steels, therefore SUPRANEL 600 is used for joining ferritic to austenitic steels, dissimilar joints, with operating temperatures or postweld heat treatment >300°C.

Classification	
EN ISO	14172: E Ni 6182
AWS	A5.11: E NiCrFe-3

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Nb	Fe
0.03	8	0.3	≤ 0.020	≤ 0.015	15	Rem.	1.7	9

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -196 °C
As Welded	≥ 360	≥ 550	≥ 30	≥ 60

Materials

UNS N06600; UNS N08800; UNS N08810

2.4816; 1.4876; 1.4958

Storage

Keep dry and avoid condensation.

Re-dry at 300-350 °C for 2 hours, 5 times max

Current condition and welding position

DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
2.5	300	50-75	19.3	200	●	90	●
3.2	350	70-95	36.3	125	●	60	●
4.0	350	95-135	54.0	80	●	40	●
5.0	350	150-185	75.2	55	●	25	●

SUPRANEL 625

OERLIKON

MMA Electrodes
Nickel and Copper alloys

Basic coated MMA electrode for welding highly corrosion-resistant Cr-Mo-Nickel base alloys, such as 625, 825 and similar alloys. Also suitable for molybdenum alloyed corrosion-resistant steels, e.g. 7%Mo, such as X1NiCrMoCuN25-20-7 and cryogenic toughness nickel steels. Very resistant to stress corrosion cracking and pitting corrosion. Cryogenic toughness down to -196°C. In sulphur-free atmospheres, non-scaling <1200°C and in sulphurous atmospheres the weld metal can be used for operating temperatures <500°C. Even at higher temperatures there is only limited carbon diffusion in the weld metal thus avoiding crack-prone carbides at the weld interface of dissimilar joints. The coefficient of thermal expansion is between austenitic and ferritic steels, therefore SUPRANEL 625 is also suited for joining ferritic to austenitic steels, dissimilar joints, at operating temperatures or postweld heat treatment >300°C.

Classification	
EN ISO	14172: E Ni 6625
AWS	A5.11: E NiCrMo-3

Approvals	Grade
DNV	
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo	Nb	Fe	Al
0.02	0.9	0.2	22	Rem	9	3.7	1	≤ 0.4

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-196 °C
As Welded	≥ 420	≥ 760	≥ 30	≥ 60	≥ 50

Materials

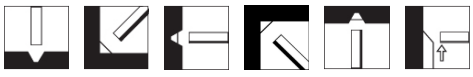
1.4539 (X2NiCrMoCu 25-20); X2CrNiMoCuN20-18-6; 1.4529 (X1NiCrMoCuN 25-20-6)

2.4856 (Alloy 625, NiCr22Mo9Nb); 2.4858 (Alloy 825, NiCr21Mo)

UNS N06625; UNS N08825

Storage
Keep dry and avoid condensation.
Re-dry at 300-350 °C for 2 hours, 5 times max

Current condition and welding position
DC+



Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		DRYF		VPMD	
				PC	Code	PC	Code	PC	Code
2.5	300	50-70	17.1	220	●	32	●	105	●
3.2	350	70-95	34.4	140	●	24	●	65	●
4.0	350	90-120	50.0	90	●	20	●	45	●
5.0	350	130-170	77.1	60	●	8	●	30	●

SUPRANEL C276

OERLIKON

MMA Electrodes
Nickel and Copper alloys

SUPRANEL C276 is a basic-coated MMA electrode for welding nickel-base alloys of type C-276, Ni-Mo16Cr15W. Also suitable for cladding and dissimilar joining of C-276 to other nickel base alloys or to other steel types. Non-scaling <1100°C.

Classification	
EN ISO	14172: E Ni 6276
AWS	A5.11: E NiCrMo-4

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	Cu	Fe	Co	V	W
≤0.02	≤1	≤0.2	≤ 0.04	≤ 0.03	14.5-16.5	Rem	15-17	≤0.5	4-7	≤2.5	≤0.4	3-4.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -196 °C
As Welded	≥ 400	≥ 690	≥ 25	≥ 55

Materials

UNS N10276; HASTELLOY C276

ASTM B574; B575; B619; B622

Storage

Keep dry and avoid condensation.

Re-dry at 300-350 °C for 2 hours, 5 times max

Current condition and welding position

DC+

PA PB PC PE PF

AIR LIQUIDE WELDING

FREEZAL ENi9

OERLIKON

MMA Electrodes
Nickel and Copper alloys

FREEZAL ENi9 is a basic coated MMA electrode for welding cryogenic steels containing 5% to 9%Ni. To reduce magnetic arc blow, which is typical when welding these steel types, AC polarity is recommended. Very high resistance to hot cracking and excellent toughness at cryogenic temperatures. Recovery ~140%

Classification	
EN ISO	14172: E Ni 6620
AWS	A5.11: E NiCrMo-6

Approvals	Grade
GL	5680

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	Nb	Fe	W
0.05	3.5	0.3	≤ 0.020	≤ 0.012	13.7	Rem	6.8	1.6	≤ 5	1.35

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation	Impact Energy ISO - V (J)
				-196 °C
As Welded	≥ 430	≥ 690	≥ 35	≥ 70

Materials

Steel 5 - 9 % Nickel, A 353-70, A 553-70

Storage

Keep dry and avoid condensation.

Re-dry at 340-360 °C for 2 hours, 5 times max.

Current condition and welding position

AC; DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	DRYF	
				PC	Code
2.5	350	65-100	28.4	26	●
3.2	350	100-140	49.4	18	●
4.0	350	130-180	71.2	16	●
5.0	450	175-210	144.0	6	●

SUPRANEL 690

SUPRANEL 690 is a basic-coated MMA electrode for welding high-temperature creep-resistant, heat resistant and corrosion-resistant Ni-Cr-alloys of alloy type 690, NiCr29Fe.

Classification	
EN ISO	14172: E Ni 6152 (nearest)
AWS	A5.11: E NiCrFe-7

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Nb	Fe
0.05	4	0.6	≤ 0.005	≤ 0.005	32	Rem	1.4	10

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -196 °C
As Welded	≥ 360	≥ 550	≥ 30	≥ 60

Materials

ASTM B166 - B167 - B168; UNS N06690

Storage

Keep dry and avoid condensation.

Re-dry at 300-350 °C for 2 hours, 5 times max

Current condition and welding position

DC+

PA PB PC PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD PC	VPMD Code
2.5	300	50-70	18.0	100	●
3.2	350	65-100	36.0	60	●
4.0	350	100-130	50.8	40	●

SUPRANEL NiCu7

OERLIKON

MMA Electrodes
Nickel and Copper alloys

SUPRANEL NiCu7 is a basic-coated MMA electrode for joining similar 70Ni - 30Cu, Monel alloys. Suitable for joining and for surfacing of unalloyed or low-alloy steels and cast iron. The weld metal has a high corrosion resistance in saline solution and seawater. Typical applications include the chemical industry and seawater desalination plants.

Classification	
EN ISO	14172: E Ni 4060 (NiCu30Mn3Ti)
AWS	A5.11: E NiCu-7

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni	Cu	Fe	Ti
0.015	3.5	0.4	≤ 0.02	≤ 0.015	Rem	29	0.8	0.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
As Welded	≥ 200	≥ 480	≥ 30

Materials

UNS N04400; UNS N 05500

2.4360 (NiCu30Fe); 2.4375 (NiCu30Al)

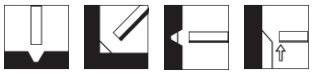
Storage

Keep dry and avoid condensation.

Re-dry at 300-350 °C for 2 hours, 5 times max

Current condition and welding position

AC; DC+



PA PB PC PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
2.5	300	50-70	17.8	110	●
3.2	350	75-100	31.6	65	●
4.0	350	90-130	48.0	45	●

CUPRONIC 70

OERLIKON

MMA Electrodes
Nickel and Copper alloys

CUPRONIC 70 is a basic-coated MMA electrode for alloy types CuNi 70-30 or CuNi 90-10. Suitable for joining and surfacing, the weld metal has an excellent resistance to salt water corrosion. Typical applications are in the shipbuilding, offshore oil and chemical industries and for seawater desalination plant.

Classification	
AWS	A5.6: E CuNi

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni	Cu	Fe	Ti	Pb
0.01	1.4	0.02	≤ 0.02	≤ 0.01	29.5	Rem	0.5	≤0.5	≤ 0.02

All-weld metal Mechanical Properties

Heat Treatment	Tensile Strength (MPa)	Elongation A5 (%)
As Welded	≥ 350	≥ 20

Materials

2.0872 (CuNi10Fe1Mn9); 2.0882 (CuNi30Mn1Fe)

UNS C70600; UNS C71500

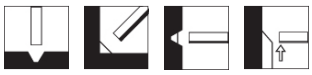
Storage

Keep dry and avoid condensation.

Re-dry at 280-300 °C for 1 hour, 5 times max.

Current condition and welding position

AC; DC+



PA PB PC PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
2.5	300	50-70	16.4	100	●
3.2	350	75-100	31.6	60	●
4.0	350	90-130	48.0	40	●

CITOBRONZE Sn

OERLIKON

MMA Electrodes
Nickel and Copper alloys

Basic coated MMA electrode for welding phosphor bronze or tin bronze, e.g. 6-8% Sn. Suitable also for joining Cu-Zn alloys (brass) and in some cases for disimilar welding to unalloyed or low-alloy steel or gray cast iron. Postweld heat treatment is not imperative but improves the toughness of the weld metal.

Classification	
AWS	A5.6: E CuSn-C

Chemical analysis (Typical values in %)

P	Cu	Fe	Pb	Sn	Al
≤ 0.35	Rem	≤ 0.25	0.02	8	0.01

All-weld metal Mechanical Properties

Tensile Strength (MPa)	Elongation A5 (%)	Hardness
≥ 280	≥ 20	80-100

Materials

2.1010; 2.1016; 2.1020; 2.1030; 2.1080; 2.1050

UNS C50700; UNS C51100; UNS C51900; UNS C52100; UNS C52400

Storage

Keep dry and avoid condensation.

Once opened, store at 90° - 150° C.

Current condition and welding position

AC; DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
2.5	300	50-70	15.6	90	●
3.2	350	60-90	29.8	55	●

SUPERFONTE Ni

OERLIKON

MMA Electrodes Cast-iron

SUPERFONTE Ni is a basic-graphite coated MMA electrode with a pure nickel core wire for dissimilar joining or surfacing of cast iron without preheating or with a minimum of <300 °C, "cast iron cold welding". Especially suited for repair welding of cracked or broken cast iron components and for joining cast iron with lamellar graphite (GJL), cast iron with globular graphite (GJS), black-heart cast iron (GJMB), white-heart cast iron (GJMW), dissimilar joints with steel, copper or nickel-based alloys. Easy arc striking, stable arc, finely-rippled bead surface, the weld metal is machinable. Weld using a low heat input and weld with short beads, ~10 to 30 mm and in order to reduce weld residual stresses, hammer-peen welds immediately after welding and before cooling.

Classification	
EN ISO	1071 : E C Ni-CI 1
AWS	A5.15: E Ni-CI

Chemical analysis (Typical values in %)

C	Mn	Si	Ni	Fe
1.2	0.2	0.5	Rem	1

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Hardness
As Welded	≥ 200	≥ 400	≥ 5	140 HB

Materials

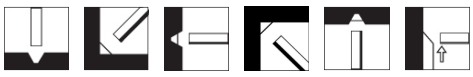
EN-GJL-100
EN-GJL-350 (GG-10 - GG-35), EN-GJMB-350
EN-GJMB-700 (GTS 35-10 - GTS 70-02), EN-GJS-400
EN-GJS-700 (GGG-40 - GGG-70), EN-GJMW-350
EN-GJMW-360 (GTW 35-04 - GTW S 38)

Storage

Keep dry and avoid condensation.
Re-drying not generally required.
If necessary: 80 °C for 1 hour, once only.

Current condition and welding position

AC; DC-



Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
2.5	350	60-80	18.1	300	●	135	●
3.2	350	75-120	32.1	170	●	80	●
4.0	350	100-150	47.0	115	●	50	●

AIR LIQUIDE WELDING

SUPERFONTE NiFe

SUPERFONTE NiFe is a basic-graphite coated MMA electrodes with nickel-iron core wire, for joining and surfacing of cast iron without preheating or with a minimum of < 300°C, "cast iron cold welding". Higher weld metal strength than SUPERFONTE Ni. Used for welding applications on new cast-iron components made of globular gray-cast iron (GJS/GGG) and dissimilar joining of GJS to steel. Suitable for cast irons with globular graphite (GJS), black-heart cast iron (GJMB), white-heart cast iron (GJMW), austenitic cast iron and dissimilar joints to steel. Easy striking, stable arc, finely-rippled bead surface. Weld at low heat input with short beads, ~10 to 30 mm, and hammer peen. Weld metal can be machined.

Classification	
EN ISO	1071 : E C NiFe-CI 1
AWS	A5.15: E NiFe-CI

Chemical analysis (Typical values in %)

C	Mn	Si	Ni	Fe
1.8	0.5	0.8	Rem	43

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Hardness
As Welded	≥ 280	400-580	≥ 6	150-170 HB

Materials

EN-GJMW-360

EN-GJS-350 bis EN-GJS-400 (GGG 40)

EN-GJMB-350 (GTS 35-10)

Storage

Keep dry and avoid condensation.

Re-drying not generally required.

If necessary: 80 °C for 1 hour, once only.

Current condition and welding position

AC; DC-; DC+

PA PB PC PD PE PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		SMPA		VPMD	
				PC	Code	PC	Code	PC	Code
2.5	350	50-75	19.1	230	●	26	●	110	●
3.2	350	70-95	31.1	155	●	12	●	70	●
4.0	350	90-125	45.7	100	●			45	●

SUPERFONTE BM

OERLIKON

MMA Electrodes Cast-iron

SUPERFONTE BM is a basic-graphite coated MMA electrode with a Ni-Fe bi-metal core wire for dissimilar joining and surfacing of cast iron either without preheating or with only a minimum of < 300°C, "cast iron cold welding". The bi-metal core wire gives excellent welding characteristics including positional welding. Higher weld metal strength than SUPERFONTE Ni. Typical applications include the welding of components made of globular gray-cast iron (GJS/GGG) and dissimilar joining of GJS to steel. Suitable for cast irons with globular graphite (GJS), black-heart cast iron (GJMB), white-heart cast iron (GJMW), austenitic cast iron and dissimilar joints to steel. Easy striking, stable arc, finely-rippled bead surface. Weld at low heat input and with short beads, ~10 to 30 mm, and hammer peen. Weld metal can be machined.

Classification	
EN ISO	1071: E C NiFe Cl 1
AWS	A5.15: E NiFe-Cl

Chemical analysis (Typical values in %)

C	Mn	Si	Ni	Cu	Fe	Al
≤ 1.5	≤ 0.8	≤ 0.8	Rem	≤ 1	45	≤ 0.7

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Hardness
As Welded	≥ 280	400-580	≥ 6	150-170 HB

Materials

- EN-GJS-350 bis EN-GJS-4000 (GGG 40)
- EN-G7MB-350 (GTS 35-10)
- EN-G7MW-360

Storage

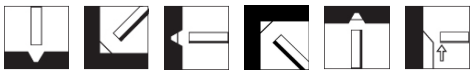
Keep dry and avoid condensation.

Re-drying not generally required.

If necessary: 250 °C for 1 hour, once only.

Current condition and welding position

AC; DC-; DC+



Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
2.5	300	50-70	14.7	285	●	130	●
3.2	350	80-110	29.4	170	●	80	●
4.0	350	100-135	43.6	115	●	55	●

AIR LIQUIDE WELDING

ALCORD AI

OERLIKON

MMA Electrodes
Aluminum alloys

ALCORD AI is an electrode with a special coating for welding aluminium. When welding, hold the electrode at a right angle to the work piece surface and welding direction and keep the arc as short as possible. Wall thicknesses greater than 10 mm and larger work pieces will require preheating from 150°C to 250 °C. This MMA electrode is also well suited for oxy-acteylene welding. Slag residues are corrosive and must be completely removed from the weld bead. The coating is highly hygroscopic, consequently electrodes must be stored in an absolutely dry location, or redried if required.

Classification	
AWS	A5.3: ~E1100
DIN	1732: EL-Al 99.8

Chemical analysis (Typical values in %)

Al
99.8

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation
As Welded	≥ 30	≥ 80	≥ 30

Materials

Al99.5 ; Al99 ; Al99.9Mg0.5 ; AlMg0.5

Storage

Keep dry and avoid condensation.

Once opened, store at 90-120 °C until used.

If necessary, Re-dry at 110-120 °C for 2 hours, 5 times max.

Current condition and welding position

DC+

PA PB

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	TUBM	
				PC	Code
2.5	350	60-90	9.2	217	●
3.2	350	80-110	14.0	143	●

ALCORD 5Si

OERLIKON

MMA Electrodes
Aluminum alloys

ALCORD 5Si is an electrode with a special coating for welding low-alloy Al-Mg-(Si) aluminium alloys and for joining dissimilar aluminium alloys. When welding, hold the electrode at a right angle to the work piece surface and welding direction and keep the arc as short as possible. Wall thicknesses greater than 10 mm and larger work pieces will require preheating from 150 °C to 250 °C. This MMA electrode is also well suited for oxy-acetylene welding. Slag residues are corrosive and must be completely removed from the weld bead. The coating is highly hygroscopic, consequently electrodes must be stored in an absolutely dry location, or redried if required.

Classification	
AWS	A5.3: E4043
DIN	1732: EL-AlSi 5

Chemical analysis (Typical values in %)

Al	Si	Fe
Rem	5	0.1

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation
As Welded	≥ 90	≥ 160	≥ 15

Materials

Al-Mg-Si and Al-Mg with max. 2.5% Mg; Al-Mn-Cu, Al-Si alloys

Storage

Keep dry and avoid condensation.

Once opened, store at 90-120 °C until used.

If necessary, Re-dry at 110-120 °C for 2 hours, 5 times max.

Current condition and welding position

DC+

PA PB PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	TUBM	
				PC	Code
2.5	350	60-90	9.0	222	●
3.2	350	80-110	13.2	152	●

AIR LIQUIDE WELDING

ALCORD 12Si

OERLIKON

MMA Electrodes
Aluminum alloys

ALCORD 12Si is an electrode with a special coating for welding Al-Si cast alloy, with high silicon content. When welding, hold the electrode at a right angle to the work piece surface and welding direction and keep the arc as short as possible. Wall thicknesses greater than 10 mm and larger work pieces will require preheating from 150°C to 250°C. This MMA electrode is also well suited for oxy-acetylene welding. Slag residues are corrosive and must be completely removed from the weld bead. The coating is highly hygroscopic, consequently electrodes must be stored in an absolutely dry location, or redried if required.

Classification	
DIN	1732: El-AlSi 12

Chemical analysis (Typical values in %)

Al	Si	Fe
Rem	12	0.4

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
As Welded	≥ 80	≥ 180	≥ 5

Materials

G-AlSi11, G-AlSi12, G-AlSi10Mg(Cu), G-AlSi12(Cu), Al-Si-Guss mit Si>7%

Storage

Keep dry and avoid condensation.

Once opened, store at 90-120 °C until used.

If necessary, Re-dry at 110-120 °C for 2 hours, 5 times max.

Current condition and welding position

DC+

PA PB PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	TUBM	
				PC	Code
2.5	350	60-90	8.8	227	●
3.2	350	80-110	13.2	152	●

SUPRAMANGAN

OERLIKON

MMA Electrodes Hardfacing

SUPRAMANGAN is a basic coated austenitic manganese steel MMA electrode for wear resisting hard facing deposits. The weld metal will increase in hardness by cold-working, ~400-500 HB, therefore it is particularly suitable for components which are subjected mainly to wear, caused by heavy impact and shock. During welding, the workpieces should not become too hot and if necessary should be allowed to cool down. When welding large workpieces of austenitic manganese steel, such as crusher jaw plates, it is advisable to weld in a water bath. High welding currents and wide-weave beads must be avoided. When building up several layers, it is recommended that a buffer layer is deposited with SUPERCHROMAX N. When welding austenitic manganese steel joints, e.g. 1.3401, it is preferable to use SUPERCHROMAX N. Applications include the hardfacing of wear resisting components such as crusher jaw plates, crusher cones, pulverising hammers and beating arms.

Classification	
EN	14700 : ~E Fe9
DIN	8555 : ~E 7-UM-200-KP

Chemical analysis (Typical values in %)

C	Mn	Cr	Ni	Fe
0.60	15	4.50	4.80	Rem.

All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded	175-225 HB

Storage

Keep dry and avoid condensation.

Re-drying not generally required.

If necessary: 300-350 °C for 2 hours, 5 times max.

Current condition and welding position

DC+

PA PB

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
3.2	450	110-135	48.4	130	●
4.0	450	140-175	70.3	90	●

MMA Electrodes Hardfacing

CITORAIL is a thick basic coated MMA electrode for producing hard facing deposits of medium hardness, which can be machined by chip-forming. Good weldability when positional welding, the weld deposit is crack and porosity resistant. Particularly suitable for hardfacing wear-resisting parts subject to sliding impact e.g. slideways, shock resistance e.g. cams and rolling impact resistance e.g. rotors. Typical applications include rails, rail crossings, switch points, sprockets and wearing parts, such as rope pulleys, tumblers, rollers, caterpillar track rollers and links, wheel flanges, stud links and similar components.

Classification	
EN	14700: E Fe1
DIN	8555: E1-UM-300

Approvals	Grade
DB	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Fe
0.1	0.8	0.9	3	Rem

All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded	275-325 HB

Materials

Electrode for surfacing rails up to 855 N/mm² tensile strength

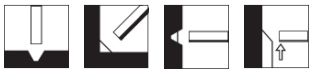
Storage

Keep dry and avoid condensation.

Re-drying recommended at 300-350 °C for 2 hours, 5 times max.

Current condition and welding position

DC+



PA PB PC PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
3.2	450	110-130	44.7	135	●
4.0	450	140-180	67.0	80	●
5.0	450	190-240	104.0	50	●
6.0	450	210-280	147.8	35	●

SUPRADUR 2015

OERLIKON

MMA Electrodes Hardfacing

Thick basic coated MMA electrode for hardfacing rail crossings and rails. Especially suited for switch points of crossings made of bainitic steels. Highly wear resistant. Hardness 48 – 52 HRC (460 – 520 HB).
Weld metal with very low content of diffusible hydrogen (HD ≤ 5 ml / 100 g deposited weld metal).
Vacuumpackaging: no rebaking of the electrodes after opening.

Classification	
EN	14700: ~E Fe1

Approvals	Grade
DB	●

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo	Fe	V
0.25	0.8	0.6	2.9	0.3	0.4	Rem	0.2

All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded	48-52 HRC

Materials

New bainitic steels for heavy duty rail crossings.

Storage

Keep dry and avoid condensation.

Re-drying recommended at 340-360 °C for 2 hours, 5 times max.

Current condition and welding position

DC+

PA PB PC

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	DRYF	
				PC	Code
5.0	450	190-240	105.6	7	●

SUPRADUR 345B

SUPRADUR 345B is a basic coated surfacing MMA electrode depositing a weld metal designed for repairing the running surface of rails.
Easy-to-use, the weld deposit hardness in the as-welded condition is 300 HB. The number of layers is unlimited.

Classification
EN 14700: E Fe13

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo
0.07	1.5	0.3	0.45	3.4	0.35

All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded	300 HB

Materials

Electrode for surfacing rails of grades 900 and 700.

Storage

Keep dry and avoid condensation.

Re-dry at 300-350ºC for 1 1/2 hours, 5 times max.

Current condition and welding position

AC; DC+

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		DRYF	
				PC	Code	PC	Code
4.0	450	160-180	69.2	80	●	18	●

SUPRADUR 400

SUPRADUR 400 is a thin rutile coated MMA electrode for hardfacing applications, which is very easy to use. Weld metal hardness of ~240 - 290HV10 in the as-welded condition, it can reach 400HV after water-quenching. Deposit a maximum of 3 layers. Used for surfacing against sliding impact, e.g. slideways, shock, e.g. cams and rolling impact, e.g. rotors. Typical applications are civil works and agricultural equipment such as crane parts, rails, slideways, rope pulleys, track-supporting rollers of crawler-type vehicles, wheel flanges and stud links.

Classification
EN 14700: E Fe1

Chemical analysis (Typical values in %)

C	Si	Cr	Fe
0.1	0.3	2.4	Rem.

All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded	240-290 HV10

Storage
Keep dry and avoid condensation.
Re-drying not generally required.
If necessary: 150-200 °C for 2 hours, 5 times max.

Current condition and welding position
AC; DC-

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
3.2	450	100-135	38.3	160	●
4.0	450	120-170	56.8	115	●
5.0	450	150-220	86.3	80	●

SUPRADUR 400B

OERLIKON

MMA Electrodes
Hardfacing

Thick basic-coated MMA electrode for depositing highly wear resisting hard facing deposits. Used for hard facing against sliding impact, e.g. slideways, shock, e.g. cams and rolling impact, e.g. rotors and rails. The weld metal is particularly resistant to impact and shock and very crack-resistant.
A tough buffer layer, deposited with TENACITO R or SUPERCHROMAX N, is only required when the base plate is very sensitive to welding conditions. Even multi layers can be deposited without cracking and intermediate buffer layers are not required. SUPRADUR 400B can be welded in all positions, except vertically-down and the weld metal can be machined only by using sintered hard metal tools. Suitable for rails, rail crossings and switch points, wearing components such as dredger parts, bearing surfaces, striking tools, forging dies, buckstays, wheel flanges, slide surfaces subject to heavy wear, reconditioning of dies and punches.

Classification	
EN	14700: E Fe1
DIN	8555: E 1-UM-400

Approvals	Grade
DB	●

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Fe
0.2	0.4	0.7	2.7	Rem

All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded ,No pre-heating / Interpass temperature < 100ºC	375-450 HB
As Welded , Pre-heating / Interpass temperature 200 ± 25°C	320-360 HB

Materials

Electrode for surfacing rails up to 1080 N/mm² tensile strength

Storage

Keep dry and avoid condensation.

Re-drying recommended at 300-350 °C for 2 hours, 5 times max.

Current condition and welding position

AC; DC+

PA PB PC PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
3.2	350	105-135	40.0	115	●
4.0	450	120-180	69.2	80	●
5.0	450	170-240	120	50	●

SUPRADUR 600

OERLIKON

MMA Electrodes Hardfacing

SUPRADUR 600 is a semi-thick basic coated rutile MMA electrode which is easy to use. Weld metal hardness ~550-650HV which can be ground. Very good resistance to medium impact. Used for hardfacing carbon steels and low alloy steels. Preheating to 400 °C is always necessary, particularly for large work pieces and deposit a maximum of 3 layers. A tough buffer layer using UNIVERS or SUPRADUR 400 is only required in the case of very crack sensitive base metal. Applications include civil works and mining equipment, shovel teeth, buckets and crawler shoes.

Classification	
EN	14700: E Fe2
DIN	8555: E 2-UM-60

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Fe
0.6	1.1	1	2.8	Rem

All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded	550-650 HV

Storage

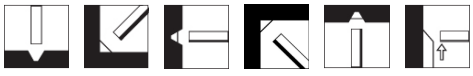
Keep dry and avoid condensation.

Re-drying not generally required.

If necessary: 150-200 °C for 2 hours, 5 times max.

Current condition and welding position

AC; DC-



Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
3.2	450	85-125	40.7	135	●
4.0	450	100-150	61.6	90	●
5.0	450	150-210	97.5	60	●

AIR LIQUIDE WELDING

SUPRADUR 600B

OERLIKON

MMA Electrodes Hardfacing

SUPRADUR 600B is a thick basic coated MMA electrode for depositing tough and wear resistant surfacing on components subjected to severe wear. The weld metal is free of cracks and pores and resistant to impact and shock and can only be machined by grinding. A tough buffer layer, deposited with TENACITO R or SUPERCHROMAX N, is only required when the base plate is very sensitive to the welding conditions and multi-layer deposits will be free of cracks, even without intermediate buffer layers. Typical applications include the hard facing of excavator parts, bucket edges, bucket teeth and drilling bits.

Classification	
EN	14700: E Fe2
DIN	8555: E 6-UM-60

Approvals	Grade
DB	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Mo	Fe	V
0.5	0.3	0.4	8	0.5	Rem	0.5

All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded	57-62 HRC

Storage

Keep dry and avoid condensation.

Re-drying recommended at 300-350 °C for 2 hours, 5 times max.

Current condition and welding position

AC; DC+

PA PB PC PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
2.5	350	70-90	21.6	210	●
3.2	450	100-135	45.2	125	●
4.0	450	140-180	68.3	80	●
5.0	450	190-240	110.7	50	●

SUPRADUR 600RB

SUPRADUR 600RB is a thick rutile coated MMA electrode with good weldability for wear-resistant and tough hard facing. With base plates which are sensitive to welding conditions a tough buffer layer, deposited with TENACITO R or SUPERCHROMAX N is required and for thick facing a buffer layer is required after every third layer. The weld metal is machinable only by grinding. Typical applications include excavator parts, bucket edges, excavator teeth, drilling bits, coal ploughs, conveyor screws, striking tools, crusher jaws and cones.

Classification	
EN	14700: E Fe2
DIN	8555: E 6-UM-60

Approvals	Grade
DB	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Mo	Fe	V
0.5	0.5	0.8	7	0.5	Rem	0.7

All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded	57-62 HRC

Storage

Keep dry and avoid condensation.

Re-drying not generally required.

If necessary: 150-200 °C for 2 hours, 5 times max.

Current condition and welding position

AC; DC-

PA PB PC PF

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		SMPA	
				PC	Code	PC	Code
2.5	350	65-90	19.2	260	●	35	●
3.2	350	100-130	33.4	155	●	22	●
4.0	350	140-160	47.9	100	●		
5.0	450	160-210	99.5	60	●		

SUPRADUR V1000

OERLIKON

MMA Electrodes
Hardfacing

SUPRADUR V1000 is a thick rutile coated high-efficiency MMA electrode, 160% recovery, the weld microstructure is a hypereutectic stainless chromium hard alloy. Used for hard facing against abrasion by mineral particles not resistant to impact and shock, the deposit is only machinable by grinding. Smooth, regular weld beads are deposited with only minimum penetration. The hardness cracks which typically appear in this weld metal are not detrimental to resistance against mineral abrasion. When welding sensitive base materials a buffer layer deposited with SUPERCHROMAX N is required. Typical applications include hard facing subject to mineral abrasion, e.g. by sand, gravel, coal, soil, clay and related minerals used in ceramics, cement and concrete building materials and mining.

Classification	
EN	14700: E Fe14
DIN	8555: E 10-UM-60-GR

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Fe
4.30	1	1	34	Rem.

All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded	58-62 HRC

Storage

Keep dry and avoid condensation.

Re-drying not generally required.

If necessary: 150-200 °C for 2 hours, 5 times max.

Current condition and welding position

AC; DC+

PA

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
3.2	450	120-150	73.0	75	●
4.0	450	140-190	104.2	45	●

SUPRADUR VF1000

OERLIKON

MMA Electrodes Hardfacing

SUPRADUR VF1000 is a special MMA electrode with a flux cored core wire, used for the hardfacing of steels where a very high resistance to abrasion is required. The weld metal is not machinable and the deposit hardness in the as welded condition is 57-62 HRC. Applications include the hardfacing of components in contact with sand, clay and similar materials such as drilling tools, mixer blades and parts of earth moving machines.

Classification	
EN	14700: E Fe14
DIN	8555: E 10 UM 60 RZ

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Mo
3-4	1-1.5	1-1.5	≤ 0.03	≤ 0.03	30-38	0.5-0.9

All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded	57 - 62 HRC

Storage

Keep dry and avoid condensation.

Re-drying not generally required.

If necessary: 300-350 °C for 2 hours, 5 times max.

Current condition and welding position

AC; DC+

PA PB

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
2.5	300	60-80	22.1	145	●
3.2	350	90-130	45.0	90	●
4.0	350	125-170	68.0	55	●
5.0	350	170-220	106.0	35	●

TOOLCORD

OERLIKON

MMA Electrodes Hardfacing

TOOLCORD is a basic coated MMA electrode for surfacing applications on tool steel. Good warm hardness and excellent service life. Weld metal can only be machined by grinding. Typical applications are tools, including hot working, such as shear blades, dies, punches, pressing tools.

Classification	
EN	14700: E Fe4
DIN	8555: E 4 UM 65 GS

Chemical analysis (Typical values in %)

C	Mn	Cr	Mo	Fe	V	W
1.5	1	4	8	Rem	1.5	2.5

All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded	58 HRC
Quenched & Tempered	65 HRC

Storage

Keep dry and avoid condensation.

Re-drying recommended at 300-350 °C for 2 hours, 5 times max.

Current condition and welding position

AC; DC+

PA PB PC

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
2.5	300	50-85	17.0	240	●
3.2	350	90-130	34.3	140	●
4.0	350	125-170	51.4	95	●

SUPRANEL C95

CE

MMA Electrodes Hardfacing

SUPRANEL C95 is a special surfacing MMA electrode with 170% recovery and a deposit composition of alloy C, Ni-Cr-Mo. Rutile-basic coating with outstanding welding characteristics. The weld deposit is resistant to corrosion and in general to oxidation, work-hardens under impact and is machinable. Generally suitable for surfacing all components subject to mechanical stress combined with corrosion and/or high temperatures, 400 - 750°C, and for pieces subject to high thermal shocks.

Classification	
EN ISO	14172 : E Ni 6275
AWS	A5.11: E NiCrMo-5
DIN	8555: E23-UM-250-CKTZ

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo	Fe	W
0.03	0.9	0.5	16	Rem	16	6	4

All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded	200 HB 350 HB (work-hardened)

Storage

Keep dry and avoid condensation.

Re-dry at 300-350 °C for 2 hours, 5 times max

PA PB

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	Code
2.5	350	75-100	31.9	60	●
3.2	350	115-160	56.4	35	●
4.0	350	140-200	89.0	25	●

ABRACITO 62

OERLIKON

MMA Electrodes
Hardfacing

ABRACITO 62 is a basic coated, slag free, hardfacing electrode with high recovery ~190%, depositing weld metal with an austenitic matrix containing Cr carbides which is highly resistant to abrasion. A second layer deposit is recommended, which is only machinable by grinding. Resistant to heavy mineral abrasion and moderate impact. . Smooth droplet transfer with no slag, depositing smooth weld beads, the formation of cracks in the weld deposit is normal for this type of composition. Applications include components subject to low or moderate impact where a high resistance to abrasion is required, including endless screws, mixer paddles, pump bodies for abrasive materials, excavator teeth, crushing of mineral materials, concrete pumps, screws for brick presses, wear plates.

Classification	
EN	14700: ~E Fe14
DIN	8555 : E-10-UM-60-GR

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Fe
5	0.3	1	32	Rem

All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded	60-62 HRC

Storage

Keep dry and avoid condensation.

Re-drying not generally required.

If necessary: 150-200 °C for 2 hours, 5 times max.

Current condition and welding position

AC; DC+

PA

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
3.2	350	110-140	53.0	75	●
4.0	350	160-185	84.0	50	●
5.0	450	220-250	171.3	30	●

ABRACITO 62S

OERLIKON

MMA Electrodes
Hardfacing

ABRACITO 62S is a basic-graphite coated high-efficiency MMA electrode with ~200% metal recovery depositing a hyper-eutectic chromium hard alloy with special alloying elements, hardness ~62 HRC. Specially developed for resistance to mineral abrasion at higher temperatures <650°C. The number of layers should be limited to 3. The typical hardening cracks that may form with this kind of weld metal do not influence the resistance to mineral abrasion. A buffer layer deposited with SUPERCHROMAX N is necessary for base materials sensitive to welding conditions. Machining of the weld metal is only possible by grinding. Typical applications include surfacing against mineral abrasion at higher temperatures in the steelmaking industry, production of construction materials and cement plants.

Classification
EN 14700: E Fe16

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Mo	Nb	Fe	V	W
5	1	1	24	5	6	Rem	1.2	2.5

All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded	~62 HRC

Storage

Keep dry and avoid condensation.

Re-drying not generally required.

If necessary: 150-200 °C for 2 hours, 5 times max.

Current condition and welding position

AC; DC-

PA PB

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
3.2	350	105-140	50.9	85	●
4.0	450	130-170	98.9	55	●

ABRACITO 65

Basic coated electrode with a high alloy content of elements which form carbides. Used for hardfacing of parts subject to high abrasion, friction, heat and corrosion.
ABRACITO 65 is easy to weld, has a smooth droplet transfer, leaving a negligible amount of slag. Efficiency ~200%. Applications include ash ploughs, coke crusher segments, screw conveyers, valves, exhaust fans, agitator fingers, mill guides, mixer paddles, rake teeth in furnaces, tong bits, slag ladles, elevator bucket-tips etc.
Operating temperatures <550°C.

Classification	
EN	14700 : E Fe16
DIN	8555 : E-10-UM-65-GR

Chemical analysis (Typical values in %)

C	Si	Cr	Mo	Nb	Fe	V	W
5	1.5	22	7	7	Rem	1	2

All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded	65 HRC

Storage

Keep dry and avoid condensation.
Re-drying not generally required.
If necessary: 150-200 °C for 2 hours, 5 times max.

PA

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
3.2	350	120-155	64.0	55	●
4.0	350	140-190	97.0	35	●
5.0	450	240-290	200.0	24	●

CITOLIT 6

OERLIKON

MMA Electrodes
Hardfacing

CITOLIT 6 is a cobalt base coated MMA electrode, type E CoCr-A, which is suitable for hardfacing valves, valve seats and other sealing faces, hot pressing tools, pump parts, extrusion screws. Machinable with tungsten carbide tools or by grinding. Large components or special steels require preheat in the range 300-600°C and this temperature should be retained during welding, followed by slow cooling, preferably in an oven, to reduce the risk of cracking.
CITOLIT 6 has a very good resistance to metal-metal wear, cavitation and corrosion as well as to heat <900°C. Excellent gliding characteristics, can be polished, non-magnetic.

Classification	
AWS	A5.13: E CoCr-A
DIN	8555: E-20-UM-45-CTZ

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo	Fe	Co	W
1.1	0.4	0.8	28	1.6	0.1	3.0	Rem	4.5

All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded	40-45 HRC

Storage

Keep dry and avoid condensation.

Re-drying not generally required.

If necessary: 300ºC for 1 hour, 5 times max.

Current condition and welding position

AC; DC+

PA PB

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
2.5	300	70-80	17.7	-	●
3.2	350	90-110	36.0	-	●
4.0	350	120-160	52.0	-	●

CITOLIT 12

OERLIKON

MMA Electrodes Hardfacing

CITOLIT 12 is a cobalt base coated electrodewith type E CoCr-B for MMA welding.
Suitable for hardfacing of cutting tools, shredding tools, saw blades, extrusion dies, mixing tools, hot working tools without thermal schock, extrusion screws in the wood, paper and plastic industry. Only machinable with tungsten carbide tools or by grinding. Preheat large components or special steels to 400-600°C. Keep this temperature during welding and cool down slowly, preferable in an oven, to reduce the risk of cracking while cooling.

CITOLIT 12 has a very good resistance to metal-metal wear, abrasion, cavitation, corrosion and heat up to 900°C. Excellent gliding characteristics, good to polish.

Classification	
AWS	A5.13: E CoCr-B
DIN	8555: E-20-UM-50-CTZ

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo	Fe	Co	W
1.6	0.4	0.8	30	2.5	0.1	2.7	Rem	8

All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded	47-50 HRC

Storage

Keep dry and avoid condensation.

Re-drying not generally required.

If necessary: 300ºC for 2 hours, 5 times max.

Current condition and welding position

AC; DC+

PA PB

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
2.5	300	70-80	20.2	-	●
3.2	350	90-110	33.0	-	●
4.0	350	120-160	52.0	-	●

CITOLIT 21

CITOLIT 21 is a cobalt base MMA electrode, type ECoCr-E. Applications include hardfacing of engine valves, hot forging dies and gas turbines. Preheat large components or special steels to 200-400°C and retain this temperature during welding, then cool down slowly preferably in an oven, to reduce the risk of cracking while cooling. CITOLIT 21 has a very good resistance to metal-metal wear, thermal shock, corrosion and heat <1000°C. Excellent gliding characteristics, high toughness, good to polish and non-magnetic.

Classification	
AWS	A5.13: E CoCr-E
DIN	8555: E-20-UM-35-CKTZ

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo	Fe	Co
0.3	0.4	0.6	27	2.7	5.3	2.5	Rem

All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded	30-34 HRC

Storage

Keep dry and avoid condensation.

Re-drying not generally required.

If necessary: 300ºC for 2 hours. 5 times max.

Current condition and welding position

AC; DC+

PA PB

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
2.5	350	70-80	22.0	-	●
3.2	350	90-110	35.0	-	●
4.0	350	120-160	52.0	-	●

CITOLIT 25

OERLIKON

MMA Electrodes Hardfacing

CITOLIT 25 is a cobalt base MMA electrode, suitable for hardfacing components such as engine valves, forging dies, gas turbines and mixers. CITOLIT 25 has a very good resistance to metal-metal wear, thermal shock and corrosion <1000°C, even in sulphurous atmospheres. Non magnetic deposit.

Classification	
DIN	8555: E 20-UM-250-CPTZ

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Fe	Co	W
0.03	2.0	1.0	21	10	2.0	Rem	15.0

All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded	~240 HB

Storage

Keep dry and avoid condensation.

Re-drying not generally required.

If necessary: 300ºC for 2 hours, 5 times max.

Current condition and welding position

AC; DC+

PA PB

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
3.2	350	90-110	38.0	-	●
4.0	450	120-160	55.0	-	●

CITOCUT is used for cutting, gouging or chamfering of mild and low-alloy steels, cast iron, nickel base alloys, etc. Applications include the removal of defects in castings, risers and gates, gouging out defective welds, back-gouging root runs and removing rivets.

Storage

Keep dry and avoid condensation.

Re-drying not generally required. If necessary: 100-110 °C for 1 hour

Current condition and welding position

AC; DC-

PA PB PC

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
3.2	350	130-150	35.3	95	●
4.0	350	250-350	56.1	60	●
5.0	350	220-280	82.5	40	●

SUPERCUT is a MMA electrode for gouging, piercing, chamfering and cutting of unalloyed, low-alloy and high-alloy steels, cast irons and nickel-based alloys. Typical applications are the removal of defects from castings and the repair of defective welds. Requires an appropriate power source.

Storage

Keep dry and avoid condensation. Re-drying not generally required. If necessary: 100-110 °C for 1 hour

Current condition and welding position

AC; DC-

PA PB PC

Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
3.2	450	130-170	55.7	70	●
4.0	450	200-260	74.9	55	●

SOLID WIRES

OERLIKON

MIG-MAG wires / C-Mn and low-alloy steels			
Product name	AWS	EN / EN ISO / DIN	Page
CARBOFIL	A5.18: ER 70S-3	14341-A: G 42 3 M G2Si1 14341-A: G 38 3 C G2Si1	225
CARBOFIL 1	A5.18: ER 70S-6	14341-A: G 42 3 C G3Si1 14341-A: G 42 4 M G3Si1	226
CARBOFIL 1 GOLD	A5.18: ER 70S-6	14341-A: G 42 4 M G3Si1 14341-A: G 42 3 C G3Si1	228
CARBOFIL 1A	A5.18: ER 70S-6	14341-A: G 46 4 M G4Si1 14341-A: G 46 3 C G4Si1	230
CARBOFIL 1A GOLD	A5.18: ER 70S-6	14341-A: G 46 4 M G4Si1 14341-A: G 46 3 C G4Si1	232
CARBOPIPE 70	A5.18: ER 70S-6	14341-A:G 46 5 M G4Si1 14341-A: G 42 4 C G4Si1	234
CARBOFIL GALVA	-	14341-A: G 42 2 M G2Ti	235
CARBOFIL Ni1	A5.28: ER 80S-Ni1	14341-A: G 46 6 M G3Ni1	236
CARBOPIPE 80Ni	A5.28: ER 80S-G	-	237
CARBOFIL Ni2	A5.28: ER 80S-Ni2	14341-A: G 46 7 M G2Ni2	238
CARBOFIL Mo	A5.28: ER 70S-A1	21952-A: G Mo Si	239
CARBOFIL CrMo1	A5.28: ER 80S-G	21952-A: G CrMo1Si	240
CARBOFIL KV5	A5.28: ER 80S-B2	21952-B: G 55 M 1CM	241
CARBOFIL CrMo2	A5.28: ER 90S-G	21952-A: G CrMo2Si	242
CARBOFIL KV3	A5.28: ER 90S-B3	21952-B: G 62M 2C1M	243
CARBOFIL CrMo5	A5.28: ER 80S-B6	21952-A: G CrMo5Si	244
CARBOFIL CrMo9	A5.28: ER 80S-B8	21952-A: G CrMo9	245
CARBOFIL KV7M	A5.28: ER 90S-B9	21952-A: G CrMo91	246

MIG-MAG wires / Weathering steels			
Product name	AWS	EN / EN ISO / DIN	Page
CARBOFIL NiCu	A5.28: ER 80S-G	14341-A: G 42 4 M G0 14341-A: G 42 3 C G0	247

MIG-MAG wires / High-strength steels			
Product name	AWS	EN / EN ISO / DIN	Page
CARBOFIL MnMo	A5.28: ER 80S-D2	14341-A: G 50 4 M G4Mo	249
CARBOFIL NiMo1	A5.28: ER 100S-G	16834-A: G 62 4 M Mn3Ni1Mo	250
CARBOFIL MnNiMoCr	A5.28: ER 100S-G	16834-A: G 62 4 M Mn3NiCrMo	251
CARBOFIL NiMoCr	A5.28: ER 110S-G	16834-A: G 69 4 M Mn3Ni1CrMo	252
CARBOFIL 2NiMoCr	A5.28: ER 120S-G	16834-A: G 89 4 M Mn4Ni2CrMo	253

MIG-MAG wires / Stainless and Heat resistant steels			
Product name	AWS	EN / EN ISO / DIN	Page
INERTFIL 410	A5.9: ER 410	14343-A: G 13	254
INERTFIL 410NiMo	A5.9: ER 410NiMo	14343-A: G 13 4	255
INERTFIL 420	A5.9: ER 420	-	256
INERTFIL 430	A5.9: ER 430	14343-A: G 17	257
INERTFIL 430LNb	-	14343-A: G 18 L Nb	258
INERTFIL 308L	A5.9: ER 308L	14343-A: G 19 9 L	259
INERTFIL 308L T	A5.9: ER 308L	14343-A: G 19 9 L	260
INERTFIL 308LSi	A5.9: ER 308LSi	14343-A: G 19 9 L Si	261
INERTFIL 347	A5.9: ER 347	14343-A: G 19 9 Nb	263
INERTFIL 347Si	A5.9: ER 347Si	14343-A: G 19 9 Nb Si	264
INERTFIL 316L	A5.9: ER 316L	14343-A: G 19 12 3L	265
INERTFIL 316L T	A5.9: ER 316L	14343-A: W 19 12 3 L	266
INERTFIL 316LSi	A5.9: ER 316LSi	14343-A: G 19 12 3 L Si	267
INERTFIL 318	A5.9: ER 318	14343-A: G 19 12 3 Nb	268
INERTFIL 318Si	-	14343-A: G 19 12 3 Nb Si	269
INERTFIL 308H	A5.9: ER 308H	14343-A: G 19 9 H	270
INERTFIL 310	A5.9: ER 310	14343-A: G 25 20	271
INERTFIL 309L	A5.9: ER 309L	14343-A: G 23 12 L	272
INERTFIL 309LSi	A5.9: ER 309LSi	14343-A: G 23 12 L Si	273
INERTFIL 309LMo	A5.9: ER 309LMo	14343-A: G 23 12 2 L	274
INERTFIL 307	A5.9: ER 307 (approx)	14343-A: G 18 8 Mn	275
INERTFIL 312	A5.9: ER 312	14343-A: G 29 9	276
INERTFIL 904L	A5.9: ER 385	14343-A: G 20 25 5 Cu L	277
INERTFIL 20 16 L	-	14343-A: G 20 16 3 Mn N L	278
INERTFIL 22 9 3	A5.9: ER 2209	14343-A: G 22 9 3 N L	279
INERTFIL 25 10 4	A5.9: ER 2594	14343-A: G 25 9 4 N L	280

293MIG-MAG wires / Nickel and Copper alloys			
Product name	AWS	EN / EN ISO / DIN	Page
CARBOCAST NiFe	-	1071: S NiFe1	281
NIFIL Ni1	A5.14: ER Ni-1	18274: S Ni 2061 (NiTi3)	282
NIFIL 600	A5.14: ER NiCr-3	18274: S Ni 6082 (NiCr20Mn3Nb)	283
NIFIL 625	A5.14: ER NiCrMo-3	18274: S Ni 6625 (NiCr22Mo9Nb)	284
NIFIL NiCu7	A5.14: ER NiCu7	18274: S Ni 4060 (NiCu30Mn3Ti)	286
COPPERFIL CuAl8	A5.7: ER CuAl-A1	24373: S Cu 6100 (CuAl8)	287
AMPCOTRODE G10	A5.7: ER CuAl-A2	-	288
AMPCOTRODE G150	A5.7: ER CuAl-A3	-	289
COPPERFIL CuSi3	A5.7: ER CuSi-A	24373: S Cu 6560 (CuSi3Mn1)	290
COPPERFIL 70/30	A5.7: ER CuNi	24373: S Cu 7158 (CuNi30Mn1FeTi)	291

MIG-MAG wires / Aluminum alloys			
Product name	AWS	EN / EN ISO / DIN	Page
ALUFIL Al99.5Ti	-	18273: S Al 1450 (Al 99.5 Ti)	292
ALUFIL AlSi5	A5.10: ER 4043	18273: S Al 4043 (AlSi5)	293
ALUFIL AlSi12	A5.10: ER 4047	18273: S Al 4047 (AlSi12)	294
ALUFIL AlMg3	A5.10: ER 5754	18273: S Al 5754 (AlMg3)	295
ALUFIL AlMg4.5Mn	A5.10: ER 5183	18273: S Al 5183 (AlMg4.5Mn0.7(A))	296
ALUFIL AlMg4.5MnZr	-	18273: S Al 5087 (AlMg4.5MnZr)	297
ALUFIL AlMg5	A5.10: ER 5356	18273: S Al 5356 (AlMg5Cr(A))	298
ALUFIL AlMg5Mn	A5.10: ER 5556	18273: S Al 5556 (AlMg5Mn)	299

MIG-MAG wires / Hardfacing			
Product name	AWS	EN / EN ISO / DIN	Page
CARBOFIL A 350	-	14700: S Fe2	300
CARBOFIL A 600	-	14700: S Fe 8	301

MIG, MAG wires and weld metal for gas-shielded metal-arc welding of unalloyed steels and fine grain structural steels.

EN ISO 14341-A

G	46	2	C	G4 Si 1
MIG, MAG wires	Table 1	Table 2	Table 3	Table 4

Table 1

Code digit for tensile and elongation properties of all-weld metal			
Code digit	Minimum yield strength (1) [MPa]	Tensile strength [MPa]	Minimum elongation (2) [%]
35	355	440–570	22
38	380	470–600	20
42	420	500–640	20
46	460	530–680	20
50	500	560–720	18

1) For yield strength the lower yield (ReL) shall be used if yielding occurs, other-wise the 0,2% proof strength (Rp0,2) shall be applied.
2) Gauge length is equal to five times the test specimen diameter.

Table 2

Symbols for impact energy of all-weld metal	
Symbols	Temperature for minimum average impact energy of 47 J [°C]
Z	no requirements
A	+20
0	0
2	–20
3	–30
4	–40
5	–50
6	–60
7	-70
8	-80
9	-90
10	-100

Table 3

Symbols for shielding gas	
Symbols	Meaning
M	This symbol for mixed gas shall be used if classification has been performed with shielding gas EN 439-M2, but without helium.
A	Text acc. to the new standard.
C	This symbol shall be used if classification has been performed with shielding gas EN 439-C1, carbon dioxide.

Table 4

Symbols for the chemical composition of wire electrodes									
Symbols	Chemical composition [%] (m/m) (1) (2) (3)								
	C	Si	Mn	P	S	Ni	Mo	Al	Ti and Zr
GO	any other chemical composition agreed upon								
G2Si	0,06–0,14	0,50–0,80	0,90–1,30	0,025	0,025	0,15	0,15	0,02	0,15
G3Si1	0,06–0,14	0,70–1,00	1,30–1,60	0,025	0,025	0,15	0,15	0,02	0,15
G4Si1	0,06–0,14	0,80–1,20	1,60–1,90	0,025	0,025	0,15	0,15	0,02	0,15
G3Si2	0,06–0,14	1,00–1,30	1,30–1,60	0,025	0,025	0,15	0,15	0,02	0,15
G2Ti	0,04–0,14	0,40–0,80	0,90–1,40	0,025	0,025	0,15	0,15	0,05–0,20	0,05–0,25
G3Ni1	0,06–0,14	0,50–0,90	1,00–1,60	0,020	0,020	0,80–1,50	0,15	0,02	0,15
G3Ni2	0,06–0,14	0,40–0,80	0,80–1,40	0,020	0,020	2,10–2,70	0,15	0,02	0,15
G2Mo	0,08–0,12	0,30–0,70	0,90–1,30	0,020	0,020	0,15	0,40–0,60	0,02	0,15
G4Mo	0,06–0,14	0,50–0,80	1,70–2,10	0,025	0,025	0,15	0,40–0,60	0,02	0,15
G2Al	0,08–0,14	0,30–0,50	0,90–1,30	0,025	0,025	0,15	0,15	0,35–0,75	0,15

1) If not specified: Cr ≤ 0,15, Cu ≤ 0,35 and V ≤ 0,03. The amount of copper in the steel plus coati ng shall not exceed 0,35 %.

2) Single values in this table are maximum values.

3) The results shall be rounded to the same decimal place as the specified values using the Rule A, Appendix B of ISO 31-0 : 1992.

MIG, MAG, TIG wires and weld metal for gas-shielded metal-arc welding of high-strength steels.

EN ISO 16834-A

G	62	4	M	Mn 3 Ni 1 Mo
Table 1	Table 2	Table 3	Table 4	Table 5

Table 1

Symbols for the product/welding process	
Symbols	Welding process
W	Tungsten-inert gas welding
G	Gas-shielded metal-arc welding

Table 2

Code digits for tensile and elongation properties of all-weld metal			
Code digits	Minimum yield strength(1)[MPa]	Tensile strength [MPa]	Minimum elongation(2)[%]
55	550	640–820	18
62	620	700–890	18
69	690	770–940	17
79	790	880–1080	16
89	890	940–1180	15

1) For yield strength the lower (ReL) shall be used if yielding occurs, otherwise the 0,2% proof strength (Rp0,2) shall be applied.
2) Gauge length is equal to five times the test specimen diameter.

Table 3

Symbols for impact energy of all-weld metal	
Symbols	Temperature for minimum average impact energy of 47 J [°C]
Z	no requirements
A	+20
0	0
2	–20
3	–30
4	–40
5	–50
6	–60

Table 4

Symbols for shielding gas	
Symbols	Meaning
M	This symbol for mixed gas shall be used if classification has been performed with shielding gas EN 439-M2, but without helium
C	This symbol shall be used if classification has been performed with shielding gas EN 439-C1, carbon dioxide
A	Text according to new standard
G	When used by agreement between buyer and supplier to another inert gas

Table 5

Symbols for the chemical composition of wire electrodes										
Symbols	Chemical composition [%] (m/m)(1) (2)(3)									
	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	all other elements
Z	any other chemical composition agreed upon									
Mn3NiCrMo	0,14	0,60–0,80	1,3–1,8	0,015	0,018	0,40–0,65	0,50–0,65	0,15–0,30	0,30	0,25
Mn3Ni1CrMo	0,12	0,40–0,7	1,3–1,8	0,015	0,018	0,20–0,4	1,2–1,6	0,20–0,3	0,35	0,25 V=0,05–0,13
Mn3Ni1Mo	0,12	0,40–0,80	1,3–1,9	0,015	0,018	0,15	0,80–1,3	0,25–0,65	0,30	0,25
Mn3Ni1,5Mo	0,08	0,20–0,60	1,3–1,8	0,015	0,018	0,15	1,4–2,1	0,25–0,55	0,30	0,25
Mn3Ni1Cu	0,12	0,20–0,60	1,2–1,8	0,015	0,018	0,15	0,80–1,25	0,20	0,30–0,65	0,25
Mn3Ni1MoCu	0,12	0,20–0,60	1,2–1,8	0,015	0,018	0,15	0,80–1,25	0,20–0,55	0,35–0,65	0,25
Mn3Ni2,5CrMo	0,12	0,40–0,70	1,3–1,8	0,015	0,018	0,20–0,60	2,3–2,8	0,30–0,65	0,30	0,25
Mn4Ni1Mo	0,12	0,50–0,80	1,6–2,1	0,015	0,018	0,15	0,80–1,25	0,20–0,55	0,30	0,25
Mn4Ni2Mo	0,12	0,25–0,60	1,6–2,1	0,015	0,018	0,15	2,00–2,6	0,30–0,65	0,30	0,25
Mn4Ni1,5CrMo	0,12	0,50–0,80	1,6–2,1	0,015	0,018	0,15–0,40	1,3–1,9	0,30–0,65	0,30	0,25
Mn4Ni2CrMo	0,12	0,60–0,90	1,6–2,1	0,015	0,018	0,20–0,45	1,8–2,3	0,45–0,70	0,30	0,25
Mn4Ni2,5CrMo	0,13	0,50–0,80	1,6–2,1	0,015	0,018	0,20–0,60	2,3–2,8	0,30–0,65	0,30	0,25

1) If not specified: Ti ≤0,1, Zr ≤0,1, Al ≤0,12 and V ≤0,03.
2) Single values in this table are maximum values.
3) The results shall be rounded to the same decimal place as the specified values using Rule A, Appendix B of ISO 31-0 : 1992.

MIG, MAG, TIG wires for arc-welding of creep resistant steels

EN 21952-A

W	Cr Mo 1 Si
Table 1	Table 2 and 3

Table 1

Symbols for the product/welding process	
Symbols	Welding process
W	Tungsten-inert gas welding
G	Gas-shielded metal-arc welding

Table 2

Alloy symbols for the chemical composition of wire electrodes, wires and rods									
Symbols	Chemical composition [%] (m/m) (1) (2)(3)								
	C	Si	Mn	P	S	Cr	Mo	V	other elements
MoSi	0,08–0,15	0,50–0,80	0,70–1,30	0,020	0,020	–	0,40–0,60	–	–
MnMo	0,08–0,15	0,05–0,25	1,30–1,70	0,025	0,025	–	0,45–0,65	–	–
MoVSi	0,08–0,15	0,40–0,70	0,70–1,10	0,020	0,020	0,30–0,60	0,50–1,00	0,20–0,40	–
CrMo1	0,08–0,15	0,05–0,25	0,60–1,00	0,020	0,020	0,90–1,30	0,40–0,65	–	–
CrMo1Si	0,08–0,14	0,50–0,80	0,80–1,20	0,020	0,020	0,90–1,30	0,40–0,65	–	–
CrMoV1Si	0,06–0,15	0,50–0,80	0,80–1,20	0,020	0,020	0,90–1,30	0,90–1,30	0,10–0,35	–
CrMo2Si	0,04–0,12	0,50–0,80	0,80–1,20	0,020	0,020	2,3–3,0	0,90–1,20	–	–
CrMo2LSi	0,05	0,50–0,80	0,80–1,20	0,020	0,020	2,3–3,0	0,90–1,20	–	–
CrMo5Si	0,03–0,10	0,30–0,60	0,30–0,70	0,020	0,020	5,5–6,5	0,50–0,80	–	–
CrMo9	0,06–0,10	0,30–0,60	0,30–0,70	0,025	0,025	8,5–10,0	0,80–1,20	0,15	Ni 1,0
CrMo9Si	0,03–0,10	0,40–0,80	0,40–0,80	0,020	0,020	8,5–10,0	0,80–1,20	–	–
CrMo91	0,07–0,15	0,60	0,4–1,5	0,020	0,020	8,0–10,5	0,80–1,20	0,15–0,30	Ni0,4-1,0 Nb 0,03-0,1 N 0,02-0,07 Cu0,25
CrMoWV12 Si	0,17–0,24	0,20–0,60	0,40–1,00	0,025	0,020	10,5–12,0	0,80–1,20	0,20–0,40	Ni0,8 W0,35–0,8
Z	any other chemical composition agreed upon								

1) If not specified N < 0,3, Cu < 0,3, V < 0,03, Nb < 0,01, Cr < 0,2.
2) Single values in this table are maximum values
3) The results shall be rounded to the same decimal place as the specified values using Rule A, Appendix B of ISO 31-0 : 1992.
4) A ratio of Mn to Si of > 2,0 is desirable.

Table 3

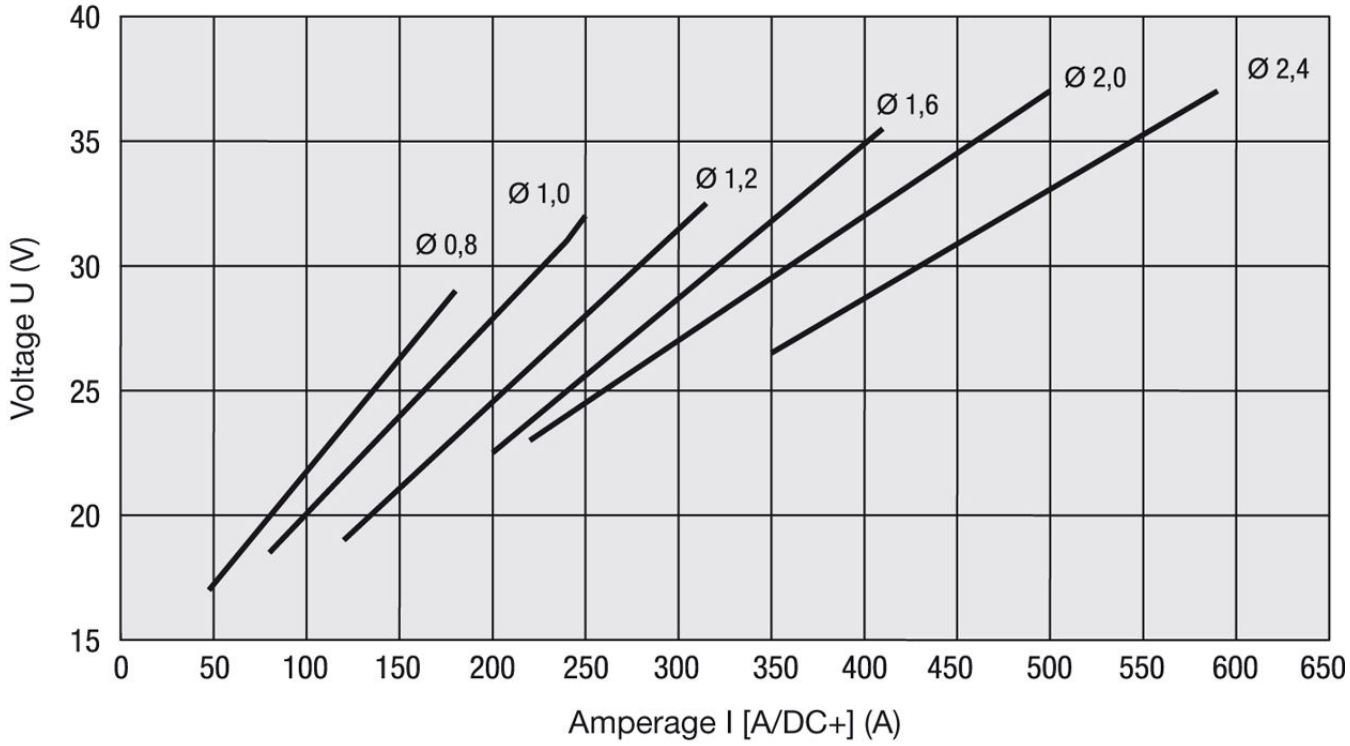
Mechanical properties of all-weld metal								
Alloy symbol	Minimum yield strength Rp0,2 [N/mm²]	Minimum tensile strength Rm [N/mm²]	Minimum elongation(1) A [%]	Impact energy (Kv) (J) at +20°C		Heat treatment of weld metal		
				Minimum average from three test specimens	Minimum single valuet(2)	Preheat and interpass temperature [°C]	Heat treatment of test specimen Temperature (3)[°C] / Time(4)[min]	
MoSi	355	510	22	47	38	<200	–	–
MnMo	355	510	22	47	38	<200	–	–
MoVSi	355	510	18	47	38	200–300	690–730	60
CrMo1Si	355	510	20	47	38	150–250	660–700	60
CrMoV1Si	435	590	15	24	21	200–300	680–730	60
CrMo2Si	400	500	18	47	38	200–300	690–750	60
CrMo2LSi	400	500	18	47	38	200–300	690–750	60
CrMo5Si	400	590	17	47	38	200–300	730-760	60
CrMo9 / CrMo9Si	435	590	18	34	27	200–300	740–780	120
CrMo91	415	585	17	47	38	250–350	750–760	180
CrMoWV12 Si	550	690	15	34	27	250–350(5) or 400–500(5)	740–780	minimum 120
Z	any other mechanical properties agreed upon							

1) Gauge length is equal to five times the test specimen diameter.
2) Only one single value lower than minimum average is permitted.
3) The test piece shall be cooled in the furnace to 300°C at a rate not exceeding 200°C/h.
4) Tolerance ±10min
5) Immediately after welding the specimen is to be cooled down to 120°C to 100°C and kept at this temperature for at least 1h.

Parameters for unalloyed and low-alloy steels

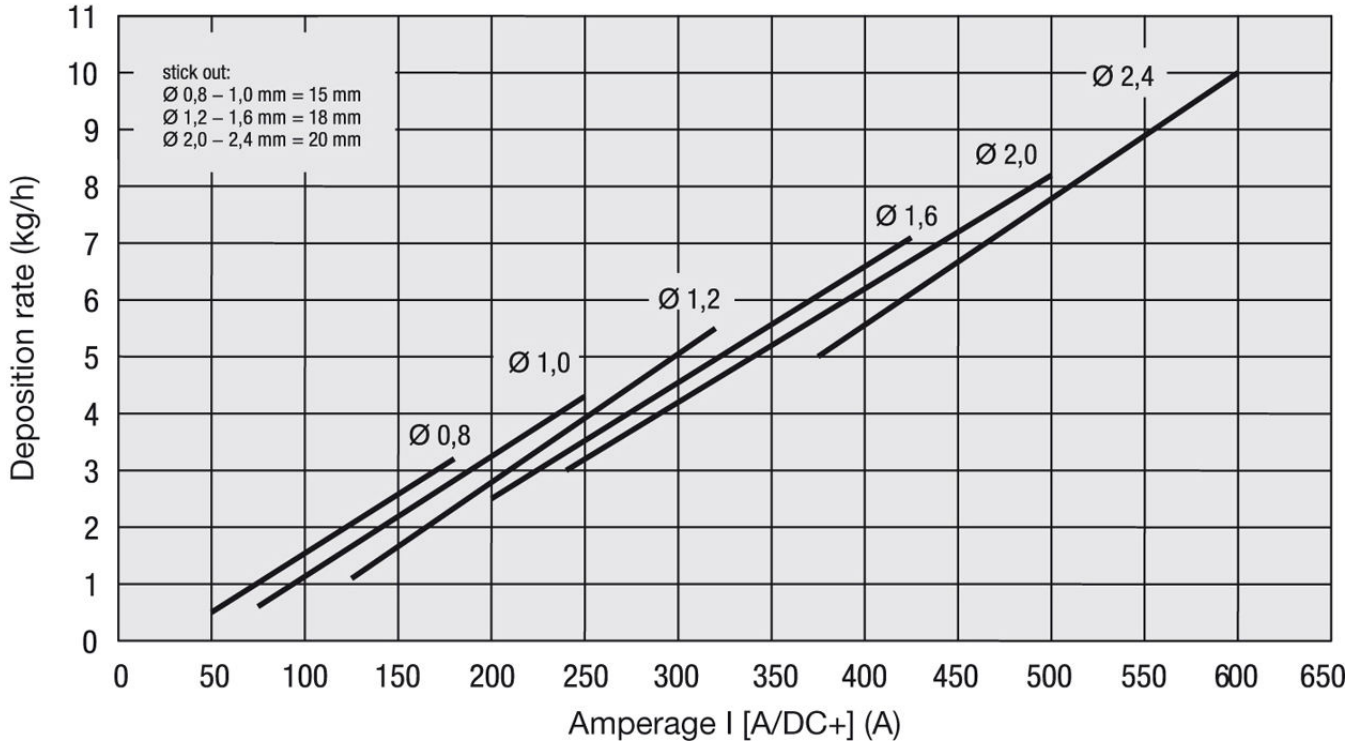
Welding parameters

Shielding gas 82% Ar + 18% CO_2



Deposition rate

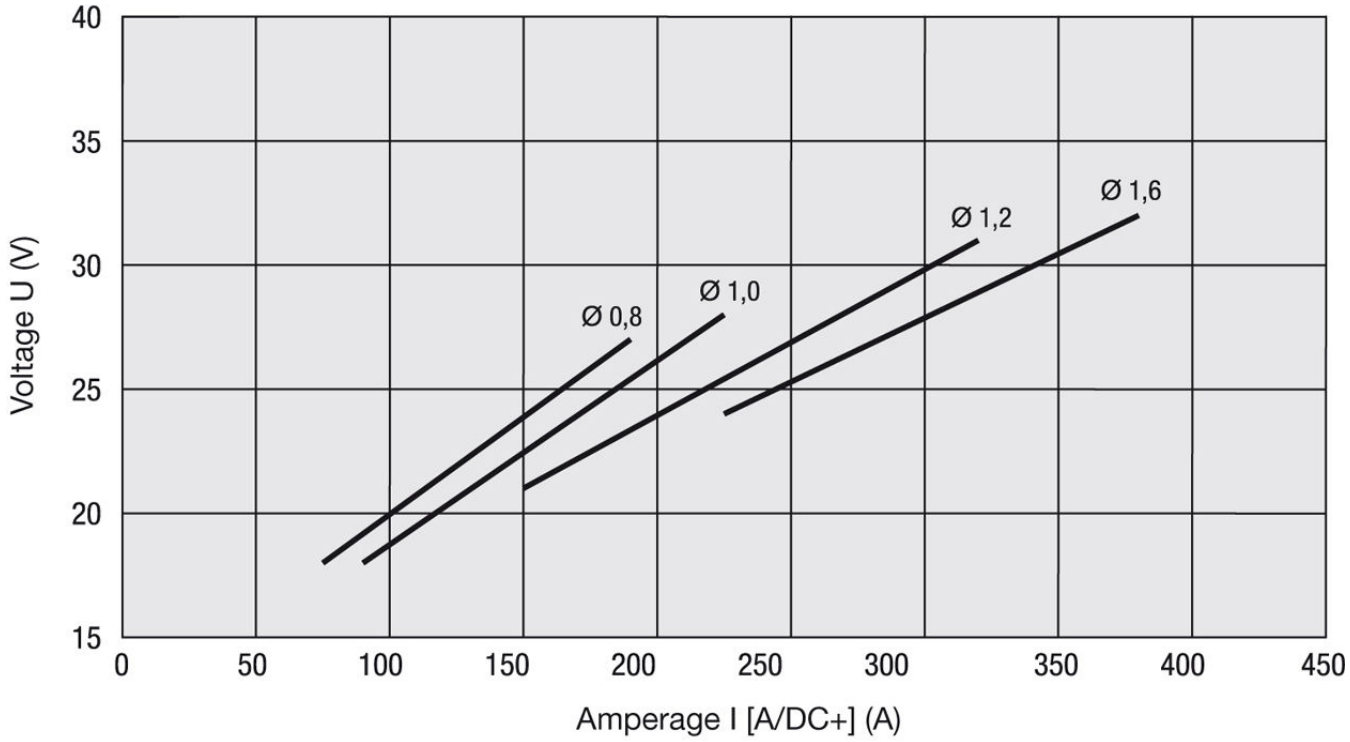
Shielding gas 82% Ar + 18% CO_2 ; 100% Duty cycle



Parameters for corrosion and heat resistant steels

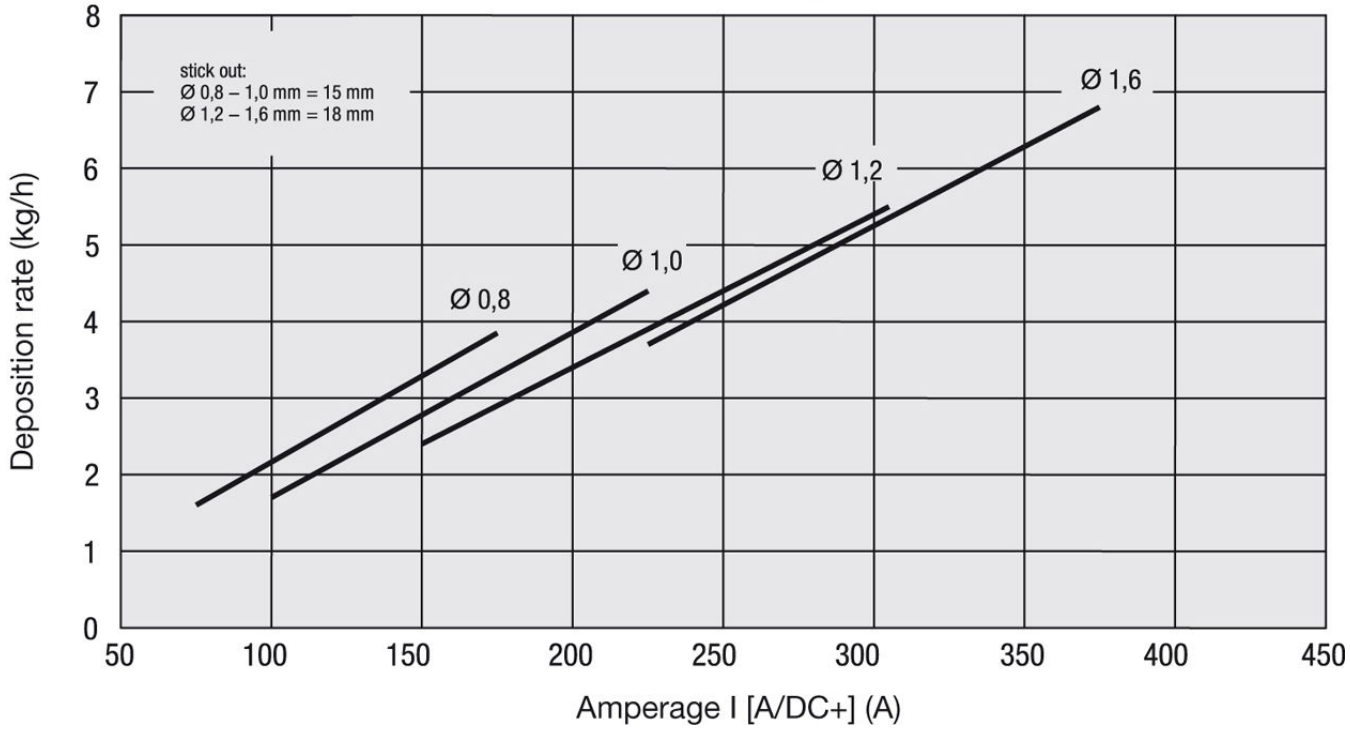
Welding parameters

Shielding gas 97,5% Ar + 2,5% CO_2



Deposition rate

Shielding gas 97,5% Ar + 2,5% CO_2 ; 100% Duty cycle



CARBOFIL

OERLIKON

MIG MAG Wires
C-Mn and low-alloy steels

CARBOFIL is a copper coated G2Si/ER70S-3 type solid MAG welding wire supplied both random and precision layer wound, depositing C-0.8%Mn weld metal, for welding a wide range of mild and C-Mn structural steels. Suitable for welding with CO2 or Ar-based mixed shielding gases.

CARBOFIL is used mainly for single pass welding and for steels that have a rusty or dirty surfaces.

Classification	
EN ISO	14341-A: G 38 3 C G2Si1
EN ISO	14341-A: G 42 3 M G2Si1
AWS	A5.18: ER 70S-3

Approvals	Grade
DB	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.07	0.9	0.5	≤ 0.025	≤ 0.025

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 0 °C
As Welded	≥ 420	480-550	≥ 22	≥ 90

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : M2 - C1

Materials

Steel up to a yield strength of 420 N/mm2: e.g. S(P)235 to S(P)355; GP240; GP280

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
0.6	●
0.8	●
1.0	●
1.2	●
1.6	●
1.60	●

CARBOFIL 1

OERLIKON

MIG MAG Wires
C-Mn and low-alloy steels

CARBOFIL 1 is a copper coated G3Si1/ER70S-6 type solid MAG welding wire supplied both random and precision layer wound, depositing C-1.1%Mn weld metal, for welding a wide range of mild and C-Mn structural steels. Suitable for welding with CO2 and Ar-based mixed shielding gases.

CARBOFIL 1 is a welding wire electrode used for general applications in both single- and multipass welding. Especially suited for sheet metal applications where smooth weld beads are required. Weld metal impact toughness properties are down to -40°C.

CARBOFIL 1 is available with a wide range of packaging format from few kgs for small MIG/MAG welding equipments to high-quantity (max. 550 kgs drum) robotic application.

Classification	
EN ISO	14341-A: G 42 3 C G3Si1
EN ISO	14341-A: G 42 4 M G3Si1
AWS	A5.18: ER 70S-6

Approvals	Grade
ABS	33YSA
ABS	3SA
BV	SA3YM
DB	●
DNV	IIIYMS

Approvals	Grade
GL	3YS
LRS	3YS H15
RINA	3YS
TÜV	●

CE

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S
Wire	0.08	1.5	0.9	≤ 0.025	≤ 0.025
All weld metal (*)	0.08	1.1	0.6	≤ 0.025	≤ 0.025
All weld metal (**)	0.09	1.0	0.5	≤ 0.025	≤ 0.025

(*) 82% Ar+18% CO2, (**) 100% CO2

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)		
				+20 °C	-30 °C	-40 °C
As Welded (*)	≥ 420	500-640	≥ 24	≥ 90	≥ 70	≥ 47
As Welded (**)	≥ 420	500-640	≥ 22	≥ 70	≥ 47	

Gas test: (*) 82% Ar+18% CO2, (**) 100% CO2

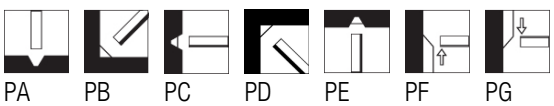
Shielding Gas - EN ISO 14175 : M2 - C1

Materials

S(P)235 - S(P)355; GP240; GP280

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



AIR LIQUIDE WELDING

Packaging data

Packaging Type	B300	BS300	DRUM		S200	S300	SUPA			
Diam(mm) / weight(kg)	16	16	200	300	5	15	150	300	450	550
0.6	●				●	●				
0.8	●	●			●	●				
0.9	●									
1.0	●	●			●	●			●	●
1.2	●	●		●	●	●	●	●	●	●
1.6	●		●					●	●	●

CARBOFIL 1 GOLD

MIG MAG Wires
C-Mn and low-alloy steels

CARBOFIL 1 GOLD is a special bronze-coated G3Si1/ER70S-6 type solid MAG welding wire, supplied both random and precision layer wound, depositing C-1.1%Mn weld metal, for welding a wide range of mild and C-Mn structural steels. Suitable for welding with CO2 and Ar-based mixed shielding gases.

CARBOFIL 1 GOLD has a very good arc stability, excellent feeding properties, low spatter during welding, good start and stop characteristics with a low consumption of contact tips. Applications are the same as CARBOFIL 1, but especially suitable for welding in spray arc.

CARBOFIL 1 GOLD is available with a wide range of packaging formats from standard spools to high-quantity (max. 300 kgs drum) robotic application. The „GOLD" coating is produced with MHC technology, which guarantee a low content of elements associated with arc instability.

Classification	
EN ISO	14341-A: G 42 3 C G3Si1
EN ISO	14341-A: G 42 4 M G3Si1
AWS	A5.18: ER 70S-6

Approvals	Grade
ABS	3SA
ABS	3YSA
BV	SA3YM
DB	●
GL	3YS
LRS	3YS H15
RINA	3YS
TÜV	●

CE

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S
Wire	0.08	1.5	0.9	≤ 0.025	≤ 0.025
All weld metal (*)	0.08	1.1	0.6	≤0.025	≤0.025
All weld metal (**)	0.09	1.0	0.5	≤0.025	0.025

(*) 82% Ar+18% CO2, (**) 100% CO2

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)		
				+20 °C	-30 °C	-40 °C
As Welded (*)	≥420	500-640	≥24	>90	≥70	>47
As Welded (**)	≥420	500-640	≥22	>70	>47	

Gas test: (*) M21-Arcal 21, (**) C1-Arcal

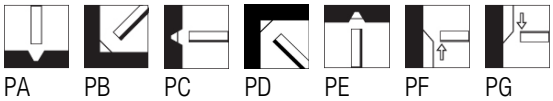
Shielding Gas - EN ISO 14175 : M2 - C1

Materials

S(P)235 - S(P)355; GP240; GP280

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	B300	DRUM	SQPA
Diam(mm) / weight(kg)	16	300	250
0.8	●		
1.0	●		
1.2	●	●	●

CARBOFIL 1A

OERLIKON

MIG MAG Wires
C-Mn and low-alloy steels

CARBOFIL 1A is a copper coated G4Si1/ER70S-6 type solid MAG welding wire supplied both random and precision layer wound, depositing C-1.3%Mn weld metal, for welding a wide range of mild and C-Mn structural steels. Suitable for welding with CO2 and Ar-based mixed shielding gases.

CARBOFIL 1A is a general application welding wire electrode used for both single- and multipass welding. Weld metal impact toughness properties are down to -40°C.

CARBOFIL 1A is available with a wide range of packaging formats, from few kgs for small MIG/MAG welding equipments to high-quantity (max. 550 kgs drum) robotic application. The increased level of Manganese and Silicon scavenge oxides enhancing weld pool fluidity and stabilizing the arc, minimising weld metal spatter and resulting in a higher strength weld metal. Excellent weld bead appearance with an even contour finish and freedom from undercut.

Classification	
EN ISO	14341-A: G 46 3 C G4Si1
EN ISO	14341-A: G 46 4 M G4Si1
AWS	A5.18: ER 70S-6

Approvals	Grade
ABS	2YSA
ABS	3YSA
BV	SA3YM
DB	●
DNV	IIIYMS

Approvals	Grade
GL	3YS
LRS	2YS H15
LRS	3YS H15
TÜV	●

CE

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S
Wire	0.07	1.7	0.9	≤ 0.025	≤ 0.025
All weld metal (*)	0.08	1.3	0.7	≤0.025	≤0.025
All weld metal (**)	0.08	1.2	0.6	≤0.025	≤0.025

(*) 82% Ar+18% CO2, (**) 100% CO2

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)		
				+20 °C	-30 °C	-40 °C
As Welded (*)	≥460	550-680	≥24	≥100	≥80	≥70
As Welded (**)	≥460	550-680	≥24	≥80	≥47	

Gas test: (*) 82% Ar+18% CO2, (**) 100% CO2

Shielding Gas - EN ISO 14175 : M2 - C1

Materials

S(P)235 - S(P)460; GP240; GP280

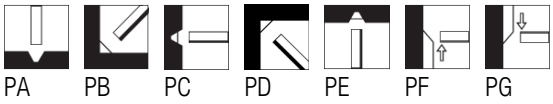
AIR LIQUIDE WELDING

Storage

Keep dry and avoid condensation

Current condition and welding position

DC+



Packaging data

Packaging Type	B300	BS300	DRUM		S300	SUPA			
Diam(mm) / weight(kg)	16	16	200	300	15	150	300	450	550
0.8	●	●			●				
0.9	●								
1.0	●	●			●		●	●	●
1.2	●	●		●	●	●	●	●	●
1.4	●							●	●
1.6	●		●				●	●	●

CARBOFIL 1A GOLD

OERLIKON

MIG MAG Wires
C-Mn and low-alloy steels

CARBOFIL 1A GOLD is a special bronze-coated G4Si1/ER70S-6 type solid MAG welding wire supplied both random and precision layer wound, depositing C-1.3%Mn weld metal, for welding a wide range of mild and C-Mn structural steels. Suitable for welding with CO2 and Ar-based mixed shielding gases.

CARBOFIL 1A GOLD has a very good arc stability, excellent feeding properties, low spatter during welding, good start and stop characteristics with a low consumption of contact tips. Applications are the same as CARBOFIL 1A, but especially suitable for welding in spray arc.

CARBOFIL 1 GOLD is available with a wide range of packaging format from the standard spools to high-quantity (max. 300 kgs drum) robotic application. The „GOLD" coating is produced with MHC technology, which guarantee a low content of elements associated with arc instability.

Classification	
EN ISO	14341-A: G 46 3 C G4Si1
EN ISO	14341-A: G 46 4 M G4Si1
AWS	A5.18: ER 70S-6

Approvals	Grade
ABS	2YSA
ABS	3YSA
BV	SA3YM
DB	●
GL	3YS
LRS	2YS H15
LRS	3YS H15
TÜV	●

CE

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S
Wire	0.07	1.7	0.9	≤ 0.025	≤ 0.025
All weld metal (*)	0.08	1.3	0.7	≤0.025	≤0.025
All weld metal (**)	0.08	1.2	0.6	≤0.025	≤0.025

(*) 82% Ar+18% CO2, (**) 100% CO2

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)		
				+20 °C	-30 °C	-40 °C
As Welded (*)	≥460	550-680	≥24	≥100	≥80	≥70
As Welded (**)	≥460	550-680	≥24	≥80	≥47	

Gas test: (*) M21-Arcal 21, (**) C1-Arcal

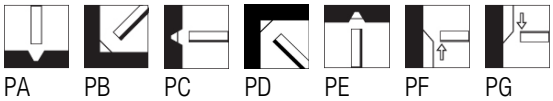
Shielding Gas - EN ISO 14175 : M2 - C1

Materials

S(P)235 - S(P)460; GP240; GP280

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



AIR LIQUIDE WELDING

Packaging data

Packaging Type	B300	DRUM	SQPA
Diam(mm) / weight(kg)	16	300	250
0.8	●		
1.0	●		
1.2	●	●	●

CARBOPIPE 70

OERLIKON

MIG MAG Wires
C-Mn and low-alloy steels

CARBOPIPE 70 is a copper coated G4Si1/ER70S-6 type solid MAG welding wire supplied both randon and precision layer wound, depositing C-1.3%Mn weld metal for welding of API X52 to X70 pipelines. Suitable for welding with CO2 and Ar-CO2 mixed shielding gases even with higher CO2 content also.

CARBOPIPE 70 is suitable for mechanized downhill GMAW welding of pipelines, and is particularly suitable to GMAW orbital application.

CARBOPIPE 70 is available in spools from S117 to S300 with different weight according to customer's needs. It has excellent mechanical properties thanks to the improved impurity level and microalloying elements, like Titanium, to meet the special requirements of pipeliner's industrial segment. With a controlled coating process with adherence Cu-coating improves the welding process - the arc is stable under both CO2 and mixed shielding gases, resulting in less spatter and less time required for final joint cleaning.
Excellent feedability and very consistent welding performance (bead profile and appearance) thanks to its mechanical, chemical and physical properties.

Classification	
EN ISO	14341-A: G 42 4 C G4Si1
EN ISO	14341-A:G 46 5 M G4Si1
AWS	A5.18: ER 70S-6

Approvals	Grade
TÜV	●

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.080	1.65	0.90	0.008	0.008

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				-40 °C	-50 °C
As Welded (*)	≥482	≥580	≥ 25		≥47
As Welded (**)	≥420	≥530	≥ 25	≥ 88	

Gas test: (*) M21-Arcal 21, (**) C1-Arcal

Shielding Gas - EN ISO 14175 : 100% CO2, Ar + 15-25% CO2

Materials

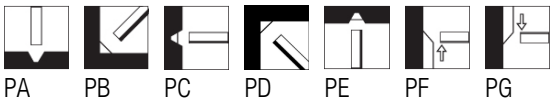
X52, X56, X60, X65, X70 (nach API 5L-92)

S(P)235 - S(P)460

L360MB, L385M, L415MB, L450MB, L485MB

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



AIR LIQUIDE WELDING

CARBOFIL GALVA

OERLIKON

MIG MAG Wires
C-Mn and low-alloy steels

CARBOFIL GALVA is a copper coated G2Ti type solid MAG welding wire supplied both random and precision layer wound. Used with ternary shielding gas mixtures, such as ARCAL 14 (Ar+CO2+O2), to obtain spatter free welding with a good bead appearance.

CARBOFIL GALVA is a microalloyed steel wire, triple-deoxidised with Ti, Al and Zr elements, used to weld C-mn and low-alloyed steels with light contamination or oxides on the surface, and for welding of galvanised steels with a tensile strength of 580 MPa, because of better fusion characteristics compared to standard unalloyed wires. Good low temperature toughness.

The use of CARBOFIL GALVA with a synergic inverter generator such as CITO@PULS (Oerlikon), gives excellent results. After welding it is recommended to restore the protective surface in the welding area.

Classification
EN ISO 14341-A: G 42 2 M G2Ti

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S	Ti	Al	Zr
Wire	0.07	1.1	0.6	≤ 0.025	≤ 0.025	0.13	0.10	0.11
All weld metal (*)	0.07	0.8	0.3	≤0.025	≤0.025	-	-	-

(*) 82% Ar+18% CO2

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-20 °C
As Welded	≥420	500-640	≥22	≥90	≥70

Gas test: 82% Ar+18% CO2

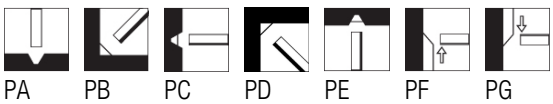
Shielding Gas - EN ISO 14175 : M2

Materials

S(P)235 - S(P)420

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
1.0	●
1.2	●

CARBOFIL Ni1

OERLIKON

MIG MAG Wires
C-Mn and low-alloy steels

CARBOFIL Ni1 is a G3Ni1/ER 80S-Ni1 type solid MAG welding wire supplied precision layer wound, depositing a C-0.8Mn1.0Ni weld metal. Suitable for use with Ar-CO2 mix shielding gases.

CARBOFIL Ni1 is used for welding of 1%Ni steels and fine grain steels, when the weld metal toughness properties down to –60°C are required in the as welded conditions. The weld metal contains less than 1% Ni conforming to NACE requirement.

Classification	
EN ISO	14341-A: G 46 6 M G3Ni1
AWS	A5.28: ER 80S-Ni1

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S	Ni
Wire	0.08	1.1	0.6	≤ 0.020	≤ 0.020	0.9
All weld metal (*)	0.07	0.8	0.4	≤ 0.020	≤ 0.020	0.9

(*) 82% Ar+18% CO2

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-60 °C
As Welded	≥480	550-680	≥24	≥110	≥47

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : M20 - M24

Materials

S(P)235-S(P)460, GP240-GP280

Storage

Keep dry and avoid condensation.

Current condition and welding position

DC+

Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
0.8	●
1.0	●
1.2	●

AIR LIQUIDE WELDING

CARBOPIPE 80Ni

OERLIKON

MIG MAG Wires
C-Mn and low-alloy steels

CARBOPIPE 80Ni is a copper coated ER 80S-G type solid MAG welding wire supplied both randon and precision layer wund, depositing C-1.5Mn0.9Ni weld metal for welding of API X65 to X80 pipelines. Suitable for welding with CO2 and Ar-CO2 mixed shielding gases even with higher CO2 content also.

CARBOPIPE 80Ni is suitable for mechanized downhill GMAW welding of pipelines, and is particularly suitable to GMAW orbital application. It is used for welding low-alloy high-strength steels requiring good toughness at temperatures as low as -50°F (-46°C). Diffusible hydrogen level is less than 2 ml/100g of deposited metal.

To ensure the consistency and continuity of the global quality of the product, the wire rod comes from mineral iron without scraps and only from qualified European supplier. Excellent mechanical properties thanks to the improved impurity level and microalloying elements, like Nickel and Titanium, to meet the special requirements of pipeliner's industrial segment.

Classification	
AWS	A5.28: ER 80S-G

Approvals	Grade
TÜV	●

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni	Cu
0.080	1.7	0.65	≤ 0.01	≤ 0.01	0.93	0.16

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				-30 °C	-50 °C
As Welded	≥520	≥610	≥ 28	≥ 120	≥ 80

Gas test: M31

Shielding Gas - EN ISO 14175 : C1, C2, M21, M31

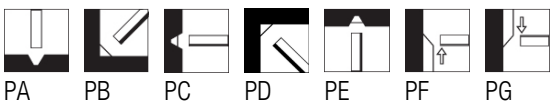
Materials

X65, X70, X80 (acc. to API 5L)

L450MB, L485MB, L555MB (acc. to EN 10208-2)

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



CARBOFIL Ni2

OERLIKON

MIG MAG Wires
C-Mn and low-alloy steels

CARBOFIL Ni2 is a G2Ni2/ER 80S-Ni2 type solid MAG welding wire supplied precision layer wound, depositing a C-0.8Mn2.3Ni weld metal. Suitable for use with Ar-CO2 mix shielding gases.

CARBOFIL Ni2 is used for the welding of 2%Ni-steels, when weld metal toughness properties down to –90°C are required in the as welded condition.

Classification	
EN ISO	14341-A: G 46 7 M G2Ni2
AWS	A5.28: ER 80S-Ni2

Approvals	Grade
GL	6Y42S
TÜV	●

CE

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S	Ni
Wire	0.08	1.1	0.5	≤ 0.020	≤ 0.020	2.3
All weld metal (*)	0.07	0.8	0.4	≤ 0.020	≤ 0.020	2.3

(*) 82% Ar+18% CO2

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)		
				+20 °C	-70 °C	-90 °C
As Welded (*)	≥460	550-680	≥22	>120	≥47	
580°C x 15h (**)	≥460	550-680	≥22	≥130	≥70	≥47

Gas test: (*) 82% Ar+18% CO2, (**) M21-Arcal 21

Shielding Gas - EN ISO 14175 : M20 - M24

Materials

S(P)275-S(P)460

Storage
Keep dry and avoid condensation.

Current condition and welding position
DC+

Packaging data

Packaging Type	B300	S300
Diam(mm) / weight(kg)	16	15
1.2	●	
0.8		●

AIR LIQUIDE WELDING

CARBOFIL Mo

OERLIKON

MIG MAG Wires
C-Mn and low-alloy steels

CARBOFIL Mo is a copper coated GMoSi/ER70S-A1 type solid MAG welding wire supplied precision layer wound, depositing a C-0.8Mn0.5Mo weld metal. Suitable for use with CO2 and Ar-CO2 mix shielding gases.

CARBOFIL Mo is used for welding low alloy creep resistant ferritic steels, used in chemical plant construction operating at elevated temperatures up to 500°C. Suitable for applications in petrochemical process plant where some resistance to hot hydrogen attack is necessary, and for welding of micro-alloyed stels where increased strength is required.

Classification	
EN ISO	21952-A: G MoSi
AWS	A5.28: ER 70S-A1

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S	Mo
Wire	0.10	1.0	0.6	≤0.020	≤0.020	0.5
All weld metal (*)	0.10	0.8	0.4	≤ 0.020	≤ 0.020	0.5

(*) 82% Ar+18% CO2

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-20 °C
As Welded (*)	≥480	515-620	≥22	≥100	≥47
580 °C x 15h (**)	≥380	480-560	≥19	≥100	≥47

Gas test: (*) M21, (**) M21-Arcal 21

Shielding Gas - EN ISO 14175 : M2 - C1

Materials

S(P)235-S(P)460, 16Mo3

Storage
Keep dry and avoid condensation.

Current condition and welding position
DC+

Packaging data

Packaging Type	B300	S300
Diam(mm) / weight(kg)	16	15
0.8	●	●
1.0	●	●
1.2	●	●

CARBOFIL CrMo1

OERLIKON

MIG MAG Wires
C-Mn and low-alloy steels

CARBOFIL CrMo1 is a copper coated GCrMo1Si/ER80S-G type solid MAG welding wire supplied precision layer wound, depositing a C-1¼Cr½Mo weld metal for the welding of creep resisting steels. Ar-CO2 mix shiel ding gases are preferred for optimum mechanical properties.

CARBOFIL CrMo1 is used for welding of similar composition steels used in power generation and chemical plant applications for service temperatures up to 550°C. Also suitable where resistance to hydrogen attack by sulphur bearing crude oil is required. Main applications are boiler, plate and tube steels as well as for the welding of quenched and tempered and case hardening steels, 13CrMo4-5 or ASTM A335 P11/P12.

CARBOFIL CrMo1 is proposed, where the operational guidelines are given by EN norms.

Classification	
EN ISO	21952-A: G CrMo1Si
AWS	A5.28: ER 80S-G

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S	Cr	Mo
Wire	0.08	1.2	0.6	≤0.020	≤0.020	1.2	0.6
All weld metal (*)	0.07	0.9	0.4	≤0.020	≤0.020	1.2	0.6

(*) 82% Ar+18% CO2

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C
690 °C x 1h	≥ 355	≥ 550	≥ 20	≥ 80

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : M20, M21, M24, M26

Materials

13CrMo4-5, 13CrMoSi5-5, 15CrMo5, 16CrMoV4, 24 CrMo5, G22CrMo5-4, G17CrMo5-5
ASTM A193 Gr. B7, A335 Gr. P11, P12, A217 Gr.WC6

Storage
Keep dry and avoid condensation.

Current condition and welding position
DC+

Packaging data

Packaging Type	B300	S300
Diam(mm) / weight(kg)	16	15
0.8	●	●
1.0	●	●
1.2	●	●

AIR LIQUIDE WELDING

CARBOFIL KV5

OERLIKON

MIG MAG Wires
C-Mn and low-alloy steels

CARBOFIL KV5 is a copper coated ER80S-B2 type solid MAG welding wire supplied precision layer wound, depositing a C-1¼Cr½Mo weld metal for the welding of creep resisting steels. Ar-CO2 mix shielding ga ses are preferred for improved mechanical properties.

CARBOFIL KV5 is used for welding of similar composition used in power generation and chemical plant applications for service temperatures <550°C. Also suitable where some resistance to hydrogen attack by sulphur bearing crude oil is required. Main applications are boiler, plate and tube steels as well as for the welding of quenched and tempered and case hardening steels produced mainly from steels 13CrMo4-5 or ASTM A335 P11/P12.

The CARBOFIL KV5 is a very clean welding wire with guaranteed X<15 Bruscato factor, and with controlled As, Sb, Sn content against temper embrittlement. CARBOFIL KV5 is used, where the operational guidelines are given by ASME norms.

Classification	
EN ISO	21952-B: G 55 M 1CM
AWS	A5.28: ER 80S-B2

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S	Cr	Ni	Mo	Cu
Wire	0.08-0.12	0.4-0.7	0.4-0.7	max. 0.01	max. 0.01	1.2-1.5	max. 0.2	0.4-0.65	max. 0.2

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -20 °C
620°C x 1h	≥470	≥550	≥20	≥70

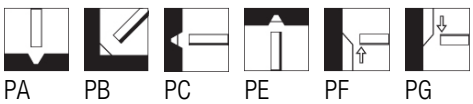
Gas test: M21-Arcal 21

Shielding Gas - EN ISO 14175 : 100% CO2, Ar + 5-25% CO2

Materials

13 CrMo4-5, 25 CrMo 4, 14 CrMo 4-5, 16 MnCr 5

Current condition and welding position
DC+



Packaging data

Packaging Type	B300	S300
Diam(mm) / weight(kg)	16	15
0.8	●	●
1.0	●	●
1.2	●	●

CARBOFIL CrMo2

OERLIKON

MIG MAG Wires
C-Mn and low-alloy steels

CARBOFIL CrMo2 is a copper coated GCrMo2Si/ER90S-G type solid MAG welding wire supplied precision layer wound, depositing a 2¼Cr1Mo weld metal for the welding of creep resistant steels. Ar-CO2 mixed shiel ding gases preferred for improved mechanical properties.

CARBOFIL CrMo2 is used for welding of similar composition and ½Mo¼V and 1Cr1Mo steels. Used in the construction of steam generating plant operating at temperatures up to 600°C. Also suitable for the welding of 1¼Cr½Mo steels where improved resistance to hydrogen attack or corrosion by sulphur is required. Mai n applications include the welding of boilers, plates and tubes as well as oil refineries e.g. in crack plants produced from mainly 10CrMo9-10 (ASTM A335 Gr. P/T22).

CARBOFIL CrMo2 is used, where the operational gidelines are given by the EN norms.

Classification	
EN ISO	21952-A: G CrMo2Si
AWS	A5.28: ER 90S-G

Approvals	Grade
TÜV	●

CE

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S	Cr	Mo
Wire	0.09	1.2	0.7	≤0.020	≤0.020	2.5	1.0
All weld metal (*)	0.07	0.9	0.5	≤0.020	≤0.020	2.4	1.0

(*) 82% Ar+18% CO2

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C
690 °C x 1h	≥ 400	≥ 620	≥ 18	≥ 47

Gas test: 82% Ar+18% CO2

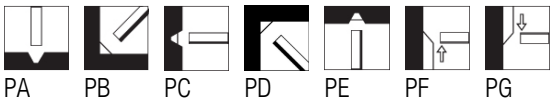
Shielding Gas - EN ISO 14175 : M20, M21, M24, M26

Materials

10CrMo9-10, 10CrSiMoV7, 12CrMo9-10, G17CrMo9-10; ASTM A387 Gr.22, Cl 1 and 2, A 182 Gr.F 22, A 336 Gr.F22

Storage
Keep dry and avoid condensation.

Current condition and welding position
DC+



Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
1.0	●

AIR LIQUIDE WELDING

CARBOFIL KV3

OERLIKON

MIG MAG Wires
C-Mn and low-alloy steels

CARBOFIL KV3 is a copper coated ER90S-B3 type solid MAG welding wire supplied precision layer wound, depositing a 2¼Cr1Mo weld metal for the welding of creep resistant steels. Ar-CO2 mix shielding gase s are preferred for improved mechanical properties.

CARBOFIL KV3 is used for welding of similar composition and ½Mo¼V and 1%Cr1Mo steels. Used in the construction of steam generating plant operating at temperatures <600°C. Also suitable for the welding of 1¼Cr 1Mo steels where improved resistance to hydrogen attack or corrosion by sulphur is required. Main applications are welding of boilers, plates and tubes as well as oil refineries e.g. in crack plants produced from mainly 10CrMo9-10 (ASTM A335 Gr. P/T22).

CARBOFIL KV3 is a very clean welding wire with guaranteed X<15 Bruscato factor, and with controlled As, Sb, Sn content against temper embrittlement. CARBOFIL KV3 is used, where the operational guidelines are given by the ASME norms.

Classification	
EN ISO	21952-B: G 62M 2C1M
AWS	A5.28: ER 90S-B3

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S	Cr	Ni	Mo	Cu
Wire	0.07-0.12	0.4-0.7	0.4-0.7	max. 0.01	max. 0.01	2.3-2.7	max. 0.2	0.9-1.2	max. 0.2

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C
620°C x 1h	≥540	≥620	≥20	≥70

Gas test: M21-Arcal 21

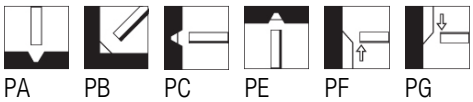
Shielding Gas - EN ISO 14175 : 100% CO2, Ar + 5-25% CO2

Materials

10CrMo 9-10, 12CrMo 9-10

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
1.0	●
1.2	●

CARBOFIL CrMo5

OERLIKON

MIG MAG Wires
C-Mn and low-alloy steels

CARBOFIL CrMo5 is a copper coated GCrMo5Si/ER 80S-B6 type solid MAG welding wire supplied precision layer wound, depositing a nominal C-0.3Mn5.6Cr0.6Mo low alloy steel weld metal. Ar-CO2 mixed shielding gases preferred for improved mechanical properties.

CARBOFIL CrMo5 is used for welding elevated temperature creep resisting steels of similar composition (P/T5) as used in the power generation and petrochemical industries where corrosion resistance to steam, hot hydrogen gas and high sulphur crude oils is required.

Classification	
EN ISO	21952-A: G CrMo5Si
AWS	A5.28: ER 80S-B6

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S	Cr	Mo
Wire	0.07	0.5	0.5	≤ 0.020	≤ 0.020	5.70	0.6
All weld metal (*)	0.05	0.3	0.3	≤0.020	≤0.020	5.6	0.6

(*) 82% Ar+18% CO2

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C
760 °C x 1h	≥ 470	≥ 590	≥ 17	≥ 47

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : M20, M21, M24, M26

Materials

X12CrMo5,GX12CrMo5,A213 Gr.T5,A217 Gr.C5,A335 Gr.P5,A336 Cl. F5, A369 Gr. FP5, A387 Gr.5, Cl 1 and 2

12CrMo19-5, A182 Gr. F5, A199 Gr. T5 and similar steels

Storage

Keep dry and avoid condensation.

Current condition and welding position

DC+

AIR LIQUIDE WELDING

CARBOFIL CrMo9

OERLIKON

MIG MAG Wires
C-Mn and low-alloy steels

CARBOFIL CrMo9 is a copper coated GCrMo9/ER 80S-B8 solid MAG welding wire supplied precision layer wound, depositing a nominal C-0.4Mn9Cr1Mo low alloy steel weld metal. Ar-CO2 mixed shielding gases preferred for improved mechanical properties.

CARBOFIL CrMo9 is used for welding creep resisting steels of the type 9Cr - 1Mo (P/T9) used for elevated temperatures applications up to 600°C, where creep resistance and strength are required for service in high temperature steam, hot hydrogen and high sulphur crude oil.

Classification	
EN ISO	21952-A: G CrMo9
AWS	A5.28: ER 80S-B8

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S	Cr	Ni	Mo
Wire	0.06	0.7	0.5	≤ 0.025	≤ 0.025	9	0.06	1

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)
				+20 °C
760 °C x 2h	≥ 470	≥ 590	≥ 18	≥ 34

Materials

A335 Gr. P9

Storage

Keep dry and avoid condensation.

Current condition and welding position

DC+

Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
1.0	●

CARBOFIL KV7M

OERLIKON

MIG MAG Wires
C-Mn and low-alloy steels

CARBOFIL KV7M is a copper coated GCrMo91/ER90S-B9 type solid MAG welding wire supplied precision layer wound, for welding creep resisting steels of the type 9Cr1MoVNbN. Ar-CO2 mix shielding gases preferred for improved mechanical properties.

CARBOFIL KV7M is especially designed for the ASTM steels T91/P91. Approved in long-term condition <+650°C service temperature.

Improved creep strength is obtained by the addition of nitrogen, niobium and vanadium.

Classification	
EN ISO	21952-A: G CrMo91
AWS	A5.28-05: ER 90S-B9

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo	Nb	V
0.10	0.6	0.3	9.0	0.7	0.9	0.06	0.2

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C
760°C x 2h	≥ 620	≥ 720	≥ 17	≥55

Gas test: 97.5%Ar + 2.5%CO2

Shielding Gas - EN ISO 14175 : M12

Materials

1.4903, X10CrMo V9-1, X10CrMoVNb9-1, A199 T91, A200 T91, A213 T91, A335 P91, A336 P91

Storage

Keep dry and avoid condensation.

Current condition and welding position

DC+

Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
1.0	●
1.2	●

AIR LIQUIDE WELDING

CARBOFIL NiCu

OERLIKON

MIG MAG Wires
Weathering steels

CARBOFIL NiCu is a copper coated ER80S-G type solid MAG welding wire supplied both random and precision layer wound, depositing a C-1Mn0.8Ni0.4Cu for the welding of weathering steels such as COR-TEN, Patinax, etc. Suitable for welding with CO2 or Ar+CO2 mixed shielding gases.

CARBOFIL NiCu is suitable for welding a range of structural weather resistant steels in applications such as bridge fabrication, exposed frame structures, transmission towers, barriers, ducting, chimneys, shields and inner exhaust systems. Due to the alloying elements, CARBOFIL NiCu canalso be used for the welding of high yield strength steels.

The addition of Ni and Cu to the weld metal provides increased resistance to atmospheric corrosion compared to conventional C-Mn steels.

Classification	
EN ISO	14341-A: G 42 3 C G0
EN ISO	14341-A: G 42 4 M G0
AWS	A5.28: ER 80S-G

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S	Cr	Ni	Cu
Wire	0.06	1.4	0.8	≤ 0.025	≤ 0.025	0.3	0.8	0.4
All weld metal (*)	0.06	1.1	0.5	≤0.025	≤0.025	0.3	0.8	0.4
All weld metal (**)	0.07	1.0	0.4	≤0.025	≤0.025	0.3	0.8	0.4

(*) 82% Ar+18% CO2, (**) 100% CO2

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)		
				+20 °C	-30 °C	-40 °C
As Welded (*)	≥420	500-640	≥22	≥120	≥90	>80
As Welded (**)	>420	500-640	≥22	≥100	≥47	

Gas test: (*) 82% Ar+18% CO2, (**) 100% CO2

Shielding Gas - EN ISO 14175 : C1, M2

Materials

S235J0W; S235J2W; S355J0W; S355J2W; S355K2W

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
0.8	●
1.0	●
1.2	●

CARBOFIL MnMo

OERLIKON

MIG MAG Wires
High strength steels

CARBOFIL MnMo is a copper coated G4Mo/ER 80S-D2 type solid MAG welding wire supplied both randon and precision layer wound, depositing a C-1.6Mn0.5Mo weld metal for welding low alloy creep resistant ferritic steels. Suitable for use with Ar-CO2 mix shielding gases.

CARBOFIL MnMo is used in chemical plant construction operating at elevated temperatures up to 500°C. Suitable for applications in petrochemical process plant where some resistance to hot hydrogen attack is necessary. CARBOFIL MnMo is also suitable for welding of high yield strength steels <500 MPa.

CARBOFIL MnMo is available also in 300kg drum format.

Classification	
EN ISO	14341-A: G 50 4 M G4Mo
AWS	A5.28: ER 80S-D2

Approvals	Grade
DB	●

CE

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S	Mo
Wire	0.09	1.85	0.70	≤0.020	≤0.020	0.50
All weld metal (*)	0.09	1.60	0.6	≤0.020	≤0.020	0.50

(*) 82% Ar+18% CO2

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-40 °C
620°C x 3h	≥500	≥600	≥22	≥120	≥90
As Welded	≥520	≥680	≥22	≥100	≥70

Gas test: M21

Shielding Gas - EN ISO 14175 : M20, M21

Materials

16Mo3

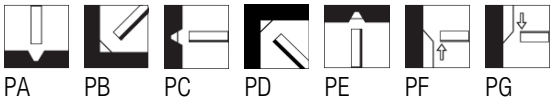
fine grain steels with YS≤500

Storage

Keep dry and avoid condensation

Current condition and welding position

DC+



Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
0.8	●
1.0	●
1.2	●

CARBOFIL NiMo1

OERLIKON

MIG MAG Wires
High strength steels

CARBOFIL NiMo1 is a copper coated GMn3Ni1Mo/ER100S-G type solid MAG welding wire supplied both randon and precision layer wound, depositing C-1.5Mn1.0Ni0.4Mn weld metal for welding of high strength steels. Suitable for use with Ar-CO2 mix shielding gases.

CARBOFIL NiMo1 is used to weld <620 MPa yield strength steels with excellent machanical properties. Because of its chemical composition the weld metal has good impact toughness down to -40°C. Typical applications include the welding of higher strength fine grained steels used in the fabrication of oil field equipment, process plant and cranes, where low temperature weld metal toughness properties are also required.

Low heat inputs are recommended to obtain optimum joint mechanical properties.

Classification	
EN ISO	16834-A: G 62 4 M Mn3Ni1Mo
AWS	A5.28: ER 100S-G

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S	Ni	Mo	Ti
Wire	0.08	1.8	0.6	≤ 0.015	≤ 0.018	1.0	0.4	0.1
All weld metal (*)	0.07	1.5	0.4	≤ 0.015	≤ 0.018	1.0	0.4	0.1

(*) 82% Ar+18% CO2

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-40 °C
As Welded (*)	≥620	700-890	≥18	≥100	≥60
As Welded (**)	≥550	640-820	≥18	≥100	≥47

Gas test: (*) 82% Ar+18% CO2, (**) 100% CO2

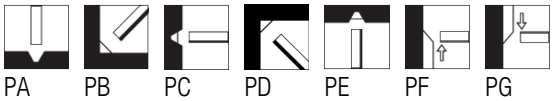
Shielding Gas - EN ISO 14175 : C1, M2

Materials

S(P)460-S(P)620

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
1.0	●
1.2	●

AIR LIQUIDE WELDING

CARBOFIL MnNiMoCr

OERLIKON

MIG MAG Wires
High strength steels

CARBOFIL MnNiMoCr is a copper coated GMn3NiCrMo/ER 100S-G type solid MAG welding wire supplied both randon and precision layer wound, depositing C-0.5Cr0.5Ni0.2Mo weld metal for welding high yield strength steels. Suitable for use with Ar-CO2 mix shielding gases.

CARBOFIL MnNiMoCr is used for welding high yield strength steels <610 MPa. Used also for welding in low temperature applications >-40°C. The weld metal contains less than 1% Ni conforming to NACE requirement.

CARBOFIL MnNiMoCr is available in 300kg drums.

Classification	
EN	16834-A: G 62 4 M Mn3NiCrMo
AWS	A5.28: ER 100S-G

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo
0.08	1.50	0.60	≤0.015	≤0.018	0.50	0.54	0.25

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -40 °C
As Welded	≥620	≥690	≥18	≥47

Gas test: M21

Shielding Gas - EN ISO 14175 : M21

Materials

S(P)460-S(P)620

Storage

Keep dry and avoid condensation

Current condition and welding position

DC+

Packaging data

Packaging Type	B300	DRUM
Diam(mm) / weight(kg)	16	300
1.0	●	
1.2	●	●

CARBOFIL NiMoCr

OERLIKON

MIG MAG Wires
High strength steels

CARBOFIL NiMoCr is a copper coated GMn3Ni1CrMo/ER110S-G type solid MAG welding wire supplied randon and precision layer wound, depositing C-1.2Mn0.25Cr1.5Ni0.25Mo weld metal, used for the welding of high tensile strength steels and type TI-HY100 steels. Suitable for use with Ar-CO2 mix shielding gases.

CARBOFIL NiMoCr is used to weld <690 MPa yield strength steels with excellent mechanical properties and also for low temperature applications down to -40°C.

CARBOFIL NiMoCr is available also in 300kg drum format. Low heat inputs are recommended to obtain optimum joint mechanical properties.

Classification	
EN ISO	16834-A: G 69 4 M Mn3Ni1CrMo
AWS	A5.28: ER 110 S-G

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S	Cr	Ni	Mo
Wire	0.08	1.6	0.5	≤ 0.015	≤ 0.018	0.3	1.5	0.25
All weld metal (*)	0.08	1.2	0.3	≤ 0.015	≤ 0.018	0.25	1.5	0.25

(*) 82% Ar+18% CO2

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-40 °C
As Welded	≥690	770 - 890	≥17	≥80	≥47

Gas test: M21-Arcal 21

Shielding Gas - EN ISO 14175 : M20, M21, M24, M26

Materials

S620, S690, HY 100

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	B300	S300
Diam(mm) / weight(kg)	16	15
0.8	●	
1.0	●	●
1.2	●	

AIR LIQUIDE WELDING

CARBOFIL 2NiMoCr

OERLIKON

MIG MAG Wires
High strength steels

CARBOFIL 2NiMoCr is a copper coated GMn4Ni2CrMo/ER 120S-G type solid MAG welding wire supplied both randon and precision layer wound, depositing C-1.5Mn0.4Cr2.2Ni0.6Mo weld metal, used for welding Cr-Ni-Mo low alloyed and high yield strength steels. Suitable for use with Ar-CO2 mix shielding gases.

Excellent mechanical properties, CARBOFIL 2NiMoCr up to 890 MPa yield strength steels and also for low temperature applications to -40°C.

CARBOFIL 2NiMoCr is also available in 300kg drum packaging. Low heat imputs are recommended to obtain optimum joint mechanical properties.

Classification	
EN ISO	16834-A: G 89 4 M Mn4Ni2CrMo
AWS	A5.28: ER 120S-G

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S	Cr	Ni	Mo
Wire	0.08	1.7	0.7	≤ 0.015	≤ 0.018	0.4	2.2	0.6
All weld metal (*)	0.08	1.5	0.6	≤ 0.015	≤ 0.018	0.4	2.2	0.6

(*) 82% Ar+18% CO2

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-40 °C
As Welded	≥890	≥940	≥15	≥80	≥47

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : M20, M21, M24, M26

Materials

S690; S890

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	B300	DRUM	S300
Diam(mm) / weight(kg)	16	300	15
0.8	●		
1.0	●		●
1.2	●	●	

INERTFIL 410

INERTFIL 410 is a ER410/G13 type solid MAG welding wire supplied precision layer wound, depositing a C-13%Cr weld metal. Suitable for use with Ar-CO2 mix shielding gases.

INERTFIL 410 is mainly used for deposition of overlays on carbon steels to resist corrosion, erosion or abraison.

Classification	
EN ISO	14343-A: G 13
AWS	A5.9: ER 410

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S	Cr
Wire	0.1	0.45	0.4	≤ 0.030	≤ 0.020	13.0

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C
750 °C x 1h	≥350	≥450	≥20	≥47

Gas test: M13

Shielding Gas - EN ISO 14175 : 98%Ar+2%O2, Ar+0.5≤CO2≤5

Materials

1.4000 (X6Cr13); 1.4006 (X12Cr13)

AISI 410

Storage

Keep dry and avoid condensation.

Current condition and welding position

DC+

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1.0	●
1.2	●

INERTFIL 410NiMo

INERTFIL 410NiMo is a ER 410NiMo/G 13 4 type solid MAG welding wire supplied precision layer wound, depositing a C-12Cr4Ni0.5Mo weld metal. Suitable for use with Ar-CO2 mix shielding gases.

INERTFIL 410NiMo is used for the welding of high strength martensitic steels, with excellent resistance to corrosion, hydrocavitation and sulphide induced stress corrosion cracking, Good sub-zero notch toughness properties.

INERTFIL 410NiMo contains less chromium and more nickel than INERTFIL 410 to eliminate ferrite in the microstructure as it has a deleterious effect on mechanical properties. AISI 410NiMo steels are self-hardening steels and usually require pre-heating and stress relieving treatments in order to obtain adequate ductility.

Classification	
EN ISO	14343-A: G 13 4
AWS	A5.9: ER 410NiMo

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo
0.04	0.5	0.4	≤ 0.030	≤ 0.020	12	4	0.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C
600°C x 8h	≥500	≥760	≥15	≥50

Gas test: 98% Ar+2% O2

Shielding Gas - EN ISO 14175 : M12, M13

Materials

ASTM CA6NM; G-X5CrNi 13-4; Z6 CND 1304 M; X6CrAl13

Storage

Keep dry and avoid condensation.

Current condition and welding position

DC+

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1.0	●
1.2	●

INERTFIL 420

OERLIKON

MIG MAG Wires
Stainless and Heat resistant steels

INERTFIL 420 is a ER 420 type solid MAG welding wire supplied precision layer wound. Suitable for use with Ar-CO2 mix shielding gases.

INERTFIL 420 is used for many surfacing operations.

INERTFIL 420 is similar to INERTFIL 410, but with higher chromium and carbon content, which increases the wear resistance.

Classification	
AWS	A5.9: ER 420

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S	Cr	Ni	Mo
Wire	0.3	0.45	0.4	≤ 0.030	≤ 0.020	13.0	0.25	0.2

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
750 °C x 1h	≥ 400	≥ 450	≥ 15

Gas test: M13

Shielding Gas - EN ISO 14175 : 98%Ar+2%O2, Ar+0.5%≤CO2≤5%

Materials

AISI 420, hardfacing harder than ER410, X12Cr13

Storage

Keep dry and avoid condensation.

Current condition and welding position

DC+

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1.0	●
1.2	●

AIR LIQUIDE WELDING

INERTFIL 430

INERTFIL 430 is a ER430/G17 type solid MAG welding wire supplied precision layer wound. Suitable for use with Ar-CO2 mix shielding gases.

INERTFIL 430 is used for many surfacing applications.

The composition of INERTFIL 430 is balanced by optimising the chromium content to give adequate corrosion resistance and yet retain sufficient ductility.

Classification	
EN ISO	14343-A: G 17
AWS	A5.9: ER 430

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr
0.08	0.5	0.4	≤ 0.030	≤ 0.020	17

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)
				+20 °C
770 °C x 2h	≥ 400	≥ 450	≥ 15	≥27

Gas test: 98% Ar+2% O2

Shielding Gas - EN ISO 14175 : M12, M13

Materials

AISI 430; X20CrNi17-2, G-X 40 CrSi17, G-X 22 CrNi7, X10CrAl18

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1.0	●
1.2	●

INERTFIL 430LNb

INERTFIL 430LNb is a G18LNb type solid MAG welding wire supplied precision layer wound, for the welding of ferritic steels. Suitable for use with Ar-CO2 mix shielding gases.

INERTFIL 430LNb is developed mainly for welding catalytic exhaust systems where both fatique behaviour and corrosion resistance is important.

The feature of INERTFIL 430LNb is ensured with the low C-content and Nb-stabilisation.

Classification
EN ISO 14343-A: G 18 L Nb

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Nb
0.015	0.7	0.45	≤0.020	≤0.015	18.5	0.25

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C
As Welded	≥280	≥400	≥ 26	≥47

Shielding Gas - EN ISO 14175 : M12, M13

Materials

AISI 430Ti

Storage
Keep dry and avoid condensation.

Current condition and welding position
DC+

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1.0	●
1.2	●

INERTFIL 308L

OERLIKON

MIG MAG Wires
Stainless and Heat resistant steels

INERTFIL 308L is a G 19 9 L/ER 308L type solid MAG welding wire, supplied precision layer wound, depositing a low C-19Cr9Ni weld metal. Suitable for use with Ar+2%O2 or Ar+0.5…5%CO2 mixed shielding gases.

INERTFIL 308L is used for welding of 304 and 304L grade stainless steel. The weld metal provides good corrosion resistance properties to intergranular attack from a range of liquid media at service temperatures up to 300°C. It is used for a wide range of applications including pipework and plate fabrication, vessel production etc. Batch with controlled low ferrite number is available for cryogenic applications.

The low carbon content reduces the propensity to intergranular carbide precipitation, which increases the resistance to intergranular corrosion without the use of stabilizers.

Classification	
EN ISO	14343-A: G 19 9 L
AWS	A5.9: ER 308L

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S	Cr	Ni
Wire	0.020	1.8	0.45	≤ 0.025	≤ 0.020	20	10

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-120 °C
As Welded	≥350	≥520	≥35	≥80	>32

Gas test: M13

Shielding Gas - EN ISO 14175 : 98%Ar+2%O2, Ar+0.5≤CO2≤5

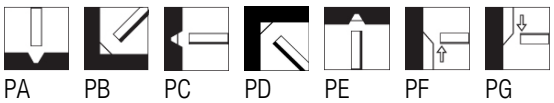
Materials

AISI 304 - 304L - 302

1.4541 (X6CrNiTi18-10); 1.4301 (X4CrNi18-10); 1.4311 (X2CrNiN18-10)

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1.6	●

INERTFIL 308LSi

OERLIKON

MIG MAG Wires
Stainless and Heat resistant steels

INERTFIL 308LSi is a G 19 9 LSi/ER 308LSi type solid MAG welding wire, supplied precision layer wound, depositing a low C-19Cr9Ni weld metal. Suitable for use with Ar+2%O2 or Ar+0.5…5%CO2 mixed shielding gases.

INERTFIL 308LSi is used for welding of 304 and 304L grade stainless steel. The weld metal provides good corrosion resistance to intergranular attack from a range of liquid media. It is used for a wide range of applications including pipework and plate fabrication, vessel production etc.

The low carbon reduces the propensity to intergranular carbide precipitation, which increases the resistance to intergranular corrosion without the use of stabilizers. The increased silicon content results in increased weld pool fluidity to give a smooth deposit appearance.

CARBOFIL 308LSi also available in 200kgs drum.

Classification	
EN ISO	14343-A: G 19 9 L Si
AWS	A5.9: ER 308LSi

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni
0.020	1.8	0.85	≤ 0.025	≤ 0.020	20	10

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				20 °C	-120 °C
As Welded	≥ 350	≥ 520	≥ 35	≥ 80	≥32

Gas test: 98% Ar+2% O2

Shielding Gas - EN ISO 14175 : M12, M13

Materials

1.4541 (X6CrNiTi18-10); 1.4301 (X4CrNi18-10); 1.4311 (X2CrNiN18-10)

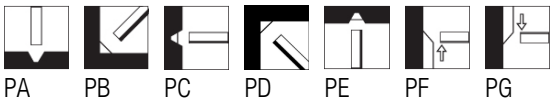
AISI 304 - 304L - 302

Storage

Keep dry and avoid condensation

Current condition and welding position

DC+



AIR LIQUIDE WELDING

Packaging data

Packaging Type	BS300	DRUM	S200	S300
Diam(mm) / weight(kg)	15	200	5	15
0.6	●		●	●
0.8	●	●	●	●
1.0	●	●	●	●
1.2	●	●	●	●
1.6	●	●	●	●

INERTFIL 347

OERLIKON

MIG MAG Wires
Stainless and Heat resistant steels

INERTFIL 347 is a G 19 9 Nb/ER 347 type solid MAG welding wire, supplied precision layer wound, depositing a niobium stabilised 19Cr9Ni weld metal. Suitable for use with Ar+2%O2 or Ar+0.5…5%CO2 mixed shielding gases.

INERTFIL 347 is used for welding of 321 and 347 grade stainless steels. The wire is used for a range of applications, including the fabrication of pipe, plate and vessels. The weld metal has a high resistance to corrosive media at service temperatures <400°C.

The presence of niobium reduces the possibility of intergranular chromium carbide precipitation and thus reduces the susceptibility to intergranular corrosion.

Classification	
EN ISO	14343-A: G 19 9 Nb
AWS	A5.9: ER 347

Approvals	Grade
DB	●

CE

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S	Cr	Ni	Nb
Wire	0.040	1.6	0.45	≤ 0.025	≤ 0.020	19.5	10	0.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-120 °C
As Welded	≥400	≥550	≥30	≥65	≥32

Gas test: M13

Shielding Gas - EN ISO 14175 : 98%Ar+2%O2, Ar+0.5≤CO2≤5

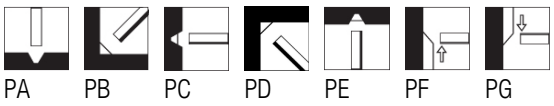
Materials

AISI 347 - 321

1.4541 (X6CrNiTi18-10); 1.4301 (X4CrNi18-10); 1.4550 (X6CrNiNb18-10);

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	BS300	S300
Diam(mm) / weight(kg)	15	15
0.8	●	●
1.0	●	●
1.2	●	●

AIR LIQUIDE WELDING

INERTFIL 347Si

OERLIKON

MIG MAG Wires
Stainless and Heat resistant steels

INERTFIL 347Si is a G 19 9 Nb Si/ER 347Si type solid MAG welding wire, supplied precision layer wound, depositing a niobium stabilised 19Cr 9Ni weld metal. Suitable for use with Ar+2%O2 or Ar+0.5…5%CO2 mixed shielding gases.

INERTFIL 347Si is used for welding of 321 and 347 grade stainless steels. The wire is used for a range of applications, including the fabrication of pipe, plate and vessels. The weld metal has a high resistance to corrosive media at service temperatures <400°C.

The presence of niobium reduces the propensity of intergranular chromium carbide precipitation and thus reduces the susceptibility to intergranular corrosion. The increased silicon content results in increased weld pool fluidity to give a smooth deposit appearance.

Classification	
EN ISO	14343-A: G 19 9 Nb Si
AWS	A5.9: ER 347Si

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Nb
0.040	1.6	0.8	≤0.025	0.020	19.5	10	0.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-120 °C
As Welded	≥400	≥550	≥30	≥65	≥32

Gas test: 98% Ar+2% O2

Shielding Gas - EN ISO 14175 : M12, M13

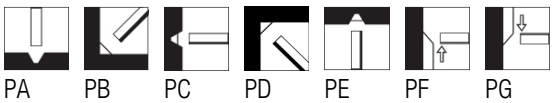
Materials

AISI 347 - 321

1.4541 (X6CrNiTi18-10); 1.4301 (X4CrNi18-10); 1.4550 (X6CrNiNb18-10)

Storage
Keep dry and avoid condensation.

Current condition and welding position
DC+



Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
0.8	●
1.0	●
1.2	●

INERTFIL 316L

OERLIKON

MIG MAG Wires
Stainless and Heat resistant steels

INERTFIL 316L is a G 19 12 3L/ER 316L type solid MAG welding wire supplied precision layer wound, depositing a low C-19Cr12Ni2.6Mo weld metal. Suitable for use with Ar+2%O2 or Ar+0.5…5%CO2 mixed shielding gases.

INERTFIL 316L is used for welding of 316 and 316L grade stainless steels. It is used for a wide range of applications including pipework and plate fabrication, vessel production etc. Batch with controlled low ferrite number is available for cryogenic applications.

The weld metal has a high resistance to crevice corrosion by oxidising acids.

Classification	
EN ISO	14343-A: G 19 12 3L
AWS	A5.9: ER 316L

Approvals	Grade
DB	●

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S	Cr	Ni	Mo
Wire	0.020	1.4	0.45	≤ 0.025	≤ 0.020	19	12.5	2.6

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-120 °C
As Welded	≥350	≥510	≥30	≥80	≥32

Gas test: M13

Shielding Gas - EN ISO 14175 : Ar+0.5%≤O2≤3%, Ar+0.5≤CO2≤5

Materials

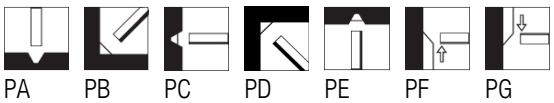
1.4571 (X6CrNiMoTi17-12-2), 1.4583 (X10CrNiMoNb18-12)

AISI 316L

1.4401 (X4CrNiMo17-12-2), 1.4435 (X2CrNiMo18-14-3)

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1.0	●
1.2	●

AIR LIQUIDE WELDING

INERTFIL 316LSi

OERLIKON

MIG MAG Wires
Stainless and Heat resistant steels

INERTFIL 316LSi is a G 19 12 3 LSi/ER 316LSi type solid MAG welding wire, supplied precision layer wound, depositing a low C-19Cr12Ni2.5Mo weld metal. Suitable for use with Ar+2%O2 or Ar+0.5…5%CO2 mixed shielding gases.

INERTFIL 316LSi is used for welding of 316 and 316L grade stainless steels, in a wide range of applications including the fabrication of pipe and plate. The higher Si level results in a smooth weld bead shape and even appearance with excellent toe blending particularly in fillet welds. The weld metal has a high resistance to pitting and crevice corrosion by non-oxidising acids. Used for applications with service temperatures <400°C.

INERTFIL 316LSi also available in 200kgs drum.

Classification	
EN ISO	14343-A: G 19 12 3 L Si
AWS	A5.9: ER 316LSi

Approvals	Grade
DB	●
TÜV	●

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo
0.020	1.4	0.85	≤ 0.025	≤ 0.020	19	12.5	2.6

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-120 °C
As Welded	≥350	≥510	≥30	≥80	>32

Gas test: M13

Shielding Gas - EN ISO 14175 : Ar+0.5%≤O2≤3%, Ar+0.5≤CO2≤5

Materials

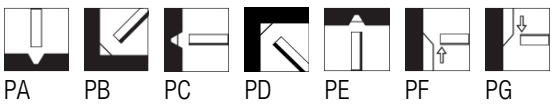
1.4571 (X6CrNiMoTi17-12-2), 1.4583 (X10CrNiMoNb18-12)

AISI 316L

1.4401 (X4CrNiMo17-12-2), 1.4435 (X2CrNiMo18-14-3)

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	BS300	S200	S300
Diam(mm) / weight(kg)	15	5	15
0.6	●	●	●
0.8	●	●	●
1.0	●	●	●
1.2	●	●	●
1.6	●	●	●

INERTFIL 318

OERLIKON

MIG MAG Wires
Stainless and Heat resistant steels

INERTFIL 318 is a G 19 12 3 Nb/ER318 type solid MAG welding wire supplied precision layer wound, depositing a niobium stabilised C-19Cr12Ni2.5Mo weld metal. Suitable for use with Ar+2%O2 or Ar+0.5…5%CO2 mixed shielding gases.

INERTFIL 318 is used for the welding of 316Ti and 316Nb stainless steels. It is used for a range of applications including the fabrication of pipe, plate and vessel.

The weld metal provides good resistance to crevice corrosion by oxidising acids.

Classification	
EN ISO	14343-A: G 19 12 3 Nb
AWS	A5.9: ER 318

Approvals	Grade
DB	●
TÜV	●

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S	Cr	Ni	Mo	Nb
Wire	0.05	1.75	0.4	≤0.025	≤0.020	19	12	2.6	0.6

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-110 °C
As Welded	≥400	≥550	≥30	≥65	≥32

Gas test: M13

Shielding Gas - EN ISO 14175 : Ar+0.5%≤O2≤3%, Ar+0.5≤CO2≤5

Materials

1.4583 (X10CrNiMoNb18-12)

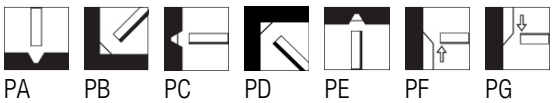
1.4580 (X6CrNiMoNb17-12-2) - 1.4408 (GX5CrNiMo19-11)

1.4581 (GX5CrNiMoNb19-10) - 1.4436 (X4CrNiMo17-13-3)

1.4571 (X6CrNiMoTi17-12-2) - 1.4401 (X4CrNiMo17-12-2)

Storage
Keep dry and avoid condensation.

Current condition and welding position
DC+



Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
0.8	●
1.0	●
1.2	●

AIR LIQUIDE WELDING

INERTFIL 318Si

INERTFIL 318Si is a G 19 12 3 Nb Si type solid MAG welding wire supplied precision layer wound, depositing a C-19Cr12Ni2.5Mo weld metal stabilised with niobium. Suitable for use with Ar+2%O2 or Ar+0.5…5%CO2 mixed shielding gases.

INERTFIL 318Si is used for the welding of 316Ti and 316Nb stainless steels. It is used for a range of applications including the fabrication of pipe, plate and vessel. The weld metal has a high resistance to crevice corrosion by oxidising acids.

The increased silicon results in increased weld pool fluidity to give a smooth deposit appearance.

Classification
EN ISO 14343-A: G 19 12 3 Nb Si

Approvals	Grade
DB	●
TÜV	●

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	Nb
0.05	1.75	0.85	≤ 0.025	≤ 0.020	19	12	2.6	0.6

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-110 °C
As Welded	≥400	≥550	≥30	≥65	≥32

Gas test: 98% Ar+2% O2

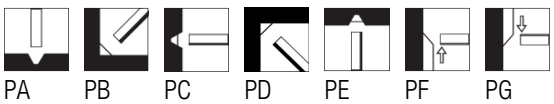
Shielding Gas - EN ISO 14175 : M12, M13

Materials

1.4580 (X6CrNiMoNb17-12-2) - 1.4408 (GX5CrNiMo19-11)
1.4581 (GX5CrNiMoNb19-10) - 1.4436 (X4CrNiMo17-13-3)
1.4583 (X10CrNiMoNb18-12)
1.4571 (X6CrNiMoTi17-12-2) - 1.4401 (X4CrNiMo17-12-2)

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1.0	●
1.2	●

INERTFIL 308H

OERLIKON

MIG MAG Wires
Stainless and Heat resistant steels

INERTFIL 308H is a G 19 9 H/ER308H type solid MAG welding wire, supplied precision layer wound, depositing a C-19Cr9Ni weld metal. Suitable for use with Ar+2%O2 or Ar+0.5…5%CO2 mixed shielding gases.

INERTFIL 308H is suitable for welding AISI 304H austenitic stainless steel and similar steels. It is used mainly in petrochemical industry including the fabrication of pipe and vessel.

The higher carbon content results in higher strength at elevated temperatures.

Classification	
EN ISO	14343-A: G 19 9 H
AWS	A5.9: ER 308H

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni
0.060	1.9	0.5	≤ 0.020	≤ 0.020	20.0	10.0

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-10 °C
As Welded	≥350	≥550	≥35	≥70	≥32

Gas test: 98% Ar+2% O2

Shielding Gas - EN ISO 14175 : M12, M13

Materials

AISI 304H; 1.4948 (X6CrNi18-10); 1.4310 (X10CrNi18-8)

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1.0	●
1.2	●

AIR LIQUIDE WELDING

INERTFIL 310

INERTFIL 310 is a G25 20/ER 310 solid MAG welding wire, supplied precision layer wound, depositing a C-25Cr 20Ni weld metal. Suitable for use with Ar+2%O2 or Ar+0.5…5%CO2 mixed shielding gases.

INERTFIL 310 weld metal has high temperature ductility and excellent resistance to oxidation at working temperatures <1000°C. It is used for the welding of 310 austenitic stainless steel pipe, plate and fittings used in the fabrication of furnaces and similar applications working at elevated temperatures. It is used mainly for heat exchangers and hot water boilers.

INERTFIL 310 weld deposit is fully austenitic.

Classification	
EN	14343-A: G 25 20
AWS	A5.9: ER 310

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni
0.12	1.8	0.6	≤ 0.020	≤ 0.020	26	21

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C
As Welded	≥350	≥550	≥30	≥70

Gas test: 98% Ar+2% O2

Shielding Gas - EN ISO 14175 : M12, M13, M20, M21

Materials

AISI 310; 1.4845 (X8CrNi25-21); 1.4841 (X15CrNiSi25-21); 1.4828 (X15CrNiSi20-12)

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
0.8	●
1.0	●
1.2	●

INERTFIL 309L

INERTFIL 309L is a G 23 12 L/ER 309L type solid MAG welding wire, supplied precision layer wound, depositing a low C-23Cr 12Ni weld metal. Suitable for use with Ar+2%O2 or Ar+0.5…5%CO2 mixed shielding gases.

INERTFIL 309L is used for the welding of stainless steels to mild and medium tensile steels. It is used for depositing intermediate layers on steel prior to depositing 308 grade stainless steel. Also used for the welding of clad steels where service temperatures are below 300°C.

The weld metal has a delta-ferrite content of ~12% resulting in a high resistance to hot cracking.

Classification	
EN ISO	14343-A: G 23 12 L
AWS	A5.9: ER 309L

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni
0.020	1.8	0.45	≤ 0.025	≤ 0.020	24	13

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-80 °C
As Welded	≥350	≥520	≥30	≥55	≥32

Gas test: 98% Ar+2% O2

Shielding Gas - EN ISO 14175 : M12, M13

Materials

A312 TP309S;

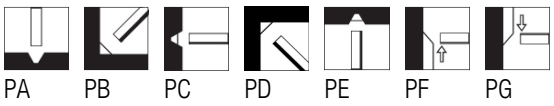
Ferrite-Austenite heterogeneous joints ("Black-White"),

Carbon steel to stainless steel joints,

Corrosion resistance surfacing

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
0.8	●

INERTFIL 309LSi

OERLIKON

MIG MAG Wires
Stainless and Heat resistant steels

INERTFIL 309LSi is a G 23 12 LSi/ER 309LSi type solid MAG welding wire, supplied precision layer wound, depositing a low C-23Cr12Ni weld metal. Suitable for use with Ar+2%O2 or Ar+0.5…5%CO2 mixed shielding gases.

INERTFIL 309LSi is used for the welding of stainless steels to mild and medium tensile steels. It is used for depositing intermediate layers on steel prior to depositing 308 grade stainless steel. Also used for the welding of clad steels where service temperatures are below 300°C.

The weld metal has a delta-ferrite content of ~12% resulting in a high resistance to hot cracking. The increased silicon content results in increased weld pool fluidity to give a smooth deposit appearance.

Classification	
EN ISO	14343-A: G 23 12 L Si
AWS	A5.9: ER 309LSi

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S	Cr	Ni
Wire	0.020	1.8	0.85	≤ 0.025	≤ 0.020	24	13

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-120 °C
As Welded	≥350	≥520	≥30	≥ 100	≥32

Gas test: 98% Ar+2% CO2

Shielding Gas - EN ISO 14175 : M12, M13

Materials

A312 TP309S; carbon steel to stainless steels joint

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
0.8	●
1.0	●
1.2	●

INERTFIL 309LMo

INERTFIL 309LMo is a G 23 12 2 L/ER 309L Mo (similar) type solid MIG welding wire, supplied precision layer wound, depositing a low C-22Cr 12Ni 2.5Mo weld metal. Suitable for use with Ar+2%O2 or Ar+0.5…5%CO2 mixed shielding gases.

INERTFIL 309LMo is used for the welding of stainless steels to mild and medium tensile steels. Used for intermediate layers on steel prior to depositing 316L grade stainless steel cladding. Also used for buffer layers prior to surfacing, where the Mo is a required alloying element.

The weld metal has a delta-ferrite content of ~15% resulting in a high resistance to hot cracking.

Classification	
EN ISO	14343-A: G 23 12 2 L
AWS	A5.9: ~ER 309LMo

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	Ferrite
0.020	1.6	0.45	≤ 0.025	≤ 0.020	24	13	2.7	10-20

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C
As Welded	≥350	≥550	≥30	≥55

Gas test: 98% Ar+2% O2

Shielding Gas - EN ISO 14175 : M12, M13

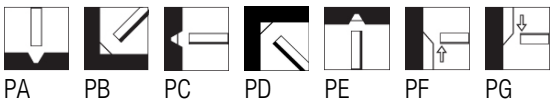
Materials

Ferrite-Austenite heterogeneous joints ("Black-White"),

Corrosion resistance surfacing

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
0.8	●
1.0	●
1.2	●

INERTFIL 307

OERLIKON

MIG MAG Wires
Stainless and Heat resistant steels

INERTFIL 307 is a G 18 8 Mn/ER 307 (similar) type solid MAG welding wire, supplied precision layer wound, depositing a C-18Cr8Ni6Mn weld metal. Suitable for use with Ar+2%O2 or Ar+0.5…5%CO2 mixed shielding gases.

INERTFIL 307 is suitable for welding dissimilar steels between unalloyed steels, austenitic stainless steels or heat resisting steels, also used for welding of hardening and tempering steels, such as ballistic steels.

The increased silicon content promotes weld pool fluidity to give a smooth deposit appearance.

Classification	
EN ISO	14343-A: G 18 8 Mn
AWS	A5.9: ER 307 (approx)

Approvals	Grade
DB	●
TÜV	●

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni
0.10	7	0.8	≤ 0.030	≤ 0.025	19	9

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-120 °C
As Welded	≥420	≥590	≥40	≥100	>32

Gas test: 98% Ar+2% CO2

Shielding Gas - EN ISO 14175 : M12, M13, M20, M21

Materials

Ferrite-Austenite heterogeneous joints ("Black-White"),

Difficult-to-weld steels

X120Mn12 (1.3401); Armour plate

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1.0	●

INERTFIL 312

OERLIKON

MIG MAG Wires
Stainless and Heat resistant steels

INERTFIL 312 is a G 29 9/ER 312 type solid MAG welding wire, supplied precision layer wound, depositing a C-29Cr9Ni weld metal. Suitable for use with Ar+2%O2 or Ar+0.5…5%CO2 mixed shielding gases.

INERTFIL 312 is used for welding of steels such as medium and high carbon steels and dissimilar steel combinations. INERTFIL 312 offer a high tolerance to dilution and is therefore particularly suitable for depositing buffer layers prior to surfacing.

The deposited weld metal contains ~30% delta-ferrite in a tough austenitic matrix with high resistance to hot cracking.

Classification	
EN ISO	14343-A: G 29 9
AWS	A5.9: ER 312

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S	Cr	Ni	Ferrite
Wire	0.1	1.8	0.4	≤ 0.030	≤ 0.020	29	9	30

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C	Hardness
As Welded	≥550	≥700	≥22	≥30	220 HB

Gas test: 98% Ar+2% O2

Shielding Gas - EN ISO 14175 : M12, M13, M20, M21

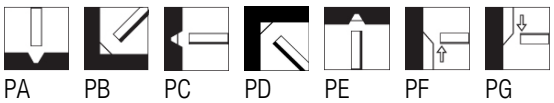
Materials

Ferrite-Austenit heterogenous joints ("Black-White"),

Difficult-to-weld steels

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
0.8	●
1.0	●
1.2	●

AIR LIQUIDE WELDING

INERTFIL 904L

OERLIKON

MIG MAG Wires
Stainless and Heat resistant steels

INERTFIL 904L is a G 20 25 5 Cu L / ER385 type solid MAG welding wire, supplied precision layer wound, depositing a 20Cr25Ni5Mo weld metal. Suitable for use with Ar+2%O2 or Ar+0.5…5%CO2 mixed shielding gases.

INERTFIL 904L is used for welding of ASTM 316 or similar steels, when a ferrite-free weld metal is required. Mainly used in cryogenic and non-magnetic applications. The impact strength at low temperatures is excellent. Also used for welding 904L to ASTM 304 and 316.

INERTFIL 904L has a very good corrosion resistance to general, pitting and crevice corrosion as well as stress corrosion cracking.

Classification	
EN ISO	14343-A: G 20 25 5 Cu L
AWS	A5.9: ER 385

Approvals	Grade
TÜV	●

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	Cu
0.020	1.9	0.4	≤ 0.020	≤ 0.020	20	25	4.5	1.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-196 °C
As Welded	≥ 410	≥ 560	≥ 35	≥ 80	≥ 32

Gas test: 81% Ar + 18% He + 1% CO2

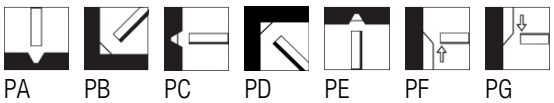
Shielding Gas - EN ISO 14175 : M12, M13

Materials

URANUS B6; AISI 904L; 1.4539 (X1NiCrMoCu25-20-5); 1.4439 (X2CrNiMoN17-13-5);

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1.0	●
1.2	●

INERTFIL 20 16 L

OERLIKON

MIG MAG Wires
Stainless and Heat resistant steels

INERTFIL 20 16 L is a G 20 16 3 Mn N L type solid MAG welding wire, supplied precision layer wound, depositing a low C-20Cr16Ni3Mo weld metal. Suitable for use with Ar+2%O2 or Ar+0.5…5%CO2 mixed shielding gases.

INERTFIL 20 16 L is suitable for welding or hardfacing austenitic stainless steels and 5% Ni steels.

INERTFIL 20 16 L has a good resistant to intercrystalline corrosion and wet corrosion <350 °C, seawater resistant, and good resistance to nitric acid. Very good toughness at low temperature.

Classification
EN ISO 14343-A:G 20 16 3 Mn N L

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	N
0.020	7	0.9	≤ 0.020	≤ 0.020	20	17	3	0.15

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-196 °C
As Welded	≥450	≥580	≥38	>100	>32

Gas test: 81% Ar + 18% He + 1% CO2

Shielding Gas - EN ISO 14175 : M12, M13

Materials

X2CrNiMoN17-13-3 (1.4429)

X2CrNiMoN18-14-3 (1.3952); X2CrNiMo18-14-3 (1.4435)

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1.0	●
1.2	●

AIR LIQUIDE WELDING

INERTFIL 22 9 3

INERTFIL 22 9 3 is a G 22 9 3 N L / ER 2209 type solid MAG welding wire, supplied precision layer wound, depositing a low C-22Cr8Ni3Mo weld metal. Suitable for use with Ar+2%O2 or Ar+0.5…5%CO2 mixed shielding gases.

INERTFIL 22 9 3 is used for the welding of duplex stainless steels in a range of applications including the fabrication of pipe and plate.

The weld metal has a PREN value >35 giving a high resistance to pitting and stress corrosion cracking especially in high chloride media. The nickel is over matches the parent material by 2-3% to provide an optimum balance of austenite and ferrite in the as welded condition.

Classification	
EN ISO	14343-A:G 22 9 3 N L
AWS	A5.9: ER 2209

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	N	Ferrite
0.020	1.7	0.5	≤ 0.025	≤ 0.020	23	9	3	0.15	30-65

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-40 °C
As Welded	≥480	≥680	≥ 22	≥50	≥32

Gas test: 81% Ar + 18% He + 1% CO2

Shielding Gas - EN ISO 14175 : M12, M13

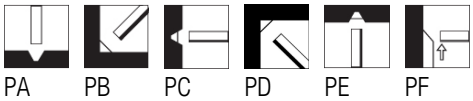
Materials

1.4462 (X2CrNiMoN22-5-3)

UNS S31803 - S31500 - S31200 - S32304

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
0.8	●
1.0	●
1.2	●

INERTFIL 25 10 4

OERLIKON

MIG MAG Wires
Stainless and Heat resistant steels

INERTFIL 25 10 4 is a G 25 9 4 N L type solid MAG welding wire, supplied precision layer wound, depositing a C-25Cr10Ni4Mo weld metal. Suitable for use with Ar+2%O2 or Ar+0.5…5%CO2 mixed shielding gases.

INERTFIL 25 10 4 is used for the welding of Super-Duplex stainless steels. Mainly used in Offshore applications, paper industry, oil industry and artificial manure production. This type is often used for root pass welding of 22%Cr standard duplex steels for critical applications, also for the welding of low carbon super martensitic 13%Cr steels.

INERTFIL 25 10 4 has a very good resistance to general corrosion, the weld metal has a high resistance to pitting with a PREN>40 value combined with a good resistance to crevice corrosion as well as stress corrosion cracking. The nickel over matches the parent material by 2-3% to provide an optimum balance of austenite and ferrite in the as welded condition.

Classification	
EN ISO	14343-A: G 25 9 4 N L
AWS	A5.9: ER 2594

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	N	Ferrite
0.010	0.6	0.5	≤ 0.020	≤ 0.020	25	9.5	4	0.25	35-70

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-40 °C
As Welded	≥ 550	≥ 800	≥ 25	≥ 80	≥ 32

Gas test: 98% Ar+2% O2

Shielding Gas - EN ISO 14175 : M13

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
0.8	●
1.0	●
1.2	●

AIR LIQUIDE WELDING

CARBOCAST NiFe

CARBOCAST NiFe is an S C NiFe1 type solid MIG/MAG welding wire, supplied layer wound for welding of cast iron. Suitable for use with inert or with Ar-CO2 mixed gases.

CARBOCAST NiFe is used for dissimilar joining and surfacing of cast iron without or with only a minimum preheating of < 300°C, cast iron cold welding. Used for welding applications on new cast-iron components made of globular gray-cast iron (GJS/GGG) and dissimilar joining of GJS to steel. Suitable for cast irons with globular graphite (GJS), black-heart cast iron (GJMB), white-heart cast iron (GJMW), austenitic cast iron and dissimilar joints to steel.

Weld at low heat input with short beads, ~10 to 30mm, and hammer pein. Weld metal can be machined.

Classification
EN ISO 1071: S NiFe1

Approvals	Grade
DB	●

Chemical analysis (Typical values in %)

C	Mn	Si	Ni	Cu	Fe	Al
0.9	0.8	0.7	55	1.0	42	0.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C	Hardness
As Welded	>290	>400	>20	>80	150-200 HB

Gas test: 98% Ar+2% CO2

Shielding Gas - EN ISO 14175 : I1, M12, M13

Materials

GJS-350 - GJS-700; GJMW-350-4 - GJMW-360-12; GJMB-300 - GJMB-700

Storage
Keep dry and avoid condensation.

Current condition and welding position
DC+

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1.0	●
1.2	●

NIFIL Ni1 is an S Ni 2061 / ER Ni-1 type solid MIG welding wire, supplied with precision layer wound, depositing Ni-3Ti1Mn weld metal. Suitable for use with inert schielding gases.

NIFIL Ni1 is suitable for welding pure nickel alloy to itself and dissimilar metal welding applications. Applications include process equipment handling alkalis and halides including chlorination and evaporation of caustic soda.

NIFIL Ni1 contains sufficient Titanium to control weld metal porosity.

Classification	
EN ISO	18274: S Ni 2061 (NiTi3)
AWS	A5.14: ER Ni-1

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni	Fe	Ti
0.1	1	0.7	≤ 0.020	≤ 0.015	Rest	0.5	3

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)
				+20 °C
As Welded	≥ 280	≥ 380	≥ 38	≥ 200

Gas test: ArHeH+C 30/2/0.12

Shielding Gas - EN ISO 14175 : I1, I3 (10-30% He), ArHeH, ArHeH+C

Materials

2.4155

Buffer layers for welding Ni- or Cu-alloys to steels

Storage
Keep dry and avoid condensation.

Current condition and welding position
DC+

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1.0	●

NIFIL 600

CE

MIG MAG Wires
Nickel and Copper alloys

NIFIL 600 is an S Ni 6082 / ER NiCr-3 type solid MIG welding wire, supplied precision layer wound, depositing Ni-20Cr3Mn2.5Nb weld metal. Suitable for use with inert shielding gases.

NIFIL 600 is used for welding of highly creep-resistant, heat and corrosion-resistant Ni-Cr alloys, where good toughness and ductility properties are required after post-weld heat treatment or prolonged operation at high temperatures. Use for 3%, 5% and 9% nickel steels to give good strength and tuoghness in LPG and LNG processing or storage plant. In sulphurous atmosphere the weld metal can be used <500°C. The thermal expansion coefficient between austenitic and ferritic steels, therefore this wire electrode is also suited for joining ferritic to austenitic steels (dissimilar) with operating temperatures or postweld heat treatment higher than 300°C. Also used for cladding of steels.

NIFIL 600 retains all-weld metal toughness -196°C, creep-resistant <800°C and is non-scaling <1000°C. Even at higher temperatures there is only limited carbon diffusion in the weld metal thus avoiding crack-prone carbide commissures in the weld interface of dissimilar joints.

Classification	
EN ISO	18274: S Ni 6082 (NiCr20Mn3Nb)
AWS	A5.14: ER NiCr-3

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Nb	Fe	Ti
0.050	3	0.3	≤ 0.020	≤ 0.015	20	Rest	2.5	2	0.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-196 °C
As Welded	≥ 380	≥ 620	≥ 35	≥ 100	≥ 55

Gas test: ArHeH+C 30/2/0.12

Shielding Gas - EN ISO 14175 : I1, I3 (10-30% He), ArHeH, ArHeH+C

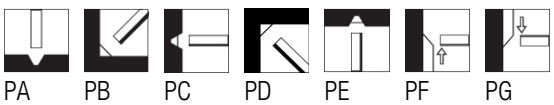
Materials

2.4816; 1.4876; 1.4958

UNS N06600; UNS N08800; UNS N08810

Storage
Keep dry and avoid condensation.

Current condition and welding position
DC+



Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1.0	●
1.2	●
1.6	●

NIFIL 625

CE

MIG MAG Wires
Nickel and Copper alloys

NIFIL 625 is an S Ni 6625 / ER NiCrMo-3 type solid MIG welding wire, supplied precision layer wound, depositing Ni-22Cr9Mo3.5Nb weld metal. Suitable for use with inert shielding gases.

NIFIL 625 is used for welding of highly corrosion-resistant Cr-Mo-Nickel base alloys such as alloy 625, alloy 825 and similar alloys. Also suitable for molybdenum alloyed corrosion-resistant steels with e.g. 7% Mo as X1NiCrMoCuN25-20-7 and cold-tough nickel steels. In sulphur-free atmospheres the weld metal is non-scaling <1200°C, in sulphurous atmospheres the weld metal can be used <500°C. Thermal expansion coefficient between austenitic and ferritic steels, therefore this wire electrode is also suited for joining ferritic to austenitic steels (dissimilar) with operating temperatures or postweld heat treatment >300°C. Also used for the cladding of steels.

NIFIL 625 is very resistant to stress corrosion cracking and pitting corrosion in a range of media including phosphoric acid, organic acids, sea water and polluting environments. Cryoganic toughness down to -196°C. Even at higher temperatures only limited carbon diffusion in the weld metal thus avoiding crack susceptible carbides in the weld interface of dissimilar joints.

Classification	
EN	18274: S Ni 6625 (NiCr22Mo9Nb)
AWS	A5.14: ER NiCrMo-3

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	Nb	Fe	Ti
0.025	0.4	0.3	≤ 0.020	≤ 0.015	21	Rest	9	3.5	3	0.3

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-196 °C
As Welded	≥ 460	≥ 720	≥ 30	≥ 100	≥ 40

Gas test: ArHeH+C 30/2/0.12

Shielding Gas - EN ISO 14175 : I1, I3 (10-30% He), ArHeH, ArHeH+C

Materials

UNS N06625; UNS N08825

2.4856; 2.4839

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	BS300	S200
Diam(mm) / weight(kg)	15	5
0.8	●	●
1.0	●	●
1.2	●	●
1.6	●	●

NIFIL NiCu7

OERLIKON

MIG MAG Wires
Nickel and Copper alloys

NIFIL NiCu7 is an S Ni 4060 / ER NiCu-7 type solid MIG welding wire, supplied precision layer wound, depositing 65Ni-30Cu3Mn2Ti (Monel-type) weld metal. Suitable for use with inert shielding gases.

NIFIL NiCu7 is used for welding of similar alloys such as 70Ni-30Cu (Monel). Suitable for joining and surfacing also on unalloyed / low alloy steels and cast steels. The weld metal has a high corrosion resistance in saline solution and sea water. Typical applications are in the chemical industry, food processing plant and seawater desalination plants.

NIFIL NiCu7 contains sufficient titanium to control weld metal porosity and for grain refinement.

Classification	
EN ISO	18274: S Ni 4060 (NiCu30Mn3Ti)
AWS	A5.14: ER NiCu7

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni	Cu	Fe
0.10	3	1	≤ 0.02	≤ 0.015	Rest	30	1

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C
As Welded	≥ 350	≥ 480	≥ 30	≥ 150

Gas test: ArHeH+C 30/2/0.12

Shielding Gas - EN ISO 14175 : I1, I3 (10-30% He), ArHeH, ArHeH+C

Materials

2.4360 (NiCu30Fe); 2.4375 (NiCu30Al); 2.4377

UNS N04400; UNS N 05500

Storage
Keep dry and avoid condensation.

Current condition and welding position
DC+

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1.0	●
1.2	●

AIR LIQUIDE WELDING

COPPERFIL CuAl8

COPPERFIL CuAl8 is an S Cu 6100 / ER CuAl-A1 type solid MIG welding wire, supplied precision layer wound, depositing Cu-8Al weld metal. Suitable for use with inert shielding gases.

COPPERFIL CuAl8 has been developed for welding copper alloys and steel castings, nickel alloys and for welding in artistic foundries. Used for welding galvanized steel sheets and components in the automobile industry.

COPPERFIL CuAl8 is an iron-free aluminum bronze, which composition offers a very high resistance to sea water-corrosion and to the most commonly used acids in any concentrations and at a wide range of operating temperatures. High erosion resistance.

Classification	
EN ISO	24373: S Cu 6100 (CuAl8)
AWS	A5.7: ER CuAl-A1

Chemical analysis (Typical values in %)

Mn	Si	Ni	Cu	Fe	Al
0.2	0.1	0.7	Rest	0.4	8.0

All-weld metal Mechanical Properties

Heat Treatment	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C	Hardness
As Welded	390-450	≥ 45	>80	80-100 HB

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1, I3

Materials

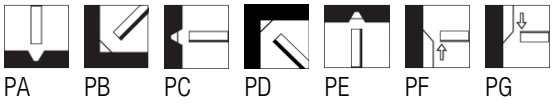
For MIG-Brazing applications

For welding of galvanized steels

Cu-Al-alloys, like CuAl8, CuAl5, G-CuAl9

Storage
Keep dry and avoid condensation.

Current condition and welding position
DC+



Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1.6	●

AMPCOTRODE G10

OERLIKON

MIG MAG Wires
Nickel and Copper alloys

AMPCOTRODE G10 is an ER CuAl-A2 type solid MIG welding wire, supplied precision layer wound, depositing Cu-9.5Al weld metal. Suitable for use with inert shielding gases.

AMPCOTRODE G10 aluminum bronze will weld and join many ferrous and nonferrous metals and combinations of dissimilar metals. These metals include the more weldable grades of cast iron, high and low carbon steels, copper, bronzes and copper-nickel alloys. Applications for AMPCOTRODE G10 include: building up bearing surfaces, joining and fabricating copper alloys, overlaying for resistance to corrosion and erosion and general maintenance and repair welding. Typical applications: cast iron, cast iron to steel, steel to bronze, silicon bronze, cupro-nickel, copper to steel, bushings, condenser boxes, brake drums, idler pulleys, paper mill rolls, tin plate mill rolls, valve seats, mixer arms, ship propellers, malleable iron, cast iron to bronze, aluminum bronze, manganese bronze, tool steel, bearings, pump housings, hydraulic pistons, tractor gear housings, pickling hooks, motor bases, impellers, gears, press rams, lance heads.

Classification	
AWS	A5.7: ER CuAl-A2

Chemical analysis (Typical values in %)

	Si	Fe	Al
Wire	max. 0.10	1.00	9.75

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
As Welded	≥ 241	≥ 545	≥ 28

Shielding Gas - EN ISO 14175 : 100% Ar

Storage
Keep dry and avoid condensation.

Current condition and welding position
DC+

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	13.6
1.2	●
1.6	●

AIR LIQUIDE WELDING

AMPCOTRODE G150

OERLIKON

MIG MAG Wires
Nickel and Copper alloys

AMPCOTRODE G150 is an ER CuAl-A3 type solid MIG welding wire, supplied precision layer wound, depositing Cu-10.5Al3.25Fe weld metal. Suitable for use with inert shielding gases.

AMPCOTRODE G150 is ideal for piston overlay applications and bearing surfaces requiring high strength and good ductility. Typical applications: hydraulic pistons, impellers, press rams, mill slippers, breaker blocks, mandrels, steel mill rolls, bearing overlays, turbine runners, cable sheaves, valve seats and parts, ceiling machine.

AMPCOTRODE G150 aluminum bronze spooled wire produces a deposit of high strength and good ductility with a nominal hardness of 166 Brinell as applied with the inert-gas processes.

Classification	
AWS	A5.7: ER CuAl-A3

Chemical analysis (Typical values in %)

	Si	Fe	Al
Wire	max. 0.10	3.25	10.75

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
As Welded	≥ 276	≥ 621	≥ 20

Shielding Gas - EN ISO 14175 : 100% Ar

Materials

Typical application is welding AMPCO 18 alloys.

Current condition and welding position

DC+

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	13.6
1.2	●
1.6	●

COPPERFIL CuSi3

COPPERFIL CuSi3 is an S Cu 6560 / ER CuSi-A type solid MIG welding wire, supplied precision layer wound, depositing Cu-3Si weld metal. Suitable for use with inert shielding gases.

COPPERFIL CuSi3 is used for welding of copper base alloys, for example, copper-silicon, copper-zinc and galvanized sheets, also welded to steel. This wire is frequently used for joining in artistic foundries, for welding galvanized sheets and even as a steel cladding. It is also suitable for surfaces subject to corrosion.

Classification	
EN ISO	24373: S Cu 6560 (CuSi3Mn1)
AWS	A5.7: ER CuSi-A

Chemical analysis (Typical values in %)

Mn	Si	Cu	Fe	Al
1.1	3.4	Rest	0.2	0.01

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation	Impact Energy ISO - V (J) +20 °C	Hardness
As Welded	>100	330-370	≥40	>50	80-90 HB

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1, I3

Materials

Cu-Al-alloys, like CuAl8, CuAl5, G-CuAl9

For MIG-Brazing applications

For galvanized steels

Storage

Keep dry and avoid condensation.

Current condition and welding position

DC+

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
0.8	●
1.0	●
1.2	●
1.6	●

COPPERFIL 70/30

OERLIKON

MIG MAG Wires
Nickel and Copper alloys

COPPERFIL 70/30 is an S Cu 7158 / ER CuNi type solid MIG welding wire, supplied precision layer wound, depositing Cu-3Si weld metal. Suitable for use with inert shielding gases.

COPPERFIL 70/30 is a solid wire suitable for welding all copper-nickel alloys such as 70/30 - 80/20 - 90/10. Excellent corrosion resistance in saline solutions.

The nickel addition strengthens the weld metal and improves the corrosion resistance, particularly against salt water. The weld metal has good hot and cold ductility.

Classification	
EN ISO	24373: S Cu 7158 (CuNi30Mn1FeTi)
AWS	A5.7: ER CuNi

Chemical analysis (Typical values in %)

Mn	Si	Ni	Cu	Fe	Ti
0.9	0.2	30	Rest	0.5	0.3

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C
As Welded	≥250	≥345	≥20	>150

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1, I3

Materials

UNS C70600; UNS C71500

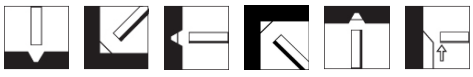
2.0872 (CuNi10Fe1Mn9); 2.0882 (CuNi30Mn1Fe); 2.0837

Storage

Keep dry and avoid condensation.

Current condition and welding position

DC+



Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1.0	●
1.2	●

ALUFIL Al99.5Ti

ALUFIL Al99,5Ti is a 1450 type aluminum solid MIG welding wire, supplied precision layer wound, depositing a 99,5% aluminum weld metal. Suitable for use with Ar, or Ar+He mixed shielding gases.

ALUFIL Al99.5Ti is used for welding of commercially pure aluminium in both wrought and cast forms.

ALUFIL Al99.5Ti is a Ti-microalloyed welding wire, with good corrosion resistance. The Ti addition reduces the crack sensitivity of the weld metal.

Classification
EN ISO 18273: S Al 1450 (Al 99.5 Ti)

Approvals	Grade
TÜV	●

CE

Chemical analysis (Typical values in %)

Al	Si	Ti
99.6	0.2	0.15

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
As Welded	≥20	≥65	≥35

Gas test: 70% Ar+30% He

Shielding Gas - EN ISO 14175 : I1, I3

Materials

Al 99; Al 99.5; Al 99,8; AlMg 0,5

Storage
Keep dry and avoid condensation.

Current condition and welding position
DC+

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	7
1.2	●
1.6	●

ALUFIL AlSi5

OERLIKON

MIG MAG Wires
Aluminum alloys

ALUFIL AlSi5 is a 4043 type aluminum solid MIG welding wire, supplied precision layer wound, depositing Al-5Si weld metal. Suitable for use with Ar, or Ar+He mixed shielding gases.

ALUFIL AlSi5 is used for welding of aluminium and aluminium alloys with a silicon content up to 7% in both wrought and cast form. Suitable for Al-Mg-Si alloys series 6000 and for dissimilar welding such as 6000/1000 or 6000/3000.

Due to its Si-alloying the weld pool is readily controllable. The weld is not sensitive for cracking and the surface is bright.

Classification	
EN ISO	18273: S Al 4043 (AlSi5)
AWS	A5.10: ER 4043

Approvals	Grade
DB	●

CE

Chemical analysis (Typical values in %)

Al	Si	Ti	Cu	Fe
Rem	5	≤ 0.2	≤ 0.3	≤ 0.8

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
As Welded	≥40	≥120	≥8

Gas test: 70% Ar+30% He

Shielding Gas - EN ISO 14175 : I1, I3

Materials

AlMgSi0.5, AlMgSi0.7, AlMgSi1

AlSi- and AlSiMg-alloys with max. 7% Si

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	7
1.2	●
1.6	●

ALUFIL AlSi12

OERLIKON

MIG MAG Wires
Aluminum alloys

ALUFIL AlSi12 is a 4047 type aluminum solid MIG welding wire, supplied precision layer wound, depositing Al-12Si weld metal. Suitable for use with Ar, or Ar+He mixed shielding gases.

ALUFIL AlSi12 is used for welding of aluminium-silicon alloys with a silicon content higher than 7%. Suitable for long term high temperature applications.

Due to the Si-alloying the weld pool is readily controllable. The weld metal is not sensitive to cracking and the surface is bright.

Classification	
EN ISO	18273: S Al 4047 (AlSi12)
AWS	A5.10: ER 4047

Chemical analysis (Typical values in %)

Al	Si	Mn	Mg	Ti	Fe
Rem	12	0.2	0.35	≤ 0.15	≤ 0.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
As Welded	≥60	≥130	≥5

Gas test: 70% Ar+30% He

Shielding Gas - EN ISO 14175 : I1, I3

Materials

G-AlSi11, G-AlSi12, G-AlSi10Mg(Cu), G-AlSi12(Cu), Al-Si-alloys with Si>7%

Storage

Keep dry and avoid condensation.

Current condition and welding position

DC+

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	7
1.0	●
1.6	●

AIR LIQUIDE WELDING

ALUFIL AlMg3

ALUFIL AlMg3 is a 5754 type aluminum solid MIG welding wire, supplied precision layer wound, depositing Al-3Mg weld metal. Suitable for use with Ar, or Ar+He mixed shielding gases.

ALUFIL AlMg3 is used for welding of 3% Mg-content aluminum.

The weld has higher strength comparing with Si-alloyed Al welding wires. Good corrosion resistance.

Classification	
EN ISO	18273: S Al 5754 (AlMg3)
AWS	A5.10: ER 5754

Chemical analysis (Typical values in %)

Al	Si	Mn	Mg	Cr	Ti	Cu	Fe
Rem	0.2	0.1	3	0.1	0.1	0.1	0.3

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
As Welded	≥80	≥190	≥20

Gas test: 70% Ar+30% He

Shielding Gas - EN ISO 14175 : I1, I3

Materials

G-AlMg3Si, AlMg1, AlMg2.5, AlMg2Mn0.3, AlMg3, G-AlMg3

Storage
Keep dry and avoid condensation.

Current condition and welding position
DC+

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	7
1.0	●
1.2	●
1.6	●

ALUFIL AlMg4.5Mn

OERLIKON

MIG MAG Wires
Aluminum alloys

ALUFIL AlMg4.5Mn is a 5183 type aluminum solid MIG welding wire, supplied precision layer wound, depositing Al-4.5Mg0.7Mn weld metal. Suitable for use with Ar, or Ar+He mixed shielding gases.

ALUFIL AlMg4.5Mn is suitable for the welding of sea- and other structures, where the strength, the toughness and the corrosion resistance are the priorities.

ALUFIL AlMg4.5Mn results the highest strength in as welded condition. Due to the high Mg-content it is not applicable for high temperature applications, because of the risk of stress corrosion.

Classification	
EN ISO	18273: S Al 5183 (AlMg4.5Mn0.7(A))
AWS	A5.10: ER 5183

Approvals	Grade
DB	●
GL	S-AlMg4,5Mn
LRS	D O BF WC/I - 1S NA
TÜV	●

CE

Chemical analysis (Typical values in %)

Al	Si	Mn	Mg	Cr	Ti	Cu	Fe
Rem	0.3	0.8	4.5	0.1	0.1	0.1	0.1

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
As Welded	≥125	≥275	≥17

Gas test: 70% Ar+30% He

Shielding Gas - EN ISO 14175 : I1, I3

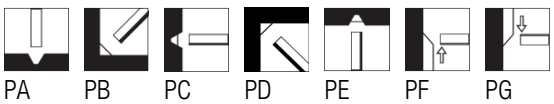
Materials

Al Mg 3, Al Mg 5, Al Mg Mn, Al Zn 4,5 Mg 1

G-Al Mg 3 Si; G-Al Mg 5 Si; G-Al Mg 10;

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	BS300	S200	S300
Diam(mm) / weight(kg)	7	2	6
1.0	●	●	●
1.2	●	●	●
1.6	●	●	●

AIR LIQUIDE WELDING

ALUFIL AlMg4.5MnZr

OERLIKON

MIG MAG Wires
Aluminum alloys

ALUFIL AlMg4.5MnZr is a 5087 type aluminum solid MIG welding wire, supplied precision layer wound, depositing Al-4.5Mg0.8Mn0.1Zr weld metal. Suitable for use with Ar, or Ar+He mixed shielding gases.

ALUFIL AlMg4.5MnZr is suitable for welding of 3-5% Mg-content aluminum.

Due to the Zirconium alloying the weld metal has a very good hot cracking resistance. Zr promotes grain refinement and increases the mechanical properties and corrosion characteristics.

Classification
EN ISO 18273: S Al 5087 (AlMg4.5MnZr)

Approvals	Grade
DB	●
GL	
LRS	
TÜV	●

CE

Chemical analysis (Typical values in %)

Al	Si	Mn	Mg	Cr	Zr	Ti	Cu	Fe
Rem	0.2	0.9	4.5	0.1	0.15	0.1	0.02	0.1

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
As Welded	≥125	≥275	≥17

Gas test: 70% Ar+30% He

Shielding Gas - EN ISO 14175 : I1, I3

Materials

G-AlMg 3 Si, G-AlMg 5 Si, G-AlMg 10

AlMg3, AlMg5, AlMgMn, AlZn4.5Mg1, AlZnMg4.5Mn, AlMgSiCu

Storage
Keep dry and avoid condensation.

Current condition and welding position
DC+

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	7
1.0	●
1.2	●
1.6	●

ALUFIL AlMg5

OERLIKON

MIG MAG Wires
Aluminum alloys

ALUFIL AlMg5 is a 5356 type aluminum solid MIG welding wire, supplied precision layer wound, depositing Al-5Mg weld metal. Suitable for use with Ar, or Ar+He mixed shielding gases.

ALUFIL AlMg5 is used for the welding of Al-Mg alloys and Al-Mg-Zn alloys. The wire is also suitable for the welding of dissimilar aluminium alloy grades containing up to 5%Mg and components which are to be subsequently anodised.

ALUFIL AlMg5 is the most popular Al welding wire, because of its high yield strength and high resistance to corrosion, including seawater.

Classification	
EN ISO	18273: S Al 5356 (AlMg5Cr(A))
AWS	A5.10: ER 5356

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

Al	Si	Mn	Mg	Cr	Ti	Cu	Fe
Rem	0.2	0.1	5	0.1	0.1	0.1	0.3

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
As Welded	≥110	≥240	≥17

Gas test: 70% Ar+30% He

Shielding Gas - EN ISO 14175 : I1, I3

Materials

Al Mg 1SiCu, Al Mg Si 0,7;

G-Al Mg 3Si; G-Al Mg 5Si

Al Mg 3, Al Mg 5, Al Zn 4,5 Mg 1;

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	BS300	S200	S300
Diam(mm) / weight(kg)	7	2	6
1.0	●	●	●
1.2	●	●	●
1.6	●	●	●
0.8		●	

AIR LIQUIDE WELDING

ALUFIL AlMg5Mn

OERLIKON

MIG MAG Wires
Aluminum alloys

ALUFIL AlMg5Mn is a 5556 type aluminum solid MIG welding wire, supplied precision layer wound, depositing Al-5Mg0.7Mn weld metal. Suitable for use with Ar, or Ar+He mixed shielding gases.

ALUFIL AlMg5Mn is used for the welding of Al-Mg alloys with 3...5% Mg content. It is used where the priority is the highest strength. Mainly used in the military industry and for constructions.

The weld metal is sea-water corrosion resistant.

Classification	
EN ISO	18273: S Al 5556 (AlMg5Mn)
AWS	A5.10: ER 5556

Chemical analysis (Typical values in %)

Al	Si	Mn	Mg	Cr	Ti	Cu	Fe
Rem	0.2	0.8	5.4	0.15	0.1	0.1	0.3

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
As Welded	≥125	≥275	≥17

Gas test: 70% Ar+30% He

Shielding Gas - EN ISO 14175 : I1, I3

Materials

AlMgSi1;

AlMg4.5Mn, AlMg5;

AlZn4.5Mg1;

AlMg5Mn, AlMg2.7Mn;

Storage

Keep dry and avoid condensation

Current condition and welding position

DC+

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	7
1.2	●
1.6	●

CARBOFIL A 350

OERLIKON

MIG MAG Wires
Hardfacing

CARBOFIL A 350 is a copper coated S Fe2 type solid MAG welding wire, supplied precision layer wound, depositing a 0.6C 1.6Mn 0.9Cr weld metal. Suitable for use with Ar+CO2 mixed shielding gases.

CARBOFIL A 350 is suitable for hardfacing of wear resistance parts with good resistance to abrasion and impact. Typical uses include: rails, rollers, axles, wheel flanges, crain wheels, etc.

The weld metal is still machinable.

Classification	
EN	14700: S Fe2
DIN	8555: MSG 2-GZ-350P

Approvals	Grade
DB	●

Chemical analysis (Typical values in %)

	C	Mn	Si	Cr
Wire	0.7	2.0	0.5	1.0
All weld metal (*)	0.6	1.6	0.4	0.9

(*) 82% Ar+18% CO2

All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded	325-380 HB

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : M20, M21, M24

Storage
keep dry and avoid condensation.

Current condition and welding position
DC+

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1.2	●

CARBOFIL A 600

CARBOFIL A 600 is a copper coated S Fe8 type solid MAG welding wire, supplied precision layer wound, depositing a 0.5C 0.3Mn 2.5Si 9.0Cr weld metal. Suitable for use with Ar+CO2 mixed shielding gases.

CARBOFIL A 600 is used for hard-surfacing applications where resistance to abrasion is required. Typical applications are: excavator parts, bucket edges, mining equipments.

CARBOFIL A 600 weld deposits can be used at service temperatures <450°C with a minimal loss of abrasion resistance. The as deposited weld metal can be shaped or profiled by grinding.

Classification	
EN	14700: S Fe 8
DIN	8555: MSG 6-GZ-60-GP

Chemical analysis (Typical values in %)

	C	Mn	Si	Cr
Wire	0.5	0.4	3	9.5
All weld metal (*)	0.5	0.3	2.5	9.0

(*) 82% Ar+18% CO2

All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded	57-62 HRC

Shielding Gas - EN ISO 14175 : M20, M21, M24

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1.2	●

TIG RODS

OERLIKON

TIG rods / C-Mn and low-alloy steels			
Product name	AWS	EN / EN ISO / DIN	Page
CARBOROD	A5.18: ER 70S-3	636-A: W 42 4 W2Si	307
CARBOROD 1	A5.18: ER 70S-6	636-A: W 42 4 W3Si1	308
CARBOROD 1A	A5.18: ER 70S-6	636-A: W 46 5 W4Si1	309
CARBOROD A15	A5.18: ER 70S-2	636-A: W2Ti	310
CARBOROD Ni1	A5.28: ER 80S-Ni1	636-A: W 46 6 M W3Ni1	311
CARBOROD Ni2	A5.28: ER 80S-Ni2	636-A: W 46 9 M W2Ni2	312
CARBOROD Ni3	A5.28: ER 80S-Ni3	636-B: W 55A 10 WN71	313
CARBOROD Mo	A5.28: ER 70S-A1	21952-A: W Mo Si	314
CARBOROD CrMo1	A5.28: ER 80S-G	21952-A: W CrMo1 Si	315
CARBOROD KV5	A5.28: ER 80S-B2	21952-B: W 55M 1CM	316
CARBOROD CrMo2	A5.28: ER 90S-G	21952-A: W CrMo2 Si	317
CARBOROD KV3	A5.28: ER 90S-B3	21952-B: W 62M 2C1M	318
CARBOROD W 225V	A5.28: ER 90S-G	-	319
CARBOROD CrMo5	A5.28: ER 80S-B6	21952-A: W CrMo5 Si	320
CARBOROD CrMo9	A5.28: ER 80S-B8	21952-A: W CrMo9	321
CARBOROD KV7M	A5.28: ER 90S-B9	21952-A: W CrMo91	322
CARBOROD NiCu	A5.28: ER 80S-G	-	323
CARBOROD 80S-D2	A5.28: ER 80S-D2	-	324
CARBOROD NiMo1	A5.28: ER 90S-G	16834-A: W Mn3Ni1Mo	325

TIG rods / Stainless and Heat resistant steels			
Product name	AWS	EN / EN ISO / DIN	Page
INERTROD 410	A5.9: ER 410	14343-A: W 13	326
INERTROD 410NiMo	A5.9: ER 410NiMo	14343-A: W 13 4	327
INERTROD 420	A5.9: ER 420	-	328
INERTROD 430	A5.9: ER 430	14343-A: W 17	329
INERTROD 308L	A5.9: ER 308L	14343-A: W 19 9 L	330
INERTROD 308L T	A5.9: ER 308L	14343-A: W 19 9 L	331
INERTROD 308LSi	A5.9: ER 308LSi	14343-A: W 19 9 L Si	332
INERTROD 347	A5.9: ER 347	14343-A: W 19 9Nb	333
INERTROD 347Si	A5.9: ER 347Si	14343-A: W 19 9 Nb Si	334
INERTROD 316L	A5.9: ER 316L	14343-A: W 19 12 3L	335
INERTROD 316L T	A5.9: ER 316L	14343-A: W 19 12 3L	336
INERTROD 316LSi	A5.9: ER 316LSi	14343-A: W 19 12 3 L Si	337
INERTROD 318	A5.9: ER 318	14343-A: W 19 12 3 Nb	338
INERTROD 318Si	-	14343-A: W 19 12 3 Nb Si	339
INERTROD 308H	A5.9: ER 308H	14343-A: W 19 9 H	340
INERTROD 310	A5.9: ER 310	14343-A: W 25 20	341
INERTROD 309L	A5.9: ER 309L	14343-A: W 23 12L	342
INERTROD 309LSi	A5.9: ER 309LSi	14343-A: W 23 12L	343
INERTROD 309LMo	A5.9: ER 309LMo	14343-A: W 23 12 2 L	344
INERTROD 307	A5.9: ~ ER 307	14343-A: W 18 8 Mn	345
INERTROD 312	A5.9: ER 312	14343-A: W 29 9	346
INERTROD 904L	A5.9: ER 385L	14343-A: W 20 25 5 Cu L	347
INERTROD 20 16 L	-	14343-A: W 20 16 3 Mn N L	348
INERTROD 22 9 3	A5.9: ER 2209	14343-A: W 22 9 3 N L	349
INERTROD 25 10 4	A5.9: ER 2594	14343-A: W 25 9 4 N L	350

Overview of TIG welding rods

Product list with classification according to standards

TIG rods / Nickel and Copper alloys			
Product name	AWS	EN / EN ISO / DIN	Page
NIROD Ni1	A5.14: ER Ni-1	18274: S Ni 2061 (NiTi3)	351
NIROD 600	A5.14: ER NiCr 3	18274: S Ni 6082 (NiCr20Mn3Nb)	352
NIROD 625	A5.14: ER NiCrMo-3	18274: S Ni 6625 (NiCr22Mo9Nb)	353
NIROD NiCu7	A5.14: ER NiCu 7	18274: S Ni 4060 (NiCu30MnTi)	355
CUROD	A5.7: ER Cu	24373: S Cu 18 98 (CuSn1)	356
AMPCOTRODE T150	A5.7: ER CuAl-A3	-	357

TIG rods / Aluminum alloys			
Product name	AWS	EN / EN ISO / DIN	Page
ALUROD Al99.5Ti	A5.10: ER 1100	18273: S Al 1450 (Al99.5Ti)	358
ALUROD AlSi5	A5.10: ER 4043	18273: S Al 4043 (AlSi5)	359
ALUROD AlSi12	A5.10: ER 4047	18273: S Al 4047 (AlSi12)	360
ALUROD AlMg3	A5.10: ER 5754	18273: S Al 5754 (AlMg3)	361
ALUROD AlMg4.5Mn	A5.10: ER 5183	18273: S Al 5183	362
ALUROD AlMg4.5MnZr	-	18273: S Al 5087 (AlMg4,5MnZr)	363
ALUROD AlMg5	A5.10: ER 5356	18273: S Al 5356	364

TIG rods / Hardfacing			
Product name	AWS	EN / EN ISO / DIN	Page
CITOLIT 6CT	A5.21: ERCoCr-A	8555: WSG-20-GO-40-CTZ	365
CITOLIT 12CT	A5.21: ERCoCr-B	8555: WSG-20-GO-50-CSTZ	366
CITOLIT 21CT	A5.21: ERCoCr-E	8555: WSG-20-GO-300-CKTZ	367
CITOLIT 25CT	-	8555: WSG 20-GZ-250-CKTZ	368

TIG Rods
C-Mn steels and low-alloy steels

CARBOROD is a copper coated W2Si/ER70S-3 type solid TIG welding rod. Suitable for use mainly with Ar shielding gas.

CARBOROD is suitable for welding mild and C-Mn steels, generally used for the root pass and to support welding when no back pass is possible. Excellent mechanical and toughness properties for low temperature applications, down to -40°C.

Classification	
EN ISO	636-A: W 42 4 W2Si
AWS	A5.18: ER 70S-3

Approvals	Grade
DB	●
DNV	

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.07	1	0.65	≤ 0.025	≤ 0.025

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-40 °C
As Welded	≥ 420	500-640	≥ 20	≥ 90	≥ 47

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

S(P)235 to S(P)355; GP240; GP280

Storage
Keep dry and avoid condensation

Current condition and welding position
DC-

Packaging data

Diam. (mm)	Length (mm)	Packaging Type	Weight (kg)	Code
1.2	1000	TUB	5	●
1.6	1000	TUB	5	●
2.0	1000	TUB	5	●
2.4	1000	TUB	5	●
3.2	1000	TUB	5	●

CARBOROD 1

OERLIKON

TIG Rods
C-Mn steels and low-alloy steels

CARBOROD 1 is a copper coated W3Si1/ER70S-6 type solid TIG welding rod. Suitable for use mainly with Ar shielding gas.

CARBOROD 1 is suitable for welding mild and C-Mn steels. and is generally used for the root pass and to support welding when no back pass is possible. Excellent mechanical and toughness properties for low temperature applications, down to -50°C.

Classification	
EN ISO	636-A: W 42 4 W3Si1
AWS	A5.18: ER 70S-6

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.08	1.5	0.9	≤ 0.025	≤ 0.025

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-50 °C
As Welded	≥ 420	500-640	≥ 24	≥ 90	≥ 47

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

S(P)235 - S(P)420

GP240; GP280

Storage
Keep dry and avoid condensation

Current condition and welding position
DC-

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.2	TUB	5	●
1.6	TUB	5	●
2.0	TUB	5	●
2.4	TUB	5	●
3.2	TUB	5	●

AIR LIQUIDE WELDING

CARBOROD 1A

OERLIKON

TIG Rods
C-Mn steels and low-alloy steels

CARBOROD 1A is a copper coated W4Si1/ER70S-6 type solid TIG welding rod depositing a C-1.5Mn weld metal. Suitable for use mainly with Ar shielding gas.

CARBOROD 1A is used for the welding of mild and C-Mn steels, requiring a yield strength <460MPa, with impact toughness properties down to -50°C.

Increased levels of manganese and silicon scavenge oxides and promote weld pool fluidity resulting in a superior weld bead appearance with an even contour finish.

Classification	
EN ISO	636-A: W 46 5 W4Si1
AWS	A5.18: ER 70S-6

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.08	1.7	0.9	≤0.020	≤0.020

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-50 °C
As Welded	≥ 460	550-680	≥ 24	≥ 120	≥ 60

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

S(P)235 - S(P)460

GP240; GP280

Storage

Keep dry and avoid condensation

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.0	TUB	5	●
1.2	TUB	5	●
2.0	TUB	5	●
3.2	TUB	5	●
3.2	TUB	5	●
4.0	TUB	5	●
4.0	TUB	5	●

CARBOROD A15

OERLIKON

TIG Rods
C-Mn steels and low-alloy steels

CARBOROD A15 is a copper coated G2Ti/ER70S-2 type solid TIG welding rod. Suitable for use mainly with Ar shielding gas.

CARBOROD A15 is a microalloyed steel rod, triple-deoxidised with Ti, Al and Zr elements, used to weld C-Mn and low-alloyed steels with light contamination or oxides on the surface, and for welding of galvanised steels with a tensile strength of 580 MPa, because of better fusion characteristics compared to standard unalloyed rods. Good low temperature toughness.

Classification	
EN ISO	636-A: W2Ti
AWS	A5.18: ER 70S-2

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ti	Al	Zr
0.06	1.30	0.65	≤0.025	≤0.025	0.13	0.10	0.11

All-weld metal Mechanical Properties

Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
			+20 °C	-20 °C
≥ 520	≥ 600	≥ 24	≥ 100	≥ 50

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Storage
Keep dry and avoid condensation.

Current condition and welding position
DC-

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.0	TUB	5	●
1.2	TUB	5	●
2.4	TUB	5	●
3.2	TUB	5	●
3.2	TUB	5	●
4.0	TUB	5	●
4.0	TUB	5	●

AIR LIQUIDE WELDING

CARBOROD Ni1

OERLIKON

TIG Rods
C-Mn steels and low-alloy steels

CARBOROD Ni1 is a copper coated W3Ni1/ER 80S-Ni1 type solid TIG welding rod depositing a C-0.8Mn 1.0Ni weld metal. Suitable for use with Ar shielding gas.

CARBOROD Ni1 is used for welding of 1%Ni steels and fine grain steels, when the weld metal toughness properties down to –60°C are required in the as welded conditions. The weld metal contains less than 1%Ni conforming to NACE requirement.

Classification	
EN ISO	636-A: W 46 6 W3Ni1
AWS	A5.28: ER 80S-Ni1

Approvals	Grade
ABS	ER 80S-Ni1
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni
0.08	1.1	0.6	≤ 0.020	≤ 0.020	0.9

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-60 °C
As Welded	≥ 480	550-680	≥ 24	≥ 120	≥ 47

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

S(P)235-S(P)460, GP240-GP280

Storage
Keep dry and avoid condensation

Current condition and welding position
DC-

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.6	TUB	5	●
2.0	TUB	5	●
2.4	TUB	5	●
3.2	TUB	5	●

CARBOROD Ni2

OERLIKON

TIG Rods
C-Mn steels and low-alloy steels

CARBOROD Ni2 is a copper coated W2Ni2 / ER 80S-Ni2 type solid TIG welding rod depositing a C-0.8Mn2.3Ni weld metal. Suitable for use with Ar shielding gas.

CARBOROD Ni2 is used for the welding of 2%Ni-steels, when the weld metal toughness properties to –90°C are required in the as welded conditions.

Classification	
EN ISO	636-A: W 46 9 M W2Ni2
AWS	A5.28: ER 80S-Ni2

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni
0.08	1.1	0.5	≤ 0.015	≤ 0.015	2.3

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)		
				+20 °C	-70 °C	-90 °C
As Welded	≥ 460	550-680	≥ 24	≥ 150	≥ 60	≥ 47

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

S(P)275 - S(P)460

Storage
Keep dry and avoid condensation

Current condition and welding position
DC-

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.6	TUB	5	●
3.2	TUB	5	●

AIR LIQUIDE WELDING

CARBOROD Ni3

OERLIKON

TIG Rods
C-Mn steels and low-alloy steels

CARBOROD Ni3 is an ER 80S-Ni3 type solid TIG welding rod depositing a C-1.0Mn3.2Ni weld metal. Suitable for use with mainly Ar shielding gas.

CARBOROD Ni3 is used for welding 3.5% nickel steels for low temperatures service, where weld metal toughness properties down to -101°C are required.

Classification	
EN ISO	636-B: W 55A 10 WN71
AWS	A5.28: ER 80S-Ni3

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni
0.08	0.8	0.5	≤0.010	≤0.010	3.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				-80 °C	-101 °C
As Welded	≥ 460	≥ 550	≥ 22	≥ 130	≥47

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

ASTM A203 Grades D, E, F

Storage

Keep dry and avoid condensation

Current condition and welding position

DC-

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.6	TUB	5	●
2.0	TUB	5	●
2.4	TUB	5	●
3.2	TUB	5	●

CARBOROD Mo

OERLIKON

TIG Rods
C-Mn steels and low-alloy steels

CARBOROD Mo is a copper coated WMoSi/ER70S-A1 type solid TIG welding rod depositing a C-0.8Mn0.5Mo weld metal. Suitable for use with Ar shielding gas.

CARBOROD Mo is used for welding low alloy creep resistant ferritic steels, used in chemical plant construction operating at elevated temperatures <500°C. Suitable for applications in petrochemical process plant where some resistance to hot hydrogen attack is necessary, and for welding of micro-alloyed steels where increased strength is required.

Classification	
EN ISO	21952-A: W Mo Si
AWS	A5.28: ER 70S-A1

Approvals	Grade
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Mo
0.10	1.0	0.6	≤0.020	≤0.020	0.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-20 °C
As Welded	≥ 480	≥ 550	≥ 29	≥ 120	≥ 47

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

S(P)235-S(P)460; 16Mo3

Storage
Keep dry and avoid condensation

Current condition and welding position
DC-

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.2	TUB	5	●

AIR LIQUIDE WELDING

CARBOROD CrMo1

OERLIKON

TIG Rods
C-Mn steels and low-alloy steels

CARBOROD CrMo1 is a copper coated WCrMo1Si/ER80S-G type solid TIG welding rod depositing a C-1¼Cr ½Mo weld metal for the welding of creep resisting steels. Suitable for use with Ar shielding gas.

CARBOROD CrMo1 is used for welding of similar composition used in power generation and chemical plant applications for service temperatures <550°C. Also suitable where some resistance to hydrogen attack by sulphur bearing crude oil is required. Main applications include boilers, plate and tube steels as well as for the welding of quenched and tempered and case hardening steels, e.g. 13CrMo4-5 or ASTM A335 P11/P12.

CARBOROD CrMo1 is specified where the operational guidelines are given by EN norms.

Classification	
EN ISO	21952-A: W CrMo1 Si
AWS	A5.28: ER 80S-G

Approvals	Grade
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Mo
0.08	1.2	0.6	≤ 0.020	≤ 0.020	1.2	0.6

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-30 °C
690 °C x 1h	≥ 355	≥ 550	≥ 22	≥ 100	≥ 70

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

13CrMo4-5, 13CrMoSi5-5; G17CrMo5-5

Storage
Keep dry and avoid condensation

Current condition and welding position
DC-

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.6	TUB	5	●
2.0	TUB	5	●
2.4	TUB	5	●

CARBOROD KV5

OERLIKON

TIG Rods
C-Mn steels and low-alloy steels

CARBOROD KV5 is a copper coated ER80S-B2 type solid TIG welding rod depositing a C-1¼Cr ½Mo weld metal for the welding of creep resisting steels. Suitable for use with Ar shielding gas.

CARBOROD KV5 is used for welding of similar composition used in power generation and chemical plant applications for service temperatures <550°C. Also suitable where some resistance to hydrogen attack by sulphur bearing crude oil is required. Main applications include boilers, plate and tube steels as well as for the welding of quenched and tempered and case hardening steels produced mainly from steels 13CrMo4-5 or ASTM A335 P11/P12.

The CARBOROD KV5 deposits very clean weld metal with guaranteed Bruscato factor X<13, and with controlled As, Sb, Sn content to minimise the propensity to temper embrittlement. CARBOROD KV5 is proposed, where the operational guidelines are given by the ASME norms.

Classification	
EN ISO	21952-B: W 55M 1CM
AWS	A5.28: ER 80S-B2

Approvals	Grade
TÜV	●

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Mo
0.08	0.56	0.50	≤0.020	≤0.020	1.25	≤0.50

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -29 °C
PWHT 620°C x 1h	≥470	≥550	≥20	≥47
PWHT 690°C x 1h	≥355	≥550	≥20	≥70

Gas test: I1

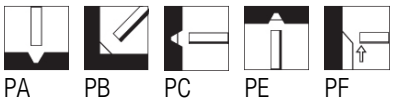
Shielding Gas - EN ISO 14175 : I1

Materials

13CrMo4-5; 13CrMoSi5-5; G17CrMo5-5

Storage
Keep dry and avoid condensation.

Current condition and welding position
DC-



Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.6	TUB	5	●
2.0	TUB	5	●
2.4	TUB	5	●

AIR LIQUIDE WELDING

CARBOROD CrMo2

OERLIKON

TIG Rods
C-Mn steels and low-alloy steels

CARBOROD CrMo2 is a copper coated WCrMo2Si/ER90S-G type solid TIG welding rod depositing a 2¼Cr 1Mo weld metal for the welding of creep resistant steels. Suitable for use with Ar shielding gas.

CARBOROD CrMo2 is used for welding of similar composition and ½Mo ¼V and 1%Cr 1Mo steels. Used in th e construction of steam generating plant operating at temperatures <600°C. Also suitable for the welding of 1¼Cr 1Mo steels where improved resistance to hydrogen attack or corrosion by sulphur is required. Main applications include the welding of boilers, plates and tubes as well as in oil refineries e.g. in crack plants produced from mainly 10CrMo9-10 (ASTM A335 Gr. P/T22).

CARBOROD CrMo2 is specified, where the operational guidelines are given by EN norms.

Classification	
EN ISO	21952-A: W CrMo2 Si
AWS	A5.28: ER 90S-G

Approvals	Grade
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Mo
0.09	1.1	0.7	≤ 0.020	≤ 0.020	2.5	1

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-30 °C
690 °C x 1h	≥ 400	≥ 620	≥ 22	≥ 120	≥ 70

Gas test: 100% Ar

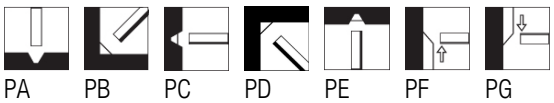
Shielding Gas - EN ISO 14175 : I1

Materials

10CrMo9 - 10, 12CrMo9 - 10; A387 Gr.22, Cl 1 and 2, A 182 Gr.F 22, A 336 Gr.F22

Storage
Keep dry and avoid condensation

Current condition and welding position
DC-



Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.6	TUB	5	●
2.4	TUB	5	●

CARBOROD KV3

OERLIKON

TIG Rods
C-Mn steels and low-alloy steels

CARBOROD KV3 is a copper coated ER90S-B3 type solid TIG welding rod depositing a 2¼Cr 1Mo weld metal for the welding of creep resistant steels. Suitable for use with Ar shielding gas.

CARBOROD KV3 is used for the welding of similar composition and ½Mo ¼V and 1%Cr 1Mo steels. Used in the construction of steam generating plant operating at temperatures <600°C. Also suitable for the welding of 1¼Cr 1Mo steels where improved resistance to hydrogen attack or corrosion by sulphur is required. Main applications are welding of boilers, plates and tubes as well as in oil refineries e.g. in crack plants produced from mainly 10CrMo9-10 (ASTM A335 Gr. P/T22).

CARBOROD KV3 deposits very clean weld metal with a guaranteed Bruscato factor of X<15, and with controlled As, Sb, Sn content to minimise the susceptibility to temper embrittlement. CARBOROD KV3 is specified, where the operational guidelines are given by ASME norms.

Classification	
EN ISO	21952-B: W 62M 2C1M
AWS	A5.28: ER 90S-B3

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Mo
0.08	0.60	0.55	≤0.020	≤0.020	2.40	1

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -29 °C
PWHT 620°C x 1h	≥540	≥620	≥ 18	≥47
PWHT 690°C x 1h	≥400	≥620	≥ 18	≥70

Gas test: I1

Shielding Gas - EN ISO 14175 : I1

Materials

10CrMo9-10; 12CrMo9-10; A387 Gr.22; Cl 1 and 2; A 182 Gr.F 22; A 336 Gr.F22

Storage

Keep dry and avoid condensation.

Current condition and welding position

DC-

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.6	TUB	5	●
2.0	TUB	5	●
2.4	TUB	5	●

AIR LIQUIDE WELDING

CARBOROD W 225V

OERLIKON

TIG Rods
C-Mn steels and low-alloy steels

CARBOROD W 225V is a copper coated ER90S-G type solid TIG welding rod depositing a 2¼Cr 1MoV weld me tal for the welding of creep resistant steels. Suitable for use with Ar shielding gas.

CARBOROD W 225V is used for welding of 2¼CrMoV (P22V) steels. Used in the petrochemical industry for hydrocrackers and heavy wall pressure vessels for hydrogen service.

CARBOROD W 225V has a very low impurity deposit. For very heavy wall-thickness in P22V it could be necessary to apply intermediate stress relieving treatments to reduce the overall stress level.

Classification	
AWS	A5.28: ER 90S-G

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Mo	Nb	V
≤ 0.13	≤ 1	≤ 0.2	2.5	1	0.02	0.25

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -29 °C
710 °C x 8h	≥ 500	≥ 680	≥ 18	≥ 100

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

ASTM541 Gr22V - SA336 F22V - SA832 Gr21V

12 Cr Mo V 910

Storage

Keep dry and avoid condensation

Current condition and welding position

DC-

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.6	TUB	5	●
2.0	TUB	5	●
2.4	TUB	5	●

CARBOROD CrMo5

OERLIKON

TIG Rods
C-Mn steels and low-alloy steels

CARBOROD CrMo5 is a copper coated WCrMo5Si/ER 80S-B6 type solid TIG welding rod depositing a nominal C-0.3Mn5.6Cr0.6Mo low alloy steel weld metal. Suitable for use with Ar shielding gas.

CARBOROD CrMo5 is used for welding elevated temperature creep resisting steels of similar composition (P/T5) as used in the power generation and petrochemical industries where corrosion resistance to steam, hot hydrogen gas and high sulphur crude oils is a requirement.

Classification	
EN ISO	21952-A: W CrMo5 Si
AWS	A5.28: ER 80S-B6

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Mo
0.07	0.5	0.5	≤ 0.020	≤ 0.020	5.7	0.6

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-30 °C
760 °C x 1h	≥ 470	≥ 590	≥ 20	≥ 100	≥ 60

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

12CrMo19-5, X12CrMo5; A182 Gr. F5, A199 Gr. T5, A213 Gr.T5, A335 Gr.P5

A 336 Cl. F5, A 369 Gr. FP5, A 387 Gr.5, Cl 1 and 2

Storage
Keep dry and avoid condensation

Current condition and welding position
DC-

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.6	TUB	5	●

AIR LIQUIDE WELDING

CARBOROD CrMo9

OERLIKON

TIG Rods
C-Mn steels and low-alloy steels

CARBOROD CrMo9 is a copper coated WCrMo9/ER 80S-B8 solid TIG welding rod depositing a nominal C-0.4Mn9Cr1Mo low alloy steel weld metal. Suitable for use with Ar shielding gas.

CARBOROD CrMo9 is used for welding creep resisting steels of the type 9Cr - 1Mo (P/T9) used for working at elevated temperatures <600°C where creep resistance and strength are required for in service applications including high temperature steam, hot hydrogen and high sulphur crude oil.

Classification	
EN ISO	21952-A: W CrMo9
AWS	A5.28: ER 80S-B8

Approvals	Grade
DB	●

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo
0.06	0.7	0.5	≤0.025	≤0.025	9.0	0.06	1.0

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C
760°C x 2h	≥ 470	≥ 590	≥ 18	≥ 34

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

A335 Gr.P9

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.6	TUB	5	●
2.0	TUB	5	●
2.4	TUB	5	●

CARBOROD KV7M

OERLIKON

TIG Rods
C-Mn steels and low-alloy steels

CARBOROD KV7M is a copper coated WCrMo91/ER90S-B9 type solid TIG welding rod for welding creep resisting steels of the type 9Cr 1Mo V Nb N. Suitable for use with Ar shielding gas.

CARBOROD KV7M is especially designed for the ASTM steels T91/P91. Approved in long-term service at temperatures <650°C.

Improved creep strength is obtained by the addition of nitrogen, niobium and vanadium.

Classification	
EN ISO	21952-A: W CrMo91
AWS	A5.28: ER 90S-B9

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo	Nb	V
0.10	0.6	0.20	9.0	0.9	1.0	0.06	0.20

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C
760 °C x 2h / Ofen bis 300 °C / Luft	≥ 560	≥ 650	≥ 17	≥ 50

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

1.4903; X10CrMoV 9-1, X10CrMoVNb9-1; A199 T91, A200 T91, A213 T91, A355 P91, A336 P91

Storage
Keep dry and avoid condensation

Current condition and welding position
DC-

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.6	TUB	5	●
2.0	TUB	5	●
2.4	TUB	5	●

AIR LIQUIDE WELDING

CARBOROD NiCu

OERLIKON

TIG Rods
C-Mn steels and low-alloy steels

CARBOROD NiCu is a copper coated ER80S-G type solid TIG welding rod depositing a C-1Mn 0.8Ni 0.4Cu weld metal for welding of weathering steels such as COR-TEN, Patinax, etc. Suitable for use mainly with Ar shielding gas.

CARBOFIL NiCu is suitable for welding a range of structural weather resistant steels in applications such as bridge fabrication, exposed frame structures, transmission towers, barriers, ducting, chimneys, shields and inner exhaust systems. Due to the alloying system, CARBOFIL NiCu can also be used for welding of high yield strength steels.

The addition of Ni and Cu to the weld metal provides increased resistance to atmospheric corrosion compared to conventional C-Mn steels.

Classification	
AWS	A5.28: ER 80S-G

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Cu
0.06	1.4	0.8	≤0.025	≤0.025	0.3	0.8	0.4

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-40 °C
As Welded	≥420	500-640	≥22	≥120	≥80

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

S235J0W, S235J2W, S355J0W, S355J2W, S355K2W

Storage

Keep dry and avoid condensation

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.6	TUB	5	●
2.0	TUB	5	●
2.4	TUB	5	●
3.2	TUB	5	●

CARBOROD 80S-D2

OERLIKON

TIG Rods
C-Mn steels and low-alloy steels

CARBOROD 80S-D2 is a copper coated ER 80S-D2 type solid TIG welding rod. Suitable for use mainly with Ar shielding gas.

CARBOROD 80S-D2 is used for the welding of a range of carbon, low alloyed and higher strength steels in both the as welded and postweld heat-treated conditions.

CARBOROD 80S-D2 contains molybdenium for increased deposit strength and a high level of deoxidizers (Mn and Si) to control porosity.

Classification	
AWS	A5.28: ER 80S-D2

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni	Mo
0.09	1.9	0.6	≤ 0.02	≤ 0.02	0.15	0.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -20 °C
620 °C x 1h	≥ 470	≥ 550	≥ 22	≥ 47

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

S(P)235-S(P)460, 16Mo3

Storage
Keep dry and avoid condensation

Current condition and welding position
DC-

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.2	TUB	5	●

AIR LIQUIDE WELDING

CARBOROD NiMo1

CARBOROD NiMo1 is a copper coated WMn3Ni1Mo/ER90S-G type solid TIG welding rod depositing C-1.5Mn1.0Ni0.4Mn weld metal for welding of high strength steels. Suitable for use mainly with Ar shielding gas.

CARBOROD NiMo1 deposits weld metal with excellent mechanical properties for the welding of higher yield strength steels, <620 MPa. The weld metal has good impact toughness values down to -40°C. Typical applications include the welding of higher strength fine grained steels used in the fabrication of oil field equipment, process plant and cranes, where low temperature weld metal toughness properties are also required.

Low heat inputs are recommended to obtain optimum joint mechanical properties.

Classification	
EN ISO	16834-A: W Mn3Ni1Mo
AWS	A5.28: ER 90S-G

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni	Mo
0.08	1.8	0.6	≤ 0.015	≤ 0.018	1	0.4

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-40 °C
As Welded	≥ 620	700-890	≥ 20	≥ 120	≥ 80

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

S(P)460-S(P)620

Storage

Keep dry and avoid condensation

Current condition and welding position

DC-

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.2	TUB	5	●
1.6	TUB	5	●
2.0	TUB	5	●
2.4	TUB	5	●
3.2	TUB	5	●
4.0	TUB	5	●

INERTROD 410

OERLIKON

TIG Rods
Stainless and Heat resistant steels

INERTROD 410 is a ER410/W13 type solid TIG welding rod depositing a C-13%Cr weld metal. Suitable for use mainly with Ar shielding gas.

INERTFIL 410 is mainly used for the deposition of overlays on carbon steels to resist corrosion, erosion or abraison.

Classification	
EN ISO	14343-A: W 13
AWS	A5.9: ER 410

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr
0.1	0.45	0.4	≤ 0.030	≤ 0.020	13.0

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 20 °C
750 °C x 1h	≥ 350	≥ 450	≥ 20	≥ 47

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

AISI 410

1.4000 (X6Cr13); 1.4006 (X12Cr13)

Storage

Keep dry and avoid condensation

Current condition and welding position

DC-

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.6	TUB	5	●
2.0	TUB	5	●
2.4	TUB	5	●

AIR LIQUIDE WELDING

INERTROD 410NiMo

INERTROD 410NiMo is a ER 410NiMo/W 13 4 type solid TIG welding rod depositing a C-12%Cr 4%Ni 0.5%Mo weld metal. Suitable for use mainly with Ar shielding gas.

INERTROD 410NiMo is used for the welding of high strength martensitic steels, providing excellent resistance to corrosion, hydrocavitation and sulphide induced stress corrosion cracking, also has good sub-zero notch toughness.

INERTROD 410NiMo is containing less chromium and more nickel than INERTROD 410 to eliminate ferrite in the microstructure due to the deleterious effect on mechanical properties.

Classification	
EN ISO	14343-A: W 13 4
AWS	A5.9: ER 410NiMo

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo
0.04	0.5	0.4	≤ 0.030	≤ 0.020	12.5	4	0.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 20 °C
600 °C x 8h	≥ 550	≥ 760	≥ 15	≥ 50

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

ASTM CA6NM; G-X5CrNi 13-4; Z6 CND 1304 M

Storage
Keep dry and avoid condensation

Current condition and welding position
DC-

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.6	TUB	5	●
2.0	TUB	5	●
2.4	TUB	5	●

INERTROD 420

OERLIKON

TIG Rods
Stainless and Heat resistant steels

INERTROD 420 is a ER 420 type solid TIG welding rod depositing a high C-13%Cr. Suitable for use mainly with Ar shielding gas.

INERTROD 420 is used for many surfacing operations.

INERTROD 420 is similar to INERTROD 410, but with higher chromium and carbon content, which increases the wear resistance.

Classification	
AWS	A5.9: ER 420

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo
0.3	0.45	0.4	≤0.030	≤0.020	13.0	0.25	0.2

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
750°C x 1h	≥400	≥450	≥15

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

AISI 420, hardfacing harder than ER410, X12Cr13

Storage

Keep dry and avoid condensation.

Current condition and welding position

DC-

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
2.0	TUB	5	●
2.4	TUB	5	●

AIR LIQUIDE WELDING

INERTROD 430

INERTROD 430 is a ER 430/W 17 type solid TIG welding rod depositing a C-16%Cr weld metal. Suitable for use mainly with Ar shielding gas.

INERTROD 430 is suitable for many surfacing operations.

The composition of INERTROD 430 is balanced by providing sufficient chromium to give adequate corrosion resistance and yet retain sufficient ductility. These steels have been developed for air hardening and require pre-heating and stress relieving treatments in order to obtain sufficient ductility to allow mechanical working.

Classification	
EN ISO	14343-A: W 17
AWS	A5.9: ER 430

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr
0.08	0.5	0.4	≤ 0.030	≤ 0.020	17

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
770°C x 2h	≥ 400	≥ 450	≥ 15

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

AISI 430

Storage

Keep dry and avoid condensation

Current condition and welding position

DC-

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
2.0	TUB	5	●
2.4	TUB	5	●

INERTROD 308L

OERLIKON

TIG Rods
Stainless and Heat resistant steels

INERTROD 308L is a W 19 9 L/ER 308L type solid TIG welding rod depositing a low C-19Cr 9 Ni weld metal. Suitable for use mainly with Ar shielding gas.

INERTROD 308L is used for the welding of 304 and 304L grade stainless steel. The weld metal has good corrosion resistance properties, including intergranular attack from a range of liquid media at service temperatures <300°C. It is used for a wide range of applications including pipework and plate fabrication, vessel production etc. Batch with controlled low ferrite number is available for cryogenic applications.

Low carbon reduces the propensity to intergranular carbide precipitation, which increases the resistance to intergranular corrosion without the use of stabilizers.

Classification	
EN ISO	14343-A: W 19 9 L
AWS	A5.9: ER 308L

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni
0.020	1.8	0.45	≤ 0.025	≤ 0.020	20	10

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-120 °C
As Welded	≥ 350	≥ 520	≥ 35	≥ 80	≥ 40

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

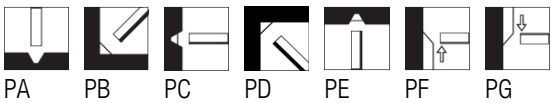
Materials

AISI 304 - 304L - 302

1.4541 (X6CrNiTi18-10); 1.4301 (X4CrNi18-10); 1.4311 (X2CrNiN18-10)

Storage
Keep dry and avoid condensation

Current condition and welding position
DC-



Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
2.0	TUB	5	●
2.4	TUB	5	●

AIR LIQUIDE WELDING

INERTROD 308LSi

OERLIKON

TIG Rods
Stainless and Heat resistant steels

INERTROD 308LSi is a W 19 9 LSi/ER 308LSi type solid TIG welding rod depositing a low C-19Cr 9 Ni weld metal. Suitable for use mainly with Ar shielding gas.

INERTROD 308LSi is used for welding of 304 and 304L grade stainless steel. The weld metal has good corrosion resistance properties, including intergranular attack from a range of liquid media at service temperature <300°C. It is used for a wide range of applications including pipework and plate fabrication, vessel production etc.

Low carbon reduces the possibility to intergranular carbide precipitation, which increases the resistance to intergranular corrosion without the use of stabilizers. The increased silicon promotes weld pool fluidity and a smoother weld deposit appearance.

Classification	
EN ISO	14343-A: W 19 9 L Si
AWS	A5.9: ER 308LSi

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni
0.020	1.8	0.85	≤ 0.025	≤ 0.020	20	10

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-120 °C
As Welded	≥ 350	≥ 520	≥ 35	≥ 80	≥ 40

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

1.4541 (X6CrNiTi18-10); 1.4301 (X4CrNi18-10); 1.4311 (X2CrNiN18-10)

AISI 304 - 304L - 302

Storage
Keep dry and avoid condensation

Current condition and welding position
DC-

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.6	TUB	5	●
2.0	TUB	5	●
2.4	TUB	5	●

INERTROD 347

INERTROD 347 is a W 19 9 Nb/ER 347 type solid TIG welding rod depositing a niobium stabilised 19Cr 9Ni weld metal. Suitable for use mainly with Ar shielding gas.

INERTROD 347 is used for the welding of 321 and 347 grade stainless steels in a wide range of applications, including the fabrication of pipe, plate and vessels. The weld metal has a high resistance to corrosive media at service temperatures <400°C.

The presence of niobium reduces the possibility to intergranular chromium carbide precipitation and thus reduces to susceptibility to intergranular corrosion.

Classification	
EN ISO	14343-A: W 19 9Nb
AWS	A5.9: ER 347

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Nb
0.04	1.6	0.45	≤ 0.025	≤ 0.020	19.5	10	0.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-120 °C
As Welded	≥ 400	≥ 550	≥ 30	≥ 65	≥ 32

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

AISI 347 - 321

1.4541 (X6CrNiTi18-10); 1.4301 (X4CrNi18-10); 1.4550 (X6CrNiNb18-10); 1.4551

Storage
Keep dry and avoid condensation

Current condition and welding position
DC-

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.0	TUB	5	●
1.2	TUB	5	●
1.6	TUB	5	●
2.0	TUB	5	●
2.4	TUB	5	●
3.2	TUB	5	●

INERTROD 347Si

OERLIKON

TIG Rods
Stainless and Heat resistant steels

INERTROD 347Si is a W 19 9 Nb Si/ER 347Si type solid TIG welding rod depositing a 19Cr 9Ni niobium stabilised weld metal. Suitable for use with Ar shielding gas.

INERTROD 347Si is used for welding of 321 and 347 grade stainless steels and is used for a wide range of applications, including the fabrication of pipe, plate and vessels. The weld metal has a high resistance to corrosive media at service temperatures <400°C.

The presence of niobium reduces the possibility to intergranular chromium carbide precipitation and thus reduces the susceptibility to intergranular corrosion. The increased silicon content promotes weld pool fluidity resulting in a smooth weld deposit.

Classification	
EN ISO	14343-A: W 19 9 Nb Si
AWS	A5.9: ER 347Si

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Nb
0.04	1.6	0.85	≤ 0.025	≤ 0.020	19.5	10	0.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-120 °C
As Welded	≥ 400	≥ 550	≥ 30	≥ 65	≥ 32

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

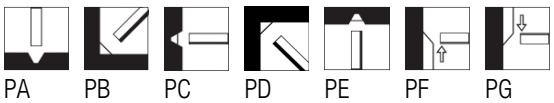
Materials

AISI 347 - 321

1.4541 (X6CrNiTi18-10); 1.4301 (X4CrNi18-10); 1.4550 (X6CrNiNb18-10); 1.4551

Storage
Keep dry and avoid condensation

Current condition and welding position
DC-



Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
2.0	TUB	5	●
2.4	TUB	5	●

INERTROD 316L

OERLIKON

TIG Rods
Stainless and Heat resistant steels

INERTROD 316L is a W 19 12 3L/ER 316L type solid TIG welding rod depositing a low C-19Cr12Ni2.6Mo weld metal. Suitable for use mainly with Ar shielding gas.

INERTROD 316L is used for the welding of 316 and 316L grade stainless steel. It is used for a wide range of applications including pipework and plate fabrication, vessel production etc. Batch with controlled low ferrite number is available for cryogenic applications.

The weld metal has good resistance to crevice corrosion by oxidising acids.

Classification	
EN ISO	14343-A: W 19 12 3L
AWS	A5.9: ER 316L

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo
0.020	1.4	0.45	≤ 0.025	≤ 0.020	19	12.5	2.6

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-120 °C
As Welded	≥ 350	≥ 510	≥ 30	≥ 80	≥ 32

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

AISI 316L

1.4401 (X4CrNiMo17-12-2), 1.4435 (X2CrNiMo18-14-3)

1.4571 (X6CrNiMoTi17-12-2), 1.4583 (X10CrNiMoNb18-12)

Storage
Keep dry and avoid condensation

Current condition and welding position
DC-

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.0	TUB	5	●

AIR LIQUIDE WELDING

INERTROD 316LSi

INERTROD 316LSi is a W 19 12 3 LSi/ER 316LSi type solid TIG welding rod depositing a low C-19Cr12Ni2.5Mo weld metal. Suitable for use with Ar shielding gas.

INERTROD 316LSi is used for the welding of 316 and 316L grade stainless steels, in a wide range of applications including the fabrication of pipe and plate. The higher Si level promotes a smooth weld bead shape of even appearance with excellent toe blending, particularly in fillet welds. The weld metal provides good resistance to pitting and crevice corrosion by non-oxidising acids. Used for applications where service temperatures <400°C.

Classification	
EN ISO	14343-A: W 19 12 3 L Si
AWS	A5.9: ER 316LSi

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo
0.02	1.4	0.85	≤ 0.025	≤ 0.020	19	12.5	2.6

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				20 °C	-120 °C
As Welded	≥ 350	≥ 510	≥ 30	≥ 80	≥ 32

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

1.4401 (X4CrNiMo17-12-2), 1.4435 (X2CrNiMo18-14-3)

AISI 316L

1.4571 (X6CrNiMoTi17-12-2), 1.4583 (X10CrNiMoNb18-12)

Storage
Keep dry and avoid condensation

Current condition and welding position
DC-

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
2.0	TUB	5	●
2.4	TUB	5	●

INERTROD 318

OERLIKON

TIG Rods
Stainless and Heat resistant steels

INERTROD 318 is a W 19 12 3 Nb/ER318 type solid TIG welding rod depositing a C-19Cr 12Ni 2.5Mo niobium stabilised weld metal. Suitable for use mainly with Ar shielding gas.

INERTROD 318 is used for the welding of 316Ti and 316Nb stainless steels in a wide range of applications including the fabrication of pipe, plate and vessel.

The weld metal provides good resistance to crevice corrosion by oxidising acids.

Classification	
EN ISO	14343-A: W 19 12 3 Nb
AWS	A5.9: ER 318

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	Nb	Ferrite
0.05	1.75	0.4	≤0.025	≤0.020	19	12	2.6	2.6	5-10

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-110 °C
As Welded	≥400	≥550	≥30	≥65	≥32

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

1.4583; 1.4580; 1.4408; 1.4581; 1.4436; 1.4571; 1.4401

Storage
Keep dry and avoid condensation.

Current condition and welding position
DC-

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.0	TUB	5	●
1.2	TUB	5	●
1.6	TUB	5	●
2.0	TUB	5	●
2.4	TUB	5	●
3.2	TUB	5	●

AIR LIQUIDE WELDING

INERTROD 318Si

OERLIKON

TIG Rods
Stainless and Heat resistant steels

INERTROD 318Si is a W 19 12 3 Nb Si type solid TIG welding rod depositing a C-19Cr 12Ni 2.5Mo niobium stabilised weld metal. Suitable for use mainly with Ar shielding gas.

INERTROD 318Si is used for the welding of 316Ti and 316Nb stainless steels in a wide range of applications including the fabrication of pipe, plate and vessel. The weld metal has good resistance to crevice corrosion by oxidising acids.

The increased silicon content promotes weld pool fluidity resulting a smoother weld deposit.

Classification
EN ISO 14343-A: W 19 12 3 Nb Si

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	Nb
0.07	1.75	0.85	≤ 0.025	≤ 0.020	19	12	2.6	0.6

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-110 °C
As Welded	≥ 400	≥ 550	≥ 30	≥ 65	≥ 32

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

1.4571 (X6CrNiMoTi17-12-2) - 1.4401 (X4CrNiMo17-12-2)

1.4583 (X10CrNiMoNb18-12)

1.4581 (GX5CrNiMoNb19-10) - 1.4436 (X4CrNiMo17-13-3)

1.4580 (X6CrNiMoNb17-12-2) - 1.4408 (GX5CrNiMo19-11)

Storage
Keep dry and avoid condensation

Current condition and welding position
DC-

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.6	TUB	5	●
2.0	TUB	5	●
2.4	TUB	5	●

INERTROD 308H

OERLIKON

TIG Rods
Stainless and Heat resistant steels

INERTROD 308H is a W 19 9 H/ER308H type solid TIG welding rod depositing a C-19Cr9Ni weld metal. Suitable for use mainly with Ar shielding gas.

INERTROD 308H is suitable for welding AISI 304H austenitic stainless steel and similar steels. It is used mainly in petrochemical industry for the fabrication of pipework and vessel.

The higher carbon content gives higher strength at elevated temperatures.

Classification	
EN ISO	14343-A: W 19 9 H
AWS	A5.9: ER 308H

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni
0.060	1.9	0.5	≤ 0.020	≤ 0.020	20	10

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-10 °C
As Welded	≥ 350	≥ 550	≥ 35	≥ 70	≥ 32

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

AISI 304H; 1.4948 (X6CrNi18-10); 1.4310 (X10CrNi18-8)

Storage

Keep dry and avoid condensation

Current condition and welding position

DC-

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.6	TUB	5	●
2.0	TUB	5	●
2.4	TUB	5	●
3.2	TUB	5	●

AIR LIQUIDE WELDING

INERTROD 310

INERTROD 310 is a W 25 20/ER 310 solid TIG welding rod depositing a C-25Cr 20Ni weld metal. Suitable for use mainly with Ar shielding gas.

INERTROD 310 weld metal has high temperature ductility and excellent resistance to oxidation at working temperatures <1000°C. It is used for the welding of 310 austenitic stainless steel pipe, plate and fittings used in the fabrication of furnaces and similar applications working at elevated temperatures. It is used mainly for heat exchangers and hot water boilers.

INERTROD 310 weld deposit is fully austenitic.

Classification	
EN	14343-A: W 25 20
AWS	A5.9: ER 310

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni
0.12	1.8	0.6	≤ 0.020	≤ 0.020	26	21

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C
As Welded	≥ 350	≥ 550	≥ 30	≥ 70

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

AISI 310; 1.4845 (X8CrNi25-21); 1.4841 (X15CrNiSi25-21); 1.4828 (X15CrNiSi20-12)

Storage

Keep dry and avoid condensation

Current condition and welding position

DC-

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.6	TUB	5	●
2.0	TUB	5	●
2.4	TUB	5	●

INERTROD 309L

OERLIKON

TIG Rods
Stainless and Heat resistant steels

INERTROD 309L is a W 23 12 L/ER 309L type solid TIG welding rod depositing a low C-23Cr 12Ni weld metal. Suitable for use mainly with Ar shielding gas.

INERTROD 309L is used for the welding of stainless steels to mild and medium tensile steels. It is ideal for depositing intermediate layers on structural steel prior to depositing 308 grade stainless steel. Also used for the welding of clad steels where service temperatures <300°C.

The weld metal has a delta-ferrite content of ~12% resulting in good resistance to hot cracking.

Classification	
EN ISO	14343-A: W 23 12L
AWS	A5.9: ER 309L

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Ferrite
0.02	1.8	0.45	≤ 0.025	≤ 0.020	24	13	10-20

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-80 °C
As Welded	≥ 350	≥ 520	≥ 30	≥ 47	≥ 32

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

A312 TP309S;

Ferrite-Austenite heterogeneous joints ("Black-White"),

Carbon steel to stainless steel joints,

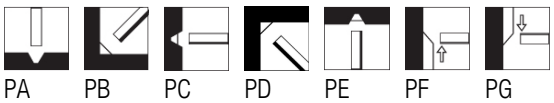
Corrosion resistance surfacing

Storage

Keep dry and avoid condensation

Current condition and welding position

DC-



Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.0	TUB	5	●
1.2	TUB	5	●
1.6	TUB	5	●
2.0	TUB	5	●
2.4	TUB	5	●
3.2	TUB	5	●

AIR LIQUIDE WELDING

INERTROD 309LSi

INERTROD 309LSi is a W 23 12 LSi/ER 309LSi type solid TIG welding rod depositing a low C-23Cr 12Ni weld metal. Suitable for use mainly with Ar shielding gas.

INERTROD 309LSi is used for the welding of stainless steels to mild and medium tensile steels. It is ideal for depositing intermediate layers on structural steel prior to depositing 308 grade stainless steel. Also used for the welding of clad steels for service temperatures <300°C.

The weld metal has a delta-ferrite content of ~12% resulting in good resistance to hot cracking. The increased silicon promotes weld pool fluidity and a smoother weld deposit appearance.

Classification	
EN ISO	14343-A: W 23 12 L Si
AWS	A5.9: ER 309LSi

Approvals	Grade
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Ferrite
0.02	1.8	0.85	0.025	0.020	24	13	10-20

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-80 °C
As Welded	≥ 350	≥ 520	≥ 30	≥ 60	≥ 32

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

SA 312 TP 309S; carbon steel to stainless steel

Storage
Keep dry and avoid condensation

Current condition and welding position
DC-

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
2.0	TUB	5	●
2.4	TUB	5	●

INERTROD 309LMo

INERTROD 309LMo is a W 23 12 2 L/ER 309L Mo (similar) type solid TIG welding rod depositing a low C-22Cr 12Ni 2.5Mo weld metal. Suitable for use mainly with Ar shielding gas.

INERTROD 309LMo is used for the welding of stainless steels to mild and medium tensile steels. Used for intermediate layers on structural steel prior to depositing 316L grade stainless steel cladding. Also used for buffer layers prior to surfacing, when Mo is a required alloying element.

The weld metal has a delta-ferrite content of ~15% resulting in good resistance to hot cracking.

Classification	
EN ISO	14343-A: W 23 12 2 L
AWS	A5.9: ~ER 309LMo

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	Ferrite
0.020	1.6	0.45	≤ 0.025	≤ 0.020	22	15	2.7	10-20

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C
As Welded	≥ 350	≥ 550	≥ 30	≥ 55

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

Ferrite-Austenite heterogeneous joints ("Black-White"),

Corrosion resistance surfacing

Storage

Keep dry and avoid condensation

Current condition and welding position

DC-

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.6	TUB	5	●
2.0	TUB	5	●
2.4	TUB	5	●

INERTROD 307

OERLIKON

TIG Rods
Stainless and Heat resistant steels

INERTROD 307 is a W 18 8 Mn/ER 307 (similar) type solid TIG welding rod depositing a C-18Cr8Ni6Mn weld metal. Suitable for use mainly with Ar shielding gas.

INERTROD 307 is suitable for welding dissimilar steels between unalloyed and austenitic stainless steels or heat resisting steels, also used for the welding of hardening and tempering steels, e.g. ballistic steels.

The increased silicon content promotes weld pool fluidity resulting in a smoother weld deposit.

Classification	
EN ISO	14343-A: W 18 8 Mn
AWS	A5.9: ~ ER 307

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni
0.1	7	0.8	≤ 0.030	≤ 0.025	19	9

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-120 °C
As Welded	≥ 420	≥ 590	≥ 40	≥ 100	≥ 32

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

X120Mn12 (1.3401); Armour plate

Difficult-to-weld steels

Ferrite-Austenite heterogeneous joints ("Black-White"),

Storage
Keep dry and avoid condensation

Current condition and welding position
DC-

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
2.0	TUB	5	●
2.4	TUB	5	●

INERTROD 312

OERLIKON

TIG Rods
Stainless and Heat resistant steels

INERTROD 312 is a W 29 9/ER 312 type solid TIG welding rod depositing a C-29Cr 9Ni weld metal. Suitable for use mainly with Ar shielding gas.

INERTROD 312 is used for the welding of steels such as medium and high carbon steels and dissimilar steel combinations. INERTROD 312 has a high tolerance to dilution and is particularly suitable for buffer layers on dissimilar steels prior to surfacing.

The deposited weld metal contains ~30% delta-ferrite in a tough austenitic matrix with a high resistance to hot cracking.

Classification	
EN ISO	14343-A: W 29 9
AWS	A5.9: ER 312

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Ferrite
0.1	1.8	0.4	≤ 0.030	≤ 0.020	29	9	30

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 20 °C	Hardness
As Welded	≥ 550	≥ 700	≥ 22	≥ 30	220 HB

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

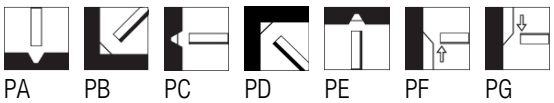
Materials

Ferrite-Austenite heterogeneous joints ("Black-White"),

Difficult-to-weld steels

Storage
Keep dry and avoid condensation

Current condition and welding position
DC-



Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.6	TUB	5	●
2.0	TUB	5	●
2.4	TUB	5	●

AIR LIQUIDE WELDING

INERTROD 904L

CE

TIG Rods
Stainless and Heat resistant steels

INERTROD 904L is a W 20 25 5 Cu L / ER385 type solid TIG welding rod depositing a 20Cr25Ni5Mo weld metal. Suitable for use mainly with Ar shielding gas.

INERTROD 904L is used for the welding of ASTM 316 or similar steels, when a ferrite-free weld metal is required. Mainly used in cryogenic and non-magnetic applications. The impact toughness at low temperatures is excellent. Also used for welding 904L to ASTM 304 and 316.

INERTROD 904L has a very good corrosion resistance to general, pitting and crevice corrosion as well as stress corrosion cracking.

Classification	
EN ISO	14343-A: W 20 25 5 Cu L
AWS	A5.9: ER 385L

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	Cu
0.020	1.9	0.4	≤ 0.020	≤ 0.020	20	25	4.5	1.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-196 °C
As Welded	≥ 410	≥ 560	≥ 35	≥ 80	≥ 32

Gas test: 100% Ar

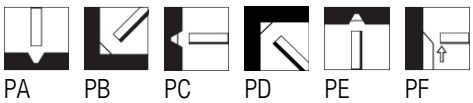
Shielding Gas - EN ISO 14175 : I1

Materials

URANUS B6; AISI 904L; 1.4539 (X1NiCrMoCu25-20-5); 1.4439 (X2CrNiMoN17-13-5); 1.4519

Storage
Keep dry and avoid condensation

Current condition and welding position
DC-



Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.6	TUB	5	●
2.0	TUB	5	●
2.4	TUB	5	●

INERTROD 20 16 L

OERLIKON

TIG Rods
Stainless and Heat resistant steels

INERTROD 20 16 L is a W 20 16 3 Mn N L type solid TIG welding rod depositing a low C 20Cr 16Ni 3Mo weld metal. Suitable for use mainly with Ar shielding gas.

INERTROD 20 16 L is suitable for welding or hardfacing austenitic stainless steels and 5% Ni steels.

INERTROD 20 16 L has good resistant to intercrystalline corrosion and acqueous corrosion <350 °C, seawater resistant, and good resistance to nitric acid. Very good toughness at low temperature.

Classification
EN ISO 14343-A: W 20 16 3 Mn N L

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	N
0.020	7	0.9	≤ 0.020	≤ 0.020	20	17	3	0.15

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-269 °C
As Welded	≥ 450	≥ 580	≥ 38	≥ 100	≥ 32

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

X2CrNiMoN17-13-3 (1.4429)

X2CrNiMoN18-14-3 (1.3952); X2CrNiMo18-14-3 (1.4435)

Storage
Keep dry and avoid condensation

Current condition and welding position
DC-

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.0	TUB	5	●
1.2	TUB	5	●
1.6	TUB	5	●
2.0	TUB	5	●
2.4	TUB	5	●
3.2	TUB	5	●

AIR LIQUIDE WELDING

INERTROD 22 9 3

OERLIKON

TIG Rods
Stainless and Heat resistant steels

INERTROD 22 9 3 is a W 22 9 3 N L / ER 2209 type solid TIG welding rod depositing a low C 22Cr 8Ni 3Mo weld metal. Suitable for use mainly with Ar shielding gas.

INERTROD 22 9 3 is used for the welding of duplex stainless steels in a range of applications including the fabrication of pipe and plate.

The weld metal has a PREN value >35 giving a high resistance to pitting and stress corrosion cracking especially in high chloride media. The weld metal nickel content over matches the parent material by 2-3% to provide an optimum balance of austenite and ferrite in the as welded condition.

Classification	
EN ISO	14343-A: W 22 9 3 N L
AWS	A5.9: ER 2209

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	N	Ferrite
0.020	1.7	0.5	≤ 0.025	≤ 0.020	23	9	3	0.15	30-65

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-40 °C
As Welded	≥ 480	≥ 680	≥ 22	≥ 50	≥ 32

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

UNS S31803 - S31500 - S31200 - S32304

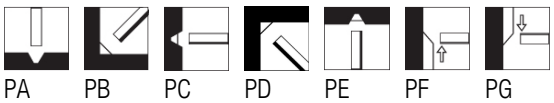
1.4462 (X2CrNiMoN22-5-3)

Storage

Keep dry and avoid condensation

Current condition and welding position

DC-



Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.6	TUB	5	●
2.0	TUB	5	●
2.4	TUB	5	●

INERTROD 25 10 4

OERLIKON

TIG Rods
Stainless and Heat resistant steels

INERTROD 25 10 4 is a W 25 9 4 N L type solid TIG welding rod depositing a C-25Cr 10Ni 4Mo weld metal. Suitable for use mainly with Ar shielding gas.

INERTROD 25 10 4 is used for the welding of super-duplex stainless steels. Mainly used in offshore applications, paper industry, oil industry and in the production of artificial manure. Used for root pass welding of 22%Cr standard duplex steels for critical applications, and for the welding of low carbon super martensitic 13%Cr steels.

INERTROD 25 10 4 has a very good resistance to general corrosion, the weld metal has a high resistance to pitting with a PREN value >40 combined with a good resistance to both crevice corrosion and stress corrosion cracking. The weld metal nickel content over matches the parent material by 2-3% to provide for an optimum balance of austenite and ferrite in the as-welded condition.

Classification	
EN ISO	14343-A: W 25 9 4 N L
AWS	A5.9: ER 2594

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	N	Ferrite
0.03	1	0.5	≤ 0.020	≤ 0.020	25	9.5	4	0.25	35-70

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-40 °C
As Welded	≥ 550	≥ 800	≥ 25	≥ 80	≥ 32

Gas test: 100% Ar

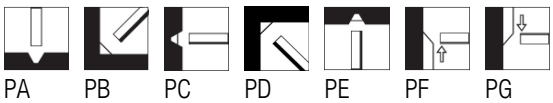
Shielding Gas - EN ISO 14175 : I1

Materials

SAF 2507; Uranus 47N; UNS S32750; ASTM A182 F53

Storage
Keep dry and avoid condensation

Current condition and welding position
DC-



Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.6	TUB	5	●
2.0	TUB	5	●
2.4	TUB	5	●
3.2	TUB	5	●

AIR LIQUIDE WELDING

NIROD Ni1

NIROD Ni1 is an S Ni 2061 / ER Ni-1 type solid TIG welding rod depositing Ni-3Ti1Mn weld metal. Suitable for use with inert schielding gases.

NIROD Ni1 is used for welding pure nickel alloys and for dissimilar welding applications. Applications include process equipment handling alkalis and halides including chlorination and evaporation of caustic soda.

NIROD Ni1 contains sufficient titanium to control the weld metal porosity.

Classification	
EN ISO	18274: S Ni 2061 (NiTi3)
AWS	A5.14: ER Ni-1

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni	Fe	Ti
0.1	1	0.7	≤ 0.020	≤ 0.015	Rest	0.5	3

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)
				+20 °C
As Welded	≥ 280	≥ 380	≥ 38	≥ 200

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

2.4155

Buffer layers for welding Ni- or Cu-alloys to steels

Storage
Keep dry and avoid condensation

Current condition and welding position
DC-

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
2.0	TUB	5	●
2.4	TUB	5	●

NIROD 600

CE

TIG Rods
Nickel and Copper alloys

NIROD 600 is an S Ni 6082 / ER NiCr-3 type solid TIG welding rod depositing Ni-20Cr3Mn2.5Nb weld metal. Suitable for use with inert shielding gases.

NIROD 600 is used for the welding of highly creep-resistant, heat and corrosion-resistant Ni-Cr alloys, where good toughness and ductility properties are required after post-weld heat treatment or prolonged operation at high temperatures. Use for joining 3%, 5% and 9% nickel steels to give good strength and tuoghness in LPG and LNG processing or storage plant. In sulphurous atmospheres the weld metal can be used <500°C. The dissimilar thermal coefficient of expansion between austenitic and ferritic steels means that NIROD 600 is also used for joining ferritic to austenitic steels (dissimilar) with operating temperatures or postweld heat treatment >300°C. Also used for cladding of steels.

NIROD 600 has cryogenic all-weld metal toughness down to -196°C, creep-resistant <800°C and non-scaling <1000°C. Even at elevated temperatures, there is only limited carbon diffusion in the weld metal thus avoiding crack-prone carbide commissures at the weld interface of dissimilar joints.

Classification	
EN ISO	18274: S Ni 6082 (NiCr20Mn3Nb)
AWS	A5.14: ER NiCr 3

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Nb	Fe	Ti
0.050	3	0.3	≤ 0.020	≤ 0.015	20	Rest	2.5	2	0.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-196 °C
As Welded	≥380	≥620	≥35	≥100	≥55

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

UNS N06600; UNS N08800; UNS N08810

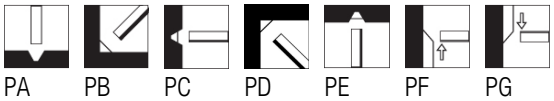
2.4816; 1.4876; 1.4958

Storage

Keep dry and avoid condensation

Current condition and welding position

DC-



NIROD 625

OERLIKON

TIG Rods
Nickel and Copper alloys

NIROD 625 is an S Ni 6625 / ER NiCrMo-3 type solid TIG welding wire depositing Ni-22Cr9Mo3.5Nb weld metal. Suitable for use with inert shielding gases.

NIROD 625 is used for the welding of highly corrosion-resistant Cr-Mo-Nickel base alloys such as alloy 625, alloy 825 and similar alloys. Also suitable for molybdenum alloyed corrosion-resistant steels with e.g. 7% Mo such as X1NiCrMoCuN25-20-7 and cryogenic-tough nickel steels. In sulphur-free atmospheres the deposit is non-scaling <1200°C, in sulphurous atmospheres the weld metal can be used <500°C. The dissimilar coefficient of thermal expansion between austenitic and ferritic steels means, that NIROD 625 is also used for joining ferritic to austenitic steels (dissimilar) with operating temperatures or postweld heat treatment > 300°C. Also used for cladding of steels.

NIROD 625 is very resistant to stress corrosion cracking and pitting corrosion in a range of media including phosphoric acid, organic acids, sea water and polluting environments. Cryogenic toughness down to -196°C. Even at elevated temperatures only limited carbon diffusion in the weld metal thus avoiding crack susceptible carbides in the weld interface of dissimilar joints.

Classification	
EN ISO	18274: S Ni 6625 (NiCr22Mo9Nb)
AWS	A5.14: ER NiCrMo-3

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	Nb	Fe	Ti
0.025	0.4	0.3	≤ 0.020	≤ 0.015	21	Rest	9	3.5	3	0.3

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				+20 °C	-196 °C
As Welded	≥ 460	≥ 720	≥ 30	≥ 120	≥ 40

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

UNS N06625; UNS N08825

2.4856; 2.4839

Storage
Keep dry and avoid condensation

Current condition and welding position
DC-

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.2	TUB	5	●
1.6	TUB	5	●
2.0	TUB	5	●
2.4	TUB	5	●

NIROD NiCu7

OERLIKON

TIG Rods
Nickel and Copper alloys

NIROD NiCu7 is an S Ni 4060 / ER NiCu-7 type solid TIG welding rod depositing 65Ni-30Cu3Mn2Ti (Monel-type) weld metal. Suitable for use with inert shielding gases.

NIROD NiCu7 is used for the welding of similar alloys such as 70 Ni - 30 Cu (Monel). Suitable for joining and surfacing also on unalloyed / low alloy steels and cast steels. The weld metal has a high resistance to corrosion in saline solution and sea water. Typical applications are in the chemical industry, food processing plant and seawater desalination plants.

NIROD NiCu7 contains sufficient titanium to control weld metal porosity and to promote grain refinement.

Classification	
EN ISO	18274: S Ni 4060 (NiCu30MnTi)
AWS	A5.14: ER NiCu 7

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni	Cu	Fe
0.1	3	1	≤ 0.020	≤ 0.015	Rest	30	1

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C
As Welded	≥ 350	≥ 480	≥ 30	≥ 150

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

2.4360 (NiCu30Fe); 2.4375 (NiCu30Al)

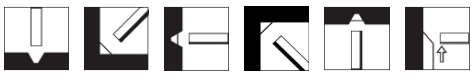
UNS N04400; UNS N 05500

Storage

Keep dry and avoid condensation

Current condition and welding position

DC-



Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
2.0	TUB	5	●
2.4	TUB	5	●

CUROD is a S Cu 1898 / ER Cu type solid TIG welding rod depositing a pure copper weld metal. Suitable for welding mainly with Ar shielding gas.

CUROD is generally used for welding of deoxidised and electrolytic tough pitch copper and copper alloys. Suitable for wear-resistant surfacing, and also for oxyacetylene welding. In last case use deoxiders. The main applications include car and bus production, electrical domestic appliances, surfacing and pipes fabrication.

It is necessary to pre-heat the base material for section >3 mm. Good sliding.

Classification	
EN	24373: S Cu 18 98 (CuSn1)
AWS	A5.7: ER Cu

Chemical analysis (Typical values in %)

	Mn	Si	P	Cu	Pb	Sn	Al
Wire	0.3	0.3	≤ 0.15	≥ 98.0	≤ 0.02	0.75	≤ 0.01

All-weld metal Mechanical Properties

Heat Treatment	Tensile Strength (MPa)
As Welded	210-245

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

Copper and Cu-alloys, like 2.0040, 2.0070, 2.0076, 2.0090, 2.1310, 2.1498, 2.1546

Storage

Keep dry and avoid condensation

Current condition and welding position

DC-

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.6	TUB	5	●
2.0	TUB	5	●
2.4	TUB	5	●

AMPCOTRODE T150

OERLIKON

TIG Rods
Nickel and Copper alloys

AMPCOTRODE T150 is an ER CuAl-A3 type solid TIG welding rod depositing Cu-10.5Al3.25Fe weld metal. Suitable for use with inert shielding gases.

AMPCOTRODE T150 is ideal for piston overlay applications and bearing surfaces requiring high strength and good ductility. Typical applications: hydraulic pistons, impellers, press rams, mill slippers, breaker blocks, mandrels, steel mill rolls, bearing overlays, turbine runners, cable sheaves, valve seats and parts, ceiling machine.

AMPCOTRODE T150 aluminum bronze bare filler rod deposits weld metal with high strength and good ductility with a nominal hardness of 166 Brinell.

Classification	
AWS	A5.7: ER CuAl-A3

Chemical analysis (Typical values in %)

	Si	Fe	Al
Wire	max. 0.10	3.25	10.75

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
As Welded	≥ 276	≥ 621	≥ 20

Shielding Gas - EN ISO 14175 : 100% Ar

Materials

Typical application is welding AMPCO 18 alloy.

Current condition and welding position

DC+

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
3.2	TUB	22.7	●

ALUROD Al99.5Ti

ALUROD Al99,5Ti is a 1450 type aluminum solid TIG welding rod depositing a 99,5% Aluminum weld metal. Suitable for use with Ar, or Ar+He mixed shielding gases.

ALUROD Al99.5Ti is used for welding of commercially pure aluminium in both wrought and cast forms.

ALUROD Al99.5Ti is a Ti-microalloyed welding wire, with good corrosion resistance. The Ti addition reduces the crack sensitivity of the weld metal.

Classification	
EN ISO	18273: S Al 1450 (Al99.5Ti)
AWS	A5.10: ER 1100

Approvals	Grade
TÜV	●

CE

Chemical analysis (Typical values in %)

Al	Si	Ti
Rem	0.3	0.15

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
As Welded	≥ 20	≥ 65	≥ 35

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

Al 99.5; Al99; Al99.9Mg0.5; AlMg0.5

Storage
Keep dry and avoid condensation

Current condition and welding position
AC

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
2.4	TUB	5	●
3.2	TUB	5	●

ALUROD AlSi5

OERLIKON

TIG Rods
Aluminum alloys

ALUROD AlSi5 is a 4043 type aluminum solid TIG welding rod depositing Al-5Si weld metal. Suitable for use with Ar, or Ar+He mixed shielding gases.

ALUROD AlSi5 is used for welding of aluminium and aluminium alloys with a silicon content up to 7% in both wrought and cast form. Suitable for Al-Mg-Si alloys series 6000 and for dissimilar joining, e.g. 6000/1000 or 6000/3000.

The weld pool is easy to manipulate due to the Si-alloying. The weld metal is not sensitive to cracking and the weld deposit surface is bright.

Classification	
EN ISO	18273: S Al 4043 (AlSi5)
AWS	A5.10: ER 4043

Approvals	Grade
DB	●

CE

Chemical analysis (Typical values in %)

Al	Si	Ti	Cu	Fe
Rem	5	0.2	0.3	0.4

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
As Welded	≥ 40	≥ 120	≥ 8

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

AlMgSi0.5, AlMgSi0.7, AlMgSi1

AlSi- und AlSiMg-alloys with max. 7% Si

Storage
Keep dry and avoid condensation

Current condition and welding position
AC

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
2.4	TUB	5	●
3.2	TUB	5	●
4.0	TUB	5	●
4.0	TUB	5	●

ALUROD AlSi12

OERLIKON

TIG Rods
Aluminum alloys

ALUROD AlSi12 is a 4047 type aluminum solid TIG welding rod depositing Al-12Si weld metal. Suitable for use with Ar, or Ar+He mixed shielding gases.

ALUROD AlSi12 is used for welding of aluminium-silicon alloys with a silicon content higher than 7%. Suitable for long term high temperature applications.

The higher Si-content results in higher fluidity and lower shrinkage in the weld. The hot cracking sensitivity also low and the weld deposit surface is bright.

Classification	
EN ISO	18273: S Al 4047 (AlSi12)
AWS	A5.10: ER 4047

Chemical analysis (Typical values in %)

Al	Si	Mn	Mg	Ti	Fe
Rem	12	0.2	0.35	≤ 0.15	≤ 0.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
As Welded	≥ 60	≥ 130	≥ 5

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

G-AlSi11, G-AlSi12, G-AlSi10Mg(Cu), G-AlSi12(Cu), Al-Si-alloys with Si>7%

Storage

Keep dry and avoid condensation

Current condition and welding position

AC

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
2.0	TUB	5	●
2.4	TUB	5	●
3.2	TUB	5	●
4.0	TUB	5	●

AIR LIQUIDE WELDING

ALUROD AlMg3

ALUROD AlMg3 is a 5754 type aluminum solid TIG welding rod depositing Al-3Mg weld metal. Suitable for use with Ar, or Ar+He mixed shielding gases.

ALUROD AlMg3 is used for the welding of Al-3%Mg alloys.

The weld metal has higher strength than joints deposited with Si-alloyed Al welding wires. Good corrosion resistance.

Classification	
EN ISO	18273: S Al 5754 (AlMg3)
AWS	A5.10: ER 5754

Chemical analysis (Typical values in %)

Al	Si	Mn	Mg	Cr	Ti	Cu	Fe
Rem	0.2	0.1	3	0.1	0.1	0.1	0.3

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
As Welded	≥ 80	≥ 190	≥ 20

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

G-AlMg3Si; AlMg1; AlMg2,5; AlMg2Mn0,3; AlMg3; G-AlMg3

Storage

Keep dry and avoid condensation

Current condition and welding position

AC

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
2.0	TUB	5	●
2.4	TUB	5	●
3.2	TUB	5	●
4.0	TUB	5	●

ALUROD AlMg4.5Mn

OERLIKON

TIG Rods
Aluminum alloys

ALUROD AlMg4.5Mn is a 5183 type aluminum solid TIG welding rod depositing Al-4.5Mg0.7Mn weld metal. Suitable for use with Ar, or Ar+He mixed shielding gases.

ALUROD AlMg4.5Mn is suitable for welding of marine and other structures, where strength, toughness and corrosion resistance are priorities.

ALUROD AlMg4.5Mn results the highest strength in as welded condition. ALUROD AlMg4.5Mn is not applicable for high temperature applications, due to the increased risk of stress corrosion.

Classification	
EN ISO	18273: S Al 5183
AWS	A5.10: ER 5183

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

Al	Si	Mn	Mg	Cr	Ti	Cu	Fe
Rem	0.30	0.8	4.5	0.1	0.1	0.1	0.1

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
As Welded	≥ 125	≥ 275	≥ 17

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

G-Al Mg 3 Si; G-Al Mg 5 Si; G-Al Mg 10;

Al Mg 3, Al Mg 5, Al Mg Mn, Al Zn 4,5 Mg 1

Storage
Keep dry and avoid condensation

Current condition and welding position
AC

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.6	TUB	5	●
2.0	TUB	5	●
2.4	TUB	5	●
3.2	TUB	5	●
4.0	TUB	5	●

ALUROD AlMg4.5MnZr

ALUROD AlMg4.5MnZr is a 5087 type aluminum solid TIG welding rod depositing Al-4.5Mg0.8Mn0.1Zr weld metal. Suitable for use with Ar, or Ar+He mixed shielding gases.

ALUROD AlMg4.5MnZr is suitable for the welding of Al 3-5% Mg alloys.

The weld metal has an excellent resistance to hot cracking due to the zirconium addition. Zr promotes grain refinement and improves the mechanical properties and corrosion characteristics.

Classification
EN ISO 18273: S Al 5087 (AlMg4,5MnZr)

Approvals	Grade
DB	●
LRS	

Chemical analysis (Typical values in %)

Al	Si	Mn	Mg	Cr	Zr	Ti	Cu	Fe
Rem	2	0.9	4.5	0.1	0.15	0.1	0.02	0.1

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
As Welded	≥ 125	≥ 275	≥ 17

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

G-AlMg3Si; G-AlMg5Si; G-AlMg10

AlMg3; AlMg5; AlMgMn; AlZn4,5Mg1; AlZnMg4,5Mn;AlMgSiCu

Storage
Keep dry and avoid condensation

Current condition and welding position
AC

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.6	TUB	5	●
2.0	TUB	5	●
2.4	TUB	5	●
3.2	TUB	5	●
4.0	TUB	5	●

ALUROD AlMg5

OERLIKON

TIG Rods
Aluminum alloys

ALUROD AlMg5 is a 5356 type aluminum solid TIG welding rod depositing Al-5Mg weld metal. Suitable for use with Ar, or Ar+He mixed shielding gases.

ALUROD AlMg5 is used for the welding of Al-Mg alloys and Al-Mg-Zn alloys. The rod is also suitable for the welding of dissimilar aluminium alloy grades containing up to 5%Mg and components which are subsequently to be anodised.

ALUROD AlMg5 is the most widely used Al welding wire, because of the weld metals high yield strength and high resistance to corrosion, including seawater.

Classification	
EN ISO	18273: S Al 5356
AWS	A5.10: ER 5356

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

Al	Si	Mn	Mg	Cr	Ti	Cu	Fe
Rem	0.2	0.1	5	0.1	0.1	0.1	0.3

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
As Welded	≥ 110	≥ 240	≥ 17

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

Al Mg 1SiCu, Al Mg Si 0,7;

Al Mg 3, Al Mg 5, Al Zn 4,5 Mg 1;

G-Al Mg 3Si; G-Al Mg 5Si

Storage
Keep dry and avoid condensation

Current condition and welding position
AC

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.6	TUB	5	●
2.0	TUB	5	●
2.4	TUB	5	●
3.2	TUB	5	●
4.0	TUB	5	●

AIR LIQUIDE WELDING

CITOLIT 6CT

OERLIKON

TIG Rods
Hardfacing

CITOLIT 6CT is a cobalt base continues cast hardfacing rod with type ER CoCr-A for GTAW/TIG and OAW/oxy-acetylene welding, supplied with 5kgs tube packaging. Suitable for use with Ar shielding gases.

CITOLIT 6CT is applied for welding of valves, valve seats and other sealing faces, hot pressing tools, pump parts, extrusion screws. Machinable with tungsten carbide tools or by grinding. For oxy-acetylene welding use a reducing flame (slight access of acetylene). Preheat large components or special steels to 300-600°C. Keep this temperature during welding and cool down slowly, preferable in an oven, to reduce the risk of cracking while cooling.

CITOLIT 6CT has a very good resistance to metal-metal wear, cavitation and corrosion as well as heat up to 900°C. Excellent gliding characteristics, good to polish, non-magnetic.

Classification	
AWS	A5.21: ERCoCr-A
DIN	8555: WSG-20-GO-40-CTZ

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S	Cr	Ni	Mo	Fe	Co	W
Wire	1.2	0.1	1.3	<0.02	<0.03	29.5	2.5	0.3	2.4	Base	4.6

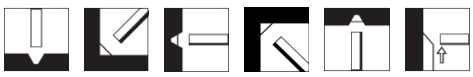
All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded	39-43 HRC

Shielding Gas - EN ISO 14175 : 100% Ar

Storage
Keep dry and avoid condensation.

Current condition and welding position
DC-



Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
3.2	TUB	5	●
4.0	TUB	5	●

CITOLIT 12CT

OERLIKON

TIG Rods
Hardfacing

CITOLIT 12CT is a cobalt base continues cast hardfacing rod with type ER CoCr-B for GTAW/TIG and OAW/oxy-acetylene welding, supplied with 5kgs tube packaging. Suitable for use with Ar shielding gases.

CITOLIT 12CT is applied for welding of cutting tools, shredding tools, saw blades, extrusion dies, mixing tools, hot working tools without thermal schock, extrusion screws in the wood, paper and plastic industry. Only machinable with tungsten carbide tools or by grinding. For oxy-acetylene welding use a reducing flame (slight excess of acetylene). Preheat large components or special steels to 400-600°C. Keep this temperature during welding and cool down slowly, preferable in an oven, to reduce the risk of cracking while cooling.

CITOLIT 12CT has a very good resistance to metal-metal wear, abrasion, cavitation, corrosion and heat up to 900°C. Excellent gliding characteristics, good to polish.

Classification	
AWS	A5.21: ERCoCr-B
DIN	8555: WSG-20-GO-50-CSTZ

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S	Cr	Ni	Mo	Fe	Co	W
Wire	1.4	0.1	1.4	<0.02	<0.03	30.5	2.4	0.2	2.0	Base	8.4

All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded	47-50 HRC

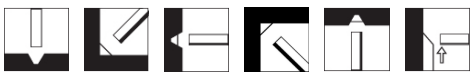
Shielding Gas - EN ISO 14175 : 100% Ar

Storage

Keep dry and avoid condensation.

Current condition and welding position

DC-



Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
3.2	TUB	5	●
4.0	TUB	5	●

AIR LIQUIDE WELDING

CITOLIT 21CT

OERLIKON

TIG Rods
Hardfacing

CITOLIT 21CT is a cobalt base continues cast hardfacing rod with type ER CoCr-E for GTAW/TIG welding, supplied with 5kgs tube packaging. Suitable for use with Ar shielding gases.

CITOLIT 21CT is applied for welding of engine valves, hot forging dies, gas turbines. Preheat large components or special steels to 200-400°C. Keep this temperature during welding and cool down slowly, preferable in an oven, to reduce the risk of crackingwhile cooling.

CITOLIT 21CT has a very good resistance to metal-metal wear, thermal shock, corrosion and heat up to 1000°C. Excellent gliding characteristics, high toughness, good to polish, non-magnetic.

Classification	
AWS	A5.21: ERCoCr-E
DIN	8555: WSG-20-GO-300-CKTZ

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S	Cr	Ni	Mo	Fe	Co	W
Wire	0.25	0.3	0.6	<0.02	<0.03	27.8	2.4	5.4	1.4	Base	0.01

All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded	29-33 HRC, ~240 HB at 600°C

Shielding Gas - EN ISO 14175 : 100% Ar

Storage
Keep dry and avoid condensation.

Current condition and welding position
DC-

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
3.2	TUB	5	●
4.0	TUB	5	●

CITOLIT 25CT

CITOLIT 25CT is a cobalt base continues cast hardfacing rod for GTAW/TIG welding, supplied with 5kgs tube packaging. Suitable for use with Ar shielding gases.

CITOLIT 25CT is applied for hardfacing of engine valves, forging dies, gas turbines, mixers.

CITOLIT 25CT has a very good resistance to metal-metal wear, thermal shock and corrosion up to 1000°C even in sulphuric gases. Non magnetic deposit.

Classification	
DIN	8555: WSG 20-GZ-250-CKTZ

Chemical analysis (Typical values in %)

	C	Mn	Si	Cr	Ni	Mo	Fe	Co	W
Wire	0.15	0.7	0.9	21.0	9.8	0.03	3.0	Base	15.0

All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded	~230 HB

Shielding Gas - EN ISO 14175 : 100% Ar

Storage	Current Conditions
Keep dry and avoid condensation.	DC-

Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
3.2	TUB	5	●
4.0	TUB	5	●

CORED WIRES

OERLIKON

Overview of flux cored wires

Product list with classification according to standards

Cored wires / C-Mn and low-alloy steels			
Product name	AWS	EN / EN ISO / DIN	Page
FLUXOFIL M 8	A5.18: E70C-3M H4	17632-A: T 46 2 M M 1 H5 / 17632-B: T552T15-1MA-UH5	399
CITOFLUX M 60A	A5.18: E70C-3M H8	17632-A: T 42 2 M M 1 H5 / 17632-B: T492T15-1MA-UH5	400
CRISTAL F206	A5.18: E70C-6M H4	17632-A: T 42 3 M M 1 H5 / 17632-B: T493T15-1MA-UH5	401
FLUXOFIL M 10	A5.18: E70C-6M H4	17632-B: T554T15-1MA-UH5 / 17632-A: T 46 4 M M 1 H5	402
CITOFLUX M 60	A5.18: E 70C-6M H4	17632-B: T494T1-1MA-UH5 / 17632-A: T 46 4 M M 1 H5	403
CITOFLUX M00	A5.18: E70C-6M H4	17632-B: T554T15-1MA-UH5 / 17632-A: T 46 4 M M 1 H5	404
FLUXOFIL M 10 S	A5.18: E70C-6M H4	17632-A: T 42 6 M M 1 H5 / 17632-B: T496T15-1MA-UH5	405
CITOFLUX M20	A5.18: E70C-GM H4	17632-A: T 46 6 Mn1Ni M M 1 H5 / 17632-B: T556T15-1MA-N1-UH5	406
FLUXOFIL M 10 PG	A5.18: E70C-GM H4	17632-B: T554TG-1MA-UH5 / 17632-A: T 46 4 M M 1 H5	407
CITOFLUX GALVA	A5.18: E70C-GS	17632-A: T3T Z M M 1 H15 / 17632-B: T43TG-1MS-H15	408
FLUXOFIL 16	A5.20: E71T-1C H4 A5.20: E71T-1M H4	17632-B: T490T1-1CA-H5 / 17632-A: T 42 0 P C 1 H5 17632-B: T492T1-1MA-H5 / 17632-A: T 42 2 P M 1 H5	409
FLUXOFIL 14	A5.20: E71T-1M-JH4	17632-B: T554T1-1MA-UH5 / 17632-A: T 46 4 P M 1 H5	410
FLUXOFIL 14 HD	A5.20: E71T-1C-H4 A5.20: E71T-1M-JH4	17632-B: T552T1-1CA-UH5 / 17632-A: T 46 2 P C 1 H5 17632-B: T553T1-1MA-UH5 / 17632-A: T 46 3 P M 1 H5	411
CITOFLUX R00	A5.20: E71T-1C-H4 A5.20: E71T-1M-JH4	17632-A: T 42 2 P C 1 H5 / 17632-A: T 42 3 P M 1 H5 17632-B: T493T1-1MA-UH5 / 17632-B: T492T1-1CA-UH5	413
FLUXOFIL 14 HD S	A5.20: E71T-1M-JH4	17632-A: T 46 4 P M 1 H5 / 17632-B: T 554T1-1MA-UH5	415
CITOFLUX R00Ni	A5.29: E81T1-GM-H4	7632-B: T554T1-1MA-N1-UH5 / 17632-A: T 46 4 1Ni P C 1 H5 17632-B: T554T1-1CA-N1-UH5 / 17632-A: T 46 4 1Ni P M 1 H5	417
FLUXOFIL 11 HD	A5.20: E71T-1 H4	17632-A: T 46 2 P C 1 H5 / 17632-B: T552T1-1CA-UH5	418
FLUXOFIL 19 HD	A5.20: E71T-1C-JH4	17632-A: T 46 3 P C 1 H5 / 17632-B: T553T1-1CA-UH5	419
CITOFLUX R00C	A5.20: E71T-1C-JH4	17632-A: T 42 3 P C 1 H5 / 17632-B: T493T1-1CA-UH5	421
CRISTAL F119	A5.20: E71T-1C-JH4	17632-B: T553T1-1CA-UH5 / 17632-A: T 46 3 P C 1 H5	422
FLUXOFIL 19 HD S	A5.20: E71T-1-JH4	17632-A: T 46 4 P C 1 H5 / 17632-B: T554T1-1CA-UH5	423
FLUXOFIL 20	A5.29: E81T1-Ni1M-JH4	17632-A: T 46 4 1Ni P M 1 H5 / 17632-B: T554T1-1MA-N1-UH5	424
FLUXOFIL 20 HD	A5.29: E81T1-Ni1M-JH4	17632-A: T 46 4 1Ni P M 1 H5 / 17632-B: T554T1-1MA-N1-UH5	425
FLUXOFIL 21 HD	A5.29: E81T1-Ni1C-JH4	17632-A: T 46 4 1Ni P C 1 H5 / 17632-B: T554T1-1CA-N1-UH5	426
CITOFLUX R82	A5.29: E81T1-Ni1M-H4	17632-A: T 46 5 1Ni P M 1 H5 / 17632-B: T555T1-1MA-N1-UH5	427
CITOFLUX R82 SR	A5.29: E81T1-Ni1M-H4	17632-B: T556T1-1MA-N1-UH5 / 17632-A: T 46 6 1Ni P M 1 H5	428
FLUXOFIL 31	A5.20: E70T-5C-JH4 A5.20: E70T-5M-JH4	17632-B: T494T5-1MA-UH5 / 17632-B: T494T5-1CA-UH5 17632-A: T 42 4 B C 2 H5 / 17632-A: T 42 4 B M 2 H5	429
FLUXOFIL 31 S	A5.20: E70T-5M-JH4 A5.20: E70T-5C-JH4	17632-B: T494T5-1MA-UH5 / 17632-B: T494T5-1CA-UH5 17632-A: T 42 4 B C 2 H5 / 17632-A: T 42 4 B M 2 H5	430
CITOFLUX B00	A5.20: E70T-5C-JH4 A5.20: E70T-5M-JH4	17632-B: T495T5-1MA-UH5 / 17632-B: T495T5-1CA-UH5 17632-A: T 42 5 B C 2 H5 / 17632-A: T 42 5 B M 2 H5	431
FLUXOFIL 40	A5.29: E80T5-GM-H4 A5.29: E80T5-GC-H4	17632-B: T556T5-1CA-N2-UH5 / 17632-A: T 46 6 1Ni B C 2 H5 17632-A: T 46 6 1Ni B M 2 H5 / 17632-B: T556T5-1MA-N2-UH5	432
FLUXOFIL 140 mod.	A5.29: E81TG-GM-H4	17632-A: T 46 6 1Ni B M 2 H5 / 17632-B: T556TG-1MA-N1-UH5	433
FLUXOFIL 44	A5.29: E70T5-GM-JH4	17632-B: T498T5-1MA-N5-UH50 / 17632-A: T 42 8 2Ni B M 2 H5	434
FLUXOFIL 43.1	-	-	435
CITOFLUX B13-O	A5.20: E71-T7	17632-A (EN 758): T 42 Z Y 1 H15	436

Cored wires / Weathering steels			
Product name	AWS	EN / EN ISO / DIN	Page
FLUXOFIL 18 HD	A5.29: E81T1-GM-H4	17632-A: T 50 3 Z P M 1 H5 / 17632-B: T573T1-1MA-NCC1-UH5	437
FLUXOFIL M 48	A5.28: E80C-W2	17632-A: T 46 3 Z M M 1 H5 / 17632-B: T553T15-1MA-NCC1-UH5	438
FLUXOFIL 48	A5.29: E81T5-GM-H4 A5.29: E81T5-GC-H4	17632-A: T 46 6 Z B C 2 H5 / 17632-B: T556T5-1MA-G-UH5 17632-B: T556T5-1CA-G-UH5 / 17632-A: T 46 6 Z B M 2 H5	439

Cored wires / High-strength steels			
Product name	AWS	EN / EN ISO / DIN	Page
FLUXOFIL M 41	A5.28: E90C-G-H4	18276-A: T 55 5 Z M M1 H5 / 18276-B: T625T15-1MA-3M2-UH5	440
FLUXOFIL 41	A5.29: E90T5-GC-H4 A5.29: E90T5-GM-H4	18276-B: T624T5-1MA-N2M2-UH5 / 18276-B: T626T5-1CA-N2M2-UH5 18276-A: T 55 6 1NiMo B C 2 H5 / 18276-A: T 55 4 1NiMo B M 2 H5	441
FLUXOFIL M 41 PG	A5.28: E90C-K3	18276-A: T55 4 Z M M 1 H5 / 18276-B: T624T15-1MA-UH5	442
CITOFLUX R550	A5.29: E91T1-G M H4	18276-A: T 55 5 Mn1.5Ni P M 1 H5	443
CITOFLUX R620	A5.29: E91T1-G H4	18276-A: T 62 4 1NiMo P M 1 H5 / 18276-B: T695T1-1MA-N2M2-H5	444
CITOFLUX R620 Ni2	A5.29: E 101 T1-G M H4	18276-A: T 62 5 Mn2,5Ni P M 1 H5 / 18276-B: T695T1-1MA-N4M1-UH5	445
FLUXOFIL 29 HD	A5.29: E 111 T1-GMJ H4	12876-A: T 69 4 Z P M1 H5	446
FLUXOFIL M 42	A5.28: E90C-G H	18276-B: T784T15-1MA-N4C1M2-UH5 / 18276-A: T 69 4 Mn2NiCrMo M M1 H5	447
FLUXOFIL 42	A5.29: E110T5-K4M-H4 A5.29: E110T5-K4C-H4	18276-B: T786T5-1 CA-N4C1M2-UH5 / 18276-A: T 69 6 Mn2NiCrMo B C 2 H5 18276-A: T 69 6 Mn2NiCrMo B M 2 H5 / 18276-B: T786T5-1 MA-N4C1M2-UH5	448
FLUXOFIL 42 LT	A5.29: E111T5-G	18276-A: T 69 6 Mn2NiCrMo B M3 H5 / 18276-B: T86T5-0MA-N4C1M2-UH5	449
FLUXOFIL 45	-	18276-A: T 89 4 Mn2Ni1CrMo B M 2 H5	450
FLUXOFIL 70	A5.29: E110T5-GM-H4	18276-A: T 69 A Z B M 3 H5 / 18276-B: T78YT5-0MP-G-UH5	451

Cored wires / Chromium-Molybdenum steels			
Product name	AWS	EN / EN ISO / DIN	Page
FLUXOFIL 25	A5.29: E81T1-A1M-H4	17634-A: T MoL P M 1 H5 / 17634-B: T55T1-1M-2M3-H5	452
FLUXOFIL 35	A5.29: E80T5-GC-H4 A5.29: E80T5-GM-H4	17634-B: T55T5-1M-2M3-H5 / 17634-B: T55T5-1C-2M3-H5 17634-A: T MoL B C 2 H5 / 17634-A: T MoL B M 2 H5	453
FLUXOFIL 36	A5.29: E80T5-B2C-H4 A5.29: E80T5-B2M-H4	17634-A: T CrMo1 B C 2 H5 / 17634-A: T CrMo1 B M 2 H5 17634-B: T55T5-1M-1CM-H5 / 17634-B: T55T5-1C-1CM-H5	454
FLUXOFIL 37	A5.29: E80T5-B3C-H4 A5.29: E80T5-B3M-H4	17634-B: T55T5-1M-2C1M-H5 / 17634-B: T55T5-1C-2C1M-H5 17634-A: T CrMo2 B C 2 H5 / 17634-A: T CrMo2 B M 2 H5	455
FLUXOFIL 38 C	A5.29: E70T5-GC-JH4 A5.29: E70T5-GM-JH4	17634-A: T Z B C 3 H5 / 17634-A: T Z B M 3 H5 17634-B: TZT5-0M-Z-H5 / 17634-B: TZT5-0C-Z-H5	456

Cored wires / Stainless and Heat resistant steels			
Product name	AWS	EN / EN ISO / DIN	Page
FLUXINOX 430Ti	A5.22: E 430 T0-G	-	457
FLUXINOX 308L	A5.22: E308LT0-1 A5.22: E308LT0-4	17633-A: T 19 9 L R M 3 / 17633-B: TS308L-FB0 17633-A: T 19 9 L R C 3	458
FLUXINOX 308L PF	A5.22: E308LT1-1 A5.22: E308LT1-4	17633-B: TS308L-FB1 / 17633-A: T 19 9 L P C 1 17633-A: T 19 9 L P M 1	459
FLUXINOX 308H	A5.22: E308HT0-1 A5.22: E308HT0-4	17633-B: TS308H-FB0 / 17633-A: T 19 9 H R C 3 17633-A: T 19 9 H R M 3	460
FLUXINOX 347	A5.22: E347T0-1 A5.22: E347T0-4	17633-A: T 19 9 Nb R M 3 / 17633-B: TS347L-FB0 17633-A: T 19 9 Nb R C 3	461
FLUXINOX 347 PF	A5.22: E347T1-4	17633-A: T 19 9 Nb P M 1 / 17633-A: T 19 9 Nb P C 1 17633-B: TS347L-FB1	462
FLUXINOX 316L	A5.22: E316LT0-1 A5.22: E316LT0-4	17633-A: T 19 12 3 L R M 3 / 17633-B: TS316L-FB0 17633-A: T 19 12 3 L R C 3	463
FLUXINOX 316L PF	A5.22: E316LT1-4 A5.22: E316LT1-1	17633-A: T 19 12 3 L P C 1 / 17633-A:T 19 12 3 L P M 1 17633-B: TS316L-FB1	464
FLUXINOX 318	-	17633-A: T 19 12 3 Nb R M 3 / 17633-A: T 19 12 3 Nb R C 3 17633-B: TS318-FB0	465
FLUXINOX 318 PF	-	17633-B: TS318-FB1 / 17633-A: T 19 12 3 Nb P M 1 17633-A: T 19 12 3 Nb P C 1	466
FLUXINOX 22 9 3 L	A5.22: E2209T0-4 A5.22: E2209T0-1	17 633-A (EN 12073): T 22 9 3 N L R M 3 17 633-A (EN 12073): T 22 9 3 N L R C 3	467
FLUXINOX 22 9 3 L PF	A5.22: E2209T1-4 A5.22: E2209T1-1	17 633-A (EN 12073): T 22 9 3 N L P C 1 17 633-A (EN 12073): T 22 9 3 N L P M 1	468
FLUXINOX 307		17633-A: T 18 8 Mn R C 3 / 17633-A: T 18 8 Mn R M 3	469
FLUXINOX 307 PF		17633-A: T 18 8 Mn P M 1 / 17633-A: T 18 8 Mn P C 1	470
FLUXINOX 309L	A5.22: E309LT0-1 A5.22: E309LT0-4	17633-A: T 23 12 L R M 3 / 17633-B: TS309L-FB0 17633-A: T 23 12 L R C 3	471
FLUXINOX 309L PF	A5.22: E309LT1-1 A5.22: E309LT1-4	17633-A: T 23 12 L P M 1 / 17633-B: TS309L-FB1 17633-A: T 23 12 L P C 1	472
FLUXINOX 309MoL	A5.22: E309LMoT0-4 A5.22: E309LMoT0-1	17633-B: TS309LMo-FB0 / 17633-A: T 23 12 2 L R C 3 17633-A: T 23 12 2 L R M 3	473
FLUXINOX 309MoL PF	A5.22: E309LMoT1-4	17633-A: T 23 12 2 L P C 1 / 17633-A: T 23 12 2 L P M 1 17633-B: TS309LMo-FB1	474
FLUXINOX 312	A5.22: E312T0-1 A5.22: E312T0-4	17633-B: TS312-FB0 / 17633-A: T 29 9 R C 3 17633-A: T 29 9 R M 3	475
FLUXINOX 312 PF	A5.22: E312T1-4 A5.22: E312T1-4	17633-B: TS312-FB1 / 17633-A: T 29 9 P C 1 17633-A: T 29 9 P M 1	476
FLUXINOX 310	A5.22: E 310T0-G	17633-A: T 25 20 R M 3 / 17633-A: T 25 20 R C 3	477
FLUXINOX 310 PF	A5.22: E 310T1-G	17633-A: T 25 20 P C 1 / 17633-A: T 25 20 P M 1	478
FLUXINOX 309H	A5.22: E309T0-1 A5.22: E309T0-4	17633-A: T 22 12 H R M 3 / 17633-B: TS309-FB0 17633-A: T 22 12 H R C 3	479
FLUXINOX 309H PF	A5.22: E309T1-4 A5.22: E309T1-1	17633-A: T 22 12 H P C 3 / 17633-A: T 22 12 H P M 3 17633-B: TS309-FB1	480
FLUXINOX 25 4	-	17633-A: T Z 25 4 R C 3 / 17633-A: T Z 25 4 R M 3	481
FLUXINOX 25 4 PF	-	17633-A: T Z 25 4 P M 3 / 17633-A: T Z 25 4 P C 3	482
FLUXINOX 904L	A5.22: ~E385LT1-1/4	17633-A: T Z 20 25 5 Cu L R M 3 / 17633-A: T Z 20 25 5 Cu L R C 3	483
FLUXINOX 625	A5.11: ~ENiCrMo-3	-	484

Cored wires / Hardfacing			
Product name	AWS	EN / EN ISO / DIN	Page
FLUXOFIL 50	-	14700: T Fe1	485
FLUXOFIL 51	-	14700: T Fe1	486
FLUXOFIL 52	-	14700: T Fe1	487
FLUXOFIL 54	-	14700: T Z Fe1	488
FLUXOFIL 56	-	14700: T Fe8	489
FLUXOFIL 58	-	14700: T Fe8	490
FLUXOFIL M 58	-	14700: T Fe8	491
CITOFLUX H06	-	14700: T Fe8	492
FLUXOFIL 66	-	14700: T Z Fe8	493
FLUXODUR 62-O	-	14700: T Fe15	494

Cored wires for metal-arc welding with or without shielding gas of unalloyed and fine grain structural steels.

EN ISO 17632-A

T	46	4	1Ni	P	M	1	H5
Cored wires	Table 1/2	Table 3	Table 4	Table 5	Table 6	Table 7	Table 8

Table 1

Code digits for tensile strength properties of multi-pass welded joints			
Code digits	Minimum yield strength(1) [MPa]	Tensile strength [MPa]	Minimum eleongation(2) [%]
35	355	440–570	22
38	380	470–600	20
42	420	500–640	20
46	460	530–680	20
50	500	560–720	18

1) Lower yield strength (ReL). will apply. In case the yield strength is not definitely determined, 0,2 % proof stress (Rp0,2) shall be applied.
2) Gauge length is equal to five times the test specimen diameter.

Table 2

Symbols for tensile strength properties of single-pass welded joints		
Symbols	Minimum yield strength of base metal [MPa]	Minimum tensile strength of welded joint [MPa]
3T	355	470
4T	420	520
5T	500	600

Table 3

Symbols for impact energy of all-weld metal or welded joint	
Symbols	Temperature for minimum impact energy 47 J [°C]
Z	no requirement
A	20
0	0
2	-20
3	-30
4	-40
5	-50
6	-60
7	-70
8	-80
9	-90
10	-100

Table 4

Symbols for chemical composition of all-weld metal			
Symbols	Chemical composition [%] (m/m) (1)(2)(3)		
	Mn	Ni	Mo
No Symbols	2,0	–	–
Mo	1,4	–	0,3–0,6
MnMo	1,4–2,0	–	0,3–0,6
1Ni	1,4	0,6–1,2	–
1,5 Ni	1,6	1,2–1,8	–
2Ni	1,4	1,8–2,6	–
3Ni	1,4	2,6–3,8	–
Mn1Ni	1,4–2,0	0,6–1,2	–
1NiMo	1,4	0,6–1,2	0,3–0,6
Z	any other composition agreed upon		

1) If not specified: Mo<0,2%, Ni<0,5%, Cr<0,2%, V<0,08%, Nb<0,05%, Cu<0,3% and only tubular cored electrodes to be welded without shielding gas Al<2,0%
2) Single values in this table are maximum values.
3) The results are to be rounded to the same decimal place as the specified values using the rules as to ISO 31-0 : 1992, Appendix B, Rule A.

Table 5

Symbols for type of filling material			
Symbols	Properties	Type of weld	Shielding gas
R	Rutile, slow-freezing slag	Single and multipass welding	required
P	Rutile, fast-freezing slag	Single and multipass welding	required
B	Basic	Single and multipass welding	required
M	Metal powder	Single and multipass welding	required
V	Rutile or Basic / fluoride	Single pass welding	not required
W	Basic / fluoride fast-freezing slag	Single and multipass welding	not required
Y	Basic / fluoride fast-freezing slag	Single and multipass welding	not required
Z	other types	–	–

Table 6

Symbols for shielding gas	
Symbols	Meaning
M	with shielding gas EN ISO 14175-M2, without helium
C	with shielding gas EN ISO 14175-C1, carbon dioxide
N	self shielded tubular cored electrodes

Table 7

Code digits for welding positions	
Code digit	Welding positions
1	all positions
2	all positions, except vertical-down
3	flat butt welds, fillet welds in the flat and horizontal position
4	butt and fillet welds in the flat position
5	vertical-down welds and as under 3

Table 8

Symbols for hydrogen content of deposited weld metal	
Symbols	Hydrogen content ml/100 grams deposited weld metal max.
H5	5
H10	10
H15	15

Cored wires for gas-shielding metal-arc welding of high-strength steels.

EN ISO 18276-A

T	69	4	Mn2NiCrMo	M	M	1	H5
Cored wires	Table 1	Table 2	Table 3	Table 4	Table 5	Table 6	Table 7

Table 1

Code digits for tensile strength properties of multi-pass welded joints			
Code digit	Minimum yield strength (1) [MPa]	Tensile strength [MPa]	Minimum elongation (2) %
55	550	610–780	18
62	620	690–890	18
69	690	760–960	17
79	790	880–1080	16
89	890	980–1180	15
1) Lower yield strength (ReL) will apply. In case yield strength is not definitely determined, 0,2 % proof stress (Rp0,2) shall be applied. 2) Gauge length is equal to five times the test specimen diameter.			

Table 2

Symbols for impact energy of all-weld metal	
Symbols	Temperature for minimum impact energy 47 J [°C]
Z	no requirement
A	20
0	0
2	-20
3	-30
4	-40
5	-50
6	-60
7	-70
8	-80

Table 3

Symbols for chemical composition of all-weld metal				
Symbols	Chemical composition [%] (m/m) (1)(2)(3)			
	Mn	Ni	Cr	Mo
MnMo	1,4–2,0	–	–	0,3–0,6
Mn1Ni	1,1–1,8	0,6–1,2	–	–
Mn1,5Ni	1,1–1,8	1,3–1,8	–	–
Mn2,5Ni	1,1–2,0	2,1–3,0	–	–
1NiMo	1,4	0,6–1,2	–	0,3–0,6
1,5NiMo	1,6	1,2–1,8	–	0,3–0,7
2NiMo	1,6	1,6–2,4	–	0,3–0,7
Mn1NiMo	1,3–2,0	0,6–1,2	–	0,3–0,7
Mn2NiMo	1,3–2,1	1,8–2,6	–	0,3–0,7
Mn2NiCrMo	1,4–2,0	1,8–2,6	0,3–0,6	0,3–0,6
Mn2Ni1CrMo	1,4–2,1	1,8–2,6	0,6–1,0	0,3–0,6
Z	any other composition agreed upon			

1) If not specified: C 0,03%-0,10%, Cr<0,2%, Cu<0,3%, Mo<0,2%, Nb<0,05%, Ni<0,3%, P<0,020%, S<0,020%, V<0,05%.
2) Individual values in this table are maximum values.
3) The results have to be rounded to the same decimal place as the specified values using the rules as to ISO 31-0 : 1992, Appendix B, Rule A.

Table 4

Symbols for type of filler material			
Symbols	Properties	Type of weld	Shielding gas
R	Rutile slow-freezing slag	Single and multi-pass welds	required
P	Rutile fast-freezing slag	Single and multi-pass welds	required
B	Basic	Single and multi-pass welds	required
M	Metal powder	Single and multi-pass welds	required
Z	other types		

Table 5

Symbols for shielding gas	
Symbols	Meaning
M	with shielding gas EN ISO 14175-M2, without helium.
C	with shielding gas EN ISO 14175-C1, carbon dioxide.

Table 6

Code digits for welding positions	
Code digits	Welding positions
1	all positions
2	all positions, except vertical-down
3	flat butt welds, fillet welds in the flat and horizontal position
4	butt and fillet welds in the flat position
5	vertical-down welds and as under 3

Table 7

Symbols for hydrogen content of deposited weld metal	
Symbols	Hydrogen content ml/100 grams deposited weld metal max.
H5	5
H10	10
H15	15

Table 8

Symbol for the stress-relieved condition	
Symbol	Meaning
T	Properties of the weld metal apply to the stress-relieved condition of 1 hr/560 °C to 600 °C, then furnace-cooling to 300 °C.

Cored wires for gas-shielded metal-arc welding of creep resistant steels

EN ISO 17634-A

T	CrMo1	B	C	3	H5
Cored wires	Table 1/2	Table 3	Table 4	Table 5	Table 6

Table 1

Symbols for chemical composition of all-weld metal								
Symbols	Chemical composition [%] (m/m) (1)(2)(3)							
	C	Si	Mn	P	S	Cr	Mo	V
Mo	0,07–0,12	0,80	0,60–1,30	0,020	0,020	–	0,40–0,65	–
MoL	0,07	0,80	0,60–1,70	0,020	0,020	–	0,40–0,65	–
MoV	0,07–0,12	0,80	0,40–1,00	0,020	0,020	0,30–0,60	0,50–0,80	0,25–0,45
CrMo 1	0,05–0,12	0,80	0,40–1,30	0,020	0,020	0,90–1,40	0,40–0,65	–
CrMo 1L	0,05	0,80	0,40–1,30	0,020	0,020	0,90–1,40	0,40–0,65	–
CrMo 2	0,05–0,12	0,80	0,40–1,30	0,020	0,020	2,00–2,50	0,90–1,30	–
CrMo 2L	0,05	0,80	0,40–1,30	0,020	0,020	2,00–2,50	0,90–1,30	–
CrMo 5	0,03–0,12	0,80	0,40–1,30	0,020	0,025	4,00–6,00	0,40–0,70	–
Z	any other chemical composition							

1) If not specified, Ni<0,3%, Cu<0,3%, V<0,03%, Nb<0,01%, Cr<0,2%.
2) Single values in this table are maximum values
3) The results have to be rounded to the same decimal place as the specified values using the rules as to ISO 31-0 : 1992 Appendix B, Rule A.

Table 2

Mechanical properties of all-weld metal								
				Impact energy KV [J] at +20 C		Heat treatment of weld metal / test piece		
Alloy symbol	Minimum yield strength Rp0,2 [MPa]	Minimum Tensile strength Rm [MPa]	Minimum Elongation A5 [%]	Minimum mean value from three specimens	Minimum individual value	Preheat and interpass temperature [°C]	Temperature(3) [°C]	Time(4) [min]
Mo/MoL	355	510	22	47	38	<200	570–620	60
MoV	355	510	18	47	38	200–300	690–730	60
CrMo 1	355	510	20	47	38	150–250	660–700	60
CrMo 1L	355	510	20	47	38	150–250	660–700	60
CrMo 2	400	500	18	47	38	200–300	690–750	60
CrMo 2L	400	500	18	47	38	200–300	690–750	60
CrMo 5	400	590	17	47	38	200–300	730–760	60
Z	any other mechanical values agreed upon by manufacturer and user							

1) The gauge length is equal to five times the test specimen diameter.
2) Only one single value lower than minimum average is permitted.
3) The test piece must be furnace-cooled to 300 °C, with a cooling rate below 200 °C/hr.
4) Tolerance ±10 minutes.

Table 3

Symbols for type of filler material	
Symbols	Properties
R	Rutile, slow-freezing slag
P	Rutile, fast-freezing slag
B	Basic
M	Metal powder
Z	other types

Table 4

Symbols for shielding gas	
Symbols	Meaning
M	with shielding gas EN ISO 14175-M2, without helium
C	with shielding gas EN ISO 14175-C1, carbon dioxide

Table 5

Code digits for welding positions	
Code digit	Welding positions
1	all-positions
2	all positions, except vertical-down
3	flat butt welds, fillets in the flat and horizontal position
4	butt and fillet welds in the flat position
5	vertical-down and as under 3

Table 6

Symbols for hydrogen content of deposited weld metal	
Symbol	Hydrogen content ml/100 grams deposited weld metal max.
H5	5
H10	10
H15	15

Cored wires for metal-arc welding with or without shielding gas of austenitic stainless and heat resisting steels.

EN ISO 17633-A

T	18 8 Mn L	R	M	1
Cored wires	Table 1/5	Table 2	Table 3	Table 4

Table 1

Minimum tensile strength of all-weld metal				
Alloy symbol	Minimum 0,2 % proof stess Rp0,2 [MPa]	Minimum tensile strength Rm [MPa]	Minimum Elongation(1) A5 [%]	Heat treatment
13	250	450	15	(2)
13 Ti	250	450	15	(2)
13 4	500	750	15	(3)
17	300	450	15	(4)
19 9 L	320	510	30	none
19 9 Nb	350	550	25	none
19 12 3 L	320	510	25	none
19 12 3 Nb	350	550	25	none
19 13 4 NL	350	550	25	none
22 9 3 NL	450	550	20	none
18 16 5 NL	300	480	25	none
18 8 Mn	350	500	25	none
20 10 3	320	510	25	none
23 12 L	320	510	25	none
23 12 2 L	350	550	25	none
29 9	450	650	15	none
22 12 H	350	550	30	none
25 20	350	550	25	none

1) Gauge length is equal to five times the test specimen diameter.
2) 840°C to 870°C within 2hrs. – furnace cooling at 600°C, then air cooling.
3) 580°C to 620°C within 2hrs. – air cooling.
4) 760°C to 790°C within 2hrs. – furnace cooling at 600°C, then air cooling.
Remark: The elongation values of the weld metal may be lower than those of the base metal.

Table 2

Symbols for the type of tubular cored electrode	
Symbol	Properties
R	Rutile, slow-freezing slag
P	Rutile, fast-freezing slag
M	Metal powder
U	Self shielding
Z	other types

Table 3

Symols for shielding gas	
Symbol	Meaning
M	with shielding gas ISO 14175-M2 without helium
C	with shielding gas ISO 14175-C1, carbon dioxide
N	self shielded tubular cored electrodes

Table 4

Code digits for welding position	
Code digit	Welding positions
1	all positions
2	all positions, except vertical-down
3	flat butt welds, fillets in the flat and horizontal position
4	butt and fillet welds in the flat position
5	vertical-down, and as under 3

Table 5 (1/2)

Symbols for chemical composition of all-weld metal									
Symbols	Chemical composition(%), (m/m), (1)(2)(3)(4)								
	C	Si	Mn	P(5)	S(5)	Cr	Ni	Mo	Other Elements
Martensitic/ ferritic 13	0,12	1,0	1,5	0,030	0,025	11,0–14,0	–	–	–
13 Ti	0,10	1,0	0,80	0,030	0,030	10,5–13,0	–	–	Ti (6)
13 4	0,06	1,0	1,5	0,030	0,025	11,0–14,5	3,0–5,0	0,4–1,0	–
17	0,12	1,0	1,5	0,030	0,025	16,0–18,0	–	–	–
Austenitic 19 9 L	0,04	1,2	2,0	0,030	0,025	18,0–21,0	9,0–11,0	–	–
19 9 Nb	0,08	1,2	2,0	0,030	0,025	18,0–21,0	9,0–11,0	–	Nb (7)
19 12 3 L	0,04	1,2	2,0	0,030	0,025	17,0–20,0	10,0–13,0	2,5–3,0	–
19 12 3 Nb	0,08	1,2	2,0	0,030	0,025	17,0–20,0	10,0–13,0	2,5–3,0	Nb (7)
19 13 4 NL (8)	0,04	1,2	1,0–5,0	0,030	0,025	17,0–20,0	12,0–15,0	3,0–4,5	N 0,20 (5)
Ferritic austenitic high-corrosion resistant 22 9 3 NL(9)	0,04	1,2	2,5	0,030	0,025	21,0–24,0	7,5–10,5	2,5–4,0	N 0,08–020
Fully austenitic high-corrosion resistant 18 16 5 NL(8)	0,04	1,2	1,0–4,0	0,035	0,025	17,0–20,0	15,5–19,0	3,5–5,0	N 0,08–020 (5)
Special types	0,20	1,2	4,5–7,5	0,035	0,025	17,0–20,0	7,0–10,0	–	–
20 10 3	0,08	1,2	2,5	0,035	0,025	19,5–22,0	9,0–11,0	2,0–4,0	–
23 12 L	0,04	1,2	2,5	0,030	0,025	22,0–25,0	11,0–14,0	–	–
23 12 2 L	0,04	1,2	2,5	0,030	0,025	22,0–25,0	11,0–14,0	2,0–3,0	–
29 9	0,15	1,2	2,5	0,035	0,025	27,0–31,0	8,0–12,0	–	–

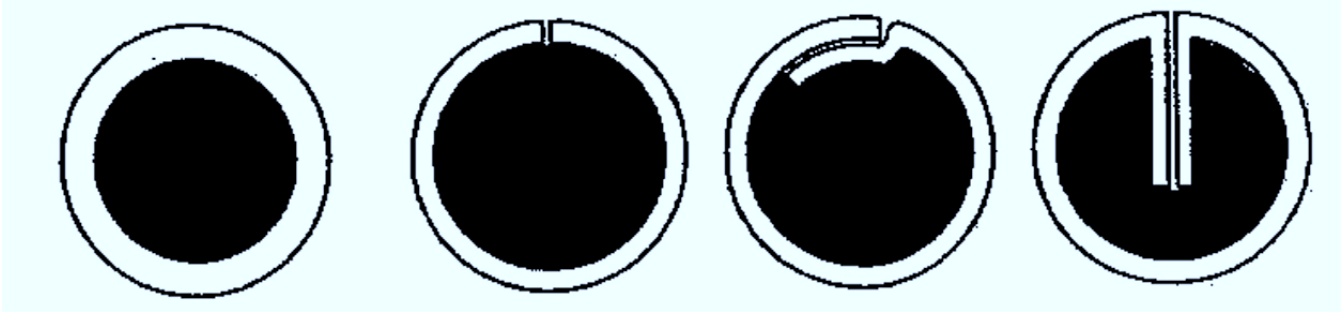
Table 5 (2/2)

Symbols for chemical composition of all-weld metal								
Symbols	Chemical composition(%), (m/m), (1)(2)(3)(4)							
Heat resisting types 22 12 H	0,15	1,2	2,5	0,030	0,025	20,0–23,0	–	–
25 20 (8)	0,06–0,20	1,2	1,0–5,0	0,030	23,0–27,0	18,0–22,0	–	–

1) If not specified Mo<0,75 %, Cu<0,75 %, Ni<0,60 %
2) Individual values in this table are maximum values.
3) Tubular cored electrodes not listed in this table are analogously to be marked with the prefix letter Z.
4) The results obtained have to be rounded to the same decimal place as the specified values using the rules as to ISO 31-0 : 1992, Enclosure B, Rule A.
5) The sum of P and S must not exceed 0,050 %, except for 18 16 5 NL, 18 8 Mn and 29 9.
6) Ti at least 10 times C, not exceeding 1,5 %.
7) Nb at least 8 times C, not exceeding 1,1 %; up to 20 % of the Nb-content may be substituded by Ta.
8) In most cases, all-weld metal is fully austenitic and may tend to produce microcracks. The formation of such cracks will be reduced by increasing the manganese content. With regard to this fact, the range of manganese of some types has been extended.
9) Tubular cored electrodes with this symbol are usually selected for special properties and are not simply interchangeable.

Tubular cored wires are composed of metallic sheath and powder filling

Cross sections of tubular cored wires



Cross sections of tubular cored wires			
seamless tubular cored wire	butt joint	lapped joint	flanged joint
	Folded cored wire		

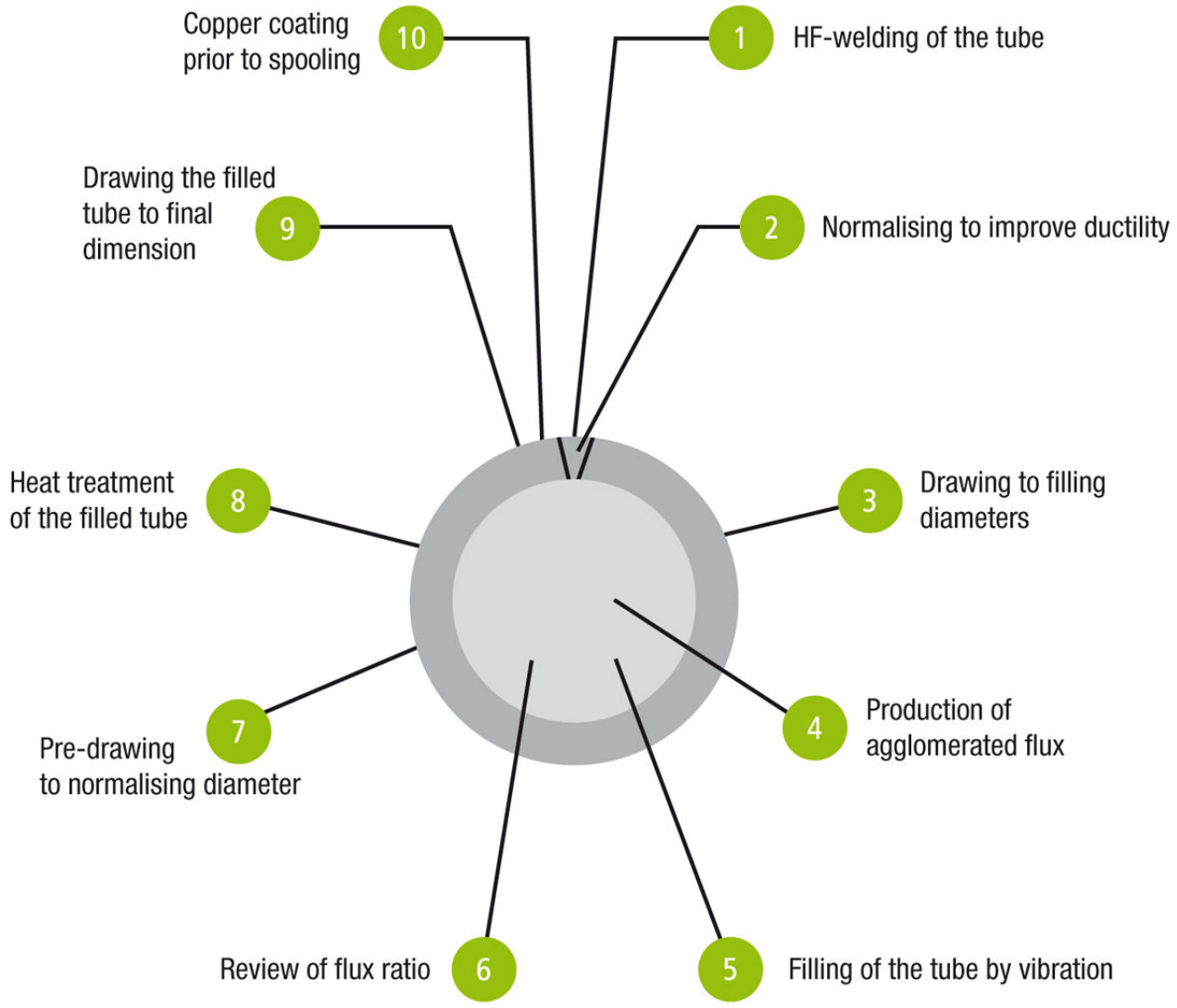
Function of metallic sheath:

- Holds the flux powder inside the cored wire, avoiding flux leakage
- Imparts form stability to the electrode
- Current transfer during welding

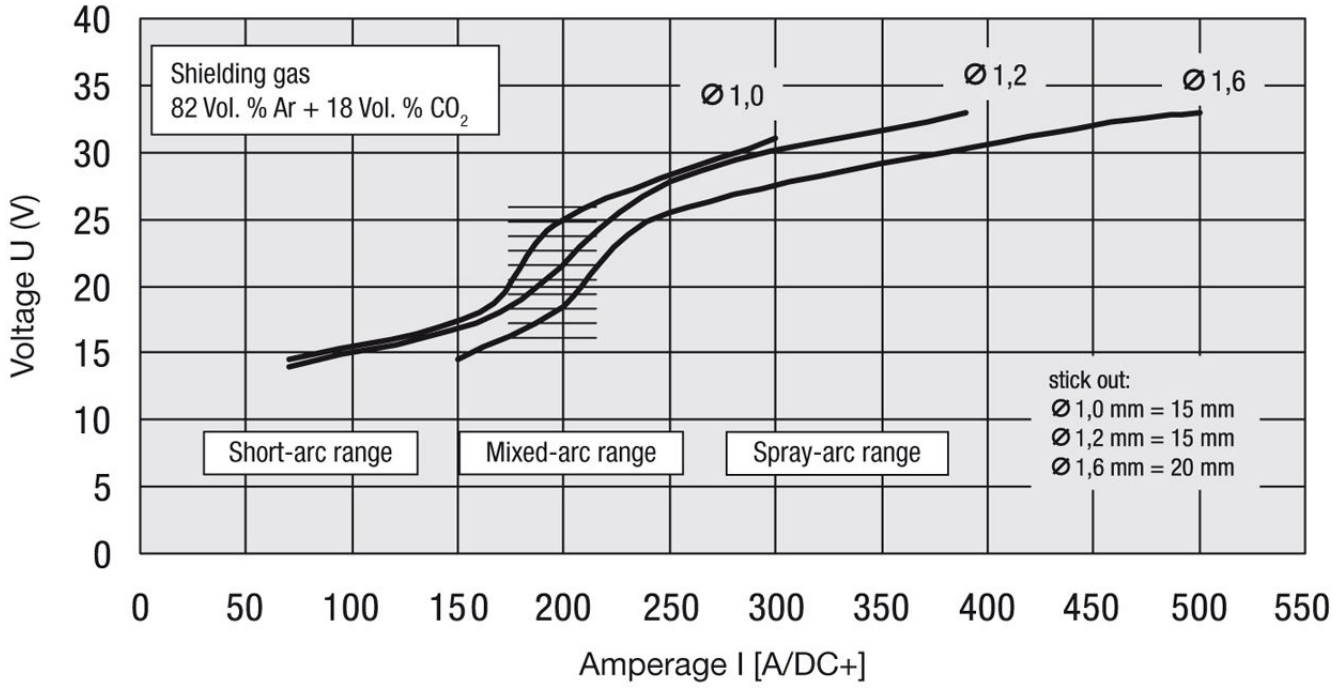
The filling powder is a mixture of various components that have different functions:

- Arc stabilisers for high process stability
- Alloying elements to optimise metallurgy
- Micro-alloying elements for improving mechanical properties of the weld metal
- Slag forming elements
- Prevention of moisture pick-up
- Purify the weld pool from elements promoting cracking and to improve weldability especially in positional welding

Schematic representation of the FLUXOFIL process

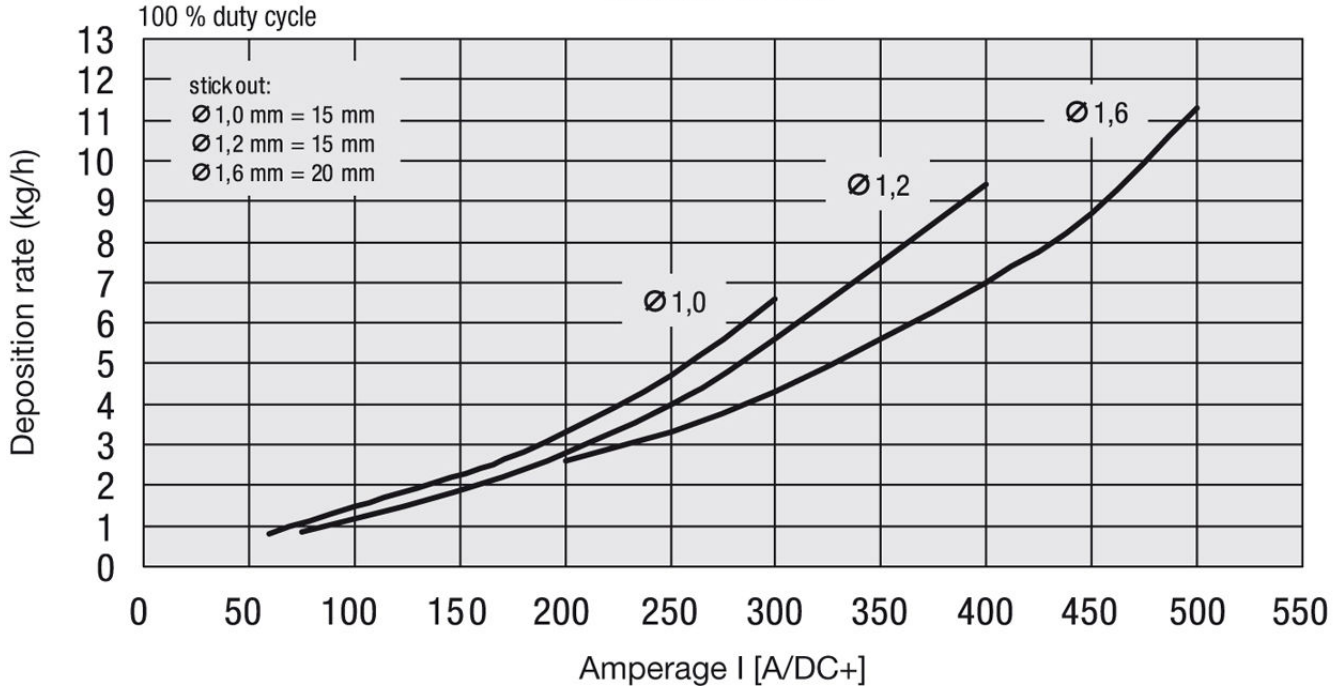


Welding parameters for flux cored wire FLUXOFIL M 8

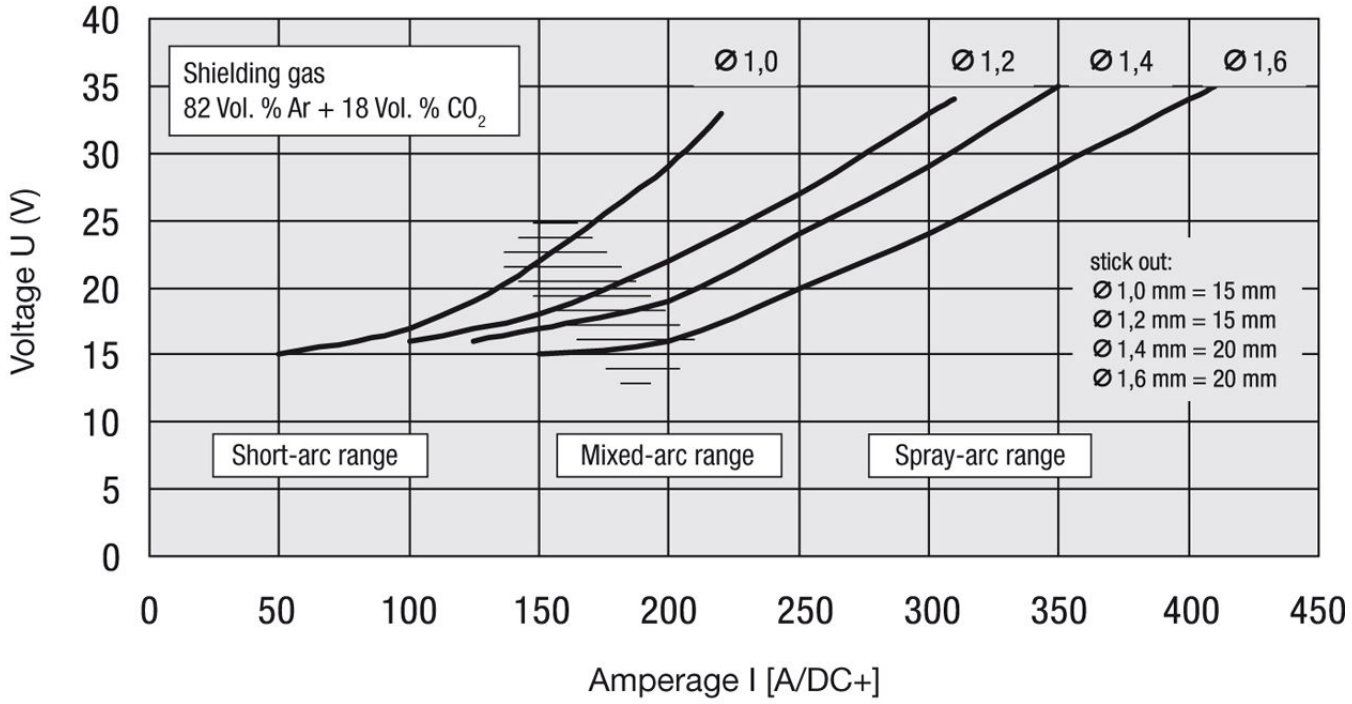


When using shielding gas according to DIN EN 439-C1 (100 Vol % CO_2) increase arc-voltage by about 3 volts

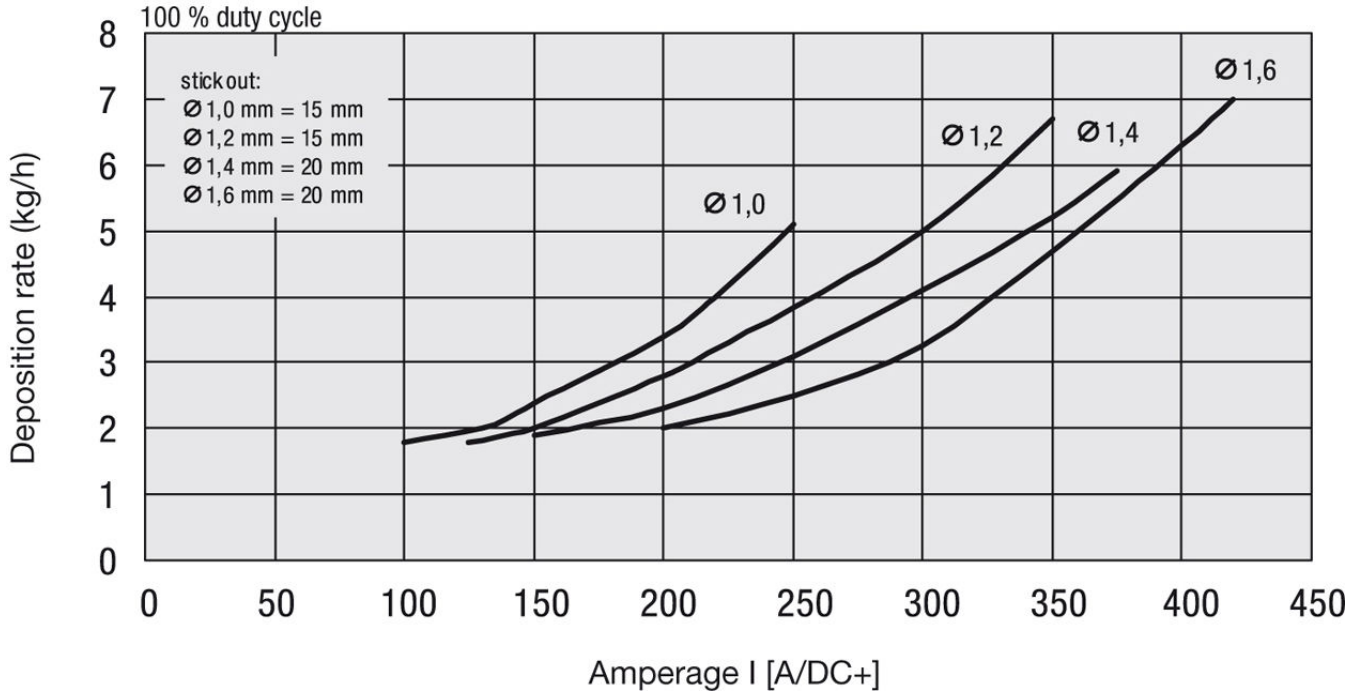
Deposition rate of flux cored wire FLUXOFIL M 8

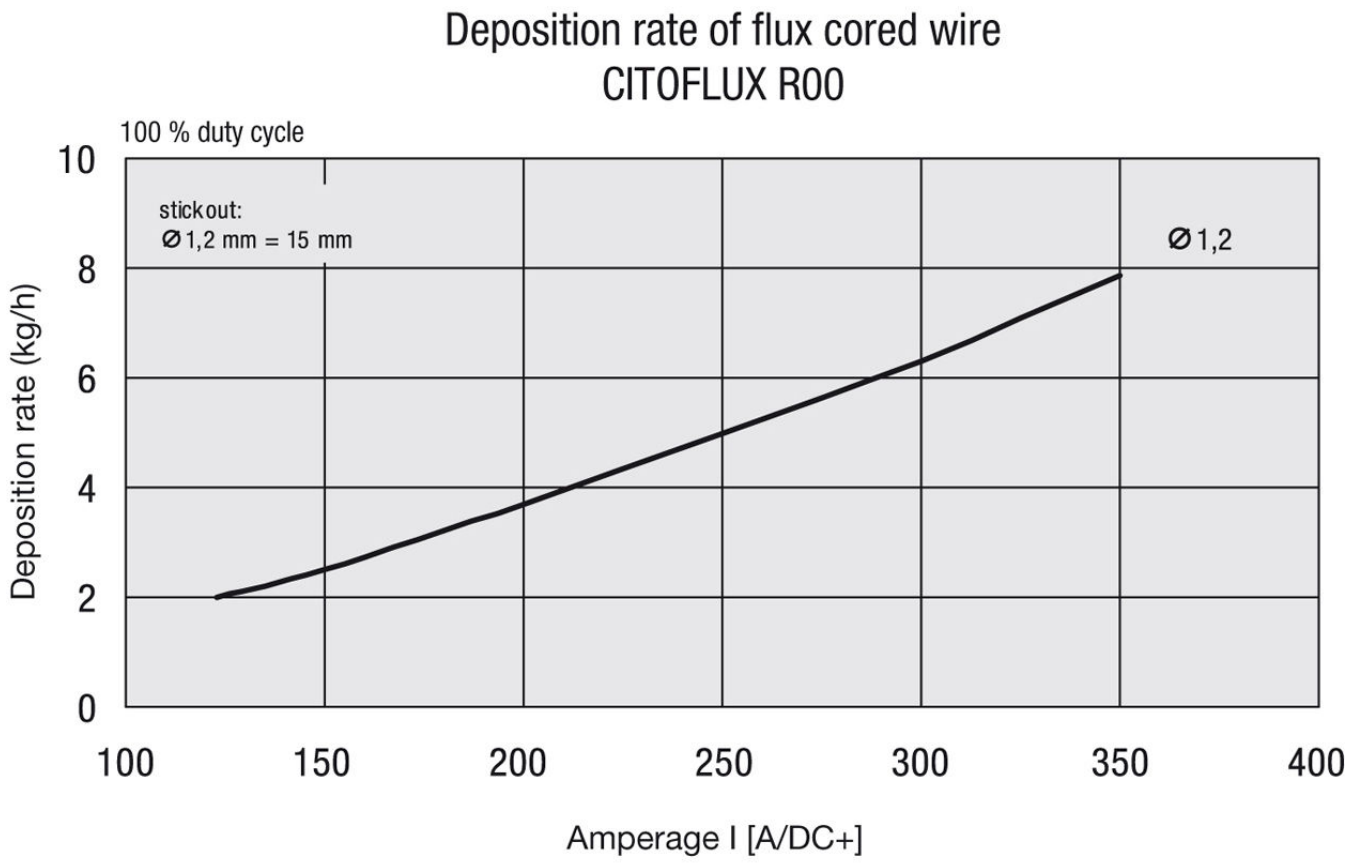


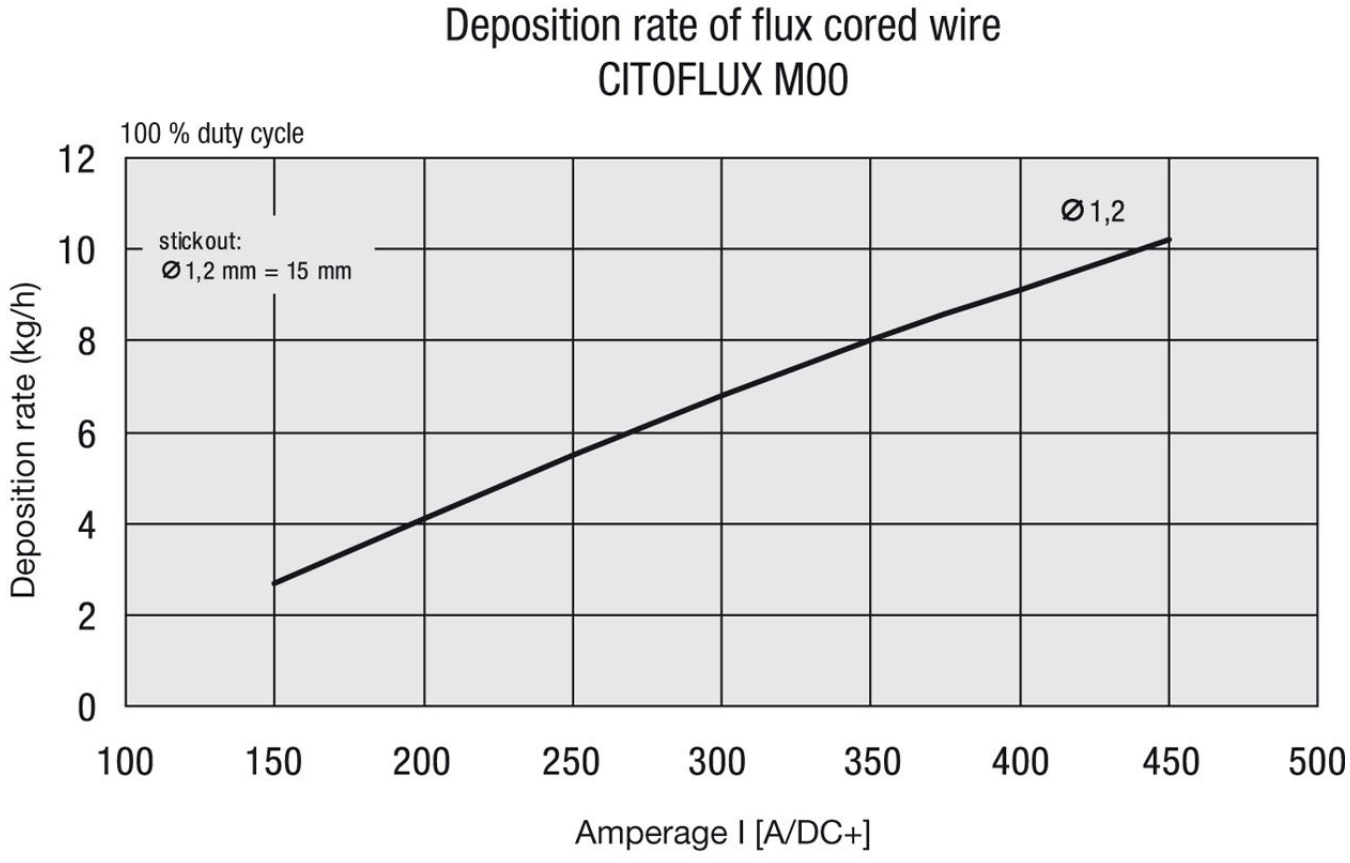
Welding parameters for flux cored wire FLUXOFIL M 10 and FLUXOFIL M 42



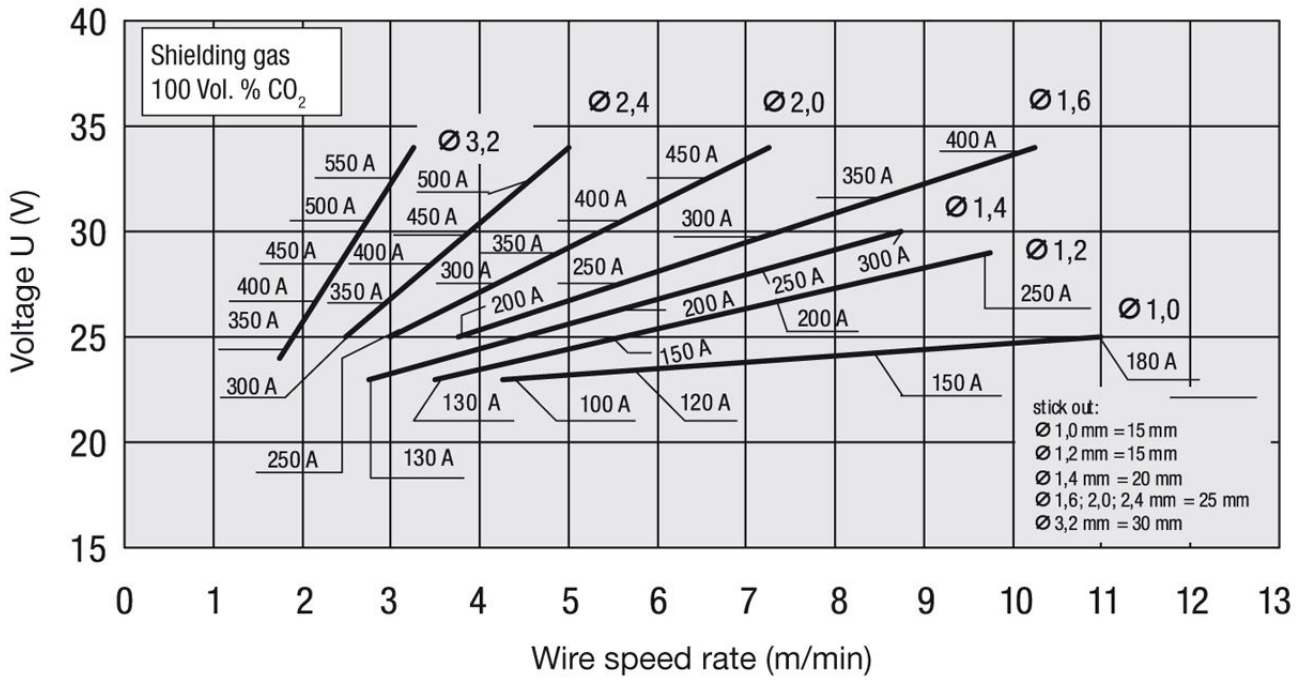
Deposition rate of flux cored wire FLUXOFIL M 10 and FLUXOFIL M 42




Deposition rate of flux cored wire
CITOFLUX R00
100 % duty cycle
stickout:
Ø1,2 mm = 15 mm
Ø1,2
Deposition rate (kg/h)
0
2
4
6
8
10
100
150
200
250
300
350
400
Amperage I [A/DC+]

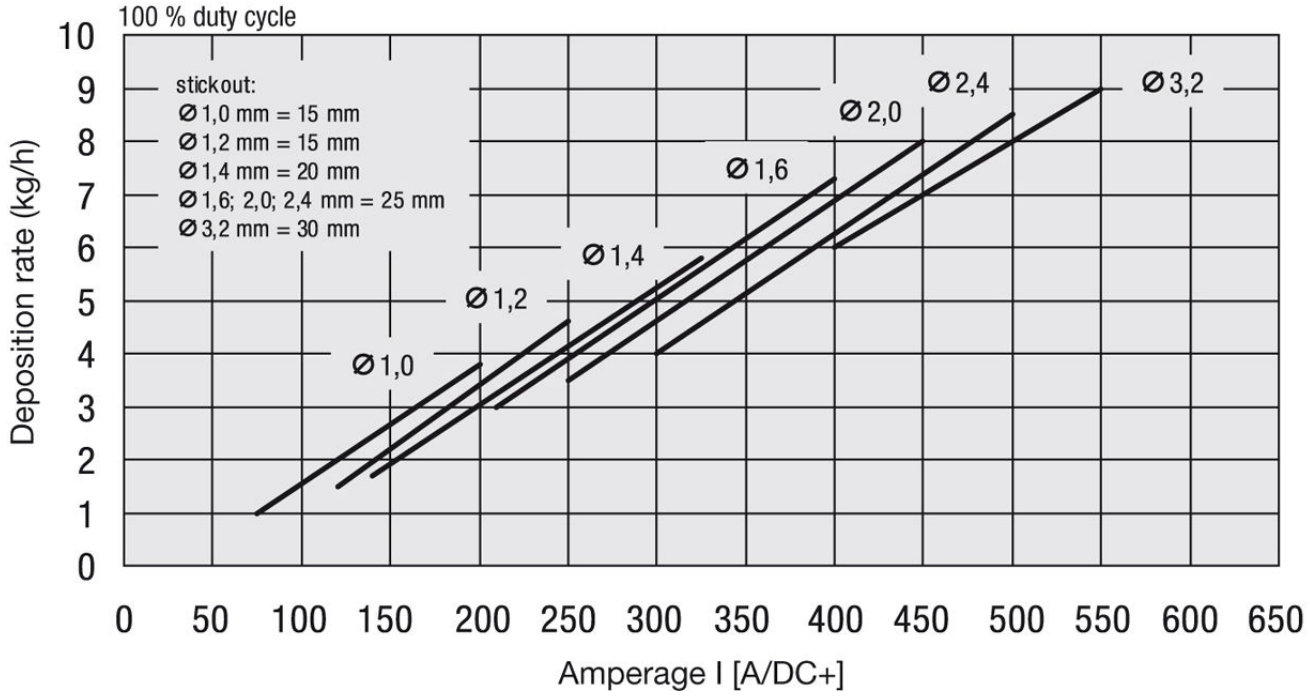

Deposition rate of flux cored wire
CITOFLUX M00
100 % duty cycle
stickout:
Ø1,2 mm = 15 mm
Ø1,2
Deposition rate (kg/h)
0
2
4
6
8
10
12
100
150
200
250
300
350
400
450
500
Amperage I [A/DC+]

Welding parameters for flux cored wires
FLUXOFIL 14, 20, 25, 30, 31, 35, 36, 37, 40, 41, 42, 43.1, 44, 48, 70

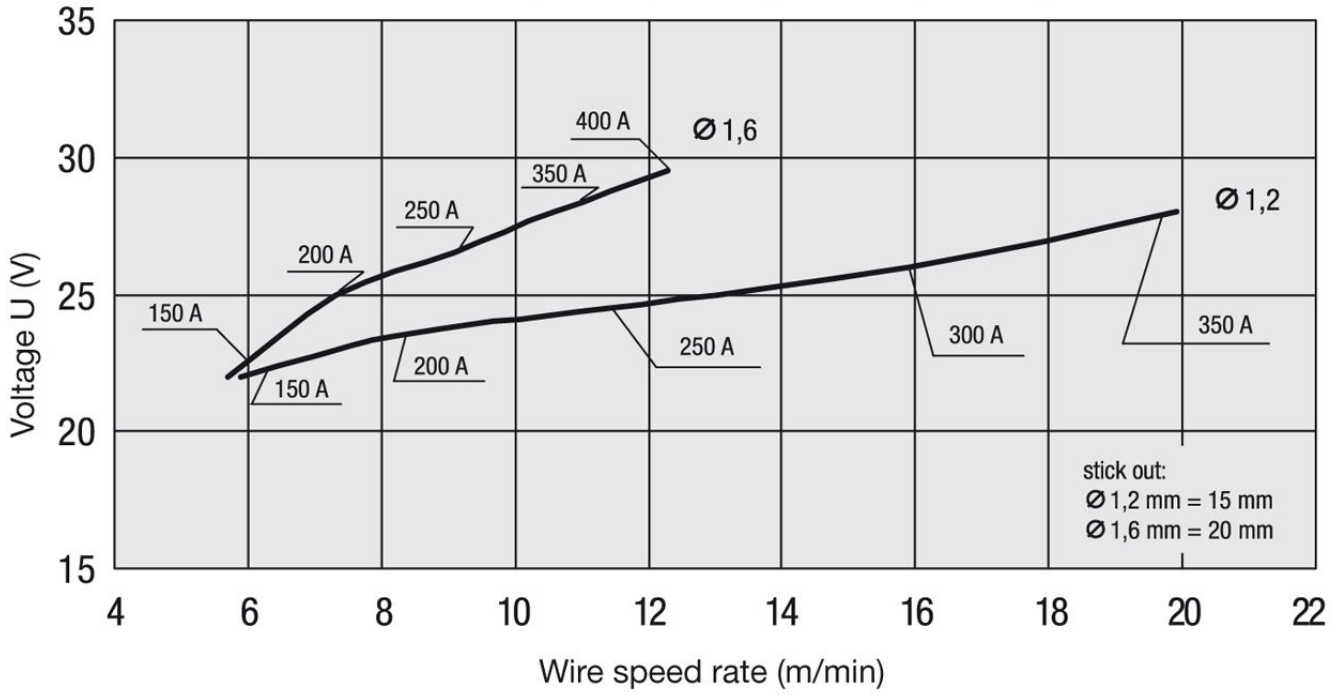


When using shielding gas according to DIN EN 439 M21 (82 Vol.% Ar + 18 Vol.% CO_2) reduce arc-voltage by about 3 volts

Deposition rates of flux cored wires
FLUXOFIL 14, 20, 25, 30, 31, 35, 36, 37, 40, 41, 42, 43.1, 44, 48, 70

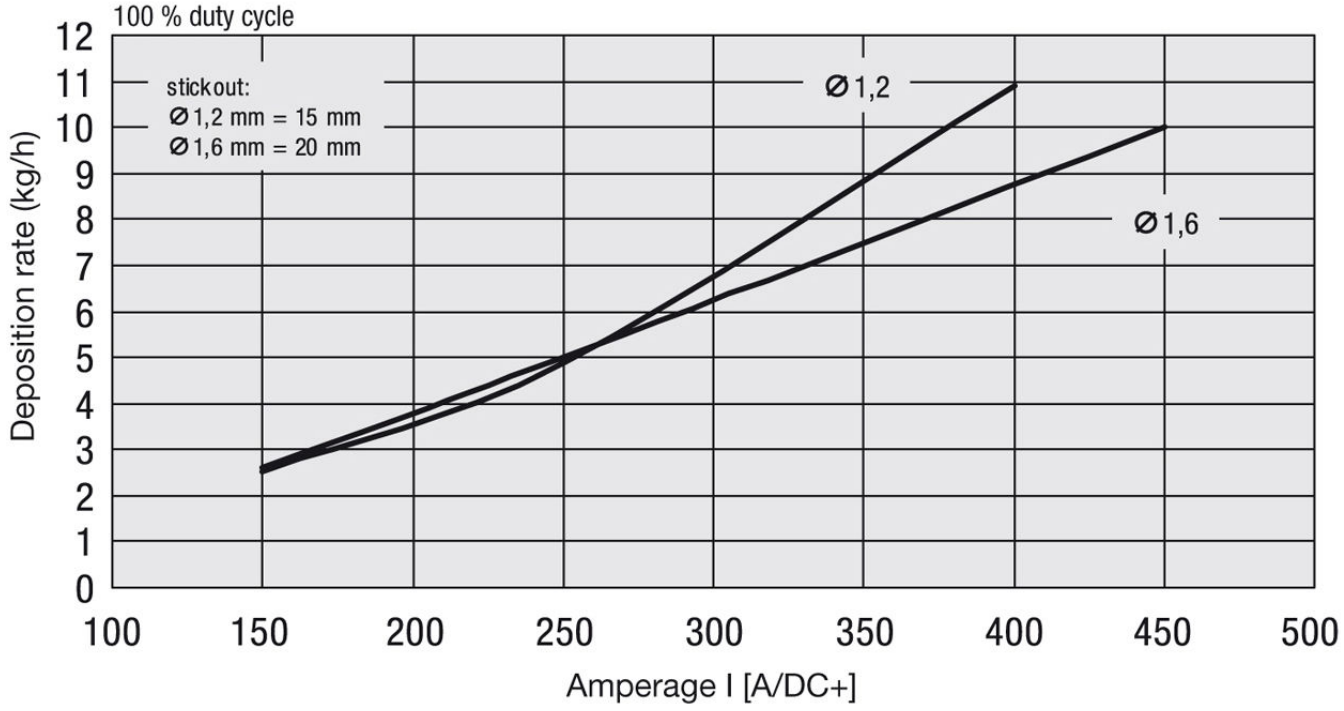


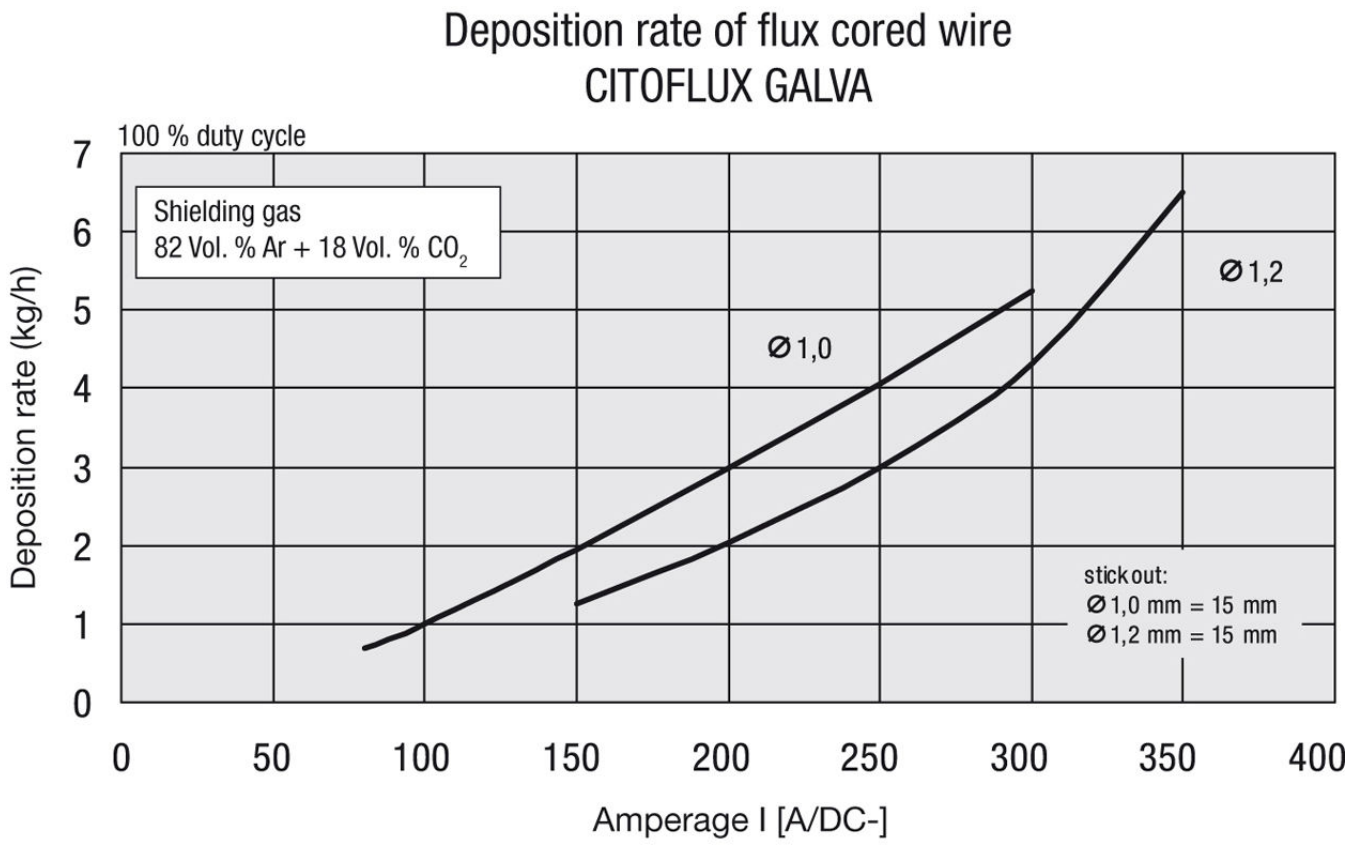
Welding parameters for flux cored wires
FLUXOFIL 14 HD, 19 HD, 18 HD, 19 HDS, 20 HD, 21 HD



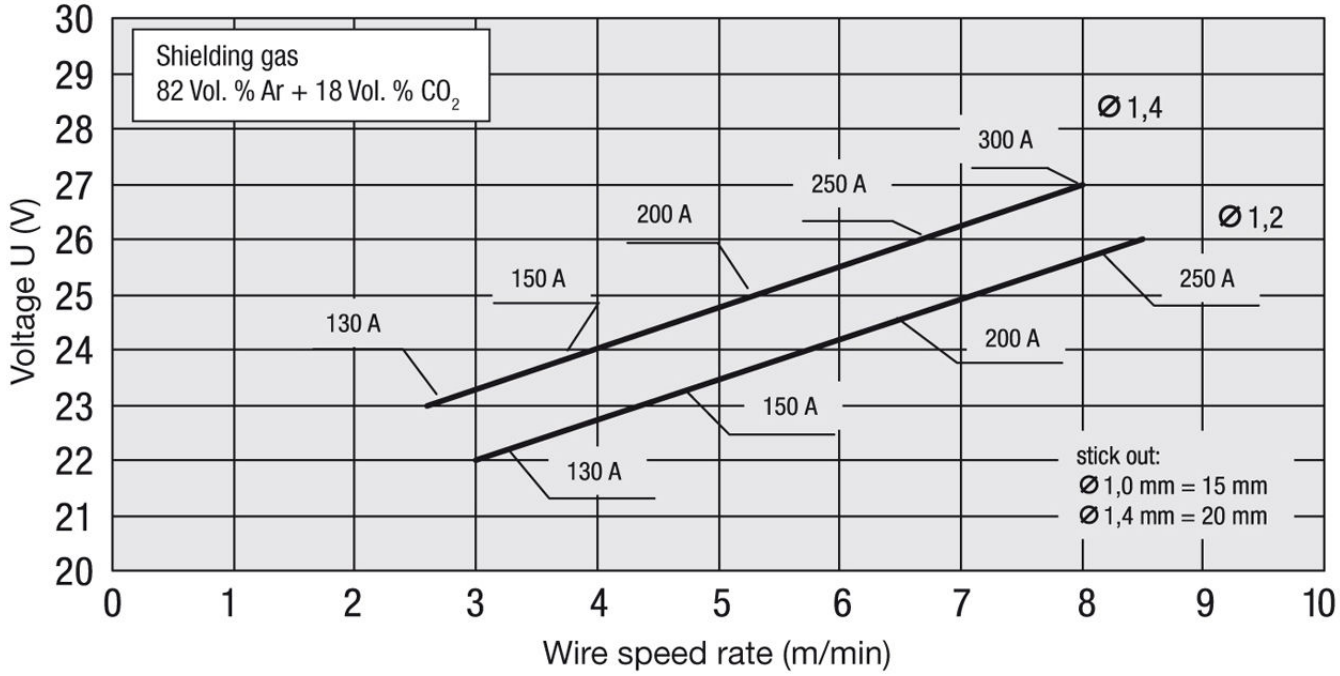
When using shielding gas according to DIN EN 439 - C1 (100 Vol% CO_2) increase arc-voltage by about 3 volts

Deposition rate of flux cored wires
FLUXOFIL 14 HD, 19 HD, 18 HD, 19 HDS, 20 HD, 21 HD

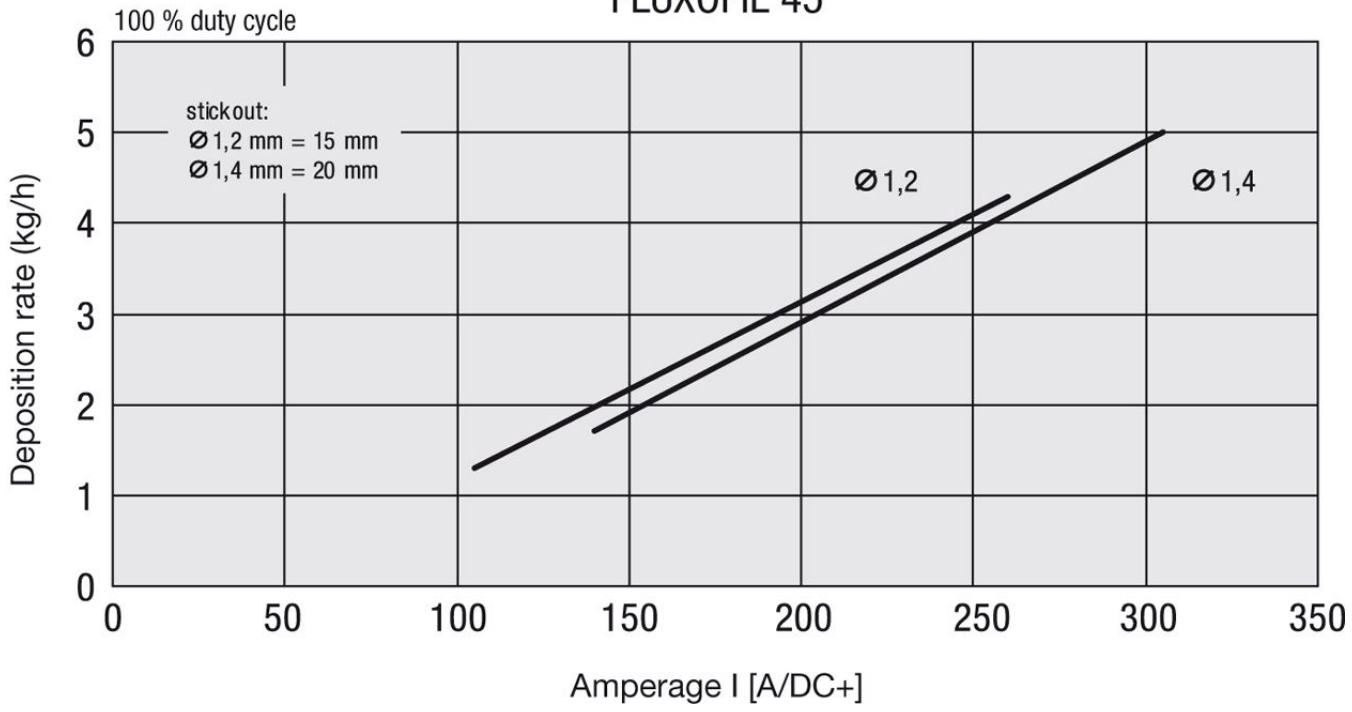



Deposition rate of flux cored wire
CITOFLUX GALVA
100 % duty cycle
Shielding gas
82 Vol. % Ar + 18 Vol. % CO_2
Ø1,0
Ø1,2
stick out:
Ø1,0 mm = 15 mm
Ø1,2 mm = 15 mm
Deposition rate (kg/h)
0
1
2
3
4
5
6
7
0
50
100
150
200
250
300
350
400
Amperage I [A/DC-]

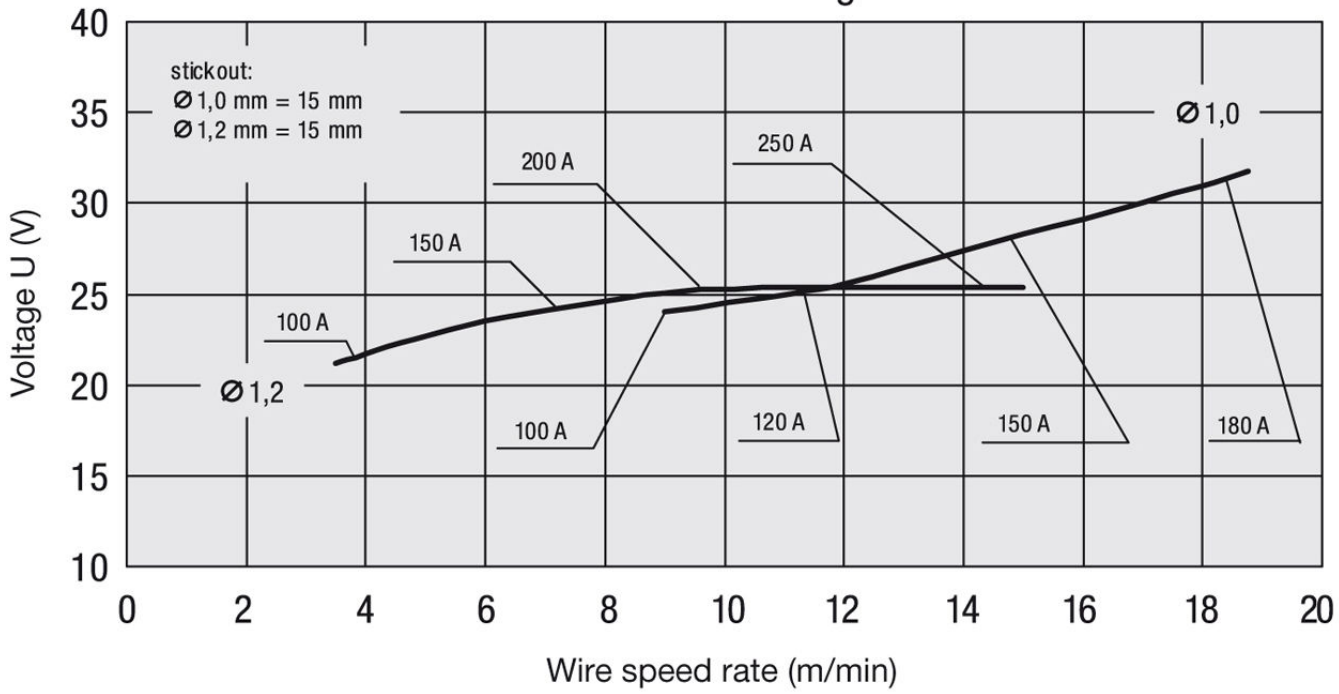
Welding parameters for flux cored wire FLUXOFIL 45



Deposition rate of flux cored wire FLUXOFIL 45

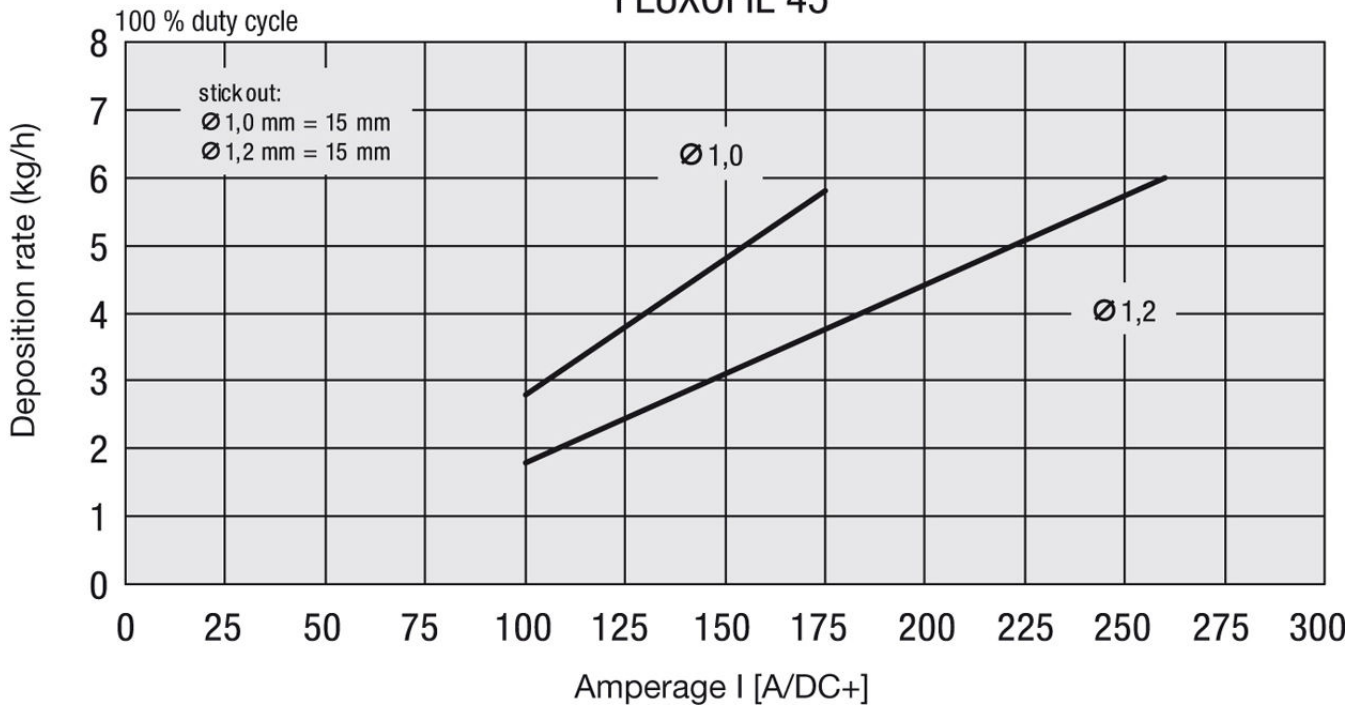


Welding parameters for flux cored wire FLUXINOX - Range

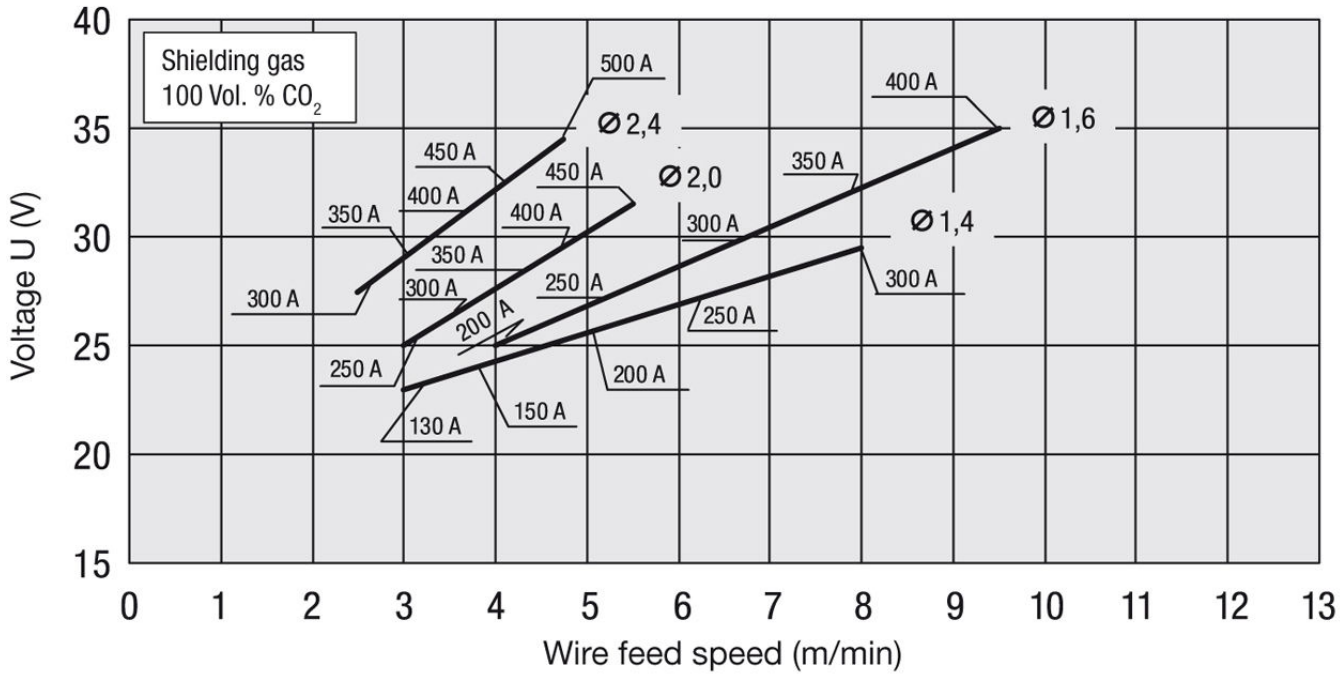


Shielding gas 82 Vol.% Ar + 18 Vol.% CO_2
When using 100 Vol. % CO_2 increase voltage by about 3 volts

Deposition rate of flux cored wire FLUXOFIL 45

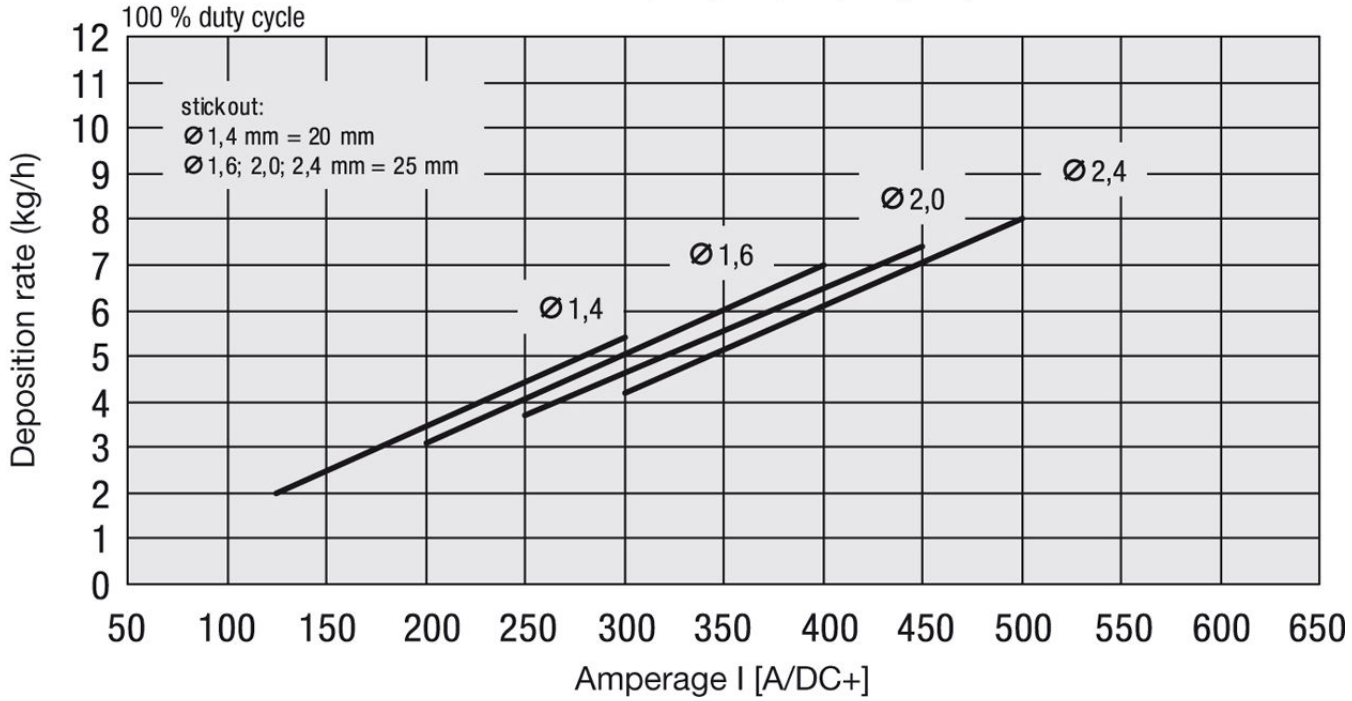


Welding parameters for flux cored wires
FLUXOFIL 50, 51, 52, 54, 56, 58, 66

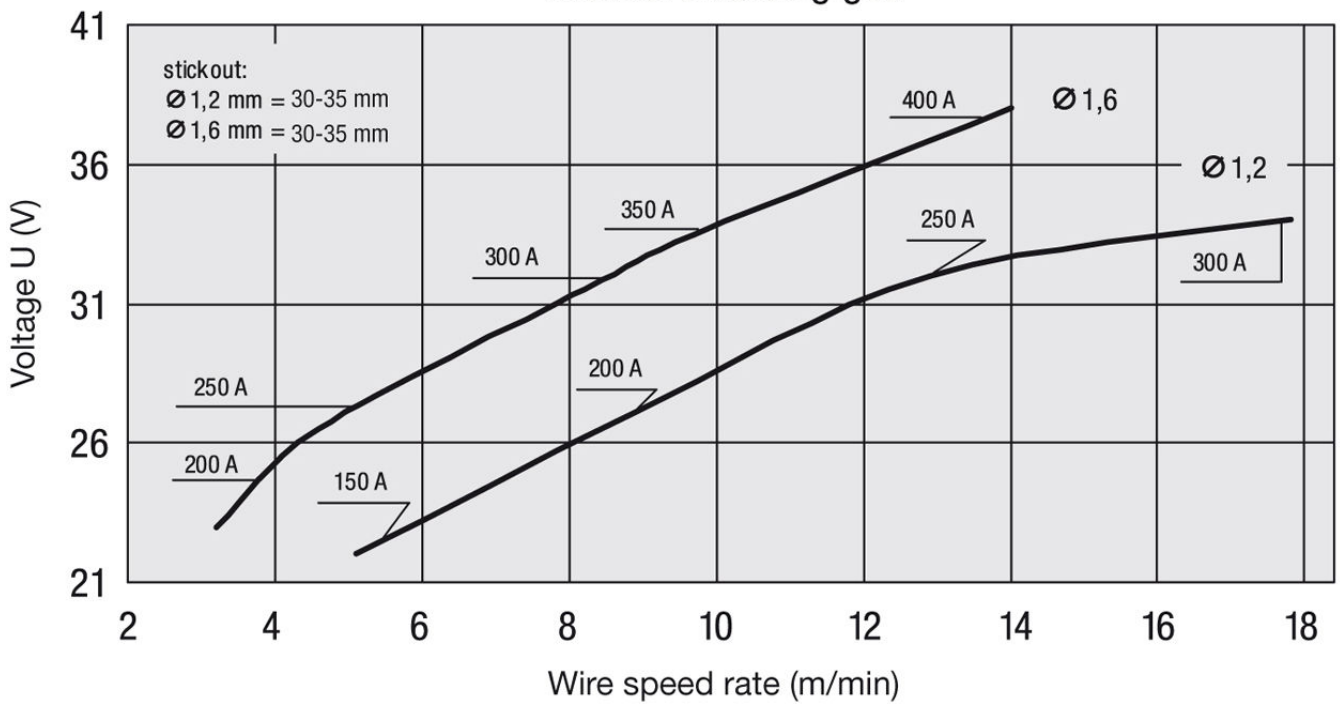


When using shielding gas (82 Vol.% Ar + 18 Vol.% CO_2) reduce arc-voltage by about 3 volts

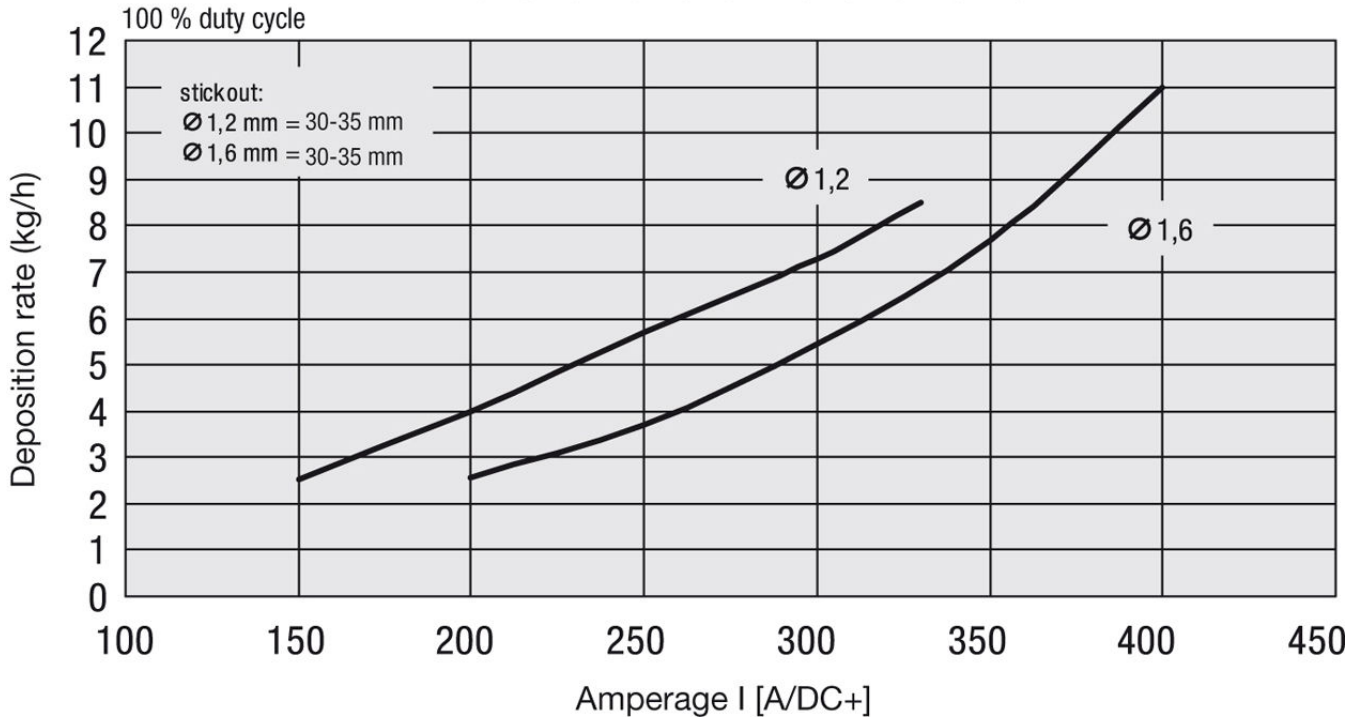
Deposition rate of flux cored wires
FLUXOFIL 50, 51, 52, 54, 56, 58, 66



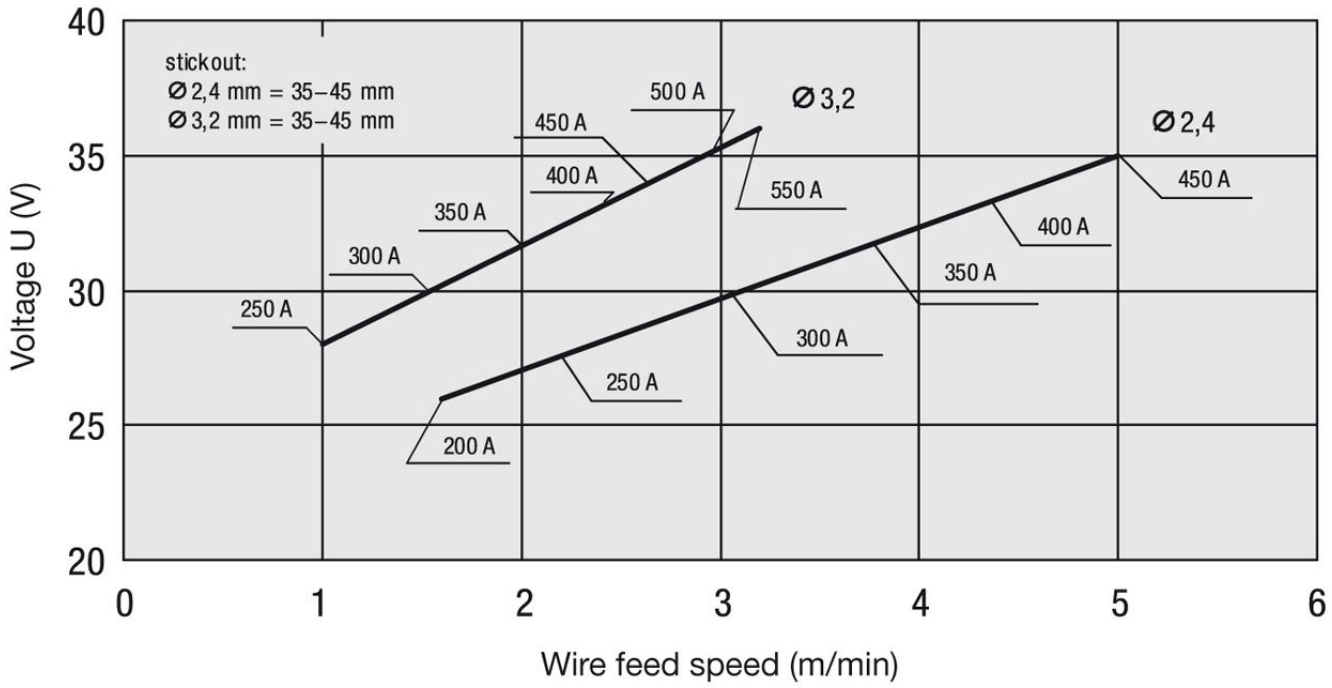
Welding parameters for flux cored wires FLUXODUR 62 and FLUXODUR 62-0 without shielding gas



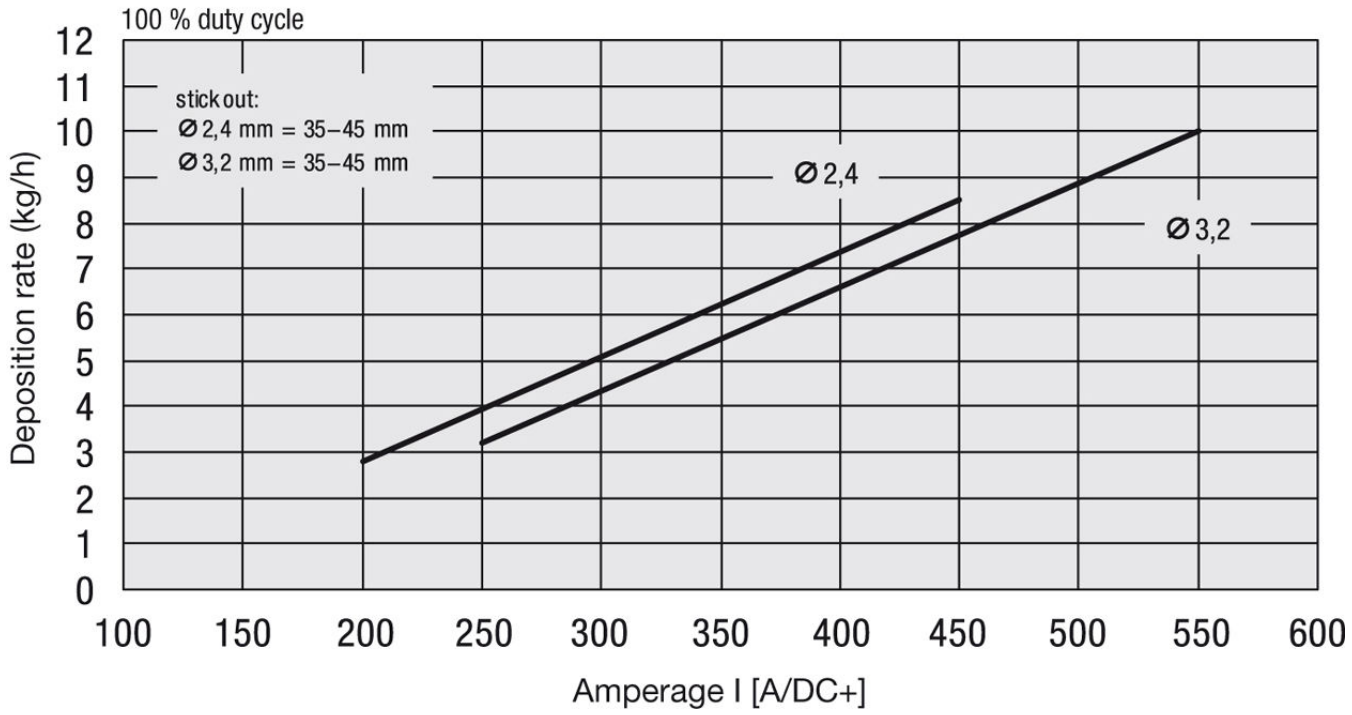
Deposition rates of flux cored wires FLUXODUR 62 and FLUXODUR 62-0



Welding parameters for flux cored wires FLUXODUR 62 and FLUXODUR 62-0 without shielding gas



Deposition rates of flux cored wires FLUXODUR 62 and FLUXODUR 62-0



FLUXOFIL M 8

OERLIKON

Cored Wires
C-Mn and low-alloy steels

FLUXOFIL M8 is a seamless copper coated metal cored wire with outstanding welding characteristics in short-arc and spray-arc ranges depositing slag free weld metal. Almost spatter-free when welding in the spray-arc range. Good restriking, even with a cold wire tip, thus being suitable for robotic applications. Characteristic features: high deposition rate and welding speed, good side wall fusion, finely rippled welds, without undercut into the base metal, even on contaminated or corroded metal surfaces. Little formation of silicates on the weld surface, so multi-pass welds can made without inter-run cleaning. Due to an easily controllable weld pool in the short-arc range, FLUXOFIL M8 is well-suited for root- and positional welding and gap bridging.

Classification	
EN ISO	17632-A: T 46 2 M M 1 H5
EN ISO	17632-B: T552T15-1MA-UH5
AWS	A5.18: E70C-3M H4

Approvals	Grade
BV	SA3-3YM H5
DB	●
DNV	IIIY40MS H5
GL	3Y40H5S
LRS	3Y40SH5
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.07	1.3	0.7	0.010	0.010

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -20 °C
As Welded	≥ 460	550-680	≥ 24	≥ 50

Gas test: 82% Ar+18% CO2

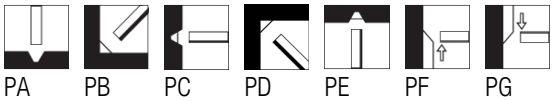
Shielding Gas - EN ISO 14175 : M21

Materials

S(P)235-S(P)460

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	B300	DRUM
Diam(mm) / weight(kg)	16	200
1.0	●	●
1.2	●	●
1.4	●	●
1.6	●	●

CITOFLUX M60A

OERLIKON

Cored Wires
C-Mn and low-alloy steels

CITOFLUX M60A is a metal cored wire which produces a fine aspect to the weld bead. High deposition rate and excellent arc stability with no slag residue, suitable for single and multipass automatic welding. The main applications are mechanical constructions and earth moving equipment.
Diffusible hydrogen 5 ml/100g max.

Classification	
EN ISO	17632-A: T 42 2 M M 1 H5
EN ISO	17632-B: T492T15-1MA-UH5
AWS	A5.18: E70C-3M H8

Approvals	Grade
ABS	SA3YM H5
DB	●
DNV	IIIY40MS
LRS	3Y40H5
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.05	1.4	0.6	≤ 0.010	≤ 0.02

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -20 °C
As Welded	≥ 420	500-640	≥ 26	≥ 60

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : M20, M21

Materials

S(P)235-S(P)460, GP240-GP280

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	B300	DRUM
Diam(mm) / weight(kg)	16	200
1.0	●	●
1.2	●	●
1.4	●	●
1.6	●	●

AIR LIQUIDE WELDING

CRISTAL F206

OERLIKON

Cored Wires
C-Mn and low-alloy steels

CRISTAL F206 is a new low fume metal cored wire which generates less welding fume than standard products. It enables a fume emission rate reduction from 50% (Standard shielding gas M21) up to 80% (shielding gas M14). High current carrying capacity, almost spatter-free when welding in the spray-arc range. Good restriking, even with a cold wire tip, thus being suitable for robotic applications. Characteristic features: high deposition rate and welding speed, good side wall fusion, finely rippled welds, without undercut into the base metal, not even on contaminated or corroded metal surfaces. Little formation of silicates on the weld surface, so that multi-pass welds can made without inter-run cleaning. Due to an easily controllable weld pool in the short-arc range, CRISTAL F 206 is well-suited for root- and positional welding and gap bridging.

Classification	
EN ISO	17632-A: T 42 3 M M 1 H5
EN ISO	17632-B: T493T15-1MA-UH5
AWS	A5.18: E70C-6M H4

Approvals	Grade
BV	SA3YM H5
DB	●
DNV	IIIY40MS
LRS	3S-3Y H5
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.02	1.3	0.75	≤ 0.015	≤ 0.020

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -30 °C
As Welded	≥ 420	500-610	≥ 24	≥ 60

Gas test: 82% Ar+18% CO2

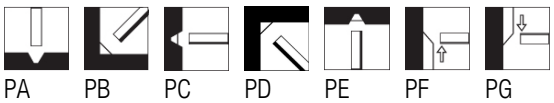
Shielding Gas - EN ISO 14175 : M21

Materials

S(P)235-S(P)420

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	B300	DRUM
Diam(mm) / weight(kg)	16	230
1.2	●	●
1.4	●	●

FLUXOFIL M 10

OERLIKON

Cored Wires
C-Mn and low-alloy steels

FLUXOFIL M10 is a seamless copper coated metal cored wire with outstanding welding properties in the short-arc and spray-arc ranges depositing slag free weld metal. Almost spatter-free when welding in the spray-arc range. Good restriking, even with a cold wire tip, thus being suitable for robotic applications. Characteristic features: good side wall fusion, smooth and finely rippled welds without undercut into the base metal. Little formation of silicates on top of weld, so that multi-pass welds can be made without inter-run cleaning. Due to an easily controllable weld pool in the short-arc range, FLUXOFIL M 10 is well-suited for root- and positional welding.

Classification	
EN ISO	17632-A: T 46 4 M M 1 H5
EN ISO	17632-B: T554T15-1MA-UH5
AWS	A5.18: E70C-6M H4

Approvals	Grade
ABS	4YSA H5
BV	SA3Y M H5 KV40
DB	●
DNV	IVY40MS H5
GL	4YH5S
LRS	4Y40S H5
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.08	1.5	0.4	0.010	0.010

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -40 °C
580°C x 2 h/furnace	≥ 460	550-680	≥ 24	≥ 80
As Welded	≥ 460	550-680	≥ 24	≥ 60

Gas test: 82% Ar+18% CO2

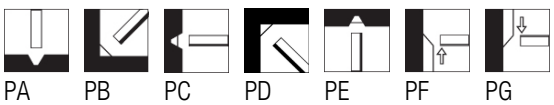
Shielding Gas - EN ISO 14175 : M21

Materials

S(P)235-S(P)460, GP240-GP280

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	B300	DRUM
Diam(mm) / weight(kg)	16	200
1.0	●	
1.2	●	●
1.6	●	●

AIR LIQUIDE WELDING

CITOFLUX M60

OERLIKON

Cored Wires
C-Mn and low-alloy steels

CITOFLUX M60 is a metal cored wire depositing a fine well shaped weld bead. High deposition rate and excellent weldability. No slag residue, suitable for single and multipass automatic welding. Main applications include mechanical constructions and earth moving equipment.
Diffusible hydrogen 5 ml/100g max.

Classification	
EN ISO	17632-A: T 46 4 M M 1 H5
EN ISO	17632-B: T494T1-1MA-UH5
AWS	A5.18: E 70C-6M H4

Approvals	Grade
BV	SA3YM H5 (P)
DB	●
DNV	IIIY40MS (P)
LRS	3YS H5 (P)

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.06	1.6	0.4	≤ 0.015	≤ 0.02

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -40 °C
As Welded	≥ 460	530-680	≥ 26	≥ 60

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : M21

Materials

S(P)235-S(P)460, GP240-GP280

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	B300	DRUM
Diam(mm) / weight(kg)	16	200
1.2	●	●
1.4	●	●
1.6	●	●

CITOFLUX M00

OERLIKON

Cored Wires
C-Mn and low-alloy steels

CITOFLUX M00 is a high deposition rate metal cored wire. Excellent welding properties with both short and spray arc. Virtually spatter free in the spray-arc range. Particularly suitable for robotic applications. Characteristic features are: good edge wetting, finely rippled welds, little oxide formation on the weld surface making multipass welding possible without inter-run cleaning.The weld profile is easily controllable making this wire well suited for gap bridging and positional welding.

Classification	
EN ISO	17632-A: T 46 4 M M 1 H5
EN ISO	17632-B: T554T15-1MA-UH5
AWS	A5.18: E70C-6M H4

Approvals	Grade
ABS	3YSA H5
BV	SA3YM H5
DNV	IVY42MSH5
LRS	4Y40H5
RINA	3YSH5

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.04	1.7	0.5	≤ 0.02	≤ 0.02

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -40 °C
As Welded	≥ 460	530-680	≥ 24	≥ 75

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : M20, M21

Materials

S(P)235-S(P)460, GP240-GP280

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
1.2	●
1.6	●

AIR LIQUIDE WELDING

FLUXOFIL M 10 S

OERLIKON

Cored Wires
C-Mn and low-alloy steels

FLUXOFIL M10S is a seamless copper coated metal cored wire producing no slag, for welding with both the single and multi-run techniques. Excellent weldability, high deposition rate, very good impact toughness at low temperatures, down to -60°C, both as welded and following post-weld heat treatment. Suitable for applications where very high toughness properties are required.

Classification	
EN ISO	17632-A: T 42 6 M M 1 H5
EN ISO	17632-B: T496T15-1MA-UH5
AWS	A5.18: E70C-6M H4

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.07	1.6	0.4	0.010	0.010

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -60 °C
As Welded	≥ 420	500-640	≥ 26	≥ 60
620°C x 1h	≥ 420	500-640	≥ 27	≥ 80

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : M21

Materials

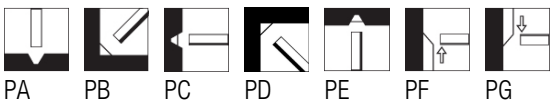
S(P)235-S(P)420, GP240-GP280

Storage

Keep dry and avoid condensation

Current condition and welding position

DC+



Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
1.2	●
1.4	●
1.6	●

CITOFLUX M20

OERLIKON

Cored Wires
C-Mn and low-alloy steels

CITOFLUX M20 is a metal cored wire containing nickel, for welding in all positions. Main applications: Off-shore fabrications, pipework, pressure vessels, shipbuilding (LPG tankers, ice breakers).CITOFLUX M 20 can be used for automatic multi-run welding. Diffusible hydrogen <3ml/100g of deposited weld metal.

Classification	
EN ISO	17632-A: T 46 6 Mn1Ni M M 1 H5
EN ISO	17632-B: T556T15-1MA-N1-UH5
AWS	A5.18: E70C-GM H4

Approvals	Grade
DNV	VYMS

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni
0.05	1.45	0.9	≤ 0.010	≤ 0.010	0.8

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -60°c °C
As Welded	≥ 460	530-680	≥ 26	≥ 80

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : M21

Materials

S(P)275-S(P)460

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16.0
1.2	●
1.4	●
1.6	●

AIR LIQUIDE WELDING

FLUXOFIL M 10 PG

OERLIKON

Cored Wires
C-Mn and low-alloy steels

FLUXOFIL M 10 PG is a seamless metal-powder cored electrode for gas-shielded metal arc welding of unalloyed steels for operating temperatures from -40°C up to +450°C in welding position PG (vertical down). Used with spray arc with negative poled flux-cored wire electrode (direct current, negative polarity). Very good gap-bridging characteristics und safe side wall fusion. Less distortion when working with thin-sheet base material by decreased heat input compared to welding position PF (vertical up). To be used under mixed gas only.

Classification	
EN ISO	17632-A: T 46 4 M M 1 H5
EN ISO	17632-B: T554TG-1MA-UH5
AWS	A5.18: E70C-GM H4

Approvals	Grade
ABS	4YSA H5
BV	SA3Y M H5 KV40
DB	●
DNV	IVY40MS H5
GL	4YH5S
LRS	4Y40S H5

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.04	1.8	0.8	≤ 0.010	≤ 0.010

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -40 °C
As Welded	≥ 460	550-680	≥ 24	≥ 60

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : M21

Materials

S(P)235-S(P)460

Storage
Keep dry and avoid condensation

Current condition and welding position
DC-

Packaging data

Packaging Type	B200	B300
Diam(mm) / weight(kg)	5.0	16.0
1.0	●	●
1.2	●	●

CITOFLUX GALVA

OERLIKON

Cored Wires
C-Mn and low-alloy steels

CITOFLUX GALVA is a metal cored wire suitable for manual or automatic, single-pass welding of galvanised steels or primed plates (0,8 to 4 mm). Low spatter level and excellent bead appearance. Used with spray arc with negative-poled flux-cored wire electrode (direct current, negative polarity). There is a limited oxidation zone around the weld bead. The main applications are in the car industry, shipyards and for air conditioning equipment. To be used with Ar/CO2 gas shielding.

Classification	
EN ISO	17632-A: T3T Z M M 1 H15
EN ISO	17632-B: T43TG-1MS-H15
AWS	A5.18: E70C-GS

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

	C	Mn	Si	Al
All weld metal (*)	0.4	1.2	0.3	< 3

(*) 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : M21, M14

Materials

S(P)235 - S(P)420

Storage

Keep dry and avoid condensation

Current condition and welding position

DC-

Packaging data

Packaging Type	B300	DRUM
Diam(mm) / weight(kg)	16	200
1.0	●	
1.2	●	●
1.4	●	●

AIR LIQUIDE WELDING

FLUXOFIL 16

CE

Cored Wires
C-Mn and low-alloy steels

FLUXOFIL 16 is a seamless copper coated rutile flux cored wire producing an excellent weld bead appearance. Easy slag removal, stable, practically spatter-free arc. Applications include structures with low temperature applications, to -20°C.

Classification	
EN ISO	17632-A: T 42 0 P C 1 H5
EN ISO	17632-A: T 42 2 P M 1 H5
EN ISO	17632-B: T490T1-1CA-H5
EN ISO	17632-B: T492T1-1MA-H5
AWS	A5.20: E71T-1M H4
AWS	A5.20: E71T-GC H4

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.04	1.4	0.45	≤ 0.02	≤ 0.02

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				0 °C	-20 °C
As Welded	≥ 420	500-640	≥ 20	≥ 70	≥ 47

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : M21,C1

Materials

S(P)235-S(P)420, GP240-GP280

Shipbuilding steels A,B,D,E,AH32 to EH36

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	B200	B300
Diam(mm) / weight(kg)	5.0	16.0
1.2	●	●
1.4	●	●

FLUXOFIL 14

OERLIKON

Cored Wires
C-Mn and low-alloy steels

FLUXOFIL 14 is a seamless copper coated rutile flux cored wire with a fast-freezing slag. Due to an easily controllable weld pool, it shows outstanding welding characteristics in all positions. It is particularly suitable for partly and fully mechanized welding of girth seams in pipelines. In MAG-orbital welding in the 6 to 12 o'clock position, 1.2-1.4 mm electrodes, are preferred. Low spatter loss, easy slag removal, smooth finely rippled welds without undercut into the base metal are outstanding features.

Classification	
EN ISO	17632-A: T 46 4 P M 1 H5
EN ISO	17632-B: T554T1-1MA-UH5
AWS	A5.20: E71T-1M-JH4

Approvals	Grade
ABS	3YSA H5
BV	SA3YM H5
DNV	IIIY46MS H5
GL	3YH5S
LRS	3S-3YS H5
RMRS	3YS H10
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.05	1.2	0.5	≤ 0.010	≤ 0.010

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				-20 °C	-40 °C
As Welded	≥ 460	550-650	≥ 22	≥ 80	≥ 47

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : M21

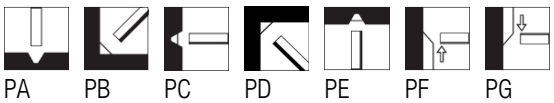
Materials

Shipbuilding steels A,B,D,E,AH32 - EH36

S(P)235-S(P)460, GP240-GP280

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
1.2	●

AIR LIQUIDE WELDING

FLUXOFIL 14 HD

OERLIKON

Cored Wires
C-Mn and low-alloy steels

FLUXOFIL 14 HD is a seamless copper coated rutile flux cored wire with an enhanced degree of fill for gas-shielded metal arc welding of unalloyed steels for operating temperatures from -30°C up to +450°C. Due to its easily controllable weld pool, the welding characteristics are outstanding. It can be welded in all positions with only one parameter setting (24 Volts, wire feed 9m/min, wire dia. 1,2 mm). The enhanced degree of filling results in increased current carrying capacity and deposition rate, thus increasing welding speed and leading to a saving of time and costs. Low spatter loss, easy slag removal, smooth and finely rippled welds are produced without undercut into the base metal. Preferably used under mixed gas. The use of CO2 is possible.

Classification	
EN ISO	17632-A: T 46 2 P C 1 H5
EN ISO	17632-A: T 46 3 P M 1 H5
EN ISO	17632-B: T552T1-1CA-UH5
EN ISO	17632-B: T553T1-1MA-UH5
AWS	A5.20: E71T-1C-H4
AWS	A5.20: E71T-1M-JH4

Approvals	Grade
ABS	3Y40SA H5
BV	SA3Y40M H5
DB	●
DNV	IIIY40MS H5
GL	3Y40H5S
LRS	3Y40S H5
PRS	3S-3Y40SH5
RMRS	3S-3Y40S H5
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.05	1.4	0.5	≤ 0.010	≤ 0.010

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				-20 °C	-30 °C
As Welded	≥ 460	550-650	≥ 24	≥ 80	≥ 50

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Materials

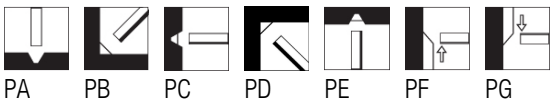
Shipbuilding steels A,B,D,E,AH32 - EH36

X42 - X65

S(P)235-S(P)460

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	B300	DRUM	S200
Diam(mm) / weight(kg)	16	200	5
1.2	●	●	●
1.4	●		
1.6	●		

CITOFLUX R00

OERLIKON

Cored Wires
C-Mn and low-alloy steels

CITOFLUX R00 is folded rutile flux-cored wire for gas-shielded metal arc welding of unalloyed steels for operating temperatures from -30°C up to +450°C in all welding positions. The weld pool is easily controllable with outstanding welding properties. The enhanced filling results in increased current carrying capacity and hence deposition rate, thus essentially increasing welding speed, leading to savings of time and costs. Low spatter loss and easy slag removal result in smooth and finely rippled welds without undercut. Can be used in manual and fully-mechanised processes, very well suited for use on ceramic backing. Preferably used under mixed gas. The use of CO2 is possible.

Classification	
EN ISO	17632-A: T 42 2 P C 1 H5
EN ISO	17632-A: T 42 3 P M 1 H5
EN ISO	17632-B: T492T1-1CA-UH5
EN ISO	17632-B: T493T1-1MA-UH5
AWS	A5.20: E71T-1C-H4
AWS	A5.20: E71T-1M-JH4

Approvals	Grade
ABS	3YSA H5
BV	SA3YM H5
DB	●
DNV	IIIY40MS H5
GL	3YH5S
LRS	3Y40 H5
RINA	3YS H5 (M21), 2YS H5
RMRS	3Y40SHHH
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.05	1.4	0.5	≤ 0.020	≤ 0.025

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				-20 °C	-30 °C
As Welded	≥ 420	500-640	≥ 20	≥ 80	≥ 50

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Materials

X42 - X65

S(P)235-S(P)420, GP240-GP280

Shipbuilding steels A,B,D,E,AH32 - EH36

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	B300	S200
Diam(mm) / weight(kg)	16	5
1.0	●	
1.2	●	●
1.6	●	

FLUXOFIL 14 HD S

OERLIKON

Cored Wires
C-Mn and low-alloy steels

FLUXOFIL 14 HDS is a seamless copper coated rutile flux cored wire with an enhanced degree of fill. Due to an easily controllable weld pool, it features outstanding welding properties. FLUXOFIL 14 HDS can be welded in all positions with only one parameter setting. The enhanced degree of filling results in higher current carrying capacity and deposition rate, thus increased welding speeds may be used which leads to a saving of time and costs. Low spatter loss, easy slag removal, finely rippled and pore-free welds are produced without undercut.

Classification	
EN ISO	17632-A: T 46 4 P M 1 H5
EN ISO	17632-B: T 554T1-1MA-UH5
AWS	A5.20: E71T-1M-JH4

Approvals	Grade
ABS	3Y400SA H5
ABS	3Y400SA H5
BV	SA3Y40M H5
BV	SA3Y40M H5
DB	●
DB	●
DNV	IIIY40MS H5

Approvals	Grade
DNV	IIIY40MS H5
GL	3Y40H5S
GL	3Y40H5S
LRS	3Y40S H5
LRS	3Y40S H5
TÜV	●
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	Ni
0.05	1.2	0.55	0.4

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -40 °C
As Welded	≥ 460	550-650	≥ 22	≥ 50

Gas test: M21

Shielding Gas - EN ISO 14175 : M21-ATAL

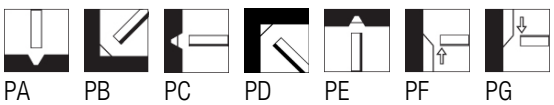
Materials

Shipbuilding steels A,B,D,E,AH32 to EH36

S(P)235-S(P)460, GP240-GP280

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16.0
1.2	●
1.4	●
1.6	●

CITOFLUX R00Ni

OERLIKON

Cored Wires
C-Mn and low-alloy steels

CITOFLUX R00 Ni is folded rutile flux-cored wire for gas-shielded metal arc welding of unalloyed steels for operating temperatures from -40°C up to +450°C in all welding positions. The weld pool is easily controllable with outstanding welding properties. The enhanced filling results in increased current carrying capacity and hence deposition rate, thus essentially increasing welding speed, leading to savings of time and costs. Low spatter loss and easy slag removal result in smooth and finely rippled welds without undercut. Can be used in manual and fully-mechanised processes, very well suited for use on ceramic backing. Preferably used under mixed gas. The use of CO2 is possible.

Classification	
EN ISO	17632-A: T 46 4 1Ni P C 1 H5
EN ISO	17632-A: T 46 4 1Ni P M 1 H5
EN ISO	17632-B: T554T1-1CA-N1-UH5
EN ISO	17632-B: T554T1-1MA-N1-UH5
AWS	A5.29: E81T1-GC-H4
AWS	A5.29: E81T1-GM-H4

Approvals	Grade
ABS	4Y400SAH5
BV	SA3YMH5
DB	●
DNV	IV Y40MS H5
LRS	4Y40 H5
RINA	4Y40SH5

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni
0.06	1.2	0.4	≤ 0.015	≤ 0.015	0.7

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -40 °C
As Welded	≥ 460	570-680	≥ 24	≥ 80

Gas test: 82% Ar+18% CO2

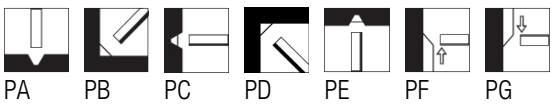
Shielding Gas - EN ISO 14175 : C1, M21

Materials

S(P)235-S(P)460, GP240-GP280

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	B300	S200
Diam(mm) / weight(kg)	16	5
1.2	●	●

FLUXOFIL 11 HD

OERLIKON

Cored Wires
C-Mn and low-alloy steels

FLUXOFIL 11 HD is a seamless copper coated rutile flux cored wire with excellent weldability in all position. The high filling degree of FLUXOFIL 11 HD results in a higher current carrying capacity and deposition rate. Welding speed is increased which leads to a saving of time and reduction of costs. It can be used in all positions with only one welding parameter setting (24 volts, wire feed = 9m/min, wire dia. 1,2 mm). FLUXOFIL 11 HD is used for manual welding, as well as in fully mechanized welding. To be used under CO2 and it is characterized by low spatter loss, good slag removal and finely rippled, pore-free welds without undercut into the base metal.

Classification	
EN ISO	17632-A: T 46 2 P C 1 H5
EN ISO	17632-B: T552T1-1CA-UH5
AWS	A5.20: E71T-1C H4

Approvals	Grade
ABS	3Y40SA H5
LRS	3Y40S H5
RINA	3Y40S H5
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si
0.05	1.2	0.55

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -20 °C
As Welded	≥ 460	550-650	≥ 22	≥ 60

Gas test: 100% CO2

Shielding Gas - EN ISO 14175 : C1

Materials

Shipbuilding steels A,B,D,E,AH32 to EH36

S(P)235-S(P)460, GP240-GP280

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
1.2	●

AIR LIQUIDE WELDING

FLUXOFIL 19 HD

OERLIKON

Cored Wires
C-Mn and low-alloy steels

FLUXOFIL 19 HD is a seamless copper coated rutile flux cored wire with an enhanced degree of fill for gas-shielded metal arc welding of unalloyed steels for operating temperatures from -30°C up to +450°C. Due to its easily controllable weld pool, the welding characteristics are outstanding. It can be welded in all positions with only one parameter setting (24 Volts, wire feed 9m/min, wire dia. 1,2 mm). The enhanced degree of filling results in increased current carrying capacity and deposition rate, thus increasing welding speed and leading to a saving of time and costs. Low spatter loss, easy slag removal, smooth and finely rippled welds are produced without undercut into the base metal. To be used under CO2 as shielding gas only.

Classification	
EN ISO	17632-A: T 46 3 P C 1 H5
EN ISO	17632-B: T553T1-1CA-UH5
AWS	A5.20: E71T-1C-JH4

Approvals	Grade
ABS	3Y40SA H5
BV	SA3Y40M H5
DB	●
DNV	IIIY40MS H5
GL	3Y40H5S

Approvals	Grade
LRS	3Y40S H5
PRS	3S-3Y40SH5
RINA	3Y40S H5
RMRS	3S-3Y40S H3
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.05	1.3	0.5	≤ 0.010	≤ 0.010

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				-20 °C	-30 °C
As Welded	≥ 460	550-650	≥ 24	≥ 80	≥ 50

Gas test: 100% CO2

Shielding Gas - EN ISO 14175 : C1

Materials

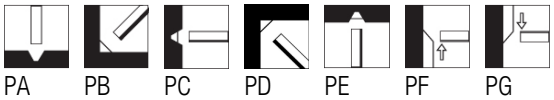
Shipbuilding steels A,B,D,E,AH32 - EH36

S(P)235-S(P)460, GP240-GP280

X42 to X65

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	B300	DRUM	S200
Diam(mm) / weight(kg)	16	200	5
1.2	●	●	●
1.6	●	●	

CITOFLUX R00C

OERLIKON

Cored Wires
C-Mn and low-alloy steels

CITOFLUX R00C is a folded rutile flux-cored wire for gas-shielded metal arc welding of unalloyed steels for operating temperatures from -30°C up to +450°C in all welding positions. The weld pool is easily controllable with outstanding welding properties. The enhanced filling results in increased current carrying capacity and hence deposition rate, thus essentially increasing welding speed, leading to savings of time and costs. Low spatter loss and easy slag removal result in smooth and finely rippled welds without undercut. Can be used in manual and fully-mechanised processes, very well suited for use on ceramic backing. To be used under CO2 gas.

Classification	
EN ISO	17632-A: T 42 3 P C 1 H5
EN ISO	17632-B: T493T1-1CA-UH5
AWS	A5.20: E71T-1C-JH4

Approvals	Grade
ABS	3YSA H5
ANR	3YH5S
BV	SA3YM H5
DB	●
DNV	IIIY40MS H5

Approvals	Grade
GL	3Y40H5S
LRS	3Y40 H5
RINA	2YS H5
RMRS	3Y40SHHH
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.05	1.2	0.35	≤ 0.020	≤ 0.025

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				-20 °C	-30 °C
As Welded	≥ 420	530-680	≥ 20	≥ 60	≥ 47

Gas test: 100% CO2

Shielding Gas - EN ISO 14175 : C1

Materials

Shipbuilding steels A,B,D,E,AH32 - EH36

X42 to X65

S(P)235-S(P)460, GP240-GP280

Storage

Keep dry and avoid condensation

Current condition and welding position

DC+

Packaging data

Packaging Type	B300	S200
Diam(mm) / weight(kg)	16	5
1.2	●	●

CRISTAL F119

OERLIKON

Cored Wires
C-Mn and low-alloy steels

CRISTAL F119 is a new low fume seamless copper coated metal cored wire which generates less welding fume than similar standard products. It enables a fume emission rate reduction of up to 30% (Standard shielding gas C1). Due to the easily controllable weld pool, the welding characteristics are outstanding. Weldable in all positions with only one setting of parameters (24 Volts, wire feed 9m/min, wire dia. 1,2 mm). The enhanced filling degree results in increased current carrying capacity and deposition rate, thus increasing welding speed and leading to a saving of time and costs. Low spatter loss, easy slag removal, smooth and finely rippled welds without undercut into the base metal.

Classification	
EN ISO	17632-A: T 46 3 P C 1 H5
EN ISO	17632-B: T553T1-1CA-UH5
AWS	A5.20: E71T-1C-JH4

Approvals	Grade
ABS	3Y400SA H5
BV	SA3Y40M H5
DB	●
DNV	IIIY40MS H5
GL	3Y40H5S
LRS	3Y40S H5
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si
0.03	1.5	0.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -30 °C
As Welded	≥ 460	550-650	≥ 22	≥ 60

Gas test: C1

Shielding Gas - EN ISO 14175 : C1

Materials

S(P)235-S(P)460, GP240-GP280

Shipbuilding steels A,B,D,E,AH32 to EH36

X42 to X65

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	B300	S200
Diam(mm) / weight(kg)	16	5
1.2	●	●

AIR LIQUIDE WELDING

FLUXOFIL 19 HD S

OERLIKON

Cored Wires
C-Mn and low-alloy steels

FLUXOFIL 19HDS is a seamless copper coated rutile flux cored wire with an enhanced degree of fill. Due to its easily controllable weld pool, the welding characteristics are outstanding . It can be welded in all positions, using only one parameter setting (24 volts, wire feed 9m/min, wire dia. 1,2 mm). The enhanced degree of filling results in increased current carrying capacity and deposition rate, thus increasing welding speed and leading to a saving of time and costs. Low spatter loss, easy slag removal producing smooth and finely rippled, pore-free welds without undercut into the base metal.

Classification	
EN ISO	17632-A: T 46 4 P C 1 H5
EN ISO	17632-B: T554T1-1CA-UH5
AWS	A5.20: E71T-1C-JH4

Approvals	Grade
ABS	3Y400SA H5
BV	SA3Y40M H5
DNV	IIIY40MS H5
GL	3Y40H5S
LRS	3Y40S H5
RINA	3Y40S H5
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	Ni
0.05	1.2	0.5	0.4

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -40 °C
As Welded	≥ 460	550-650	≥ 22	≥ 50

Shielding Gas - EN ISO 14175 : C1

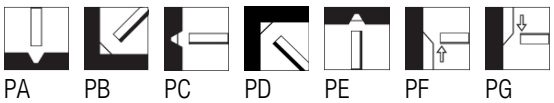
Materials

S(P)235-S(P)460, GP240-GP280

Shipbuilding steels A,B,D,E,AH32 to EH36

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16.0
1.2	●
1.4	●
1.6	●

FLUXOFIL 20

OERLIKON

Cored Wires
C-Mn and low-alloy steels

FLUXOFIL 20 is a seamless copper coated rutile flux cored wire with a fast-freezing slag, producing a weld metal with excellent mechanical-technological properties and a hydrogen content of < 5 ml per 100g deposited weld metal. Easily controllable weld pool and outstanding welding properties in all positions. Low spatter loss, easy slag removal producing finely rippled, pore-free welds without undercut.

Classification	
EN ISO	17632-A: T 46 4 1Ni P M 1 H5
EN ISO	17632-B: T554T1-1MA-N1-UH5
AWS	A5.29: E81T1-Ni1M-JH4

Approvals	Grade
ABS	4Y46SA H5
BV	SA4Y46M H5
DB	●
GL	4Y46H5S
LRS	4Y46S H5
RMRS	4Y46S H5
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni
0.03	1.2	0.5	≤ 0.010	≤ 0.010	≤ 0.9

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -40 °C
As Welded	≥ 480	570-680	≥ 23	≥ 47

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : M21

Materials

S(P)275-S(P)460

X42 - X70

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
1.2	●

AIR LIQUIDE WELDING

FLUXOFIL 20 HD

OERLIKON

Cored Wires
C-Mn and low-alloy steels

FLUXOFIL 20HD is a seamless copper coated rutile flux cored wire for gas-shielded metal arc welding of fine grain steels with operating temperatures from -40°C up to +450°C. The enhanced degree of fill, results in a higher current carrying capacity and deposition rate. It can be welded in all positions using only one parameter setting (24 volts, wire feed 9 m/min, wire dia. 1,2 mm). The weld metal produced features excellent mechanical-technological properties and a hydrogen content of hydrogen < 5 ml per 100g deposited weld metal. Low spatter loss, easy slag removal producing finely rippled, pore-free welds without undercut. To be used under mixed gas

Classification	
EN ISO	17632-A: T 46 4 1Ni P M 1 H5
EN ISO	17632-B: T554T1-1MA-N1-UH5
AWS	A5.29: E81T1-Ni1M-JH4

Approvals	Grade
ABS	4Y46SA H5
BV	SA4Y46M H5
DB	●
DNV	IVY46MS H5
GL	4Y46H5S
LRS	4Y46S H5
RMRS	4Y46S H5
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni
0.06	1.3	0.4	≤ 0.010	≤ 0.010	≤ 0.9

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -40 °C
As Welded	≥ 480	570-680	≥ 24	≥ 80
580 °C x 2 h/f.	≥ 480	570-670	≥ 22	≥ 100

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : M21

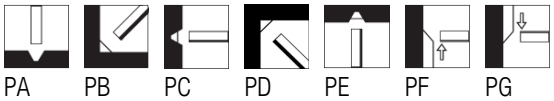
Materials

S(P)275-S(P)460

X42 - X70

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
1,6	●
1.2	●
1.4	●

FLUXOFIL 21 HD

OERLIKON

Cored Wires
C-Mn and low-alloy steels

FLUXOFIL 21HD is a seamless copper coated rutile flux cored wire for gas-shielded metal arc welding of fine grain steels with operating temperatures from -40°C up to +450°C. The enhanced degree of fill, results in a higher current carrying capacity and deposition rate. It can be welded in all positions using only one parameter setting (24 volts, wire feed 9 m/min, wire dia. 1,2 mm). The weld metal produced features excellent mechanical-technological properties and a hydrogen content of hydrogen < 5 ml per 100g deposited weld metal. Low spatter loss, easy slag removal producing finely rippled, pore-free welds without undercut. To be used under CO2 gas.

Classification	
EN ISO	17632-A: T 46 4 1Ni P C 1 H5
EN ISO	17632-B: T554T1-1CA-N1-UH5
AWS	A5.29: E81T1-Ni1C-JH4

Approvals	Grade
ABS	4Y46SA H5
BV	SA4Y46M H5
DNV	IVY46MS H5
GL	4Y46H5S
LRS	4Y46S H5

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni
0.07	1.4	0.4	≤ 0.010	≤ 0.010	0.9

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -40 °C
As Welded	≥ 490	570-670	≥ 22	≥ 70

Gas test: 100% CO2

Shielding Gas - EN ISO 14175 : C1

Materials

S(P)275-S(P)460

X42 - X70

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	B200	B300
Diam(mm) / weight(kg)	5.0	16.0
1.2	●	●

AIR LIQUIDE WELDING

CITOFLUX R82

OERLIKON

Cored Wires
C-Mn and low-alloy steels

CITOFLUX R82 is a folded rutile flux cored wire with excellent all-positional weldability. Suitable for the welding of fine-grain structural steels for operating temperatures from -50°C up to +450°C. Very good slag removal, smooth seam surface without undercutting into the base metal. Very good mechanical property values and highly X-ray proof. Can be welded in all positions with one setting of parameters. Ideal for offshore and naval shipyard applications. To be used with Ar/CO2 gas shielding.

Classification	
EN ISO	17632-A: T 46 5 1Ni P M 1 H5
EN ISO	17632-B: T555T1-1MA-N1-UH5
AWS	A5.29: E81T1-Ni1M-H4

Approvals	Grade
ABS	4Y400SA H5
DNV	VY46MS H5
LRS	4Y40S H5

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni
0.05	1.3	0.4	≤ 0.010	≤ 0.010	0.85

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				-40 °C	-50 °C
As Welded	≥ 460	550-690	≥ 22	≥ 80	≥ 60

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : M21

Materials

S(P)235-S(P)460, GP240-GP280

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
1.2	●

CITOFLUX R82 SR

OERLIKON

Cored Wires
C-Mn and low-alloy steels

CITOFLUX R82SR is a folded rutile flux cored wire for all-positional welding with good iMPact toughness at -60°C (as welded and after PWHT). Very easy to use for vertical up welding. Suitable for the welding of fine-grain structural steels for low temperature applications. Can be welded in all positions with one setting of parameters. To be use under mix gas. Ideal for offshore, naval shipbuilding, bridges and structures and pressure vessel applications. Good CTOD toughness.

Classification	
EN ISO	17632-A: T 46 6 1Ni P M 1 H5
EN ISO	17632-B: T556T1-1MA-N1-UH5
AWS	A5.29: E81T1-Ni1M-H4

Approvals	Grade
ABS	4Y400SA H5
DNV	VY46MS H5
LRS	4Y40S H5

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni
0.07	1.35	0.3	≤ 0.015	≤ 0.015	0.8

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -60 °C
As Welded	≥ 460	530-680	≥ 22	≥ 47
580 °C /2h	≥ 460	530-680	≥ 22	≥ 47

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : M21

Materials

S(P)235-S(P)460, GP240-GP280

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
1.2	●

AIR LIQUIDE WELDING

FLUXOFIL 31

OERLIKON

Cored Wires
C-Mn and low-alloy steels

FLUXOFIL 31 is a seamless copper coated basic flux cored wire. The operating features produce very crack resistant and tough welded joints with very low hydrogen content, especially when welding steels with a higher carbon content. Pore-free welds with easy slag removal. A low-slag variant FLUXOFIL 31 S is available to order.

Classification	
EN ISO	17632-A: T 42 4 B C 2 H5
EN ISO	17632-A: T 42 4 B M 2 H5
EN ISO	17632-B: T494T5-1CA-UH5
EN ISO	17632-B: T494T5-1MA-UH5
AWS	A5.20: E70T-5C-JH4
AWS	A5.20: E70T-5M-JH4

Approvals	Grade
ABS	3YSA H5
BV	SA3-3YM H5
DB	●
DNV	IIIY40MS H5
GL	3YH5S
LRS	3S-3YS-H5
PRS	3S-3YS H5
TÜV	●

CE

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S
All weld metal (**)	0.05	1.2	0.3	≤ 0.010	≤ 0.010

(**) 100% CO2

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -40 °C
As Welded	≥ 420	500-640	≥ 25	≥ 80

Gas test: 100% CO2

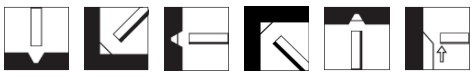
Shielding Gas - EN ISO 14175 : M21,C1

Materials

S(P)235-S(P)420, GP240-GP280

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
1.2	●
1.4	●
1.6	●

FLUXOFIL 31 S

OERLIKON

Cored Wires
C-Mn and low-alloy steels

FLUXOFIL 31 S is a seamless copper coated basic flux cored wire and is a slag-reduced version of FLUXOFIL 31, producing weld metal with excellent mechanical properties. Suitable for depositing very crack resistant and tough welded joints, especially when welding steels having a higher carbon content. Pore-free welds, easy slag removal.

Classification	
EN ISO	17632-A: T 42 4 B C 2 H5
EN ISO	17632-A: T 42 4 B M 2 H5
EN ISO	17632-B: T494T5-1CA-UH5
EN ISO	17632-B: T494T5-1MA-UH5
AWS	A5.20: E70T-5C-JH4
AWS	A5.20: E70T-5M-JH4

Approvals	Grade
ABS	3YSA H5
BV	SA3-3YM H5
DB	●
DNV	IIIY40MS H5
GL	3YH5S

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.05	1.2	0.3	≤ 0.010	≤ 0.010

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -40 °C
As Welded	≥ 420	500-640	≥ 25	≥ 80

Gas test: 100% CO2

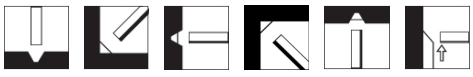
Shielding Gas - EN ISO 14175 : M21,C1

Materials

S(P)235-S(P)420, GP240-GP280

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
1.2	●
1.4	●
1.6	●

AIR LIQUIDE WELDING

CITOFLUX B00

OERLIKON

Cored Wires
C-Mn and low-alloy steels

CITOFLUX B00 is a basic flux cored wire with excellent mechanical properties, suitable for the welding of heavy sections. Excellent low temperature impact toughness in both the as welded and stress-relieved conditions.
Stable arc, spatter-free both in the flat and vertical positions. The weld deposit has a very low hydrogen content and a good crack resistant. Preferably used under mixed gas, however the use of CO2 for short and spray arc processes is possible.

Classification	
EN ISO	17632-A: T 42 5 B C 2 H5
EN ISO	17632-A: T 42 5 B M 2 H5
EN ISO	17632-B: T495T5-1CA-UH5
EN ISO	17632-B: T495T5-1MA-UH5
AWS	A5.20: E70T-5C-JH4
AWS	A5.20: E70T-5M-JH4

Approvals	Grade
ABS	3YSA H5
BV	SA3YM H5
DNV	IVY40MS H5
GL	4YH5S
LRS	4Y40H5
RINA	3YSH5

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.06	1.5	0.6	≤ 0.020	≤ 0.020

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -50 °C
As Welded	≥ 420	500-640	≥ 26	≥ 60

Gas test: 82% Ar+18% CO2

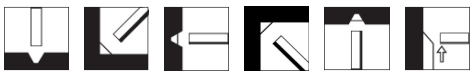
Shielding Gas - EN ISO 14175 : C1, M21

Materials

S(P)235-S(P)420, GP240-GP280

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
1.2	●
1.4	●
1.6	●

FLUXOFIL 40

OERLIKON

Cored Wires
C-Mn and low-alloy steels

FLUXOFIL 40 is a seamless flux-cored wire electrode with basic slag for gas-shielded metal arc welding of unalloyed steels with yield strengths of up to 460 MPa. The weld metal is very crack resistant, good toughness down to -60°C and very low hydrogen content. Stable operating characteristics and low spatter formation with short, spray and pulsed arc applications alike. Safe side wall fusion and very good gap bridging characteristics. Preferably used under mixed gas. The use of CO2 for short and spray arc processes is possible.

Classification	
EN ISO	17632-A: T 46 6 1Ni B C 2 H5
EN ISO	17632-A: T 46 6 1Ni B M 2 H5
EN ISO	17632-B: T556T5-1CA-N2-UH5
EN ISO	17632-B: T556T5-1MA-N2-UH5
AWS	A5.29: E80T5-GC-H4
AWS	A5.29: E80T5-GM-H4

Approvals	Grade
DB	●
DNV	VYMS H5
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni
0.05	1.1	0.2	≤ 0.010	≤ 0.010	1.0

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -60 °C
As Welded	≥ 470	550-650	≥ 24	≥ 60

Gas test: 100% CO2

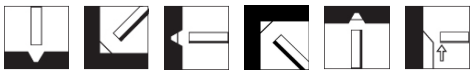
Shielding Gas - EN ISO 14175 : C1, M21

Materials

S(P)275-S(P)460

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
1.2	●
1.4	●
1.6	●

AIR LIQUIDE WELDING

FLUXOFIL 140 mod.

CE

Cored Wires
C-Mn and low-alloy steels

FLUXOFIL 140 mod. is a seamless copper coated basic flux cored wire for the welding of high-strength fine grain structural steels. Used on DC-, negative pole, when positional welding. The maximum nickel content of 0.9 % indicates suitability for welding components for sour-gas installations. FLUXOFIL 140 mod. is CTOD tested for offshore applications.

Classification	
EN ISO	17632-A: T 46 6 1Ni B M 2 H5
EN ISO	17632-B: T556TG-1MA-N1-UH5
AWS	A5.29: E81TG-GM-H4

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni
0.09	1.2	0.5	≤ 0.010	≤ 0.010	≤ 0.8

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -60 °C
As Welded	≥ 470	550-640	≥ 24	≥ 70

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : M21

Materials

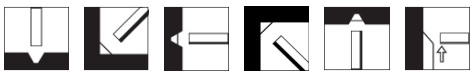
S(P)235-S(P)460, GP240-GP280

Storage

Keep dry and avoid condensation

Current condition and welding position

DC-



Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16.0
1.0	●
1.2	●
1.6	●

FLUXOFIL 44

OERLIKON

Cored Wires
C-Mn and low-alloy steels

FLUXOFIL 44 is a seamless copper coated basic flux cored wire for the welding of fine grain structural steels, and cryogenic steel grades. The weld metal meets high toughness mechanical property requirements in both the as-welded and stress relieved conditions. Quiet and smooth operation and low spatter loss with easy slag removal produces uniform and smooth weld beads which are free from porosity.

Classification	
EN ISO	17632-A: T 42 8 2Ni B M 2 H5
EN ISO	17632-B: T498T5-1MA-N5-UH5
AWS	A5.29: E70T5-GM-JH4

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni
0.05	0.8	0.2	≤ 0.010	≤ 0.010	2.4

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				-60 °C	-80 °C
As Welded	≥ 420	500-640	≥ 26	≥ 70	≥ 47

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : M21

Materials

S(P)275-S(P)420

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16.0
1.2	●

AIR LIQUIDE WELDING

FLUXOFIL 43.1

OERLIKON

Cored Wires
C-Mn and low-alloy steels

FLUXOFIL 43.1 is a seamless copper coated basic flux cored wire used for the welding of high-strength fine grain structural steels which are normalized (N) or normalized + tempered (N + T) after welding. The heat treatment required depends on the base metal being welded. The weld metal is not recommended for use in the as-welded or stress relieved conditions. Quiet and smooth running with low spatter loss and easy slag removal produces uniform and smooth beads which are free from porosity. To be used under Ar/CO2 gas.

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni	Mo	V
0.05	1.2	0.3	≤ 0.010	≤ 0.010	2	0.3	0.1

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -20 °C
940°C /40 min	≥ 480	570-670	≥ 20	≥ 40
940°C /40 min.+580°C /2h	≥ 430	550-650	≥ 20	≥ 50

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : M21

Materials

S(P)355-S(P)460

Storage

Keep dry and avoid condensation

Current condition and welding position

DC+

Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
1.2	●
1.4	●

CITOFLUX B13-O

OERLIKON

Cored Wires
C-Mn and low-alloy steels

CITOFLUX B13-0 is self shielded flux cored wire for welding in all positions. It is used for on-site assembly of sheet and plate metal or profile sections (thickness 3 to 15mm), for the spot welding of round bars for reinforced concrete and for joining galvanized parts.

Classification	
EN ISO	17632-A: T 42 Z Y 1 H15
AWS	A5.20: E71-T7

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Al
0.3	0.6	0.15	≤ 0.025	≤ 0.025	1.6

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 20 °C
As Welded	≥ 420	≥ 540	≥ 22	≥ 30

Shielding Gas - EN ISO 14175 : C1, M21

Materials

Fe E215; Fe E235

S(P)235; GP240

Storage
Keep dry and avoid condensation

Current condition and welding position
DC-

Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
1.2	●
1.6	●

AIR LIQUIDE WELDING

FLUXOFIL 18 HD

OERLIKON

Cored Wires
Weathering steels

FLUXOFIL 18HD is a seamless copper coated special rutile cored wire for gas-shielded metal arc welding of weathering steels such as Patinax or Cor-ten. The weld metal corrosion behaviour is adapted to these steel types. Excellent weldability. Very good slag removal, smooth weld bead surfaces without undercutting into the base metal. Very good mechanical property values and highly X-ray proof. Can be welded in all positions with one parameter setting. Preferably used under mixed gas. The use of CO2 is possible.

Classification	
EN ISO	17632-A: T 50 3 Z P M 1 H5
EN ISO	17632-B: T573T1-1MA-NCC1-UH5
AWS	A5.29: E81T1-GM-H4

Approvals	Grade
RINA	

CE

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Cu
0.04	1.1	0.5	0.6	0.6	0.7

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				-20 °C	-30 °C
As Welded	≥ 500	560-690	≥ 23	≥ 60	≥ 47

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : M21

Materials

S235J0W; S235J2W; S355J0W; S355J2W; S355K2W

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	B200	B300
Diam(mm) / weight(kg)	5.0	16.0
1.2	●	●
1.4	●	●
1.6		●

FLUXOFIL M 48

OERLIKON

Cored Wires
Weathering steels

FLUXOFIL M 48 is a seamless copper coated metal flux cored wire for gas-shielded metal arc welding of weathering and fine grain structural steels such as Patinax or Cor-ten. The weld metal is resistant to atmospheric corrosion. The weld metal corrosion behaviour is adapted to these steel types. Stable operating characteristics in short, spray and pulsed arc applications alike. Safe side wall fusion and very good gap bridging characteristics. To be used with Ar/CO2 gas shielding.

Classification	
EN ISO	17632-A: T 46 3 Z M M 1 H5
EN ISO	17632-B: T553T15-1MA-NCC1-UH5
AWS	A5.29: E81TG-W2M

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Cu
0.04	1.0	0.4	≤ 0.010	≤ 0.010	0.5	0.5	0.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -30 °C
As Welded	≥ 470	560-680	≥ 24	≥ 47

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : M21

Materials

S235J0W; S235J2W; S355J0W; S355J2W; S355K2W

Storage

Keep dry and avoid condensation

Current condition and welding position

DC+

Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16.0
1.2	●
1.4	●

AIR LIQUIDE WELDING

FLUXOFIL 48

OERLIKON

Cored Wires
Weathering steels

FLUXOFIL 48 is a seamless copper coated basic flux cored wire for gas-shielded metal arc welding of weathering and fine grain structural steels such as Patinax or Cor-ten. The weld metal is resistant to atmospheric corrosion. Low spatter loss, easy slag removal, smooth and uniform bead appearance. The weld metal is very crack-resistant, cold-tough down to 60°C with very low hydrogen content.

Classification	
EN ISO	17632-A: T 46 6 Z B C 2 H5
EN ISO	17632-A: T 46 6 Z B M 2 H5
EN ISO	17632-B: T556T5-1CA-G-UH5
EN ISO	17632-B: T556T5-1MA-G-UH5
AWS	A5.29: E81T5-GC-H4
AWS	A5.29: E81T5-GM-H4

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni	Cu
0.05	1.1	0.25	0.010	0.010	1.2	0.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -60 °C
As Welded	≥ 470	550-680	≥ 24	≥ 47

Gas test: 100% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Materials

S235J0W; S235J2W; S355J0W; S355J2W; S355K2W

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
1.2	●
1.6	●

FLUXOFIL M 41

OERLIKON

Cored Wires
High-strength steels

FLUXOFIL M41 is a seamless copper coated cored wire for welding of high strength steels with minimum yield strengths of 550 MPa. Stable operating characteristics and low spatter formation with short, spray and pulsed arc applications alike. Safe side wall fusion and very good gap bridging characteristics. To be used under mixed gas only

Classification	
EN ISO	18276-A: T 55 5 Z M M 1 H5
EN ISO	18276-B: T625T15-1MA-3M2-UH5
AWS	A5.28: E90C-GM H4

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni	Mo
0.06	1.7	0.6	≤ 0.015	≤ 0.015	0.6	0.3

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -50 °C
As Welded	≥ 550	640-820	≥ 22	≥ 47

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : M21

Materials

S(P)460-S(P)500, S550, HY 80

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	B200	B300
Diam(mm) / weight(kg)	5.0	16.0
1.0	●	●
1.2	●	●

AIR LIQUIDE WELDING

FLUXOFIL 41

OERLIKON

Cored Wires
High-strength steels

FLUXOFIL 41 is a seamless copper coated basic cored wire for welding of high strength steels with minimum yield strength of 550 MPa. operating features include low spatter loss, easy slag removal and uniform bead appearance.

Classification	
EN ISO	18276-A: T 55 4 1NiMo B M 2 H5
EN ISO	18276-A: T 55 6 1NiMo B C 2 H5
EN ISO	18276-B: T624T5-1MA-N2M2-UH5
EN ISO	18276-B: T626T5-1CA-N2M2-UH5
AWS	A5.29: E90T5-GC-H4
AWS	A5.29: E90T5-GM-H4

Approvals	Grade
DB	●
RMRS	5Y50 H5

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni	Mo
0.07	1.3	0.4	0.01	0.01	1.1	0.4

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -40 °C
As Welded	≥ 550	640-760	≥ 23	≥ 60

Gas test: 82% Ar+18% CO2

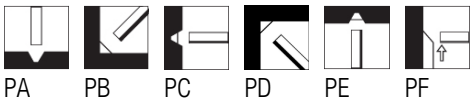
Shielding Gas - EN ISO 14175 : C1, M21

Materials

S(P)500, S550, HY 80

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
1.2	●
1.4	●
1.6	●

FLUXOFIL M 41 PG

OERLIKON

Cored Wires
High-strength steels

FLUXOFIL M41 PG is a seamless copper coated cored wire for welding of high strength steels with minimum yield strengths of 550 MPa in welding position PG (vertical down). Used with spray arc with negative poled flux-cored wire electrode (direct current, negative polarity). Stable operating characteristics and low spatter formation with short. To be used under mixed gas only

Classification	
EN ISO	18276-A: T55 4 Z M M 1 H5
EN ISO	18276-B: T624T15-1MA-UH5
AWS	A 5.28 : E90C-K3

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni	Mo
0.06	1.7	0.6	≤ 0.015	≤ 0.015	0.8	0.25

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -40 °C
As Welded	≥ 550	640-820	≥ 22	≥ 47

Gas test: 82% Ar+18% CO2

Materials

S(P)460-S(P)500, S550, HY 80

Storage
Keep dry and avoid condensation

Current condition and welding position
DC-

Packaging data

Packaging Type	B200	B300
Diam(mm) / weight(kg)	5.0	16.0
1.0	●	●
1.2	●	●

AIR LIQUIDE WELDING

CITOFLUX R550

OERLIKON

Cored Wires
High-strength steels

CITOFLUX R550 is rutile cored wire for the welding of high-strength fine grain structural steels with minimum yield strength of 550 MPa. Very good slag removal, smooth seam surface without undercutting into the base metal. Can be used in manual and fully-mechanised processes for example with orbital or vertical guiding device. Can be welded in all positions with one setting of parameters! Used under mixed gas as shielding gas only.

Classification	
EN ISO	18276-A: T55 5 Mn1,5Ni P M 1 H5
AWS	A5.29: E91T1-G M H4

Approvals	Grade
DNV	VY55MS H5

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni
0.07	1.3	0.4	≤ 0.015	≤ 0.015	1.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -50 °C
As Welded	≥ 550	620-760	≥ 22	≥ 47

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : M21

Materials

S(P)460, S(P)500, S550, HY 80

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
1.2	●

CITOFLUX R620

CE

Cored Wires
High-strength steels

CITOFLUX R620 is a rutile flux cored wire with excellent all-positional weldability. Suitable for welding of high-strength fine grain structural steels with minimum yield strength of 620 MPa. Low spatter with easy slag removal and regular bead appearance. Ideal for offshore and naval shipyard applications. Adapted for high heat input procedures. Exceptional weldability in particular for pipe welding in vertical up position.

Classification	
EN ISO	18276-A: T 62 4 1NiMo P M 1 H5
EN ISO	18276-B: T695T1-1MA-N2M2-H5
AWS	A5.29: E91T1-G H4

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni	Mo
0.07	1.40	0.40	≤ 0.015	≤ 0.015	0.9	0.4

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -40 °C
As Welded	≥ 620	700-800	≥ 20	≥ 47

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : M21

Materials

S(P)460-S(P)620

Storage

Keep dry and avoid condesation

Current condition and welding position

DC+

Packaging data

Packaging Type	B300	S200
Diam(mm) / weight(kg)	16.0	5.0
1.2	●	●

CITOFLUX R620 Ni2

OERLIKON

Cored Wires
High-strength steels

CITOFLUX R620 Ni2 is the new name of the former CITOFLUX R26 is a rutile flux cored wire suitable for welding of high-strength fine grain structural steels with minimum yield strength of 620 MPa. Low spatter with easy slag removal and regular bead appearance.

Classification	
EN ISO	18276-A: T 62 5 Mn2,5Ni P M 1 H5
EN ISO	18276-B: T695T1-1MA-N4M1-UH5
AWS	A5.29: E 101 T1-G M H4

Approvals	Grade
ABS	UP
DNV	IVY55MS H5
LRS	4Y62S H5

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni
0.08	1.35	0.35	≤ 0.015	≤ 0.015	2.2

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				-40 °C	-50 °C
As Welded	≥ 620	700-890	≥ 18	≥ 62	≥ 47

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : M21

Materials

S(P)460-S(P)620

Storage
Keep dry and avoid condesation

Current condition and welding position
DC+

Packaging data

Packaging Type	B300	S200
Diam(mm) / weight(kg)	16.0	5.0
1.2	●	●

FLUXOFIL 29 HD

CE

Cored Wires
High-strength steels

FLUXOFIL 29HD is a seamless rutile flux cored wire for gas shielded metal arc welding of high-strength fine grain structural steels with minimum yield strength of 690 MPa. Very good slag removal, smooth seam surface without undercutting into the base metal. Good mechanical property. Can be welded in all positions with one setting of parameters.

Classification	
EN ISO	18276-A: T 69 4 Z P M 1 H5
AWS	A5.29: E 111 T1-GMJ H4

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni	Mo
0.06	1.4	0.4	≤ 0.010	≤ 0.010	2.9	0.35

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -40 °C
As Welded	≥ 690	770-940	≥ 17	≥ 50

Shielding Gas - EN ISO 14175 : M21

Materials

S620, S690, HY 100

Storage

Keep dry and avoid condensation

Current condition and welding position

DC+

Packaging data

Packaging Type	B300	S200
Diam(mm) / weight(kg)	16.0	5.0
1.2	●	●

FLUXOFIL M 42

OERLIKON

Cored Wires
High-strength steels

FLUXOFIL M42 is a seamless copper coated metal cored wire for welding of high strength steels with minimum yield strength of 690 MPa with outstanding welding characteristics in the short-arc and spray-arc ranges. Almost spatter-free when welding in the spray-arc range. Good restriking, even with a cold wire tip, thus being suitable for robotic applications. Characteristic features: good side wall fusion, smooth and finely rippled welds without undercut into the base metal. Little formation of silicates on the weld surface, so that multi-pass welds can be made without inter-run cleaning. Due to the easily controllable weld pool in the short-arc range, FLUXOFIL M 42 is suitable for positional welding.

Classification	
EN ISO	18276-A: T 69 4 Mn2NiCrMo M M 1 H5
EN ISO	18276-B: T784T15-1MA-N4C1M2-UH5
AWS	A5.28: E110C-GM H4

Approvals	Grade
ABS	4Y 690 MS H5
BV	4Y 69 MS H5
DB	●
DNV	IVY 69 MS H5
LRS	4Y 690 MS H5
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo
0.05	1.5	0.5	0.01	0.01	0.4	2	0.4

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -40 °C
As Welded	≥ 690	780-980	≥ 17	≥ 70

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : M21

Materials

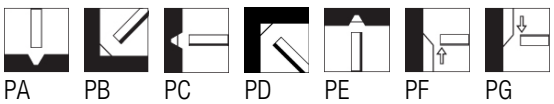
S620, S690, HY 100

Storage

Keep dry and avoid condensation

Current condition and welding position

DC+



Packaging data

Packaging Type	B300	DRUM	
Diam(mm) / weight(kg)	16	16	200
1.2	●		●
1.6	●	●	

FLUXOFIL 42

OERLIKON

Cored Wires
High-strength steels

FLUXOFIL 42 is a seamless copper coated basic flux cored wire for the welding of high-strength fine grain structural steels with minimum yield strength of 690 MPa. Operating features include low spatter loss, easy slag removal and uniform bead appearance.

Classification	
EN ISO	18276-A: T 69 6 Mn2NiCrMo B C 2 H5
EN ISO	18276-A: T 69 6 Mn2NiCrMo B M 2 H5
EN ISO	18276-B: T786T5-1 CA-N4C1M2-UH5
EN ISO	18276-B: T786T5-1 MA-N4C1M2-UH5
AWS	A5.29: E110T5-K4C-H4
AWS	A5.29: E110T5-K4M-H4

Approvals	Grade
ABS	3YQ690SA
ABS	4YQ690SA H5
BV	3Y69 MS H5
BV	4Y69 MS H5
DB	●
DNV	IIIY69MS H5
DNV	IVY69MS H5
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo
0.06	1.5	0.3	0.01	0.01	0.4	2.3	0.4

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)		
				-20 °C	-40 °C	-60 °C
As Welded	≥ 690	780-890	≥ 17		≥ 80	≥ 60
580 °C x 2 h	≥ 670	760-840	≥ 17	≥ 60	≥ 47	

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Materials

S620, S690, HY 100

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
1.2	●
1.6	●

AIR LIQUIDE WELDING

FLUXOFIL 42 LT

OERLIKON

Cored Wires
High-strength steels

FLUXOFIL 42LT is a seamless copper coated basic flux cored wire alloyed with Cr-Ni-Mo. Used for applications requiring very high yield strength and impact toughness values at low temperatures. Suitable for steels such as S690. Suitable for welding in all positions. To be used with Ar/CO2 shielding gas.

Classification	
EN ISO	18276-A: T 69 6 Mn2NiCrMo B M 2 H5
EN ISO	18276-B: T86T5-1MA-N4C1M2-UH5
AWS	A5.29: E111T5-GM H4

Approvals	Grade
ABS	4Y69 SA H5
BV	4Y69 MS H5
DNV	IVY69 MS H5

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo
0.08	1.6	0.4	≤ 0.015	≤ 0.015	0.3	2.4	0.45

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -50 °C
As Welded	≥ 690	760-900	≥ 15	≥ 47

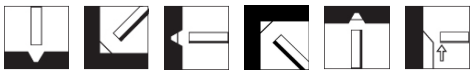
Shielding Gas - EN ISO 14175 : M21

Materials

S620; S690; HY 100

Storage
Keep dry and avoid condensation

Current condition and welding position
DC-



Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16.0
1.2	●

FLUXOFIL 45

OERLIKON

Cored Wires
High-strength steels

FLUXOFIL 45 is a seamless copper coated basic flux cored wire for welding high-strength fine grain structural steels. Quiet and smooth running with low spatter loss and easy slag removal producing uniform and smooth beads which are free from porosity. The mechanical properties of the weld depend on the cooling conditions and are influenced by the heat input and interpass temperature.

Classification	
EN ISO	18276-A: T 89 4 Mn2Ni1CrMo B M 2 H5
AWS	A5.29: E120T5-GM H4

Approvals	Grade
DB	●
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo
0.09	2	0.5	0.01	0.01	1	1.8	0.4

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -40 °C
As Welded	≥ 890	940-1180	≥ 15	≥ 47

Gas test: 82% Ar+18% CO2

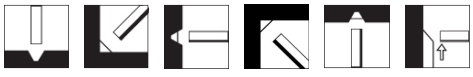
Shielding Gas - EN ISO 14175 : M21

Materials

S890

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
1.2	●

AIR LIQUIDE WELDING

FLUXOFIL 70

OERLIKON

Cored Wires
High-strength steels

FLUXOFIL 70 is a seamless copper coated basic flux cored wire for the joining and surfacing of stamping and pressing tools, dies, rolls and other components made of corresponding steel grades. The weld metal is developped for hardening and tempering and the mechanical properties are a function of the heat treatment.

Classification	
EN ISO	18276-A: T 69 A Z B M 3 H5
EN ISO	18276-B: T78YT5-0MP-G-UH5
AWS	A5.29: E110T5-GM-H4

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo
0.08	1.1	0.4	1	2.2	1

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 20 °C
640°C x 2 h	≥ 700	780-890	≥ 17	≥ 50

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : M21

Materials

28 NiCrMo 44, 28 NiCrMo 74, 34 CrMo 4, 28 NiCrMo 4, 34 CrNiMo 6, 30 CrNiMo 8

Storage

Keep dry and avoid condensation

Current condition and welding position

DC+

PA PB

Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16.0
1.2	●
1.4	●
1.6	●

FLUXOFIL 25

OERLIKON

Cored Wires
Chromium-Molybdenum steels

FLUXOFIL 25 is a seamless copper coated rutile flux cored wire with a fast-freezing slag, suitable for the welding of creep resistant boiler and pipe steels, for operating temperatures up to 530 °C, as well as fine grain structural steels. Due to its easily controllable weld pool, it features outstanding welding properties in all positions. Low spatter loss, finely rippled welds without undercut.

Classification	
EN ISO	17634-A: T MoL P M 1 H5
EN ISO	17634-B: T55T1-1M-2M3-H5
AWS	A5.29: E81T1-A1M-H4

Approvals	Grade
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Mo
0.05	1.1	0.4	0.01	0.01	0.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 20 °C
As Welded	≥ 490	550-650	≥ 22	≥ 50
580°C x 1h	≥ 470	550-620	≥ 23	≥ 70

Gas test: 82% Ar+18% CO2

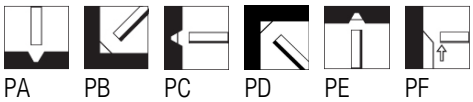
Shielding Gas - EN ISO 14175 : M21

Materials

S(P)235-S(P)460, 16Mo3

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
1.2	●

AIR LIQUIDE WELDING

FLUXOFIL 35

OERLIKON

Cored Wires
Chromium-Molybdenum steels

FLUXOFIL 35 is a seamless copper coated basic flux cored wire suitable for the welding of creep resistant boiler and pipe steels for operating temperatures up to 530 °C, as well as fine grain structural steels. Quiet and stable arc with low spatter loss and easy slag removal produce a uniform and smooth weld bead surface which is free from porosity..

Classification	
EN ISO	17634-A: T MoL B C 2 H5
EN ISO	17634-A: T MoL B M 2 H5
EN ISO	17634-B: T55T5-1C-2M3-H5
EN ISO	17634-B: T55T5-1M-2M3-H5
AWS	A5.29: E80T5-GC-H4
AWS	A5.29: E80T5-GM-H4

Approvals	Grade
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Mo
0.05	1.1	0.3	0.010	0.010	0.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -40 °C
As Welded	≥ 490	550-650	≥ 23	≥ 47
620°C x 1h	≥ 470	550-620	≥ 25	≥ 47

Gas test: 100% CO2

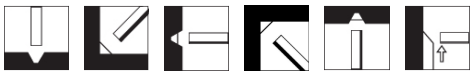
Shielding Gas - EN ISO 14175 : C1, M21

Materials

S(P)235-S(P)460, 16Mo3

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
1.2	●
1.6	●

FLUXOFIL 36

OERLIKON

Cored Wires
Chromium-Molybdenum steels

FLUXOFIL 36 is a seamless copper coated basic flux cored wire suitable for the welding of Cr Mo-alloyed boiler and pipe steels for high creep rupture strength up to 570 °C. Quiet and smooth fusion and low spatter loss with easy slag removal produce uniform and smooth weld beads which are free from porosity.

Classification	
EN ISO	17634-A: T CrMo1 B C 2 H5
EN ISO	17634-A: T CrMo1 B M 2 H5
EN ISO	17634-B: T55T5-1C-1CM-H5
EN ISO	17634-B: T55T5-1M-1CM-H5
AWS	A5.29: E80T5-B2C-H4
AWS	A5.29: E80T5-B2M-H4

Approvals	Grade
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Mo
0.08	0.8	0.3	0.010	0.010	1.2	0.4

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C
690 °C x 1h	≥ 470	550-660	≥ 22	≥ 120

Gas test: 100% CO2

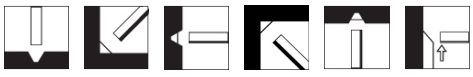
Shielding Gas - EN ISO 14175 : C1, M21

Materials

13CrMo4-5, 13CrMoSi5-5; G17CrMo5-5

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
1.2	●
1.6	●

AIR LIQUIDE WELDING

FLUXOFIL 37

OERLIKON

Cored Wires
Chromium-Molybdenum steels

FLUXOFIL 37 is a seamless copper coated basic flux cored wire, suitable for the welding of Cr Mo-alloyed boiler and pipe steels, for high creep rupture strength up to 600 °C. Quiet and smooth running and low spatter loss with easy slag removal produce uniform and smooth beads which are free from porosity.

Classification	
EN ISO	17634-A: T CrMo2 B C 2 H5
EN ISO	17634-A: T CrMo2 B M 2 H5
EN ISO	17634-B: T55T5-1C-2C1M-H5
EN ISO	17634-B: T55T5-1M-2C1M-H5
AWS	A5.29: E80T5-B3C-H4
AWS	A5.29: E80T5-B3M-H4

Approvals	Grade
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Mo
0.1	0.8	0.4	0.010	0.010	2.4	1.1

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C
700°C x 1h	≥ 470	570-670	≥ 20	≥ 100

Gas test: 82% Ar+18% CO2

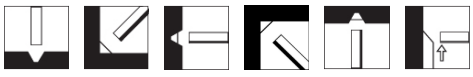
Shielding Gas - EN ISO 14175 : C1, M21

Materials

10CrMo9-10, 12CrMo9-10; A387 Gr.22, Cl 1and 2, A 182 Gr.F 22, A 336 Gr.F22

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
1.2	●
1.6	●

FLUXOFIL 38 C

OERLIKON

Cored Wires
Chromium-Molybdenum steels

FLUXOFIL 38C is a seamless copper coated basic flux cored wire, suitable for the welding of Cr Mo V-alloyed steels for high creep rupture strength up to 600 °C. Quiet and smooth running and low spatter loss with easy slag removal produce uniform and smooth weld beads which are free from porosity.

Classification	
EN ISO	17634-A: T Z B C 3 H5
EN ISO	17634-A: T Z B M 3 H5
EN ISO	17634-B: TZT5-0C-Z-H5
EN ISO	17634-B: TZT5-0M-Z-H5
AWS	A5.29: E70T5-GC-JH4
AWS	A5.29: E70T5-GM-JH4

Approvals	Grade
TÜV	●

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	V
0.1	0.7	0.3	0.010	0.010	1.3	0.3	0.9	0.25

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C
950°C x 0,5h + 700°C x 16h	≥ 440	590-780	≥ 15	≥ 47

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Materials

G17CrMoV5-11

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

PA PB

Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
1.2	●
1.6	●

AIR LIQUIDE WELDING

FLUXINOX 430Ti

FLUXINOX 430TI is a metal cored wire for the welding of 17% Chromium stainless steel. Applications include catalytic exhaust systems in the automotive industry.

Classification	
AWS	A5.22: E 430 T0-G

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ti
0.02	0.2	0.2	≤ 0.015	≤ 0.010	15-18	0.6

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
As Welded	≥ 380	≥ 450	≥ 15

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Materials

For 17 % Cr-Steel

Storage

Keep dry and avoid condensation

Current condition and welding position

DC+

PA PB

Packaging data

Packaging Type	BS300	DRUM
Diam(mm) / weight(kg)	15.0	200.0
1.2	●	●
1.4	●	●

FLUXINOX 308L

OERLIKON

Cored Wires
Stainless and Heat resistant steels

FLUXINOX 308L is an alloyed rutile flux cored wire for the welding of unstabilized and stabilized corrosion resistant Cr Ni-steels. Suitable for operating temperatures up to 350 °C, non-scaling up to approximately 800 °C. FLUXOFIL 308 L features outstanding, almost spatter-free, welding properties. Very easy slag removal from fillet welds. Flat and smooth weld beads without undercut.

Classification	
EN ISO	17633-A: T 19 9 L R C 3
EN ISO	17633-A: T 19 9 L R M 3
EN ISO	17633-B: TS308L-FB0
AWS	A5.22: E308LT0-1
AWS	A5.22: E308LT0-4

Approvals	Grade
DB	●
DNV	308L
GL	4550S
LRS	304LS
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Ferrite
≤ 0.04	1.7	0.6	20	10	6-10

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				-20 °C	-196 °C
As Welded	≥ 350	≥ 520	≥ 35	≥ 47	≥ 27

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Materials

AISI 304 - 304L - 302

1.4541 (X6CrNiTi18-10); 1.4301 (X4CrNi18-10); 1.4311 (X2CrNiN18-10)

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+
 PA PB

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1.0	●
1.2	●

AIR LIQUIDE WELDING

FLUXINOX 308L PF

FLUXINOX 308L-PF is an alloyed rutile flux cored wire with a fast-freezing slag for the welding of unstabilized and stabilized corrosion resistant Cr Ni-steels. Suitable for operating temperatures up to 350 °C, non-scaling up to approximately 800 °C. FLUXINOX 308L-PF exhibits outstanding, almost spatter-free, welding properties with very easy slag removal from fillet welds resulting in flat and smooth weld beads without undercut into the base metal. Due to only slight discolouration of the weld beads, pickling costs can be minimised. Due to the fast-freezing slag of FLUXINOX 308L-PF, it is well-suited for welding in the horizontal (PD), overhead (PE) and vertical-up (PF) positions.

Classification	
EN ISO	17633-A: T 19 9 L P C 1
EN ISO	17633-A: T 19 9 L P M 1
EN ISO	17633-B: TS308L-FB1
AWS	A5.22: E308LT1-1
AWS	A5.22: E308LT1-4

Approvals	Grade
DNV	308L
LRS	304LS
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Ferrite
≤ 0.04	1.4	0.6	20	10	6-10

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation	Impact Energy ISO - V (J)	
				-20 °C	-196 °C
As Welded	≥ 350	≥ 520	≥ 35	≥ 47	≥ 32

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Materials

1.4541 (X6CrNiTi18-10); 1.4301 (X4CrNi18-10); 1.4311 (X2CrNiN18-10)

AISI 304 - 304L - 302

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1.0	●
1.2	●

FLUXINOX 308H

OERLIKON

Cored Wires
Stainless and Heat resistant steels

FLUXINOX 308H is an alloyed rutile cored wire for joining and surfacing of identical and similar high temperature resisting steels and cast steels. The weld metal is suitable for operating temperatures up to 700°C and is non-scaling up to approximately 800°C. FLUXINOX 308H features outstanding, almost spatter-free, welding properties with very easy slag removal from fillet welds and narrow grooves. The weld beads produced are flat and smooth without undercut into the base metal.

Classification	
EN ISO	17633-A: T 19 9 H R C 3
EN ISO	17633-A: T 19 9 H R M 3
EN ISO	17633-B: TS308H-FB0
AWS	A5.22: E308HT0-1
AWS	A5.22: E308HT0-4

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni
0.06	1.4	0.6	20	10

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 20 °C
As Welded	≥ 350	≥ 550	≥ 35	≥ 40

Shielding Gas - EN ISO 14175 : M21-ATAL

Materials

1.4941(X8CrNiTi18-10)

AISI 304H; 1.4948 (X6CrNi18-10); 1.4310 (X10CrNi18-8)

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

PA PB PC

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15.0
1.0	●
1.2	●

FLUXINOX 347

OERLIKON

Cored Wires
Stainless and Heat resistant steels

FLUXINOX 347 is an alloyed rutile flux cored wire for the welding of stabilized corrosion resistant Cr Ni-steels. The weld metal is used for operating temperatures up to 400 °C, non-scaling up to about 800 °C. FLUXINOX 347 exhibits excellent, almost spatter-free, welding properties with very easy slag removal from fillet welds. The weld beads produced are flat and smooth without undercut and with little discolouration of the weld, thus pickling costs can be minimised.

Classification	
EN ISO	17633-A: T 19 9 Nb R C 3
EN ISO	17633-A: T 19 9 Nb R M 3
EN ISO	17633-B: TS347L-FB0
AWS	A5.22: E347T0-1
AWS	A5.22: E347T0-4

Approvals	Grade
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Nb	Ferrite
≤ 0.04	1.8	0.4	20	10	0.4	5-10

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				20 °C	-196 °C
As Welded	≥ 350	≥ 550	≥ 30	≥ 47	≥ 32

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Materials

1.4541 (X6CrNiTi18-10); 1.4301 (X4CrNi18-10); 1.4550 (X6CrNiNb18-10);

AISI 347 - 321

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

PA PB

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1,2	●
1.0	●

FLUXINOX 347 PF

OERLIKON

Cored Wires
Stainless and Heat resistant steels

FLUXINOX 347-PF is an alloyed rutile flux cored wire with a fast-freezing slag for the welding of stabilized corrosion resistant Cr Ni-steel. The weld metal is suitable for operating temperatures up to 400°C, non-scaling up to approximately 800°C. FLUXINOX 347-PF exhibits outstanding, easy slag removal from fillet welds, even in acute angles. Welds produced are flat and smooth without undercut and due to only slight discolouration of the welds, pickling costs can be minimised. Owing to the fast-freezing slag, FLUXINOX 347 PF is used for welding in the horizontal (PD), overhead (PE) and vertical-up (PF) positions.

Classification	
EN ISO	17633-A: T 19 9 Nb P C 1
EN ISO	17633-A: T 19 9 Nb P M 1
EN ISO	17633-B: TS347L-FB1
EN ISO	A5.22: E347T1-1
AWS	A5.22: E347T1-4

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Nb	Ferrite
≤ 0.04	1.5	0.9	20	10	0.4	5-10

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				20 °C	-196 °C
As Welded	≥ 350	≥ 550	≥ 30	≥ 47	≥ 32

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Materials

1.4541 (X6CrNiTi18-10); 1.4301 (X4CrNi18-10); 1.4550 (X6CrNiNb18-10);

AISI 347 - 321

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1,2	●
1.0	●

AIR LIQUIDE WELDING

FLUXINOX 316L

OERLIKON

Cored Wires
Stainless and Heat resistant steels

FLUXINOX 316L is an alloyed rutile flux cored wire for the welding of unstabilized and stabilized corrosion resistant Cr Ni Mo-steels. The weld metal is resistant to intergranular corrosion up to 400 °C and non-scaling up to 800 °C. FLUXINOX 316L exhibits outstanding, almost spatter-free, welding properties. Very easy slag removal from fillet welds, even in acute angles. The weld beads produced are finely rippled and without undercut. Due to only slight discolouration of the welds, pickling costs can minimised.

Classification	
EN ISO	17633-A: T 19 12 3 L R C 3
EN ISO	17633-A: T 19 12 3 L R M 3
EN ISO	17633-B: TS316L-FB0
AWS	A5.22: E316LT0-1
AWS	A5.22: E316LT0-4

Approvals	Grade
DB	●
DNV	316L
GL	4571S
LRS	316L S
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo	Ferrite
≤ 0.04	1.7	0.6	19	12	2.8	5-10

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				20 °C	-196 °C
As Welded	≥ 320	≥ 510	≥ 30	≥ 47	≥ 27

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Materials

1.4571 (X6CrNiMoTi17-12-2), 1.4583 (X10CrNiMoNb18-12)

1.4401 (X4CrNiMo17-12-2), 1.4435 (X2CrNiMo18-14-3)

AISI 316L

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

PA PB

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1.0	●
1.2	●

FLUXINOX 316L PF

OERLIKON

Cored Wires
Stainless and Heat resistant steels

FLUXINOX 316L-PF is a rutile flux cored wire with a fast-freezing slag suitable for the welding of unstabilized and stabilized corrosion resistant CrNiMo steels. The weld metal is resistant to intergranular corrosion up to 400°C, and non-scaling up to 800°C. FLUXINOX 316 L-PF exhibits outstanding, almost spatter-free, welding properties with very easy slag removal from fillet welds, even in acute angles. The weld beads produced are finely rippled without undercut. Due to only slight discolouration of the welds, pickling costs can be minimised. Due to its fast-freezing slag, FLUXINOX 316 L-PF is used for welding in the horizontal (PD), overhead (PE) and vertical-up (PF) positions.

Classification	
EN ISO	17633-A: T 19 12 3 L P C 1
EN ISO	17633-A:T 19 12 3 L P M 1
EN ISO	17633-B: TS316L-FB1
AWS	A5.22: E316LT1-1
AWS	A5.22: E316LT1-4

Approvals	Grade
DNV	316L
LRS	316L S
LRS	316L S
TÜV	●
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo	Ferrite
≤ 0.04	1.4	0.6	19	12	2.8	5-10

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				20 °C	-196 °C
As Welded	≥ 320	≥ 510	≥ 30	≥ 47	≥ 27

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Materials

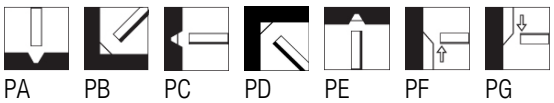
1.4401 (X4CrNiMo17-12-2), 1.4435 (X2CrNiMo18-14-3)

AISI 316L

1.4571 (X6CrNiMoTi17-12-2), 1.4583 (X10CrNiMoNb18-12)

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	BS300	S200
Diam(mm) / weight(kg)	15	5
1.0	●	
1.2	●	●

AIR LIQUIDE WELDING

FLUXINOX 318

OERLIKON

Cored Wires
Stainless and Heat resistant steels

FLUXINOX 318 is an alloyed rutile flux cored wire for the welding of unstabilized and stabilized corrosion resistant Cr Ni Mo-steels. The weld metal is resistant to intergranular corrosion up to 400 °C and non-scaling up to 800 °C. FLUXINOX 318 is characterized by excellent, almost spatter-free, welding properties with very easy slag removal from fillet welds, even in acute angles. The weld beads produced are finely rippled and free of undercut and the weld surface is shiny.

Classification	
EN ISO	17633-A: T 19 12 3 Nb R C 3
EN ISO	17633-A: T 19 12 3 Nb R M 3
EN ISO	17633-B: TS318-FB0

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo	Nb
≤ 0.04	1.5	0.8	19	12	2.8	0.4

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				20 °C	-60 °C
As Welded	≥ 350	≥ 550	≥ 25	≥ 40	≥ 32

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Materials

1.4571 (X6CrNiMoTi17-12-2) - 1.4401 (X4CrNiMo17-12-2)
1.4580 (X6CrNiMoNb17-12-2) - 1.4408 (GX5CrNiMo19-11)
1.4581 (GX5CrNiMoNb19-10) - 1.4436 (X4CrNiMo17-13-3)
1.4583 (X10CrNiMoNb18-12)

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

PA PB

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1.0	●
1.2	●

FLUXINOX 318 PF

OERLIKON

Cored Wires
Stainless and Heat resistant steels

FLUXINOX 318-PF is an alloyed rutile cored wire with a fast-freezing slag for the welding of unstabilized and stabilized corrosion resistant CrNiMo steels. The weld metal is resistant to intergranular corrosion up to 400°C, and non-scaling up to 800°C. FLUXINOX 318-PF exhibits outstanding, almost spatter-free, welding properties with very easy slag removal from fillet welds, even in acute angles. The weld beads produced are finely rippled and free of undercut with a shiny weld surface. Due to its fast-freezing slag, FLUXINOX 318-PF is used for welding in the horizontal (PD), overhead (PE) and vertical-up (PF) positions.

Classification	
EN ISO	17633-A: T 19 12 3 Nb P C 1
EN ISO	17633-A: T 19 12 3 Nb P M 1
EN ISO	17633-B: TS318-FB1

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo	Nb
≤ 0.04	1.5	0.8	19	12	2.8	0.4

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				20 °C	-60 °C
As Welded	≥ 350	≥ 550	≥ 25	≥ 40	≥ 32

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Materials

1.4581 (GX5CrNiMoNb19-10) - 1.4436 (X4CrNiMo17-13-3)
1.4583 (X10CrNiMoNb18-12)
1.4571 (X6CrNiMoTi17-12-2) - 1.4401 (X4CrNiMo17-12-2)
1.4580 (X6CrNiMoNb17-12-2) - 1.4408 (GX5CrNiMo19-11)

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1,2	●
1.0	●

FLUXINOX 22 9 3 L

OERLIKON

Cored Wires
Stainless and Heat resistant steels

FLUXINOX 22 9 3 L is an alloyed rutile flux cored wire, suitable for the joining and cladding of corrosion resistant ferritic-austenitic duplex-steels. The weld metal consists of approximately 30% ferrite and 70% austenite and is particularly resistant to pitting, crevice corrosion and stress corrosion cracking in chloride and hydrogen sulphide bearing media. Principal applications include the construction of chemical plants and offshore installations, for operating temperatures up to 250 °C.

Classification	
EN ISO	17633-A: T 22 9 3 N L R C 3
EN ISO	17633-A: T 22 9 3 N L R M 3
AWS	A5.22: E2209T0-1
AWS	A5.22: E2209T0-4

Approvals	Grade
DNV	DUPLEX
GL	4462
LRS	S31803S
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo	N	Ferrite
≤ 0.04	1.1	0.5	22	9	3	0.1	38-60

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				20 °C	-30 °C
As Welded	≥ 550	750 - 900	≥ 24	≥ 47	≥ 40

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Materials

UNS S31803 - S31500 - S31200 - S32304

1.4462 (X2CrNiMoN22-5-3)

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+
 PA PB

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1.0	●
1.2	●

FLUXINOX 22 9 3 L PF

OERLIKON

Cored Wires
Stainless and Heat resistant steels

FLUXINOX 22 9 3L PF is an alloyed rutile flux cored wire, suitable for the joining and cladding of corrosion resistant ferritic-austenitic duplex steels. The weld metal consists of about 30% ferrite and 70% austenite and is particularly resistant to pitting, crevice corrosion cracking in chloride and hydrogen sulphide bearing media. Principal applications include the construction of chemical plants and offshore weldments for operating temperatures up to 250 °C. Due to its fast-freezing slag, FLUXINOX 22 9 3 L PF is used for welding in the horizontal (PC), overhead (PE) and vertical-up (PF) positions.

Classification	
EN ISO	17633-A: T 22 9 3 N L P C 1
EN ISO	17633-A: T 22 9 3 N L P M 1
AWS	A5.22: E2209T1-1
AWS	A5.22: E2209T1-4

Approvals	Grade
DNV	DUPLEX
GL	4462
LRS	S31803S
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo	N	Ferrite
≤ 0.04	0.8	0.5	22.5	9	3	0.1	38-60

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				20 °C	-30 °C
As Welded	≥ 550	750 - 900	≥ 24	≥ 47	≥ 40

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Materials

UNS S31803 - S31500 - S31200 - S32304

1.4462 (X2CrNiMoN22-5-3)

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1.0	●
1.2	●

AIR LIQUIDE WELDING

FLUXINOX 307

CE

Cored Wires
Stainless and Heat resistant steels

FLUXINOX 307 is an alloyed rutile cored wire for crack-resistant joining and surfacing of heat treatable steels, armour plates, corrosion resisting steels and high manganese steels. It is also suitable for joining austenitic stainless steels to unalloyed steels. The weld metal is suitable for operating temperatures up to 300 °C, and is non-scaling up to 850°C. It is highly rust and corrosion resistant, and will harden by cold working.

Classification
EN ISO 17633-A: T 18 8 Mn R C 3
EN ISO 17633-A: T 18 8 Mn R M 3

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni
0.04	6.5	0.7	19	9

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 20 °C
As Welded	≥ 400	600 - 700	≥ 30	≥ 40

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Materials

Armour plate; Ferrite-Austenite heterogeneous joints

X120Mn12 (1.3401)

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+
 PA PB

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15.0
1.0	●
1.2	●

FLUXINOX 307 PF

OERLIKON

Cored Wires
Stainless and Heat resistant steels

FLUXINOX 307-PF is an alloyed rutile flux cored wire with a fast-freezing slag for crack-resistant joining and surfacing of heat treatable steels, armour plates, corrosion resisting steels and high manganese steels. It is also suitable for joining austenitic stainless steels to unalloyed steels. The weld metal is suitable for operating temperatures up to 300 °C, and is non-scaling up to 850 °C. It is highly rust and corrosion resistant, and will harden by cold working. Due to its fast-freezing slag, FLUXINOX 307 PF is well-suited for welding in the horizontal (PC), overhead (PE) and vertical-up (PF) positions.

Classification	
EN ISO	17633-A: T 18 8 Mn P C 1
EN ISO	17633-A: T 18 8 Mn P M 1

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni
≤ 0.1	6.5	0.7	19	8.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 20 °C
As Welded	≥ 350	≥ 590	≥ 30	≥ 40

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Materials

Armour plate; Ferrite-Austenite heterogeneous joints

X120Mn12 (1.3401)

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1,2	●
1.0	●

AIR LIQUIDE WELDING

FLUXINOX 309L

OERLIKON

Cored Wires
Stainless and Heat resistant steels

FLUXINOX 309L is an alloyed rutile flux cored wire for joining high-alloyed Cr and Cr-Ni-(Mo) steels with unalloyed steels, as well as for depositing austenitic stainless cladding. The highest operating temperature for dissimilar joints is 300°C. The weld metal is non-scaling up to 850°C. Preheating and interpass temperatures should be calculated according to the base metal used.
FLUXINOX 309 L exhibits outstanding, almost spatter-free, welding properties. It produces finely rippled flat and smooth welds, free of undercut into the base metal. Very easy slag removal.

Classification	
EN ISO	17633-A: T 23 12 L R C 3
EN ISO	17633-A: T 23 12 L R M 3
EN ISO	17633-B: TS309L-FB0
AWS	A5.22: E309LT0-1
AWS	A5.22: E309LT0-4

Approvals	Grade
DB	●
DNV	309L
GL	4332S
LRS	SS/CMn
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Ferrite
≤ 0.04	1.5	0.6	≤ 0.03	≤ 0.03	24	13	12-20

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation	Impact Energy ISO - V (J)	
				20 °C	-60 °C
As Welded	≥ 320	≥ 520	≥ 30	≥ 40	≥ 32

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Materials

A312 TP309S; Ferrite-Austenite heterogeneous joints, Cladding

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

PA PB

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1.0	●
1.2	●

FLUXINOX 309L PF

OERLIKON

Cored Wires
Stainless and Heat resistant steels

FLUXINOX 309L-PF is an alloyed rutile flux cored wire for joining high-alloyed Cr and Cr-Ni-(Mo) steels to unalloyed steels, as well as for depositing austenitic stainless cladding. The highest operating temperature for dissimilar joints is 300 °C. The weld metal is non-scaling up to 850 °C. Preheating and interpass temperatures should be calculated according to the base metal used. FLUXINOX 309L-PF exhibits outstanding, almost spatter-free, welding properties and produces finely rippled flat and smooth welds which are free of undercut. Very easy slag removal. Due to its fast-freezing slag, FLUXINOX 309L-PF is used for welding in the horizontal (PD), overhead (PE) and vertical-up (PF) positions.

Classification	
EN ISO	17633-A: T 23 12 L P C 1
EN ISO	17633-A: T 23 12 L P M 1
EN ISO	17633-B: TS309L-FB1
EN ISO	A5.22: E309LT1-4
AWS	A5.22: E309LT1-1

Approvals	Grade
DNV	309L
GL	4332S
GL	4332S
LRS	SS/CMn
LRS	SS/CMn
TÜV	●
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Ferrite
≤ 0.04	0.7	0.6	24	13	10-20

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation	Impact Energy ISO - V (J)	
				-20 °C	-60 °C
As Welded	≥ 320	≥ 520	≥ 30	≥ 40	≥ 32

Gas test: 82% Ar+18% CO2

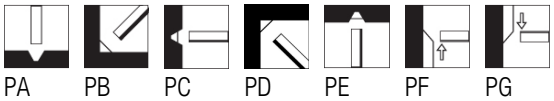
Shielding Gas - EN ISO 14175 : C1, M21

Materials

A312 TP309S; Ferrite-Austenite heterogeneous joints, Cladding

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	BS300	S200
Diam(mm) / weight(kg)	15	5
1.0	●	
1.2	●	●

AIR LIQUIDE WELDING

FLUXINOX 309MoL

CE

Cored Wires
Stainless and Heat resistant steels

FLUXINOX 309MoL is an alloyed rutile flux cored wire mainly used for cladding. The highest operating temperature for dissimilar joints is 300 °C.
FLUXINOX 309MoL exhibits outstanding, almost spatter-free, welding properties. It produces finely rippled, flat and smooth welds, free of undercut with very easy slag removal. The weld metal, containing approximately 20% ferrite, is crack-resistant and therefore well-suited for buffer layers on high-carbon, difficult to weld steels.

Classification	
EN ISO	17633-A: T 23 12 2 L R C 3
EN ISO	17633-A: T 23 12 2 L R M 3
EN ISO	17633-B: TS309LMo-FB0
AWS	A5.22: E309LMoT0-1
AWS	A5.22: E309LMoT0-4

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo	Ferrite
≤ 0.04	1.2	0.7	24	13	2.5	20-30

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)
				20 °C
As Welded	≥ 350	≥ 550	≥ 25	≥ 40

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Materials

Ferrite-Austenite heterogeneous joints, Cladding

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+
 PA PB

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1.0	●
1.2	●

FLUXINOX 309MoL PF

OERLIKON

Cored Wires
Stainless and Heat resistant steels

FLUXINOX 309MoL-PF is an alloyed rutile flux cored wire mainly used for cladding. The highest operating temperature for dissimilar joints is 300°C and the weld metal is non-scaling up to 850 °C. Preheating and interpass temperatures should be calculated according to the base metal used. FLUXINOX 309MoL-PF exhibits outstanding, almost spatter-free, welding properties. It produces finely rippled flat and smooth welds, free of undercut with very easy slag removal. Due to its fast-freezing slag, FLUXINOX 309MoL-PF is used for welding in the horizontal (PD), overhead (PE) and vertical-up (PF) positions.

Classification	
EN ISO	17633-A: T 23 12 2 L P C 1
EN ISO	17633-A: T 23 12 2 L P M 1
EN ISO	17633-B: TS309LMo-FB1
EN ISO	A5.22: E309LMoT1-1
AWS	A5.22: E309LMoT1-4

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo	Ferrite
≤ 0.04	1.5	0.7	24	13	2.5	12-20

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 20 °C
As Welded	≥ 350	≥ 550	≥ 28	≥ 40

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Materials

Ferrite-Austenite heterogeneous joints, Cladding

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	BS300	S200
Diam(mm) / weight(kg)	15	5
1.0	●	
1.2	●	●

AIR LIQUIDE WELDING

FLUXINOX 312

OERLIKON

Cored Wires
Stainless and Heat resistant steels

FLUXINOX 312 is an alloyed rutile flux cored wire for the joining and surfacing of dissimilar steels. The ferritic-austenitic weld metal (Delta-ferrite approximately 50%) is non-scaling up to 1100 °C. Due to the high ferrite content, the weld metal is suited for difficult-to-weld steels and stress-relaxing buffer layers on crack-susceptible base plates.
FLUXINOX 312 is characterized by outstanding, almost spatter-free, welding properties. It produces finely rippled flat and smooth welds which are free of undercut into the base metal. Very easy slag removal. FLUXINOX 312 is mainly used for joining dissimilar steels and difficult-to-weld steels, e.g. heat treatable steels, tool steels, and high manganese steels, and for surfacing or repair welding.

Classification	
EN ISO	17633-A: T 29 9 R C 3
EN ISO	17633-A: T 29 9 R M 3
EN ISO	17633-B: TS312-FB0
AWS	A5.22: E312T0-1
AWS	A5.22: E312T0-4

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni
≤ 0.15	1.3	0.9	29	9

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 20 °C
As Welded	≥ 450	≥ 660	≥ 25	≥ 32

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Materials

Ferrite-Austenite heterogeneous joints and difficult to weld steels

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+
 PA PB

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1.2	●

FLUXINOX 312 PF

OERLIKON

Cored Wires
Stainless and Heat resistant steels

FLUXINOX 312 PF is an alloyed rutile flux cored wire with a fast-freezing slag for joining and surfacing of dissimilar steels, as well as galvanized steels. The ferritic-austenitic weld metal (Delta-ferrite approximately 50%) is non-scaling up to 1100°C. FLUXINOX 312 PF is characterized by outstanding, almost spatter-free, welding properties. It produces finely rippled flat and smotth welds, free of undercut with very esay slag removal. FLUXINOX 312 PF is mainly used for joining dissimilar steels, difficult-to-weld steels, e.g. heat treatable steels, tool steels and high manganese steels, and for surfacing or repair welding, due to the fast -freezing slag, FLUXINOX 312 PF is used for welding in the horizontal (PD), overhead ((PE) and vertical-up (PF) positions.

Classification	
EN ISO	17633-A: T 29 9 P C 1
EN ISO	17633-A: T 29 9 P M 1
EN ISO	17633-B: TS312-FB1
AWS	A5.22: E312T1-4
AWS	A5.22: E312T1-4

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni
≤0.15	1.30	0.90	29	9

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 20 °C
As Welded	≥ 450	≥ 660	≥ 25	≥ 32

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Materials

Ferrite-Austenite heterogeneous joints and difficult to weld steels

Storage

Kepp dry and avoid condensation

Current condition and welding position

DC+

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1.2	●

AIR LIQUIDE WELDING

FLUXINOX 310

OERLIKON

Cored Wires
Stainless and Heat resistant steels

FLUXINOX 310 is an alloyed rutile flux cored wire for the joining of heat resistant Cr and Cr-Ni steels and cast steel. The weld metal is fully austenitic and non-scaling up to 1200 °C. It is not resistant to sulphur-bearing gases. FLUXINOX 310 features outstanding, almost spatter-free, welding properties with very easy slag removal, finely rippled and shiny weld beads which are free of undercut into the base metal.

Classification	
EN ISO	17633-A: T 25 20 R C 3
EN ISO	17633-A: T 25 20 R M 3
AWS	A5.22: E 310T0-G

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni
0.1	2.5	0.55	25	20

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 20 °C
As Welded	≥ 350	≥ 550	≥ 30	≥ 40

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Materials

AISI 310; 1.4845 (X8CrNi25-21); 1.4841 (X15CrNiSi25-21); 1.4828 (X15CrNiSi20-12)

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+
 PA PB

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1,2	●

FLUXINOX 310 PF

OERLIKON

Cored Wires
Stainless and Heat resistant steels

FLUXINOX 310-PF is an alloyed rutile flux cored wire with a fast-freezing slag for the welding of heat resistant Cr and Cr-Ni steels and cast steels. The weld metal is fully austenitic and non-scaling up to 1200 °C. It is not resistant to sulphur-bearing gases.FLUXINOX 310-PF exhibits outstanding, almost spatter-free, welding properties with very easy slag removal, finely rippled and shiny welds which are free of undercut. FLUXINOX 310-PF is used for welding in the horizontal (PD), overhead (PE) and vertical-up (PF) positions.

Classification	
EN ISO	17633-A: T 25 20 P C 1
EN ISO	17633-A: T 25 20 P M 1
AWS	A5.22: E 310T1-G

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni
0.1	2.5	0.55	25	20

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 20 °C
As Welded	≥ 350	≥ 550	≥ 30	≥ 40

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Materials

AISI 310; 1.4845 (X8CrNi25-21); 1.4841 (X15CrNiSi25-21); 1.4828 (X15CrNiSi20-12)

Storage

Keep dry and avoid condensation

Current condition and welding position

DC+

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1,2	●

AIR LIQUIDE WELDING

FLUXINOX 309H

OERLIKON

Cored Wires
Stainless and Heat resistant steels

FLUXINOX 309 H is an alloyed rutile flux cored wire for welding of identical/similar heat-resistant steel or cast steel. Austenitic strutture with 8% of ferrite, the weld metal has a scaling temperature higher than 1000°C. The controlled carbon and ferrite levels improve microstructural stability and high temperature strength. FLUXINOX 309 H exhibits outstanding, almost spatter-free, welding properties. It produces finely rippled flat and smooth welds, free of undercut into the base metal. Very easy slag removal. Suitable for welding positions PA / PB.

Classification	
EN ISO	17633-A: T 22 12 H R C 3
EN ISO	17633-A: T 22 12 H R M 3
EN ISO	17633-B: TS309-FB0
AWS	A5.22: E309T0-1
AWS	A5.22: E309T0-4

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Ferrite
≤ 0.12	1.6	1.1	22	11	5-15

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 20 °C
As Welded	≥ 350	≥ 550	≥ 30	≥ 40

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Materials

1.4828 (X15 CrNiSi 20 12), AISI 309

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+
 PA PB

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1,2	●

FLUXINOX 309H PF

OERLIKON

Cored Wires
Stainless and Heat resistant steels

FLUXINOX 309H PF is an alloyed rutile flux cored wire for welding of identical/similar heat-resistant steel or cast steel. Austenitic strutture with 8% of ferrite, the weld metal has a scaling temperature higher than 1000°C. The controlled carbon and ferrite levels improve microstructural stability and high temperature strength. FLUXINOX 309 H exhibits outstanding, almost spatter-free, welding properties. It produces finely rippled flat and smooth welds, free of undercut into the base metal. Very easy slag removal. Suitable for welding in all positions.

Classification	
EN ISO	17633-A: T 22 12 H P C 3
EN ISO	17633-A: T 22 12 H P M 3
EN ISO	17633-B: TS309-FB1
AWS	A5.22: E309T1-1
AWS	A5.22: E309T1-4

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Ferrite
≤ 0.12	1.6	1.1	22	11	5-15

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) +20 °C
As Welded	≥ 350	≥ 550	≥ 30	≥ 40

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Materials

1.4828 (X15 CrNiSi 20 12), AISI 309

Storage

Keep dry and avoid condensation

Current condition and welding position

DC+

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1,2	●

AIR LIQUIDE WELDING

FLUXINOX 25 4

OERLIKON

Cored Wires
Stainless and Heat resistant steels

FLUXINOX 25.4 is an alloyed rutile flux cored wire for the joint welding of heat resistant Cr and Cr-Ni steels and cast steel. The weld metal is ferritic- austenitic. Due to the low nickel content, applications include weldments subject to sulphur- bearing, reducing or oxidizing atmospheres. It is non-scaling up to 1100 °C. FLUXINOX 25.4 is characterized by outstanding, almost spatter-free, welding properties. Very easy slag removal, finely rippled and shiny welds, free of undercut into the base metal.

Classification	
EN ISO	17633-A: T Z 25 4 R C 3
EN ISO	17633-A: T Z 25 4 R M 3

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni
0.1	0.6	0.9	25.5	4.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 20 °C
As Welded	≥ 400	≥ 600	≥ 15	≥ 27

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Materials

1.4762 (X 10 CrAl 24) - 1.4823 (G-X CrNiSi 27 4)

1.4724 (X 10 CrAl 13) - 1.4776 (G-X 40 CrSi 29) - 1.4742 (X 10 CrAl 18)

1.4821 (X 20 CrNiSi 25 4) - 1.4745 (G-X 40 CrSi 29) - 1.4822 (G-X 40 CrNi 24 5)

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+
 PA PB

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1.2	●

FLUXINOX 25 4 PF

OERLIKON

Cored Wires
Stainless and Heat resistant steels

FLUXINOX 25.4-PF is an alloyed rutile cored wire with a fast-freezing slag for the joint welding of heat resistant Cr and Cr-Ni steels and cast steel. The weld metal is ferritic-austenitic. Due to its low nickel content, it can also be used for applications in sulphur-bearing, reducing or oxidizing conditions. It is non-scaling up to 1100 °C.
FLUXINOX 25.4-PF exhibits excellent, almost spatter-free, welding properties. Very easy slag removal, finely rippled and shiny welds, free of undercut. The fast-freezing slag makes FLUXINOX 25.4-PF well-suited for welding in the horizontal (PC), overhead (PE) and vertical-up (PF) positions.

Classification	
EN ISO	17633-A: T Z 25 4 P C 3
EN ISO	17633-A: T Z 25 4 P M 3

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni
0.1	0.6	0.9	25.5	4.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) 20 °C
As Welded	≥ 400	≥ 600	≥ 15	≥ 27

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Materials

1.4762 (X 10 CrAl 24) - 1.4823 (G-X CrNiSi 27 4)
1.4724 (X 10 CrAl 13) - 1.4776 (G-X 40 CrSi 29) - 1.4742 (X 10 CrAl 18)
1.4821 (X 20 CrNiSi 25 4) - 1.4745 (G-X 40 CrSi 29) - 1.4822 (G-X 40 CrNi 24 5)

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1.2	●

FLUXINOX 904L

OERLIKON

Cored Wires
Stainless and Heat resistant steels

FLUXINOX 904L is a rutile flux cored wire for welding austenitic stainless steel type AISI 904L. Good weldability, easy slag removal, good bead appearance. Suitable for welding in all positions.

Classification	
EN ISO	17633-A: T Z 20 25 5 Cu L P M 1
AWS	A5.22: ~E385LT1-1/4

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	Cu
0.03	3.2	0.5	≤ 0.02	≤ 0.08	21	26	4.5	1.4

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)	
				-20 °C	-110 °C
As Welded	≥ 430	≥ 640	≥ 32	≥ 70	≥ 27

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : M21

Materials

URANUS B6; AISI 904L; 1.4539 (X1NiCrMoCu25-20-5); 1.4439 (X2CrNiMoN17-13-5); 1.4537 (X1CrNiMoCuN25-25-5)

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1.2	●

FLUXINOX 625

OERLIKON

Cored Wires
Stainless and Heat resistant steels

FLUXINOX 625 ia a basic flux cored wire used for welding cryogenic steels and 9% Nickel steel, alloys 625 and 825. The weld metal deposited is resistant to intergranular corrosion, pitting and oxidation at high temperatures (max. 1200°C).

Classification	
AWS	A5.11: ~ENiCrMo-3

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	Nb	Fe
0.03	0.5	0.4	≤ 0.015	≤ 0.015	21	Rem	9	3.6	0.50

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -196 °C
As Welded	≥ 500	≥ 750	≥ 35	≥ 50

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : M21

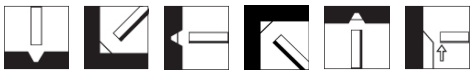
Materials

UNS N06625; UNS N08825

2.4856; 2.4839

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+



Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1,2	●

AIR LIQUIDE WELDING

FLUXOFIL 50

OERLIKON

Cored Wires
Hardfacing

FLUXOFIL 50 ia a seamless copper coated basic flux cored wire for the hardfacing of wear components subjected to heavy impact such as pulleys, rollers, caterpillar track rollers, sprockets, track links, etc. The weld metal is of medium hardness and machinable by chip-forming. Flame and inductive hardening are feasible. Before depositing the final pass, the interpass temperature should not exceed 250 °C. Due to the very tough and crack-resistant weld metal, a buffer layer is not normally necessary.

Classification	
EN	14700: T Fe1

Chemical analysis (Typical values in %)

C	Mn	Si	Cr
0.2	1.6	0.5	0.7

All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded	225-275 HB

Gas test: 100% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+
 PA PB

Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16.0
1.4	●
1.6	●

FLUXOFIL 51

OERLIKON

Cored Wires
Hardfacing

FLUXOFIL 51 is a seamless copper coated basic flux cored wire for hardfacing of wearing parts subjected to heavy impact such as pulleys, railway crossings and switch points, rollers, caterpillar track, sprockets, track links. The weld metal is of medium hardness and is machinable by chip-forming. Flame and inductive hardening are possible. Before depositing the final pass, the interpass temperature should not exceed 250 °C. Due to the very tough and crack-resistant weld metal, a buffer layer is not required.

Classification	
EN	14700: T Fe1

Chemical analysis (Typical values in %)

C	Mn	Si	Cr
0.2	1.6	0.6	1.4

All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded	275-325 HB

Gas test: 100% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

PA PB

Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16.0
1.2	●
1.4	●
1.6	●
2.0	●
2.4	●

FLUXOFIL 52

OERLIKON

Cored Wires
Hardfacing

FLUXOFIL 52 is a seamless copper coated basic flux cored wire for hardfacing of wear parts, such as pulleys, rollers, caterpillar track rollers, sprockets. The weld metal is of medium hardness, and is machinable by chip-forming. The weld metal is tough and free of cracks and therefore resistant to shock and impact. It is suitable for flame and inductive hardening. Before depositing the final pass, the interpass temperature should not exceed 250 °C.
A buffer layer, using FLUXOFIL 31, is only required for higly hardenable base metals.

Classification
EN 14700: T Fe1

Chemical analysis (Typical values in %)

C	Mn	Si	Cr
0.25	1.5	0.4	1.8

All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded	325-375 HB

Gas test: 100% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+
 PA PB

Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16.0
1.4	●
1.6	●

FLUXOFIL 54

OERLIKON

Cored Wires
Hardfacing

FLUXOFIL 54 is a seamless copper coated basic flux cored wire for hardfacing deposits having high wear resistance, such as excavator parts and bearing surfaces. Due to the low carbon content, the weld metal is very tough and therefore particularly resistant to heavy shock and impact. Machining by chip-forming is possible using carbide-tipped or hard metal cutting tools. A buffer layer, using FLUXOFIL 31, is only required in case of difficult-to-weld steels. When hardfacing unalloyed base metal, maximum hardness of the deposit is obtained in the first layer. Before depositing the final layer in multi-layer welds, the interpass temperature should not exceed 250 °C.

Classification	
EN	14700: T Z Fe1

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Mo
0.07	1.6	0.3	6	0.9

All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded	37-42 HRC

Gas test: 100% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

PA PB

Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16.0
1.4	●
1.6	●

FLUXOFIL 56

OERLIKON

Cored Wires
Hardfacing

FLUXOFIL 56 is a seamless copper coated basic flux cored wire for the hardfacing of wear parts, such as excavator parts, scraper blades, dipper teeth, worm conveyors, beaters, crusher jaws, crusher cones, subjected to heavy wear. The weld metal is tough and free of cracks and therefore resistant to shock and impact. Machining is only possible by grinding. A tough buffer layer using FLUXOFIL 31 is only required with highly hardenable base metals.

Classification	
EN	14700: T Fe8

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Mo
0.4	1.7	0.6	6	0.7

All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded	52-57 HRC

Gas test: 100% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+
 PA PB

Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
1.4	●
1.6	●

FLUXOFIL 58

OERLIKON

Cored Wires
Hardfacing

FLUXOFIL 58 is a seamless copper coated metal flux cored wire for the hardfacing of wear parts, such as excavator parts, scraper blades, dipper teeth, worm conveyors, beaters, crusher jaws, crusher cones, subjected to heavy wear. The weld metal is tough, free of cracks and therefore resistant to shock and impact. Machining is only possible by grinding. A tough buffer layer using FLUXOFIL 31 is only required with highly hardenable base plates.

Classification	
EN	14700: T Fe8

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Mo
0.5	1.5	0.6	5.5	0.6

All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded	57-62 HRC

Gas test: 100% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+
 PA PB

Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
1.2	●
1.6	●

AIR LIQUIDE WELDING

FLUXOFIL M 58

OERLIKON

Cored Wires
Hardfacing

FLUXOFIL M 58 is a seamless copper coated metal cored wire for the hardfacing of wear parts, such as excavator parts, scraper blades, dipper teeth, worm conveyors, beaters, crusher jaws, crusher cones, subjected to heavy wear. The weld metal is tough, free of cracks and therefore resistant to shock and impact. Machining is only possible by grinding. A tough buffer layer using FLUXOFIL 31 is only required with highly hardenable base plates.

Classification	
EN	14700: T Fe8

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Mo
0.6	1.9	0.7	5.4	0.7

All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded	57-60 HRC

Gas test: 100% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+

PA PB

Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
1,4	●
1.2	●
1.6	●

CITOFLUX H06

OERLIKON

Cored Wires
Hardfacing

CITOFLUX H 06 is a metalcored wire for hardfacing of wear parts, such as excavator components, scraper blades, dipper teeth, worm conveyors, beaters, crusher jaws, crusher cones, subjected to heavy wear. The weld metal is tough, free of cracks and therefore resistant to shock and impact. Machining is only possible by grinding.

Classification
EN 14700: T Fe8

Chemical analysis (Typical values in %)

C	Mn	Si	Cr
0.42	0.55	2.6	9.5

All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded	57-60 HRC

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : C1, M21

Current condition and welding position
DC+
 PA PB

Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
1.2	●
1.6	●

FLUXOFIL 66

OERLIKON

Cored Wires
Hardfacing

FLUXOFIL 66 is a seamless copper coated slagless metal cored wire for high hardness wear overlay. Suitable for roll type crushers, worm conveyors, scraper blades, dipper teeth etc. The weld metal is crack resistant and highly resistant to impact and abrasion. In the case of thick overlays, it is recommended to weld only the last two layers with FLUXOFIL 66 and to use FLUXOFIL 31 or FLUXOFIL 35 for the preceding passes. Machining by chip-forming is not possible with this weld metal. The weld deposit contains hard phases in the form of special carbides.

Classification
EN 14700:T Z Fe8

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo	Nb	W
1.4	0.9	0.9	6.3	0.8	0.2	9	0.25

All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded	57-62 HRC

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : M21

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+
 PA PB

Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16
1.6	●
2.4	●

FLUXODUR 62-O

FLUXODUR 62-0 is a self-shielded flux cored wire producing a weld metal with a hypereutectic structure of a chromium carbide alloy. Suitable for wear component applications, such as worm conveyors, mixing blades, cement and concrete pump parts, gravel pumps, mixer parts, etc. Resistant to mineral abrasion, but the deposit is not suitable for shock and impact conditions. Weld metal can only be machined by grinding.

Classification	
EN	14700: T Fe15

Chemical analysis (Typical values in %)

C	Mn	Si	Cr
5	2	1.1	27

All-weld metal Mechanical Properties

Heat Treatment	Hardness
As Welded	57-62 HRC

Storage
Keep dry and avoid condensation

Current condition and welding position
DC+
 PA

Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1.2	●
1.6	●
2.4	●
2.8	●

SUBMERGED ARC WELDING

OERLIKON

Notes on welding consumables for submerged arc welding

Technical data in this part of the catalogue serve as a guide to selecting welding consumables and auxiliary materials used in submerged-arc welding.

Functions of welding fluxes

Welding fluxes are granulated, fusible mineral substances that have similar functions in submerged-arc welding as the coatings of MMA electrodes, namely:

- a) Improving the conductivity of the arc gap, facilitating arc striking and stabilising the arc.
- b) Slag forming for protecting the metal droplet transfer, as well as the molten weld pool, shaping the weld bead and reducing its cooling rate.
- c) Metallurgically influencing the weld metal, by the reactions taking place in the gaseous phase of the arc cavity between the fused flux and the weld metal.
- d) Deoxidising and alloying the weld metal by adding deoxidizing agents and, if necessary, alloying elements, such as Cr, Mo, Ni, ...

Manufacture of welding fluxes

Welding fluxes may be divided into three categories according to the manufacturing process:

- a) fused fluxes
- b) agglomerated fluxes
- c) mixed fluxes

Fused fluxes

Fused fluxes are manufactured by re-fusing the raw material constituents into a vitreous product, which is subsequently crushed and then sieved to the desired grain size. The bulk densities, as well as the consumption of such fluxes are higher than agglomerated fluxes. Fused fluxes are relatively insensitive to moisture.

Agglomerated welding fluxes

Agglomerated welding fluxes consist of small granules formed by mixing finely ground individual components with a bonding agent (silicates) and baking at temperatures between 600 °C and 800 °C after agglomeration. Since the manufacture of agglomerated fluxes is carried out at temperatures below the reactivity of the raw materials used, this permits the transfer of deoxidants and alloying constituents into the weld metal, thus favourably influencing operating characteristics, as well as mechanical properties. The consumption of agglomerated fluxes is lower than fused fluxes, owing to a lower bulk density.

Mixed fluxes

Mixed fluxes are those which are mixed by the manufacturer from two or more individual fluxes.

Type of flux

According to EN 760, welding fluxes are divided according to their mineralogical structure into various groups and classified in accordance with their flux reference analysis.

Notes on welding consumables for submerged arc welding

Recommendations for the Storage and Processing of Welding Fluxes.

Owing to their mineralogical structure and manufacture, welding fluxes are more or less susceptible to moisture. Agglomerated fluxes are bonded mixtures of finely ground raw materials which may absorb more moisture from the atmosphere than a fused flux. Therefore, their ability to be stored for long periods of time can be affected. Fluxes that have become damp, must be redried in order to reduce the moisture content to an acceptable level.

OERLIKON welding fluxes are supplied in PE bags of 25 kg. On demand, flux can also be supplied in DRY BAG, big bags or metal drums. It is recommended to store welding fluxes in a dry location at a constant temperature. Fluxes stored in such a way in undamaged containers, can be stored up to one year without deterioration.

The re-drying temperatures specified in the DVS-Richtlinie (Guideline) 0914 should be considered as reference values. Due to the variations in composition of different fluxes, the data provided by the manufacturer will be binding.

OERLIKON-welding fluxes should be re-dried as follows:
Agglomerated fluxes – not less than 2 hours at 300-350 °C
Fused fluxes – not less than 2 hours at 250 °C

The maximum recommended re-drying time is 10 hours.

Recycling of fluxes

The portion of flux not fused during submerged-arc welding may be recovered and re-used. Recycling through the feeding system can take place several times, provided that the feeding system was designed for the handling of agglomerated fluxes. Transport speeds should be low and the route as short as possible, with smooth bends.

When removing the flux, a change in grain size cannot always be avoided. For this reason, following consumption of about 50-60 % of the flux in circulation, dry, fresh flux should be added in order to ensure that the flux circulating in the feeding system will always have a uniform grain size distribution, thus ensuring satisfactory flux performance.

In addition, the guidelines according to Richtlinie DVS 0914, are applicable to the storing and processing of welding fluxes.

Interpass temperature:

- a) for unalloyed and alloyed steels: 150-200 °C
- b) for creep resistant steels: according to base metal
- c) for Cr-Ni-steels: max. 100-150 °C

Welding parameters:
a) for unalloyed and alloyed steels, as well as creep resistant steels:
- Wire diameter [mm]: 4,0
- Welding current [A]: 600
- Welding voltage [V]: 30
- Welding speed [cm/min]: 60

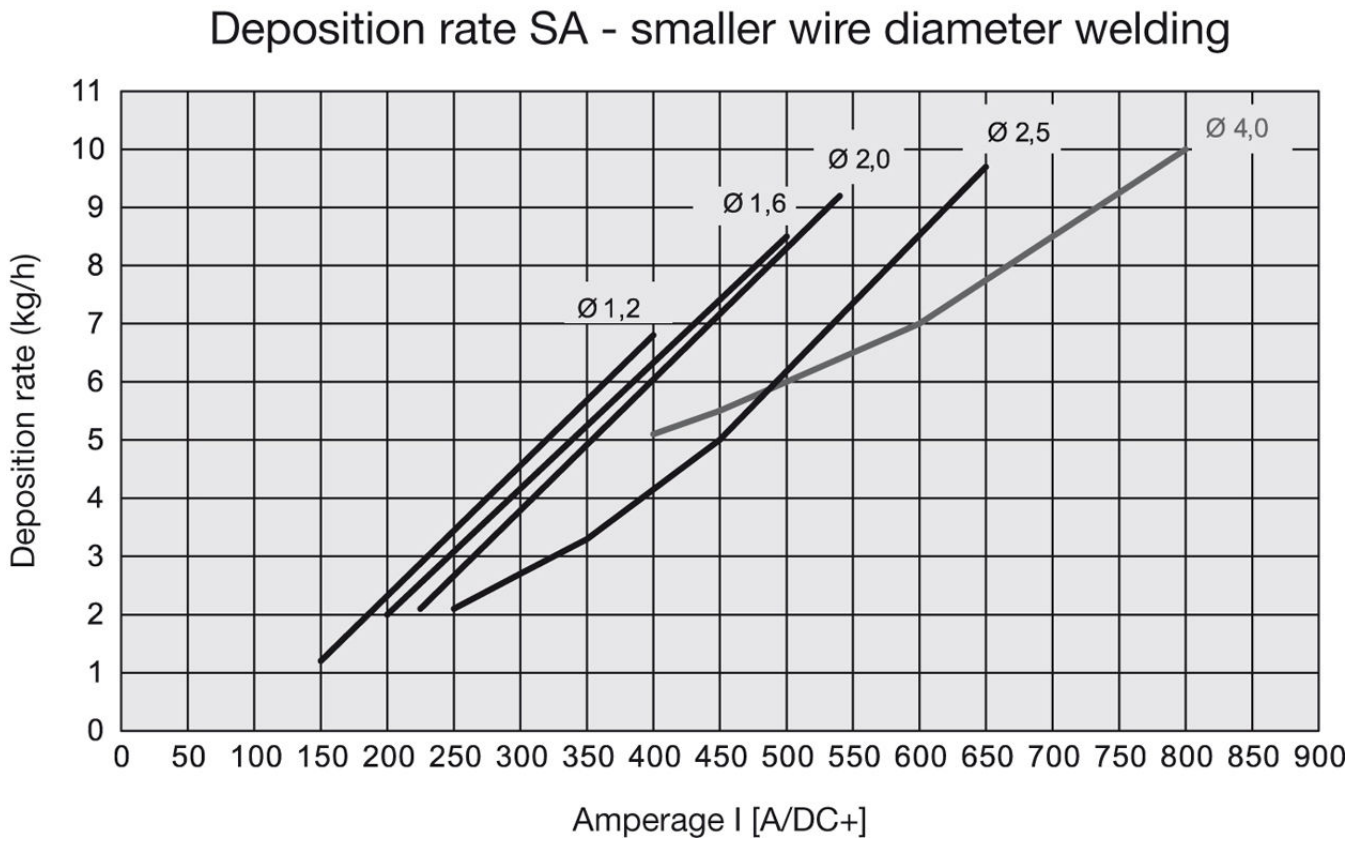
b) for Cr-Ni-steels
- Wire diameter [mm]: 4,0
- Welding current [A]: 550
- Welding voltage [V]: 30
- Welding speed [cm/min]: 70

Depending upon the base metal, joint preparation, welding parameters and cooling conditions, different mechanical properties of the welded joint may be obtained. Thus, for instance, in the case of a square butt joint, the dilution of base metal into the weld metal may be up to 75 %. In such a weld, the mechanical properties will most certainly deviate from those given in the respective data sheet. In the case of multi-pass joints, however, the technological properties of the all-weld metal produced by the respective wire/flux combination will apply.

For the reasons given above, it is advisable to carry out test welding procedures using the actual welding conditions and base materials. This will also be required if the welded joint is to be heat treated.

Submerged-arc smaller diameter wire welding technique

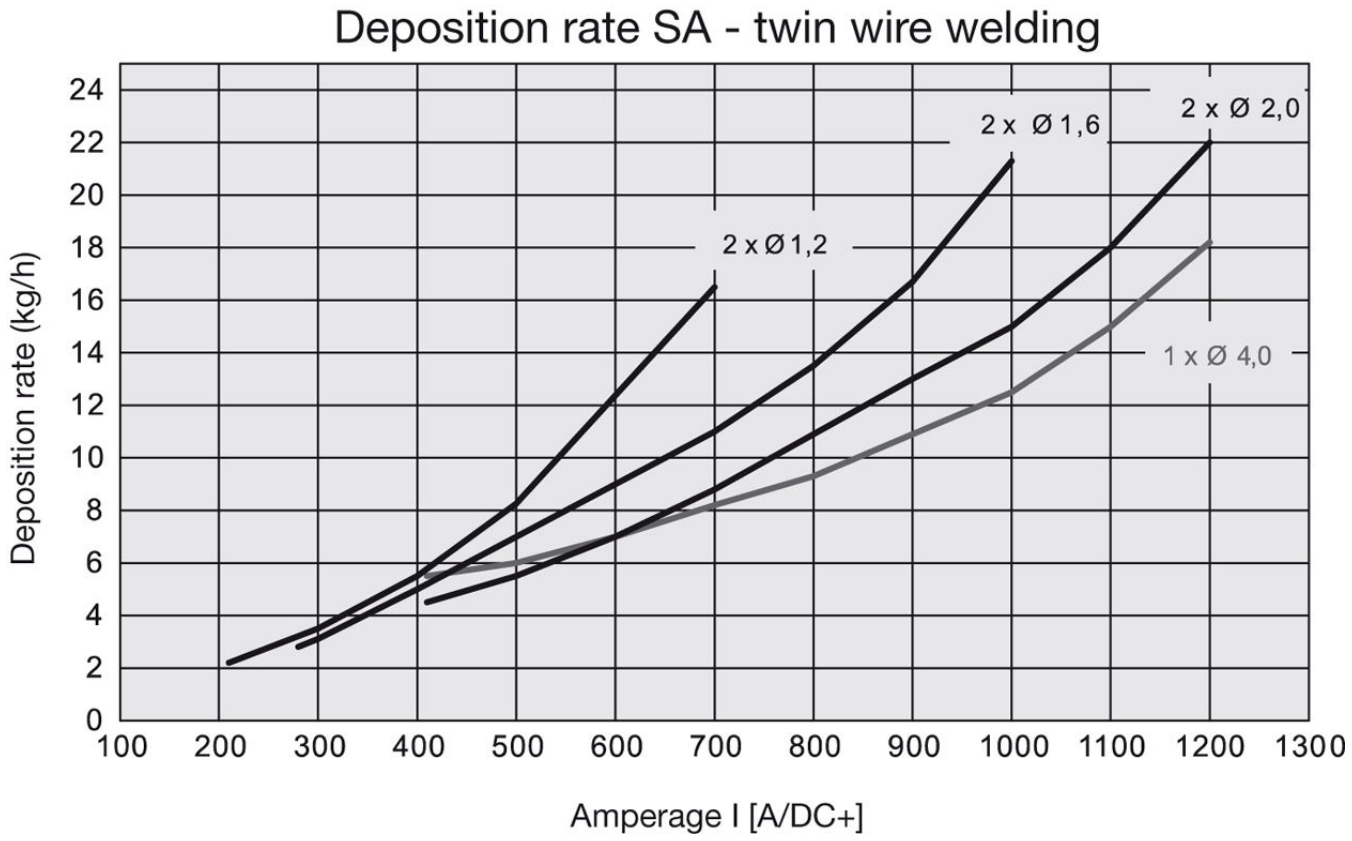
Submerged-arc welding with smaller diameter wires constitutes a high deposition rate process variant, which permits the optimisation of technology and efficiency. Using wire electrodes of 1.2 mm, 1.6 mm and 2.0 mm diameter, submerged-arc welding enters domains formerly reserved for MAG-welding, thus associating high efficiency with high-quality SAW-welding. OERLIKON offers both suitable welding fluxes and SAW-wires according to EN 756 and EN 12072.



The deposition rate is dependent upon the current in SAW single wire welding using smaller diameter wires, as compared to SAW single wire welding with a 4.0 mm diameter wire.

Submerged-arc twin-wire welding technique

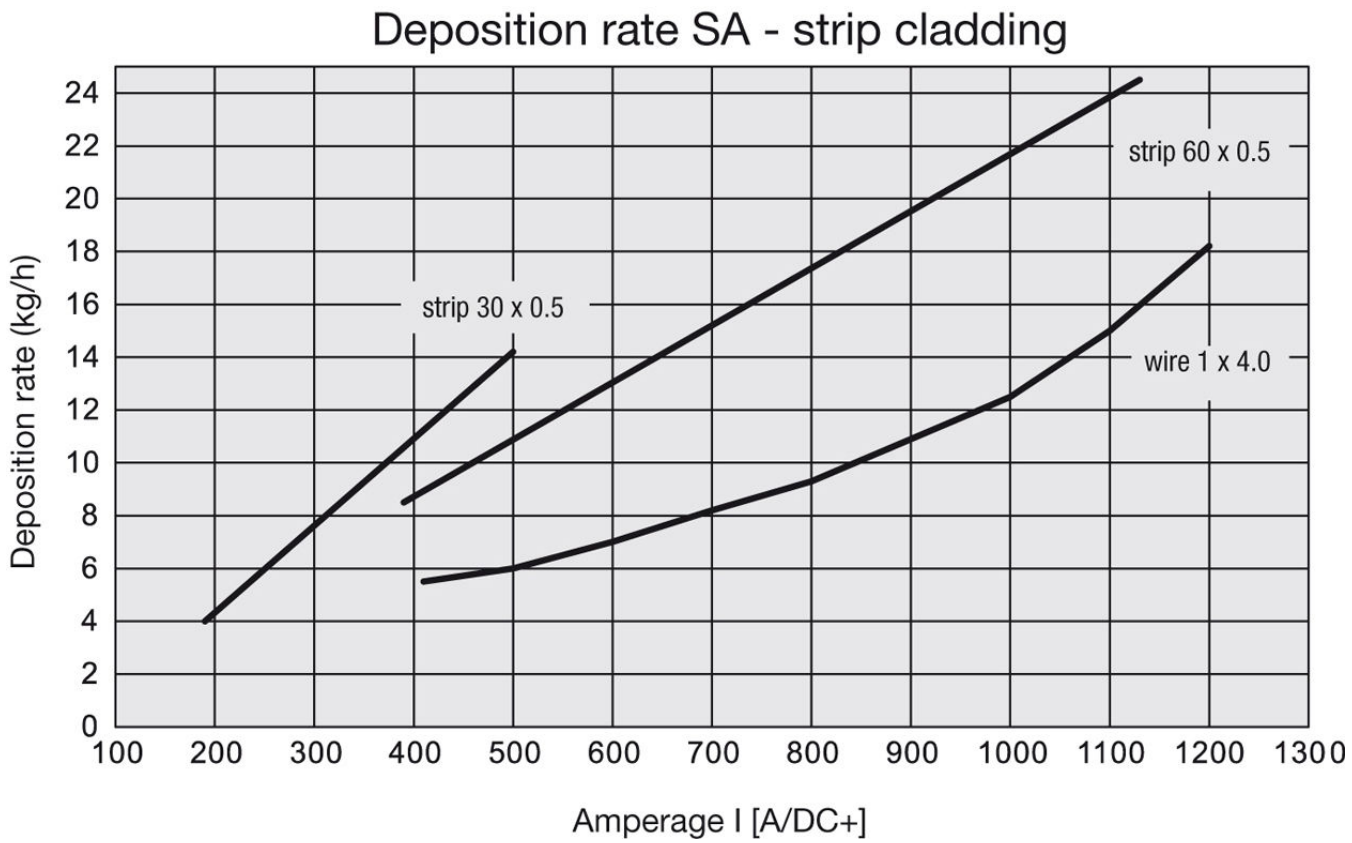
Submerged-arc twin-wire welding, a process variant using smaller diameter wires (e.g. 2 x 1.2 mm Ø, 2 x 1.6 mm Ø, ...), results in a significant increase in deposition rate compared to single wire welding while maintaining a favourable bead geometry (ratio of width to height). This process can be used for cost effective fillet and butt-welding. Owing to the high deposition rate, it is possible to obtain large weld beads. For smaller beads, the high deposition rate can be converted into considerably higher welding speeds. The OERLIKON product range contains suitable welding fluxes and wires according to EN 756; EN 12070 and EN 12072.



Deposition rate is dependent upon current in SA-twin-wire welding using smaller diameter wires, as compared to SAW single wire welding with a 4.0 mm diameter wire.

Submerged-arc and Electro-slag Strip Cladding

For high-efficiency corrosion resistant cladding of vessels used in the chemical and petro-chemical industries. Welds deposited are flat with a very smooth surface, even if cladding rates are as high as 0.8 m2/hour. For this application there is a range of OERLIKON fluxes used in combination with OERLIKON SUPRASTRIP electrodes.



Deposition rate is dependent upon current in SA & ESW-strip cladding, as compared to SAW single wire welding with a 4.0 mm diameter wire.

Fluxes for submerged-arc welding Classification

EN 760

S	A	FB	1	66	AC	H10
Flux/submerged-arc welding	Table 1	Table 2	Table 3	Table 4/5/6	Table 7	Table 8

Table 1

Symbols for the method of manufacture	
Symbols	Method of manufacture
F	fused flux
A	agglomerated flux
M	mixed flux

Table 2

Symbols for type of flux, characteristic constituents		
Symbols	Characteristic constituents	Threshold values [%]
MS manganese-silicate	MnO + SiO2 CaO	min. 50 max. 15
CS calcium-silicate	CaO + MgO + SiO2 CaO + MgO	min. 55 min. 15
ZS zirconium-silicate	ZrO2 + SiO2 + MnO ZrO2	min. 45 min. 15
RS rutile-silicate	TiO2 + SiO2 TiO2	min. 50 min. 20
AR aluminate-rutile	Al2O3 + TiO2	min. 40
AB aluminate-basic	Al2O3 + CaO + MgO Al2O3 CaF2	min. 40 min. 20 max. 22
AS aluminate-silicate	Al2O3 + SiO2 + ZrO2 CaF2 + MgO ZrO2	min. 40 min. 30 min. 5
AF aluminate-fluoride-basic	Al2O3 + CaF2	min. 70
FB fluoride-basic	CaO + MgO + CaF2 + MnO SiO2 CaF2	min. 50 max. 20 min. 15
Z	other compositions	

Table 3

Code digits for the application, flux class	
Code digits	Application
1	Fluxes for submerged-arc welding of unalloyed and low-alloy steels,such as structural steels, high-tensile steels and creep resisting steels. The fluxes do not contain alloying elements other than Mn and Si, thus the weld metal analysis is predominantly influenced by the composition of the wire electrode and metallurgical reactions. The fluxes are suitable for both joint welding and surfacing.
2	Fluxes for joint welding and surfacing of austenitic stainless and heat resisting chromium and chromium-nickel steels and/or nickel and nickel-base alloys and unalloyed fluxes for hardfacing...
3	Fluxes mainly for surfacing purposes depositing a wear-resistant weld metal by transfer of alloying elements from the flux, such as C, Cr, or Mo.

Table 4

Code digits for the metallurgical behaviour of welding fluxes of class 1		
Metallurgical behaviour	Code digits	Amount by flux in the weld metal [%]
Burn-out	1	over 0,7
Burn-out	2	over 0,5 up to 0,7
Burn-out	3	over 0,3 up to 0,5
Burn-out	4	over 0,1 up to 0,3
Pick-up and /or burn-out	5	0 up to 0,1
Pick-up	6	over 0,1 up to 0,3
Pick-up	7	over 0,3 up to 0,5
Pick-up	8	over 0,5 up to 0,7
Pick-up	9	over 0,7
Pick-up and burn-out of the elements Si and Mn are indicated in this order.		

Table 5

Metallurgical behaviour of welding fluxes of class 2
The pick-up of alloying elements, except Si and Mn, is indicated by respective chemical symbols (e.g. Cr).

Table 6

Metallurgical behaviour of welding fluxes of class 3
Pick-up of alloying elements is indicated by respective symbols (e.g. C, Cr).

Table 7

Symbols for type of current	
Symbols	Type of current
DC	direct current
AC	alternating current

Table 8

Symbols for the hydrogen content of the all-weld metal	
Symbols	Hydrogen content ml/100 grams deposited weld metal max.
H5	5
H10	10
H15	15

Wire electrodes and wire/flux combinations for submerged-arc welding of un-alloyed steels and fine grain structural steels.

EN 756

S	4T	2	FB	S2Mo
Wire electrode and/or Wire-/flux-combination	Table 1/2	Table 3	Table 4	Table 5

Table 1

Symbols for tensile properties by multi-run technique			
Symbols	Minimum yield strength(1)[MPa]	Tensile strength [MPa]	Minimum elongation(2) A5 [%]
35	355	440-570	22
38	380	470–600	20
42	420	500–640	20
46	460	530–680	20
50	500	560–720	18
1) For yield strength lower yield (ReL) shall be used if yielding occurs, otherwise the 0,2% proof strength (Rp0,2) shall be applied. 2) Gauge length is equal to five times the test specimen diameter.			

Table 2

Symbols for tensile properties by two-run technique (both sides in one pass)		
Symbols	Minimum yield strength of base metal [MPa]	Minimum tensile strength of welded joint [MPa]
2T	275	370
3T	355	470
4T	420	520
5T	500	600

Table 3

Symbols for the impact energy of the all-well metal or welded joint made from both sides in one pass	
Symbols	Temperature for minimum average impact-energy of 47 J [°C]
Z	no requirement
A	20
0	0
2	-20
3	-30
4	-40
5	-50
6	-60
7	-70
8	-80

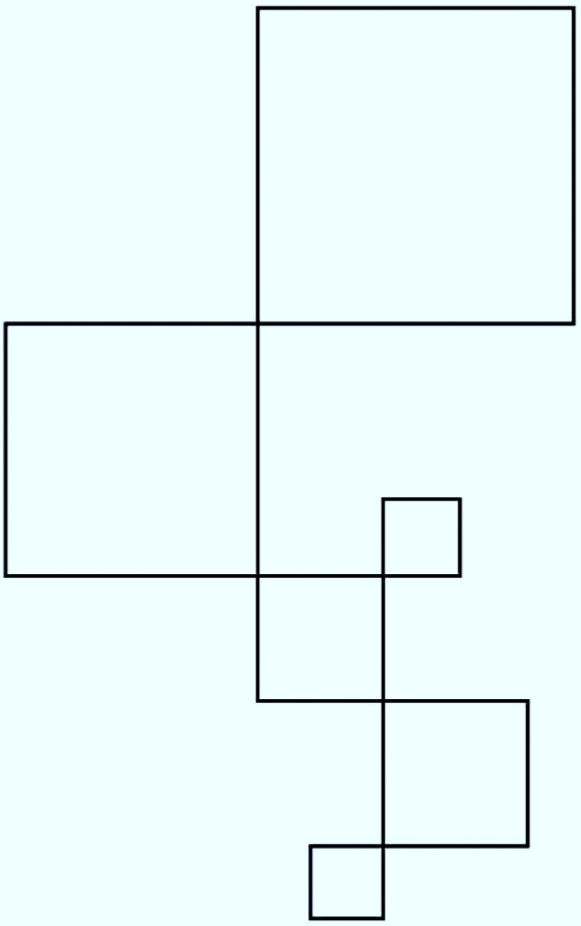
Table 4

Symbols for type of flux	
Type of flux	Symbols
Manganese-silicate	MS
Calcium-silicate	CS
Zirconium-silicate	ZS
Rutile-silicate	RS
Aluminate-rutile	AR
Aluminate-basic	AB
Aluminate-silicate	AS
Aluminate-fluoride-basic	AF
Fluoride-basic	FB
Other types	Z

Table 5

Chemical composition of wire in [%] (m/m) (1)(2)(3)								
Symbol	C	Si	Mn	P	S	Mo	Ni	Cr
S0	any other chemical composition agreed upon							
S1	0,05–0,15	0,15	0,35–0,60	0,025	0,025	0,15	0,15	0,15
S2	0,07–0,15	0,15	0,80–1,30	0,025	0,025	0,15	0,15	0,15
S3	0,07–0,15	0,15	> 1,30–1,75	0,025	0,025	0,15	0,15	0,15
S4	0,07–0,15	0,15	> 1,75–2,25	0,025	0,025	0,15	0,15	0,15
S1Si	0,07–0,15	0,15–0,40	0,35–0,60	0,025	0,025	0,15	0,15	0,15
S2Si	0,07–0,15	0,15–0,40	0,80–1,30	0,025	0,025	0,15	0,15	0,15
S2Si2	0,07–0,15	0,40–0,60	0,80–1,30	0,025	0,025	0,15	0,15	0,15
S3Si	0,07–0,15	0,15–0,40	> 1,30–1,85	0,025	0,025	0,15	0,15	0,15
S4Si	0,07–0,15	0,15–0,40	> 1,85–2,25	0,025	0,025	0,15	0,15	0,15
S1Mo	0,05–0,15	0,05–0,25	0,35–0,60	0,025	0,025	0,45–0,65	0,15	0,15
S2Mo	0,07–0,15	0,05–0,25	0,80–1,30	0,025	0,025	0,45–0,65	0,15	0,15
S3Mo	0,07–0,15	0,05–0,25	> 1,30–1,75	0,025	0,025	0,45–0,65	0,15	0,15
S4Mo	0,07–0,15	0,05–0,25	> 1,75–2,25	0,025	0,025	0,45–0,65	0,15	0,15
S2Ni1	0,07–0,15	0,05–0,25	0,80–1,30	0,020	0,020	0,15	0,80–1,20	0,15
S2Ni1,5	0,07–0,15	0,05–0,25	0,80–1,30	0,020	0,020	0,15	>1,20–1,80	0,15
S2Ni2	0,07–0,15	0,05–0,25	0,80–1,30	0,020	0,020	0,15	>1,80–2,40	0,15
S2Ni3	0,07–0,15	0,05–0,25	0,80–1,30	0,020	0,020	0,15	>2,80–3,70	0,15
S2Ni1Mo	0,07–0,15	0,05–0,25	0,80–1,30	0,020	0,020	0,45–0,65	0,80–1,20	0,20
S3Ni1,5	0,07–0,15	0,05–0,25	> 1,30–1,70	0,020	0,020	0,15	>1,20–1,80	0,20
S3Ni1Mo	0,07–0,15	0,05–0,25	> 1,30–1,80	0,020	0,020	0,45–0,65	0,80–1,20	0,20
S3Ni1,5Mo	0,07–0,15	0,05–0,25	1,20–1,80	0,020	0,020	0,30–0,50	1,20–1,80	0,20

1) Chemical composition of finished product, Cu including copper coating ≤0,30%, Al≤0,030%.
2) Single values in this table are maximum values.
3) The results shall be rounded to the same decimal place as in the specified values using the rules as to ISO 31-0, Appendix B, Rule A.



SAW & CLADDING FLUXES

OERLIKON

SAW Rutile-Acid Fluxes / C-Mn and low-alloy steels		
Product Name	Classification according to EN 760	Page
OP 176	SA MS 1 88 AC H5	511
OP F55	SF MS 1 67 AC	513
PIE 18	SF CS 1 77	515
OP F72	SF CS 1 66 AC	517
OP 119	SA CS 1 77 AC	519
OP 143	SA CS 1 98 AC	521
OP 181	SA AR 1 88 AC	523
OP 191	SA AR 1 87 AC	526
UNIFLUX D1	SA AR 1 97 AC	528

SAW Basic and Semi-basic Fluxes / C-Mn and low-alloy steels		
Product Name	Classification according to EN 760	Page
OP 100	SA AB 1 76 AC	530
OP 160	SA AB 1 66 AC H15	533
OP 180S	SA AB 1 67 AC	534
OP 192	SA AB 1 67 AC H5	537
OP 192C	SA AB 1 87 AC H5	540
OP 132	SA AB 1 67 AC H5	542
OP 139	SA AB 1 68 AC H5	545
OP 41TT	SA FB 1 53 DC H5	547
OP 120TT	SA FB 1 66 AC H5	550
OP 120C	SA FB 1 67 AC H10	553
OP 121TT	SA FB 1 55 AC H5	555
OP 121TT W	SA FB 1 55 AC H5	559
OP 122	SA FB 1 65 AC H5	562

SAW Basic Fluxes / Chromium-Molybdenum steels		
Product Name	Classification according to EN 760	Page
OP 125W	SA FB 1 55 AC H5	564
OP CROMO F537	SA FB 1 55 AC H5	566

SAW Fluxes / Stainless and Heat resistant steels		
Product Name	Classification according to EN 760	Page
OP 33	SA AF 2 54 DC	569
OP F500	SA FB 2 53 AC	571
OP 70 Cr Spezial	SA FB 2 57 H5	573
OP 76	SA FB 2 55 AC H5	575
OP F77	SF CS 2 65 AC H5	578
OP XNi	SA AB 2 AC H5	579

SAW Fluxes / Hardfacing		
Product Name	Classification according to EN 760	Page
OP 1250A	SA CS 3 97 CCrMo AC	580
OP 1300A	SA CS 3 87 CCrMo AC	581
OP 1350A	SA CS 3 99 CCrMo AC	582
OP 1450A	SA CS 3 87 CCrMo AC	583

SAW Fluxes / Backing		
Product Name	Classification according to EN 760	Page
OP 10U	SA CS 1	584

SAW Fluxes / Cladding		
Product Name	Classification according to EN 760	Page
AST 100A	SA CS 2	585
OP 87	SA CS 2 99 AC	586
AST 300	SA CS 2 Cr	588
AST 347	SA AB 2	589
AST 600	SA AB 2	590

Electroslag Fluxes / Cladding		
Product Name	Classification according to EN 760	Page
ELT 300	SA AB 2	593
ELT 300S	SA FB 2	594
ELT 347-1	SA FB 2CrNi	595
ELT 316-1	SA FB 2CrNiMo	596
ELT 600	SA FB 2	597
ELT 600S	SA FB 2	598

OP 176 is an agglomerated manganese-silicate type flux for welding of general structural steels, pipe steels, as well as fine grain structural steel. OP 176 is well-suited for single wire, tandem and multi-wire welding. It is suitable for one-side, DSAW or multi-pass-welding. It can be used on either DC or AC up to about 1000 A.
OP 176 has an extremely low flux consumption. The slag is very thin and can easily be removed.
Damp flux should be re-dried at 300-350 °C. Grain size according to DIN EN 760: 2-20

Classification		
	EN	760: SA MS 1 88 AC H5
OE-S2 Mo	AWS	A5.23: F8A0-EA2-G
OE-S1	AWS	A5.17: F7A2-EL12
OE-S2	AWS	A5.17: F7A2-EM12K

Flux Main Components	
SiO2 + TiO2	44 %
Al2O3 + MnO	24 %
CaO + MgO	23 %
CaF2	7 %

Boniszewski Basicity	0.8

Chemical analysis (Typical values in %)

	C	Mn	Si	Mo
OE-S2 Mo	0.05	1.4	0.7	0.45
OE-S1	0.06	0.8	0.15	-
OE-S2	0.05	1.5	0.7	-

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-S2 Mo	As Welded	≥ 500	≥ 600	≥ 22
OE-S1	As Welded	≥ 405	≥ 510	≥ 27
OE-S2	As Welded	≥ 410	≥ 530	≥ 28

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)		
		0 °C	-20 °C	-30 °C
OE-S2 Mo	As Welded		50	40
OE-S1	As Welded		60	50
OE-S2	As Welded	100	65	60

Typical applications

	Materials
OE-S2 Mo	ASTM A36, ASTM A121 Grades A, B, D, DS, ASTM A253 all Grades, ASTM A529 Grades 42, 50, ASTM A570 all Grades, ASTM A572 Grades 42, 50, ASTM A709 Grades 36, 50 API 5L X60, X65, X70
OE-S2	EN S235, S235JRG1, S355; L360 ASTM A36, ASTM A131 Grades A, B, D, DS, ASTM A529 Grade 42, ASTM A570 Grade 45, ASTM A572 Grade 42, ASTM A709 Grade 36

Redrying	Current Conditions
300-350°Cx2h	AC; DC+

Packaging data

Packaging Type	PE
Weight (kg)	25.0
-	●

OP F55

OP F55 is a fused flux which donates manganese and silicon. Suitable for welding carbon steels using the single or multipass techniques and single and multiwire applications. Good slag removal in fillet and butt joints. Especially suitable for high speed welding on thin plate (3-5mm). It can also be used for welding with a copper backing. Damp flux should be re-dried at 100°C (condensation). OP F55 is not hygroscopic and does not absorb moisture. Grain size according to EN 760: 2-20.

Classification		
	EN	760: S F MS 1 67 AC
OE-S1	EN	756: S 42 0 MS S1
OE-S2	EN	756: S 42 0 MS S2
OE-S1	AWS	A5.17: F7A0-EL12
OE-S2	AWS	A5.17: F7A0-EM12K

Flux Main Components	
MnO	45 %
SiO2	22 %
TiO2	20 %
CaF2	3 %
CaO	2 %

Boniszewski Basicity 0.9

Chemical analysis (Typical values in %)

	C	Mn	Si
OE-S1	0.05	1.1	0.2
OE-S2	0.05	1.3	0.2

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-S1	As Welded	≥ 400	490-560	≥ 22
OE-S2	As Welded	≥ 420	520-600	≥ 22

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)	
		20 °C	-20 °C
OE-S1	As Welded	≥ 40	≥ 27
OE-S2	As Welded	≥ 40	≥ 27

Typical applications

	Materials
OE-S1	ASME: EN: S(P)235-S(P)355; L245-L360
OE-S2	ASME: EN: S(P)235-S(P)355; L245-L360

Redrying
100°Cx1h

Current Conditions
AC; DC+

Packaging data

Packaging Type	PE
Weight (kg)	25
-	●

PIE 18 is a fused, calcium silicate type flux for welding unalloyed and low-alloy steels up to S355. PIE 18 is used in combination with OE-S2 as general purpose flux in ship building, machine and railway wagon. PIE 18 is available in two grain sizes (EN 760): standard grain size 2 – 25 for general applications and grain size 2 – 10 for tube-web-tube joints or as a backing flux. PIE 18 is welded on direct current (DC+). PIE 18 is not suitable for small diameter circumferential welds or thin section fillet welds (throat < 4mm). Damp flux should be re-dried at 100°C. PIE 18 is not hygroscopic and does not absorb moisture.

Classification	
EN	760: SF CS 1 77

	Approvals	Grade
OE-S2	DB	●
OE-S2	TÜV	●
OE-S3	DB	●

	Approvals	Grade
OE-S3	TÜV	●
OE-S2Mo	DB	●
OE-S2Mo	TÜV	●

Flux Main Components	
SiO2 + TiO2	45 %
CaO + MgO	25 %
Al2O3 + MnO	20 %
CaF2	5 %

Boniszewski Basicity	1

Chemical analysis (Typical values in %)

	C	Mn	Si	Ni	Mo	Cu
OE-S2	0.06	1.2	0.5	-	-	-
OE-S2Mo	0.06	1.2	0.5	-	0.4	-
OE-S2NiCu	0.06	1.2	0.5	0.7	-	0.4

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-S2	As Welded	≥ 420	550-640	≥ 20
OE-S2Mo	As Welded	≥ 460	550-680	≥ 19
OE-S2NiCu	As Welded	≥ 460	530-680	≥ 19

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)		
		+20 °C	0 °C	-20 °C
OE-S2	As Welded	≥ 100	≥ 75	≥ 50
OE-S2Mo	As Welded	≥ 60	≥ 47	≥ 28
OE-S2NiCu	As Welded	≥ 60	≥ 47	≥ 28

Typical applications

	Materials
OE-S2	ASME: ASTM A131 Grades A, B, D, DS; A253 all Grades; A529 Grades 42, 50; A570 all Grades; A572 Grades 42, 50; A709 Grades 36, 50 EN: S(P)235-S(P)355; L245-L360
OE-S2Mo	ASME: API 5L Grades A, B, X42, X46, X52, X56 EN: 16Mo3; S(P)235-S(P)355; L245-L360
OE-S2NiCu	ASME: EN: S235J0W; S235J2W; S355J0W; S355J2W; S355K2W

Redrying
100°Cx1h

Current Conditions
DC+

Packaging data

Packaging Type	PE
Weight (kg)	25
-	●

OP F72

OP F72 is a fused flux which donates manganese and silicon to the weld deposit. Suitable for longitudinal and spiral welding of pipes using single wire, tandem or multi-wires. It can be used for both single pass and multi pass welding. Good slag removal. Damp flux should be re-dried at 100°C. OP F72 is not hygroscopic and does not absorb moisture. Grain size according to EN 760: 2-20.

Classification		
	EN	760: S F CS 1 66 AC
OE-S1	EN	756: S 35 0 CS S1
OE-S2	EN	756: S 42 2 CS S2
OE-S2Mo	EN	756: S 46 0 CS S2Mo
OE-S1	AWS	A5.17: F6A0-EL12
OE-S2	AWS	A5.17: F7A2-EM12K
OE-S2Mo	AWS	A5.23: F8A0-EA2-A2

Flux Main Components	
SiO2	40 %
MnO	20 %
CaO	19 %
CaF2	12 %
MgO	4 %

Boniszewski Basicity 1.1

Chemical analysis (Typical values in %)

	C	Mn	Si	Mo
OE-S1	0.04	0.8	0.35	-
OE-S2	0.03	1	0.35	-
OE-S2Mo	0.03	1	0.35	0.5

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-S1	As Welded	≥ 350	440-490	≥ 22
OE-S2	As Welded	≥ 400	490-550	≥ 22
OE-S2Mo	As Welded	≥ 480	570-640	≥ 22

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)
		-20 °C
OE-S1	As Welded	≥ 35
OE-S2	As Welded	≥ 35
OE-S2Mo	As Welded	≥ 35

Typical applications

	Materials
OE-S1	ASME: EN: S(P)235-S(P)355; L245-L360
OE-S2	ASME: EN: S(P)235-S(P)355; L245-L360
OE-S2Mo	ASME: EN: 16Mo3

Redrying
100°Cx1h

Current Conditions
AC; DC+

Packaging data

Packaging Type	PE
Weight (kg)	25
-	●

OP 119 is an agglomerated calcium-silicate type flux for the welding of general structural steels, boiler and pipe steels, as well as fine grain structural steels. OP 119 is particularly suited for the multi-wire welding process at high speed. Slag removal is easy in all cases. The slag freezes quickly which means that girth seams of small-diameter work pieces can be welded without the slag running off. Damp flux should be re-dried at 300-350°C.
Grain size according to EN 760: 2-20.

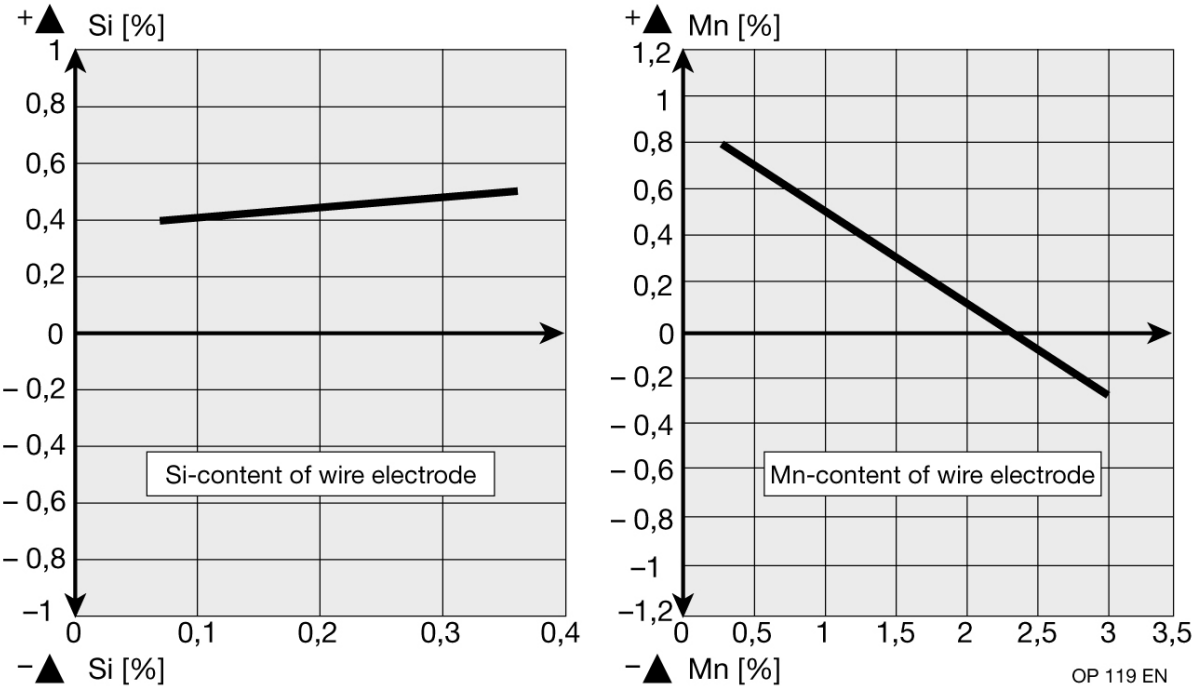
Classification		
	EN	760: SA CS 1 77 AC
OE-S1	AWS	A5.17: F7A0-EL12
OE-S2	AWS	A5.17: F7A2-EM12K
OE-S2Mo	AWS	A5.23: F8A0-EA2-A2

	Approvals	Grade
OE-S1	DB	●
OE-S1	TÜV	●
OE-S2	DB	●
OE-S2	TÜV	●
OE-S3	TÜV	●
OE-S2Mo	DB	●
OE-S2Mo	TÜV	●
OE-S2CrMo1	TÜV	●
OE-S1CrMo2	TÜV	●
OE-SD3 1Ni ½Mo	TÜV	●

Flux Main Components	
SiO2 + TiO2	40 %
Al2O3 + MnO	25 %
CaO + MgO	20 %
CaF2	10 %

METALLURGICAL BEHAVIOUR

Pick-up and burn-out of the alloying elements Si and Mn = f (alloy content of wire electrode)
DVS-Merkblatt 0907 Part 1



Chemical analysis (Typical values in %)

	C	Mn	Si	Mo
OE-S1	0.05	1.1	0.5	-
OE-S2	0.05	1.4	0.5	-
OE-S2Mo	0.05	1.3	0.5	0.5

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-S1	As Welded	≥ 360	420-520	≥ 24
OE-S2	As Welded	≥ 400	520-620	≥ 24
OE-S2Mo	As Welded	≥ 480	600-700	≥ 20

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)		
		+20 °C	0 °C	-20 °C
OE-S1	As Welded	≥ 100	≥ 60	≥ 30
OE-S2	As Welded	≥ 100	≥ 80	≥ 50
OE-S2Mo	As Welded	≥ 90	≥ 50	≥ 35

Typical applications

	Materials
OE-S1	ASME: ASTM A131 Grades A, B, D, DS; A253 all Grades; A529 Grades 42, 50; A570 all Grades; A572 Grades 42, 50; A709 Grades 36, 50 EN: S(P)235-S(P)355; L245-L360
OE-S2	ASME: ASTM A131 Grades A, B, D, DS; A253 all Grades; A529 Grades 42, 50; A570 all Grades; A572 Grades 42, 50; A709 Grades 36, 50 EN: S(P)235-S(P)355; L245-L360
OE-S2Mo	ASME: X60, X65, EN: 16Mo3, S(P)355-S(P)460, L245-L450

Redrying
300-350°Cx2-4h

Current Conditions
AC; DC+

Packaging data

Packaging Type	PE
Weight (kg)	25
-	●

OP 143

OERLIKON

SAW Fluxes
SAW Rutile-Acid Fluxes

OP 143 is an agglomerated calcium-silicate type flux for welding general structural steels, boiler and pipe steels. The welding flux produces a high silicon and manganese pick-up when using wire electrodes OE-S1, OE-S2. OP 143 is particularly suited for twin-wire and multi-wire welding at higher speeds and for welding from both sides in one pass. For enhanced weld metal toughness OE-S2Mo should be used. The high current carrying capacity up to 1200A single wire technique makes OP 143 the ideal flux for all applications where high currents are involved for example multiwire welding or surfacing. Easy slag removal in all cases. The slag freezes quickly and allows circumferential welding of small-diameter work pieces without the slag running off.
Damp flux should be re-dried at 300-350°C. Grain size according to EN 760: 2-20.

Classification		
	EN	760: SA CS 1 98 AC
OE-S1	AWS	5.17: F6A0-EL12
OE-S2	AWS	5.17: F7A0-EM12K
OE-S2Mo	AWS	5.23: F8A0-EA2-A3

	Approvals	Grade
OE-S1	DB	●
OE-S1	TÜV	●
OE-S2	DB	●
OE-S2	TÜV	●
OE-S2Mo	TÜV	●

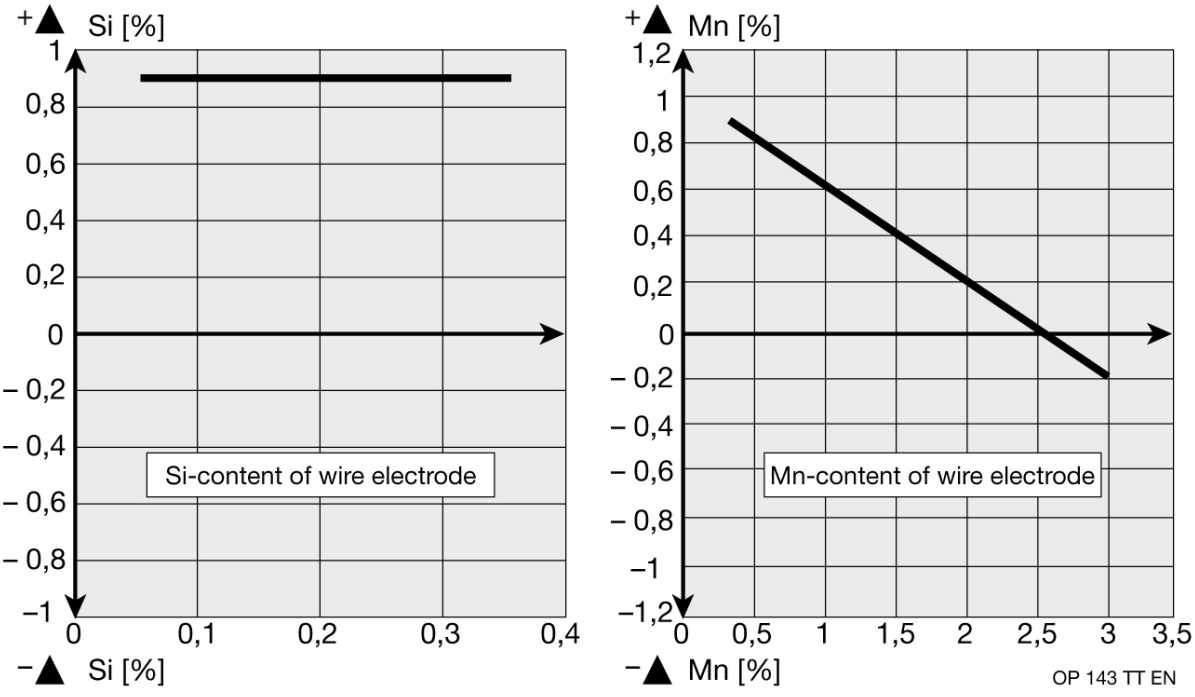
CE

Flux Main Components	
SiO2 + TiO2	40 %
Al2O3 + MnO	25 %
CaO + MgO	25 %
CaF2	10 %

Boniszewski Basicity 1.0

METALLURGICAL BEHAVIOUR

Pick-up and burn-out of the alloying elements Si and Mn = f (alloy content of wire electrode)
DVS-Merkblatt 0907 Part 1



Chemical analysis (Typical values in %)

	C	Mn	Si	Mo
OE-S1	0.04	1.30	0.80	-
OE-S2	0.05	1.70	0.90	-
OE-S2Mo	0.05	1.70	0.90	0.50

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-S1	As Welded	≥ 360	460-560	≥ 24
OE-S2	As Welded	≥ 400	530-630	≥ 24
OE-S2Mo	As Welded	≥ 480	600-700	≥ 22

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)		
		+20 °C	0 °C	-20 °C
OE-S1	As Welded	≥ 90	≥ 50	≥ 30
OE-S2	As Welded	≥ 90	≥ 50	≥ 35
OE-S2Mo	As Welded	≥ 65	≥ 50	≥ 35

Typical applications

	Materials
OE-S1	ASME: ASTM A131 Grades A, B, D, DS; A253 all Grades; A529 Grades 42, 50; A570 all Grades; A572 Grades 42, 50; A709 Grades 36, 50 EN: S(P)235-S(P)355; L245-L360
OE-S2	ASME: ASTM A131 Grades A, B, D, DS; A253 all Grades; A529 Grades 42, 50; A570 all Grades; A572 Grades 42, 50; A709 Grades 36, 50 EN: S(P)235-S(P)355; L245-L360
OE-S2Mo	ASME: API 5L Grades A, B, X42, X46, X52, X56, X60 EN: 16Mo3, S(P)355-S(P)420, L245-L450

Redrying
300-350°Cx2-4h

Current Conditions
AC; DC+

Packaging data

Packaging Type	PE
Weight (kg)	25
-	●

OP 181

OP 181 is an agglomerated rutile-aluminate type flux for welding unalloyed structural steels as well as fine-grain structural steels with a yield strength of up to 355 MPa. High silicon and manganese pick-up is obtained with this flux. It is therefore particularly suited for applications in combination with wire electrodes OE-S1 and OE-S2. OP 181 is used for high-speed welding with the SA twin-wire process, as well as for tandem and multi-wire welding of large pipes or spiral pipes in thin materials. The good slag detachability makes OP 181 particularly suitable for fillet welding applications and pipe-web-pipe joints (e.g. finned tubes). OP 181 can be welded with DC or AC at up to 1000 A. When using DC the wire electrode should be connected to the +pole.
Damp flux should be re-dried at 300-350°C. Grain size in accordance with EN 760: 2-16.

Classification		
	EN	760: SA AR 1 88 AC
OE-S1	AWS	A5.17: F7A0-F7PZ-EL12
OE-S2	AWS	A5.17: F7A0-F7PZ-EM12K

	Approvals	Grade
FLUXOCORD 31HD	DB	●
FLUXOCORD 31HD	TÜV	●
OE-S1	DB	●
OE-S1	TÜV	●
OE-S2	ABS	3YT-3YM
OE-S2	BV	3YTM
OE-S2	DB	●
OE-S2	DNV	IIIYTM

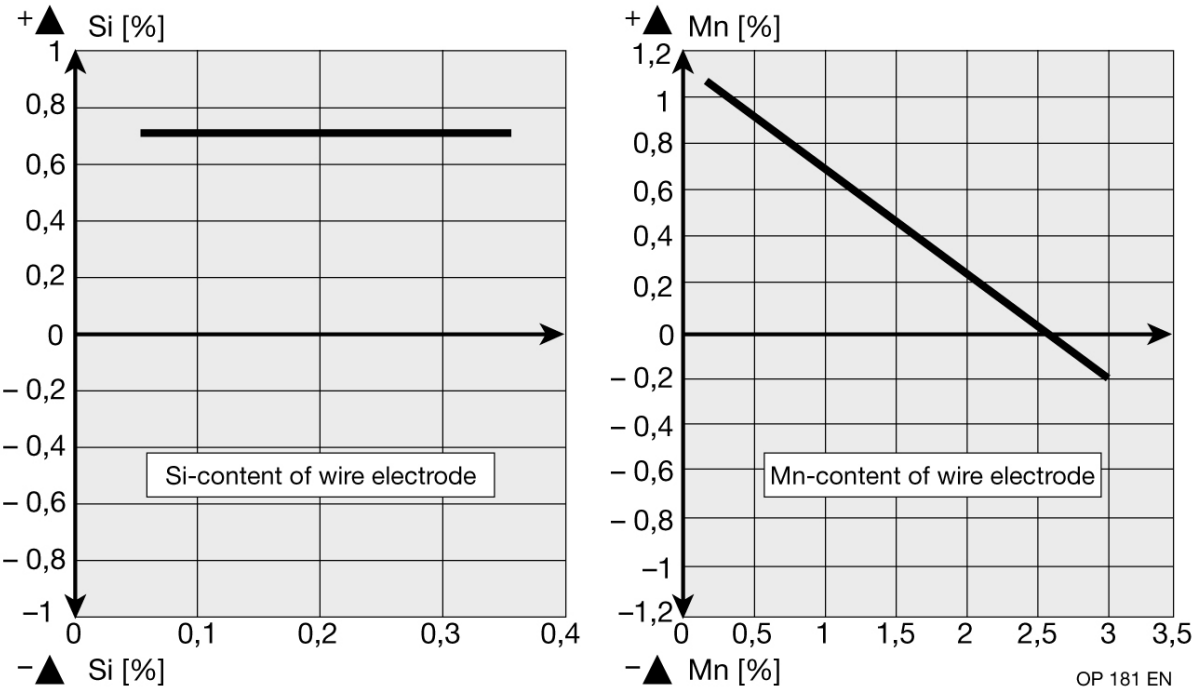
	Approvals	Grade
OE-S2	GL	3YTM
OE-S2	LRS	3YT, 3YM
OE-S2	RMRS	3YTM
OE-S2	TÜV	●
OE-S2Mo	DB	●
OE-S2Mo	TÜV	●
OE-S2CrMo1	TÜV	●

Flux Main Components	
Al_2O_3 + MnO	50 %
SiO_2 + TiO_2	30 %
CaF_2	10 %

Boniszewski Basicity	0.4

METALLURGICAL BEHAVIOUR

Pick-up and burn-out of the alloying elements Si and Mn = f (alloy content of wire electrode)
DVS-Merkblatt 0907 Part 1



Chemical analysis (Typical values in %)

	C	Mn	Si	Mo
OE-S1	0.03	1.1	0.6	-
OE-S2	0.04	1.3	0.6	-
OE-S2Mo	0.04	1.3	0.6	0.5

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-S1	As Welded	≥ 420	520-620	≥ 22
OE-S2	As Welded	≥ 450	560-660	≥ 22
OE-S2Mo	As Welded	≥ 490	610-710	≥ 18

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)
		+20 °C
OE-S1	As Welded	≥ 50
OE-S2	As Welded	≥ 50
OE-S2Mo	As Welded	≥ 50

Typical applications

	Materials
OE-S1	ASME: ASTM A131 Grades A, B, D, DS; A253 all Grades; A529 Grades 42, 50; A570 all Grades; A572 Grades 42, 50; A709 Grades 36, 50 EN: S(P)235-S(P)355; L245-L360
OE-S2	ASME: ASTM A131 Grades A, B, D, DS; A253 all Grades; A529 Grades 42, 50; A570 all Grades; A572 Grades 42, 50; A709 Grades 36, 50 EN: S(P)235-S(P)355; L245-L360
OE-S2Mo	ASME: API 5L Grades A, B, X42, X46, X52, X56 EN: 16Mo3, S(P)355-S(P)420, L245-L450

Redrying
300-350°Cx2-4h

Packaging data

Packaging Type	PE
Weight (kg)	25
-	●

OP 191

OERLIKON

SAW Fluxes
SAW Rutile-Acid Fluxes

OP 191 is an agglomerated rutile type flux for welding general structural steels. It is also used for welding fine-grain steels with a yield strength of up to 355 MPa. Relatively high silicon pick-up is achieved with this flux and when used in conjunction with OE-S1, OE-S2 wire electrodes manganese pick-up also results. OP 191 is particularly well-suited to twin-wire, tandem and multi-wire welding at high speeds. It can also be used with the two-run technique especially when weld thin-walled spiral tubes. The good slag detachability makes OP 191 a standard for fillet welding. OP 191 can be welded on DC+ or AC at up to 1500 A. Damp flux should be re-dried at 300-350°C. Grain size according to EN 760: 2-16.

Classification		
	EN	760: SA AR 1 87 AC
OE-S2 NiCu	EN	756: S 42 0 AR SZ
OE-S1	EN	756: S 42 A AR S1
OE-S2	EN	756: S 42 0 AR S2
OE-S2 NiCu	AWS	A 5.23: F8AZ-EG-G
OE-S1	AWS	A5.17: F7A0-EL12
OE-S2	AWS	A5.17: F7A0-EM12K

	Approvals	Grade
OE-S2	DB	●
OE-S4	DB	●
OE-S4	DNV	III Y40

Flux Main Components	
Al2O3 + TiO2 + ZrO2	52 %
SiO2	19 %
MnO + FeO	17 %
CaO + CaF2 + MgO	11 %

Boniszewski Basicity 0.4

Chemical analysis (Typical values in %)

		C	Mn	Si	Ni	Cu
All weld metal	OE-S2 NiCu	0.04	1.3	0.6	0.7	0.4
All weld metal	OE-S1	0.04	1.1	0.6	-	-
All weld metal	OE-S2	0.04	1.3	0.6	-	-

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-S2 NiCu	As Welded	≥ 470	550-690	≥ 22
OE-S1	As Welded	≥ 400	520-650	≥ 22
OE-S2	As Welded	≥ 400	520-650	≥ 22

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)	
		0 °C	-20 °C
OE-S2 NiCu	As Welded	30	
OE-S1	As Welded		27
OE-S2	As Welded		27

Typical applications

	Materials
OE-S2 NiCu	ASME: EN: S235J0W; S235J2W; S355J0W; S355J2W; S355K2W
OE-S1	ASME: ASTM A131 Grades A, B, D, DS; A253 all Grades; A529 Grades 42, 50; A570 all Grades; A572 Grades 42, 50; A709 Grades 36, 50 EN: S(P)235-S(P)355; L245-L360
OE-S2	ASME: ASTM A131 Grades A, B, D, DS; A253 all Grades; A529 Grades 42, 50; A570 all Grades; A572 Grades 42, 50; A709 Grades 36, 50 EN: S(P)235-S(P)355; L245-L360

Redrying
300-350°Cx2h

Current Conditions
AC; DC+

Packaging data

Packaging Type	PE
Weight (kg)	25
-	●

UNIFLUX D1

OERLIKON

SAW Fluxes
SAW Rutile-Acid Fluxes

UNIFLUX D1 is an agglomerated aluminate rutile type flux for welding general structural steels and boiler steels. It is also suited for fine-grain structural steels with a yield strength of up to 355 MPa. The comparatively fine grain size and high rutile content make UNIFLUX D1 suitable for very high welding speeds and with excellent slag detachability. UNIFLUX D1 is used for fillet welding or for tube-web-tube joints (e.g. finned tubes).
Damp flux should be re-dried at 300-350°C.
Grain size in accordance with EN 760: 2-16.

	Classification	
	EN	760: SA AR 1 97 AC
OE-S1	AWS	A5.17: F7A0-EL12
OE-S2	AWS	A5.17: F7A0-EM12K

	Approvals	Grade
OE-S1	DB	●
OE-S1	TÜV	●
OE-S2	DB	●
OE-S2	TÜV	●
OE-SD3	GL	3YM
OE-S2Mo	TÜV	●
OE-S2CrMo1	TÜV	●
OE-S1CrMo2	TÜV	●

Flux Main Components	
Al2O3 + MnO	55 %
SiO2 + TiO2	30 %
CaF2	5 %

Boniszewski Basicity 0.4

Chemical analysis (Typical values in %)

	C	Mn	Si	Mo
OE-S1	0.06	1.1	0.6	-
OE-S2	0.05	1.4	0.7	-
OE-S2Mo	0.06	1.4	0.7	0.5

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-S1	As Welded	≥ 360	450-550	≥ 22
OE-S2	As Welded	≥ 400	500-600	≥ 22
OE-S2Mo	As Welded	≥ 450	580-680	≥ 18

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)
		+20 °C
OE-S1	As Welded	≥ 60
OE-S2	As Welded	≥ 50
OE-S2Mo	As Welded	≥ 50

Typical applications

	Materials
OE-S1	ASME: ASTM A131 Grades A, B, D, DS; A253 all Grades; A529 Grades 42, 50; A570 all Grades; A572 Grades 42, 50; A709 Grades 36, 50 EN: S(P)235-S(P)355; L245-L360
OE-S2	ASME: ASTM A131 Grades A, B, D, DS; A253 all Grades; A529 Grades 42, 50; A570 all Grades; A572 Grades 42, 50; A709 Grades 36, 50 EN: S(P)235-S(P)355; L245-L360
OE-S2Mo	ASME: ASTM A355 Gr. P1; A182M Gr. F1 EN: 16Mo3
OE-S2CrMo1	ASME: A199 and A200 Grade T11, A213 Grades T11, T12 EN: 13CrMo4-5, 13CrMoSi5-5

Redrying
300-350°Cx2-4h

Current Conditions
AC; DC+

Packaging data

Packaging Type	PE
Weight (kg)	25
-	●

OP 100

OP 100 is an agglomerated aluminate-basic type flux used for the welding of general structural steels, boiler and pipe steels, as well as fine grain structural steels having a yield strength of up to 420 MPa. The welding flux produces a medium silicon and manganese pick-up and is suitable for use in combination with wire electrodes OE-S1 to OE-S3, including OE-S2Mo. OP 100 is suitable for single and multi-layer welding and for welding from both sides in one pass. The glasslike slag makes OP 100 perfectly suited for welding narrow V-type preparations. The slag freezes quickly and allows circumferential welds on small-diameter work pieces.
Grain size according to EN 760: 2-20.

Classification		
	EN	760: S A AB 1 76 AC
OE-S1	AWS	A5.17: F6A0-EL12
OE-S2	AWS	A5.17: F7A0-EM12K
OE-S2Mo	AWS	A5.23: F7A0-EA2-A2

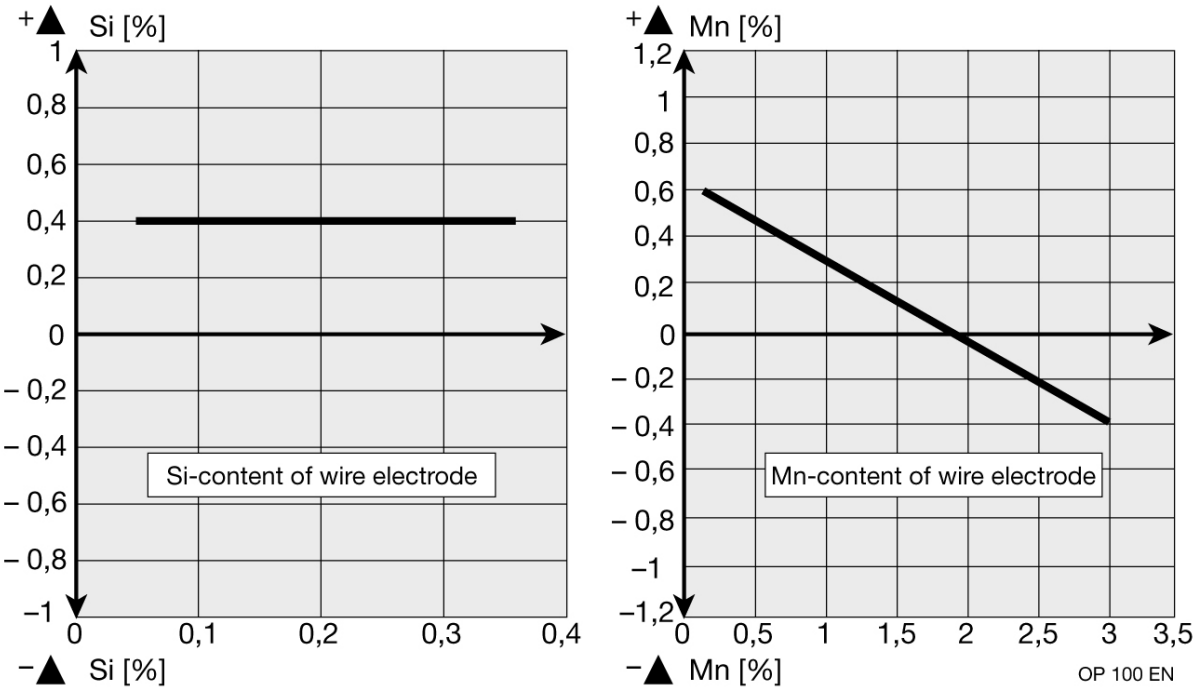
	Approvals	Grade
OE-S1	DB	●
OE-S1	TÜV	●
OE-S2	DB	●
OE-S2	TÜV	●
OE-S3	DB	●
OE-S3	TÜV	●
OE-S2Mo	DB	●
OE-S2Mo	TÜV	●
OE-S2CrMo1	TÜV	●
OE-S1CrMo2	TÜV	●

Flux Main Components	
Al2O3 + MnO	45 %
SiO2 + TiO2	25 %
CaO + MgO	20 %
CaF2	10 %

Boniszewski Basicity	0.8

METALLURGICAL BEHAVIOUR

Pick-up and burn-out of the alloying elements Si and Mn = f (alloy content of wire electrode)
DVS-Merkblatt 0907 Part 1



Chemical analysis (Typical values in %)

	C	Mn	Si	Mo
OE-S1	0.06	1.0	0.3	-
OE-S2	0.06	1.4	0.4	-
OE-S2Mo	0.06	1.4	0.4	0.4

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-S1	As Welded	≥ 360	420-420	≥ 24
OE-S2	As Welded	≥ 400	500-600	≥ 24
OE-S2Mo	As Welded	≥ 450	600-700	≥ 20

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)		
		+20 °C	0 °C	-20 °C
OE-S1	As Welded	≥ 90	≥ 60	≥ 30
OE-S2	As Welded	≥ 90	≥ 60	≥ 30
OE-S2Mo	As Welded	≥ 65	≥ 45	≥ 35

Typical applications

	Materials
OE-S1	ASME: ASTM A131 Grades A, B, D, DS; A253 all Grades; A529 Grades 42, 50; A570 all Grades; A572 Grades 42, 50; A709 Grades 36, 50 EN: S(P)235-S(P)355; L245-L360
OE-S2	ASME: ASTM A131 Grades A, B, D, DS; A253 all Grades; A529 Grades 42, 50; A570 all Grades; A572 Grades 42, 50; A709 Grades 36, 50 EN: S(P)235-S(P)355; L245-L360
OE-S2Mo	ASME: ASTM A355 Gr. P1; A182M Gr. F1 EN: 16Mo3, S(P)355-S(P)460, L245-L450

Redrying
300-350°Cx2-4h

Current Conditions
AC; DC+

Packaging data

Packaging Type	PE
Weight (kg)	25
-	●

OP 160

OP 160 is an agglomerated aluminate-basic type flux for boiler work, pipes, gas cylinders. On account of the metallurgical behaviour it is used with OE-S1, OE-S2 wires. OP 160 is suitable for submerged-arc single wire, tandem and twin arc. Very good for fillet welding, particularly with two smaller diameter wires.
Damp flux should be re-dried at 300-350°C. Grain size according to EN 760 : 2-16.

Classification		
	EN	760: SA AB 1 76 AC H5
OE-S2	EN	756: S 38 2 AB S2
OE-S2	AWS	A5.17: F7A2-EM12K

Approvals		Grade
OE-S2	ABS	2YTM
OE-S2	BV	A3YTM
OE-S2	DNV	3YTM

Flux Main Components	
Al2O3 + TiO2 + ZrO2	30 %
CaO + CaF2 + MgO	30 %
SiO2	15 %
MnO + FeO	10 %

Boniszewski Basicity 1.2

Chemical analysis (Typical values in %)

	C	Mn	Si
OE-S2	0.05	1.3	0.4

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation
OE-S2	As Welded	> 380	> 490	> 22

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)	
		0 °C	-20 °C
OE-S2	As Welded	80	47

Redrying
300-350°Cx2-4h

Current Conditions
AC; DC+

Packaging data

Packaging Type	PE
Weight (kg)	25
-	●

OP 180S

OP 180S is an agglomerated aluminate-basic type flux for the welding of general structural steels, boiler and pipe steels, shipbuilding steels, as well as fine grain structural steels. The flux is characterised by a low silicon pick-up and a moderate manganese pick-up and is mainly used in combination with OE-S1 and OE-S2 wire electrodes. OP 180S is used in shipbuilding and is suitable for SA twin wire, tandem and multi-wire welding, as well as for welding from both sides in one pass. The slag removal is good. OP 180S is suitable for use on either DC or AC up to 1000 A. Damp flux should be re-dried at 300-350°C.
Grain size according to EN 760: 2-20.

Classification		
	EN	760: SA AB 1 67 AC
OE-S1	AWS	5.17: F6A0-EL12
OE-S2	AWS	5.17: F7A0-EM12K
OE-S2Mo	AWS	5.25: F8A0-EA2-A2

	Approvals	Grade
OE-S1	DB	●
OE-S1	TÜV	●
OE-S2	ABS	2YT-3YM
OE-S2	BV	2YT-3YM
OE-S2	DB	●
OE-S2	DNV	IIIY40TM

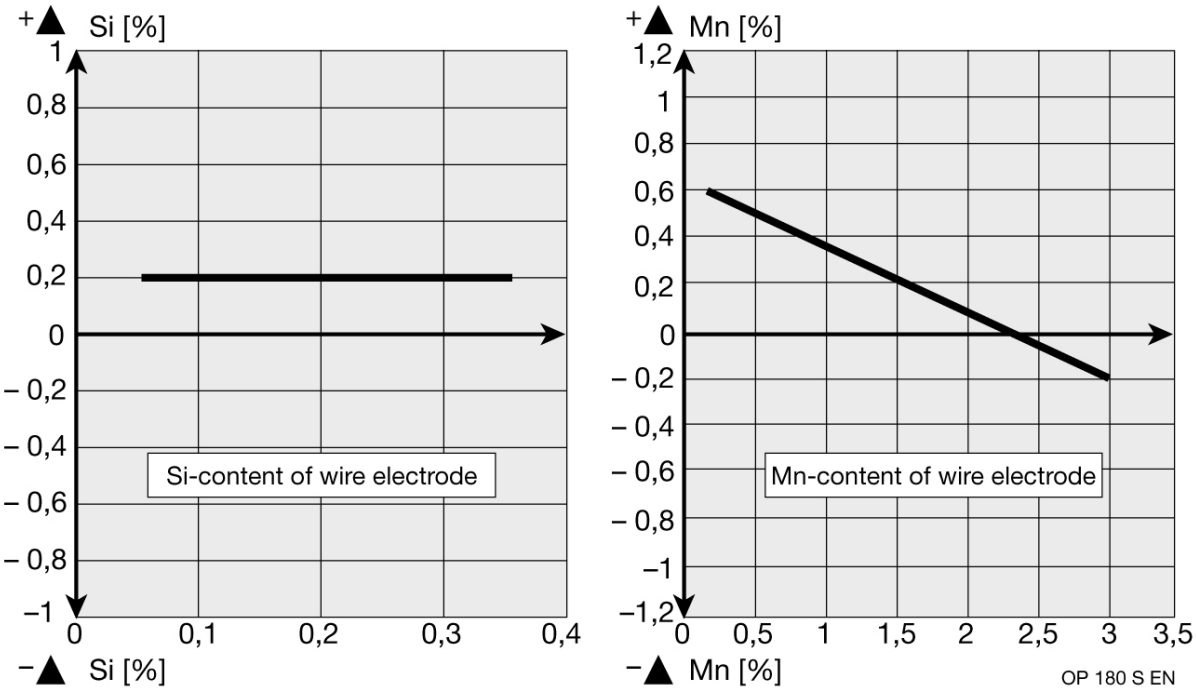
	Approvals	Grade
OE-S2	GL	2YT-3YM
OE-S2	LRS	2YT, 3YM
OE-S2	RMRS	3YTM
OE-S2	TÜV	●
OE-S2Mo	TÜV	●

Flux Main Components	
Al_2O_3 + MnO	40 %
SiO_2 + TiO_2	25 %
CaF_2	15 %
CaO + MgO	15 %

Boniszewski Basicity	1.2

METALLURGICAL BEHAVIOUR

Pick-up and burn-out of the alloying elements Si and Mn = f (alloy content of wire electrode)
DVS-Merkblatt 0907 Part 1



Chemical analysis (Typical values in %)

	C	Mn	Si	Mo
OE-S1	0.05	1	0.2	-
OE-S2	0.05	1.4	0.3	-
OE-S2Mo	0.05	1.4	0.3	0.5

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-S1	As Welded	≥ 360	430-530	≥ 25
OE-S2	As Welded	≥ 400	520-620	≥ 22
OE-S2Mo	As Welded	≥ 450	600-700	≥ 20

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)		
		20 °C	0 °C	-20 °C
OE-S1	As Welded	≥ 100	≥ 60	≥ 35
OE-S2	As Welded	≥ 120	≥ 70	≥ 50
OE-S2Mo	As Welded	≥ 60	≥ 50	≥ 35

Typical applications

	Materials
OE-S1	ASME: - EN: S(P)235-S(P)355; L245-L360
OE-S2	ASME: - EN: S(P)235-S(P)355; Ship building Grade A,B,D,E,AH32 - EH36
OE-S2Mo	ASME: - EN: 16Mo3, S(P)355-S(P)460, L245-L450

Redrying
300-350°Cx2-4h

Current Conditions
AC; DC+

Packaging data

Packaging Type	PE
Weight (kg)	25
-	●

OERLIKON

OP 192 is an agglomerated aluminate-basic type flux for the welding of general structural steels, boiler and pipe steels, as well as fine-grain structural steels. The welding flux produces a medium silicon and manganese pick-up and is therefore used in combination with the wire electrodes OE-S2 and OE-S2 Mo. OP 192 is suitable for twin-wire, tandem and multi-wire welding using the single layer or multi-layer techniques. For higher level of toughness, it an OE-S2 Mo wire electrode is recommended when welding from both sides in one pass or when welding one-sided with the single layer technique. The finely rippled bead surface and the good slag detachability make OP 192 perfectly suited for fillet welds. It can be welded on DC and AC up to 1000 A with the single-wire technique.
Damp flux should be re-dried at 300-350°C.
Grain size according to EN 760: 2-20.

Classification		
	EN	760: S A AB 1 67 AC H5
OE-S2 NiCu	EN	756: S 42 2 AB SZ
OE-S2 Mo	AWS	A5.23: F8A3-F8P2-EA2-A2
OE-S2 NiCu	AWS	A5.23: F7A2-EG-G
OE-S1	AWS	A5.17: F6A2-F6P2-EL12
OE-S2	AWS	A5.17: F7A2-F7P4-EM12K
OE-SD3	AWS	A5.17: F7A6-F7P6-EH12K

	Approvals	Grade
OE-S2 Mo	DNV	3YMT
OE-S2 Mo	TÜV	●
OE-S2	ABS	2YT
OE-S2	BV	A3M-3YM-A2T-2YT
OE-S2	DB	●
OE-S2	DNV	3YM-2YT
OE-S2	GL	3YM-2YT
OE-S2	LRS	3Y
OE-S2	TÜV	●
OE-S4	DB	●
OE-S4	DNV	IV Y40T

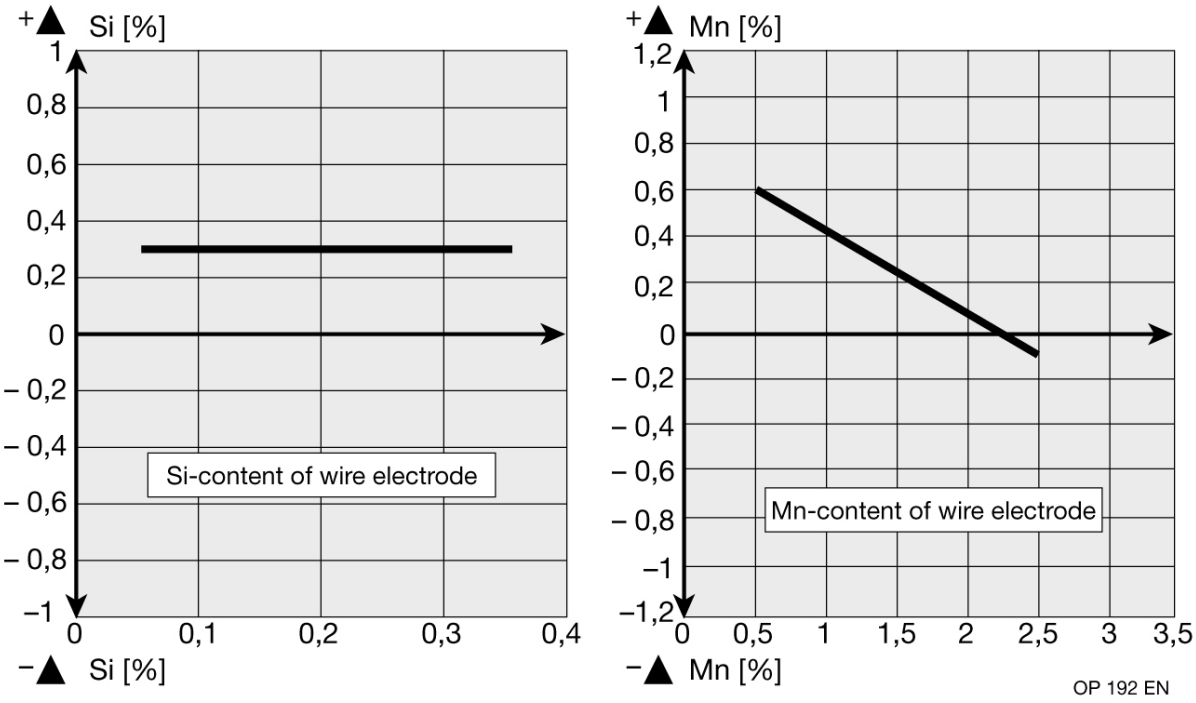
CE

Flux Main Components	
CaO + CaF2 + MgO	39 %
Al2O3 + TiO2 + ZrO2	30 %
SiO2	20 %
MnO + FeO	9 %

Boniszewski Basicity	1.3

METALLURGICAL BEHAVIOUR

Pick-up and burn-out of the alloying elements Si and Mn = f (alloy content of wire electrode)
DVS-Merkblatt 0907 Part 1



OP 192 EN

Chemical analysis (Typical values in %)

	C	Mn	Si	Ni	Mo	Cu
OE-S2 Mo	0.07	1.5	0.6	-	0.5	-
OE-S2 NiCu	0.07	1.5	0.6	0.7	-	0.5
OE-SD3 Mo	0.07	1.7	0.6	-	0.5	-
OE-S1	0.05	1	0.4	-	-	-
OE-S2	0.05	1.5	0.6	-	-	-
OE-SD3	0.07	1.7	0.7	-	-	-

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-S2 Mo	As Welded	≥ 500	560-680	≥ 22
OE-S2 Mo	620°Cx1h	≥ 480	560-690	≥ 20
OE-S2 NiCu	As Welded	≥ 450	500-600	≥ 25
OE-SD3 Mo	As Welded	≥ 490	560-680	≥ 22
OE-S1	As Welded	≥ 355	440-550	≥ 24
OE-S1	620°Cx1h	≥ 330	420-550	≥ 22
OE-S2	As Welded	≥ 420	510-620	≥ 24
OE-S2	620°Cx1h	≥ 400	490-650	≥ 22
OE-SD3	As Welded	≥ 440	530-650	≥ 22
OE-SD3	620°Cx1h	≥ 420	510-650	≥ 22

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)			
		-20 °C	-30 °C	-40 °C	-50 °C
OE-S2 Mo	As Welded	≥ 100	≥ 27		
OE-S2 Mo	620°Cx1h	≥ 90	≥ 27		
OE-S2 NiCu	As Welded	≥ 60	≥ 27		
OE-SD3 Mo	As Welded	≥ 80	≥ 50		
OE-S1	As Welded	≥ 40	≥ 27		
OE-S1	620°Cx1h	≥ 60	≥ 27		
OE-S2	As Welded	≥ 100	≥ 60	≥ 27	
OE-S2	620°Cx1h	≥ 100	≥ 60	≥ 47	
OE-SD3	As Welded	≥ 90		≥ 70	≥ 27
OE-SD3	620°Cx1h	≥ 90		≥ 60	≥ 27

Typical applications

	Materials
OE-S2 Mo	ASME: ASTM A285 Grades A, B, C; A106 Grades A, B, C; X60, X65 EN: 16Mo3, S(P)355-S(P)460, L245-L450
OE-S2 NiCu	ASME: EN: S235J0W; S235J2W; S355J0W; S355J2W; S355K2W
OE-SD3 Mo	ASME:ASTM A381 Class Y60 EN:S(P)355-S(P)460, L245-L450
OE-S1	ASME: ASTM A131 Grades A, B, D, DS; A253 all Grades; A529 Grades 42, 50; A570 all Grades; A572 Grades 42, 50; A709 Grades 36, 50 EN: S(P)235-S(P)355; L245-L360
OE-S2	ASME: ASTM A131 Grades A, B, D, DS; A253 all Grades; A529 Grades 42, 50; A570 all Grades; A572 Grades 42, 50; A709 Grades 36, 50 EN: S(P)235-S(P)355; L245-L360
OE-SD3	ASME: ASTM A131 Grades A, B, D, DS; A253 all Grades; A529 Grades 42, 50; A570 all Grades; A572 Grades 42, 50; A709 Grades 36, 50 EN: S(P)235-S(P)355; L245-L360

Redrying
300-350°Cx2-4h

Current Conditions
AC; DC+

Packaging data

Packaging Type	PE
Weight (kg)	25
-	●

OP 192C

OP 192C is an agglomerated aluminate-basic type flux for welding of general structural steels, boiler and pipe steels, fine-grain structural steels and as well for surfacing. OP 192C produces a higher silicon level compared to OP 192 with medium Manganese pick-up and allows high welding speeds (0,9 m/min). OE-S1, OE-S2 and OE-S2Mo wire electrodes are preferred for multilayer welding; OE-S2Mo is also recommended for welding from both sides in one pass or when welding one-sided with single layer technique for higher level of toughness. OP 192C is suitable for twin-wire, tandem and multi-wire welding techniques. Nice bead surface and good slag detachability make OP 192C perfectly suited for fillet welds. It can be welded on DC and AC up to 1000 A with the single-wire technique and up to 1500 A with two-wire technique. Damp flux should be re-dried at 300-350°C.
Grain size according to EN 760: 2-16. Special grain size distribution (2-20) is recommended for applications with intensive flux recycling.

Classification		
	EN	760: S A AB 1 87 AC H5
OE-S2 Mo	AWS	A5.23: F8A3-F8P2-EA2 A2
OE-S1	AWS	A5.17: F6A2-F6P2-EL12
OE-S2	AWS	A5.17: F7A4-F7P4-EM12K
OE-SD3	AWS	A5.17: F7A6-F7P6-EH12K

Flux Main Components	
CaO + CaF2 + MgO	38 %
Al2O3 + TiO2 + ZrO2	29 %
SiO2	22 %
MnO + FeO	9 %

Boniszewski Basicity 1.3

Chemical analysis (Typical values in %)

	C	Mn	Si	Mo
OE-S2 Mo	0.05	1.6	0.7	0.5
OE-S1	0.05	1	0.4	-
OE-S2	0.06	1.5	0.7	-
OE-SD3	0.07	1.7	0.7	-

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-S2 Mo	As Welded	≥ 490	570 - 680	≥ 20
OE-S2 Mo	620°Cx1h	≥ 480	560 - 690	≥ 20
OE-S1	As Welded	≥ 355	440 - 550	≥ 24
OE-S1	620°Cx1h	≥ 330	420 - 550	≥ 22
OE-S2	As Welded	≥ 420	510 - 640	≥ 22
OE-S2	620°Cx1h	≥ 400	490 - 650	≥ 22
OE-SD3	As Welded	≥ 440	530 - 650	≥ 22
OE-SD3	620°Cx1h	≥ 420	510 - 650	≥ 22

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)			
		-20 °C	-30 °C	-40 °C	-50 °C
OE-S2 Mo	As Welded	≥ 50	≥ 27		
OE-S2 Mo	620°Cx1h	≥ 50	≥ 27		
OE-S1	As Welded	≥ 40	≥ 27		
OE-S1	620°Cx1h	≥ 60	≥ 27		
OE-S2	As Welded	≥ 100	≥ 50	≥ 27	
OE-S2	620°Cx1h	≥ 110	≥ 60	≥ 40	
OE-SD3	As Welded	≥ 90		≥ 50	≥ 27
OE-SD3	620°Cx1h	≥ 90		≥ 50	≥ 27

Typical applications

	Materials
OE-S2 Mo	ASME: ASTM A285 Grades A, B, C; A106 Grades A, B, C; X60, X65 EN: 16Mo3, S(P)355-S(P)460, L245-L450
OE-S1	ASME: ASTM A131 Grades A, B, D, DS; A253 all Grades; A529 Grades 42, 50; A570 all Grades; A572 Grades 42, 50; A709 Grades 36, 50 EN: S(P)235-S(P)355; L245-L360
OE-S2	ASME: ASTM A131 Grades A, B, D, DS; A253 all Grades; A529 Grades 42, 50; A570 all Grades; A572 Grades 42, 50; A709 Grades 36, 50 EN: S(P)235-S(P)355; L245-L360
OE-SD3	ASME: ASTM A131 Grades A, B, D, DS; A253 all Grades; A529 Grades 42, 50; A570 all Grades; A572 Grades 42, 50; A709 Grades 36, 50 EN: S(P)235-S(P)355; L245-L360

Redrying
25300-350°Cx2-4h

Current Conditions
AC; DC+

Packaging data

Packaging Type	PE
Weight (kg)	25
-	●

OP 132 is an aluminate-basic type flux designed for welding pipes from both sides in one pass. OP 132 is characterised by its excellent current carrying capacity of more than 1500A on the lead wire in multi-wire welding processes. Even at very high local currents the welding process remains stable. The weld seam shows very good wetting, a regular flow and a very broad, flat profile. OP 132 contains specific components which decompose during welding and create protective gases. This gas protection prohibits the access of atmospheric nitrogen to the weld pool and thus guarantees optimum toughness particularly with TIBOR 33 wire when welding from both sides in one pass.
Grain size according to EN 760: 2-20.

Classification		
	EN	760: SA AB 1 67 AC H5
OE-S1	AWS	5.17: F6A2-EL12
OE-S2	AWS	5.17: F7A5-EM12K
OE-SD3	AWS	5.17: F7A5-EH12K
OE-S4	AWS	5.17: F8A5-EH14
OE-S2Mo	AWS	5.23: F8A5-EA2-A2
OE-SD3Mo	AWS	5.23: F9A6-EA4-A4

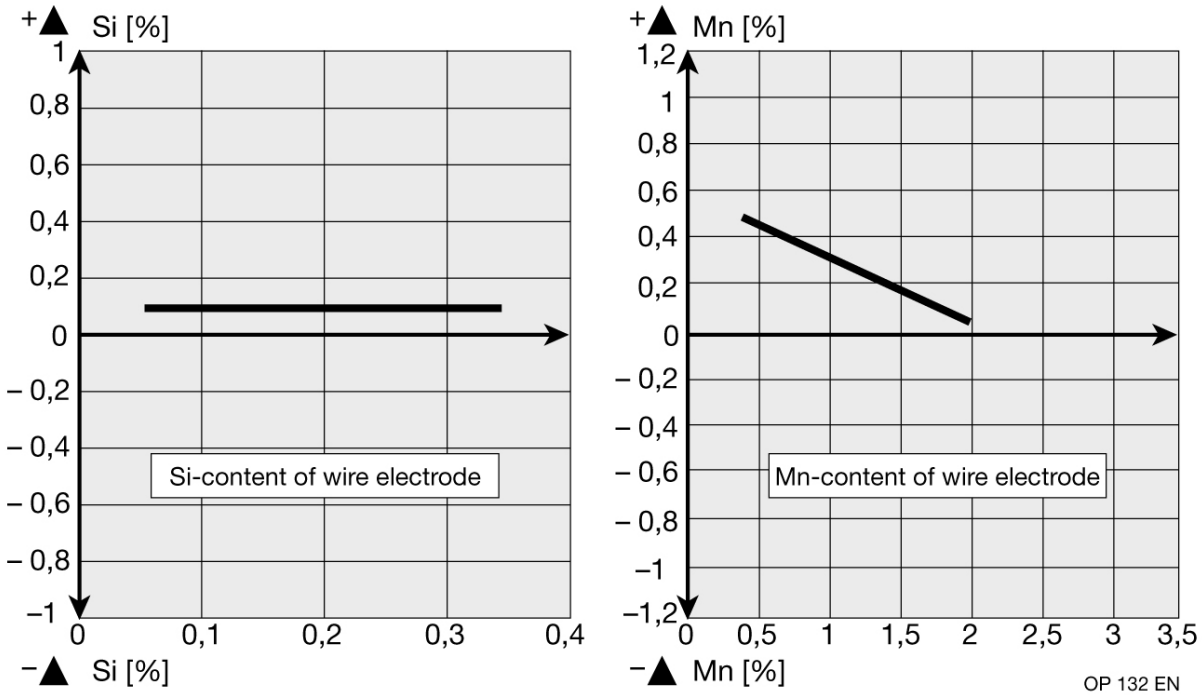
	Approvals	Grade
FLUXOCORD 31HD	DB	●
FLUXOCORD 31HD	TÜV	●
OE-S2	DB	●
OE-S2	TÜV	●
OE-S2Mo	DB	●
OE-S2Mo	TÜV	●

Flux Main Components	
Al2O3 + MnO	35 %
CaO + MgO	25 %
SiO2 + TiO2	20 %
CaF2	15 %

Boniszewski Basicity	1.5

METALLURGICAL BEHAVIOUR

Pick-up and burn-oou of the alloying elements Si and Mn = f (alloy content of wire electrode)
DVS-Merkblatt 0907 Part 1



OP 132 EN

Chemical analysis (Typical values in %)

	C	Mn	Si	Mo	Ti	B
OE-S1	0.06	0.8	0.15	-	-	-
OE-S2	0.07	1.3	0.2	-	-	-
OE-SD3	0.07	1.8	0.4	-	-	-
OE-S4	0.07	1.8	0.3	-	-	-
OE-S2Mo	0.07	1.3	0.2	0.5	-	-
OE-SD3Mo	0.05	1.7	0.4	0.4	-	-
TIBOR 33	0.05	1.6	0.4	0.4	0.03	0.003

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-S1	As Welded	≥ 360	460-500	≥ 27
OE-S2	As Welded	≥ 400	480-510	≥ 27
OE-SD3	As Welded	≥ 470	530-580	≥ 25
OE-S4	As Welded	≥ 480	560-600	≥ 25
OE-S2Mo	As Welded	≥ 470	550-620	≥ 21
OE-SD3Mo	As Welded	≥ 540	620-660	≥ 23

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)					
		0 °C	-20 °C	-30 °C	-40 °C	-50 °C	-60 °C
OE-S1	As Welded	≥ 150	≥ 80	≥ 40			
OE-S2	As Welded		≥ 140	≥ 100	≥ 40		
OE-SD3	As Welded				≥ 70	≥ 40	
OE-S4	As Welded		≥ 100		≥ 60		
OE-S2Mo	As Welded		≥ 110		≥ 80	≥ 50	
OE-SD3Mo	As Welded				≥ 60	≥ 50	≥ 40

Typical applications

	Materials
OE-S1	ASME: ASTM A131 Grades A, B, D, DS; A253 all Grades; A529 Grades 42, 50; A570 all Grades; A572 Grades 42, 50; A709 Grades 36, 50 EN: S(P)235-S(P)355; L245-L360
OE-S2	ASME: ASTM A131 Grades A, B, D, DS; A253 all Grades; A529 Grades 42, 50; A570 all Grades; A572 Grades 42, 50; A709 Grades 36, 50 EN: S(P)235-S(P)355; L245-L360
OE-SD3	ASME: EN S(P)235-S(P)420
OE-S4	ASME: EN S(P)355-S(P)460
OE-S2Mo	ASME: X60, X65 EN: 16Mo3, S(P)355-S(P)460, L245-L450
OE-SD3Mo	ASME: ASTM A204 Grades A, B, C; A355 Grade P1; A209 Grades T1, T1A, T1B EN: S(P)355-S(P)460, L245-L450
TIBOR 33	ASME: X60, X65, X70, X80 EN: S(P)355-S(P)460, L245-L450

Redrying
300-350°Cx2-4h

Current Conditions
AC; DC+

Packaging data

Packaging Type	PE	DRYBAG
Weight (kg)	25	25
-	●	●

OP 139 is an agglomerated aluminate-basic type flux which has been designed for use with the high deposition rate submerged arc processes. Therefore OP 139 is perfectly suited for single or multi-layer welding in twin-wire, tandem or multi-wire processes both for longitudinal and circumferential seams. Even at high speeds the weld metal shows good wetting properties and smooth and straight weld toes. The slag detaches very easily even in narrow joint configurations and fillet welds.
The agglomerated welding flux OP 139 can be used for all structural, boiler and pipe steels and for fine-grained structural steels. There is a low silicon and a significant manganese pick-up. Preferably, OP 139 is used in combination with wire electrode OE-S2 in multi-layer welds and in combination with wire electrode OE-S2Mo when welding from both sides in one pass.
Damp flux should be re-dried at 300-350°C.
Grain size according to EN 760: 2-20.

Classification		
	EN	760: SA AB 1 68 AC H5
OE-S2 Mo	AWS	A5.23: F8A6-EA2-A2
OE-S2 Mo	AWS	A5.23: F8P6-EA2-A2
OE-S2	AWS	A5.17: F7A6-EM12K
OE-S2	AWS	A5.17: F7P6-EM12K

	Approvals	Grade
OE-S2 Mo	DB	●
OE-S2 NiCu	TÜV	●
OE-S2 Mo	TÜV	●
OE-S2	DB	●
OE-S2	DNV	IVY40M IIIY40T H5
OE-S2	GL	4YM-3Y40T H5
OE-S2	LRS	4Y40M, 3Y40T H5
OE-S2	TÜV	●

Flux Main Components	
Al_2O_3 + MnO	30 %
CaO + MgO	25 %
CaF_2	20 %
SiO_2 + TiO_2	20 %

Chemical analysis (Typical values in %)

	C	Mn	Si	Mo
OE-S2 Mo	0.06	1.8	0.3	0.4
OE-S2	0.06	1.8	0.3	-

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-S2 Mo	As Welded	≥ 480	570-630	≥ 21
OE-S2 Mo	620°Cx1h	≥ 470	550-620	≥22
OE-S2	As Welded	≥ 430	500-570	≥ 27
OE-S2	620°Cx1h	≥ 400	490-560	≥ 25

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)				
		-20 °C	-30 °C	-40 °C	-50 °C	-70 °C
OE-S2 Mo	As Welded	≥110		≥ 80	≥ 50	
OE-S2 Mo	620°Cx1h			≥ 70	≥ 50	
OE-S2	As Welded	≥ 140	≥ 100	≥ 90		≥ 50
OE-S2	620°Cx1h	≥ 100		≥ 70	≥ 60	

Typical applications

	Materials
OE-S2 Mo	ASME: ASTM A285 Grades A, B, C; A106 Grades A, B, C; X60, X65 EN: 16Mo3, S(P)355-S(P)460, L245-L450
OE-S2	EN: S(P)235-S(P)355; L245-L360

Redrying
300-350°Cx2-4h

Current Conditions
AC; DC+

Packaging data

Packaging Type	PE	DRYBAG
Weight (kg)	25	25
-	●	●

OP 41TT is an agglomerated fluoride-basic type flux for welding high-tensile fine-grain structural steels as well as heat-resistant structural steels. In the nuclear sector it is used for many applications in combination with different wire electrodes, such as reactor pressure vessels, steam generators, pressurizers, reactor safety tanks and pipes in the primary and secondary circuits as well as the auxiliary units. OP 41TT is used with wire electrodes containing a higher level of manganese and silicon, such as e.g. OE-SD3. Due to the special manufacturing process of the flux the moisture pick up of the flux and the weld metal hydrogen content are very low. OP 41TT should be welded on DC+ at up to approximately 800 A.
Grain size according to EN 760: 2-20.

Classification		
	EN	760: SA FB 1 53 DC H5
OE-SD3	AWS	A5.17: F7A8-F6P8-EH12K
OE-S2Mo	AWS	A5.23: F8A8-F6P5-EA2
OE-S2Ni1	AWS	A5.23: F7A8-F7P10-ENi1

	Approvals	Grade
OE-SD3	ABS	3YM
OE-SD3	BV	3YM
OE-SD3	DB	●
OE-SD3	DNV	IIIYM
OE-SD3	GL	3YM
OE-SD3	LRS	3M, 3YM
OE-SD3	RMRS	3YM

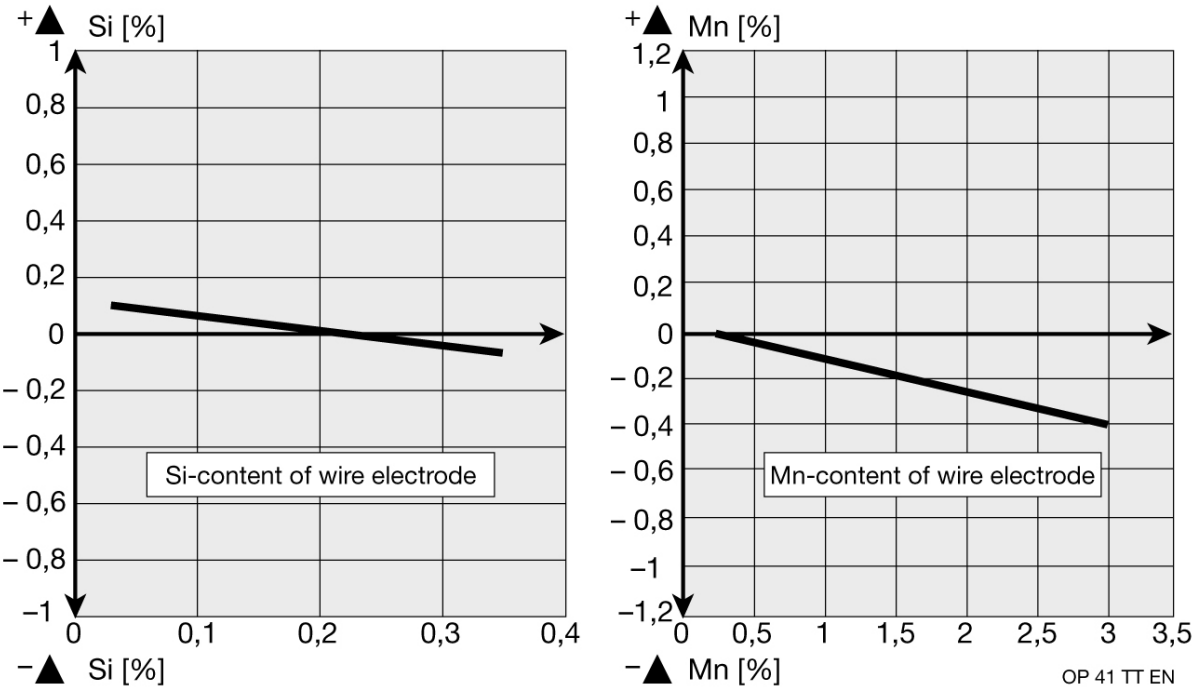
	Approvals	Grade
OE-SD3	TÜV	●
OE-S2Mo	TÜV	●
OE-SD3Mo	TÜV	●
OE-S2CrMo1	TÜV	●
OE-S2Ni2	TÜV	●
OE-SD3 1Ni ½Mo	TÜV	●

Flux Main Components	
CaO + MgO	35 %
CaF2	30 %
Al2O3 + MnO	20 %
SiO2 + TiO2	10 %

Boniszewski Basicity	3.1

METALLURGICAL BEHAVIOUR

Pick-up and burn-out of the alloying elements Si and Mn = f (alloy content of wire electrode)
DVS-Merkblatt 0907 Part 1



Chemical analysis (Typical values in %)

	C	Mn	Si	Cr	Ni	Mo
OE-SD3	0.07	1.2	0.3	-	-	-
OE-S2Mo	0.07	0.8	0.2	-	-	0.5
OE-S2CrMo1	0.07	0.8	0.2	1	-	0.5
OE-S1CrMo2	0.08	0.5	0.2	2.2	-	1
OE-S2Ni1	0.07	1.1	0.3	0.15	1.15	0.3

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-SD3	As Welded	≥ 420	530-630	≥ 24
OE-S2Mo	As Welded	≥ 490	570-670	≥ 20
OE-S2CrMo1	710°C	≥ 380	530-630	≥ 24
OE-S1CrMo2	740°C	≥ 450	550-650	≥ 22
OE-S2Ni1	As Welded	≥ 420	500-600	≥ 24
OE-S2Ni1	600°Cx2h	≥ 380	480-500	≥ 26

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)				
		+20 °C	0 °C	-20 °C	-40 °C	-60 °C
OE-SD3	As Welded	≥ 170	≥ 150	≥ 120	≥ 70	≥ 40
OE-S2Mo	As Welded	≥ 140	≥ 120	≥ 100	≥ 70	≥ 50
OE-S2CrMo1	710°C	≥ 200	≥ 150			
OE-S1CrMo2	740°C	≥ 140	≥ 100			
OE-S2Ni1	As Welded	≥ 150	≥ 130	≥ 100	≥ 70	≥ 50
OE-S2Ni1	600°Cx2h	≥ 170	≥ 140	≥ 110	≥ 90	≥ 70

Typical applications

	Materials
OE-S2	ASME: ASTM A131 Grades A, B, D, DS; A253 all Grades; A529 Grades 42, 50; A570 all Grades; A572 Grades 42, 50; A709 Grades 36, 50 EN: S(P)235-S(P)355; L245-L360
OE-SD3	ASME: A516 all Grades EN S(P)235-S(P)420
OE-S2Mo	ASME: X60, X65, ASTM A355 Gr. P1; A182M Gr. F1 EN: 16Mo3, S(P)355-S(P)460, L245-L450
OE-S2CrMo1	ASME: A199 and A200 Grade T11, A213 Grades T11, T12 EN: 13CrMo4-5, 13CrMoSi5-5
OE-S1CrMo2	ASME: A387 Gr.22, Cl 1 and 2, A182 Gr.F 22, A 36 Gr.F22 EN: 10CrMo9-10, 12CrMo9-10

Redrying
300-350°Cx2-4h

Current Conditions
DC+

Packaging data

Packaging Type	DRYBAG
Weight (kg)	25
-	●

OP 120TT

OP 120TT is an agglomerated fluoride-basic type welding flux that is used for the welding of fine-grain structural steels, especially when high levels of weld metal toughness are required. The manganese pick-up results in excellent toughness values when used in combination with wire electrode OE-S2 containing lower level of manganese. OP 120TT has a very low diffusible hydrogen content and is highly resistant to moisture pick up during use. Self-releasing slag even in narrow joint configurations. The welding flux is suitable for welding with DC+ and AC up to about 1000A. Damp flux should be re-dried at 300-350°C.
Grain size according to EN 760: 2-20.

	Classification	
	EN	760: SA FB 1 66 AC H5
OE-S2 Mo	AWS	5:23: F8A4-EA2-A2
OE-S2	AWS	5:17: F7A6-EM12K
OE-SD2 1NiCrMo	AWS	5:23: F10P4-EG-G

	Approvals	Grade
OE-S2 Mo	DB	●
OE-S2 CrMo1	TÜV	●
OE-S2 Mo	TÜV	●
OE-S2 Ni1	TÜV	●
OE-S1	DB	●
OE-S1	TÜV	●
OE-S2	ABS	3YM
OE-S2	BV	3YM

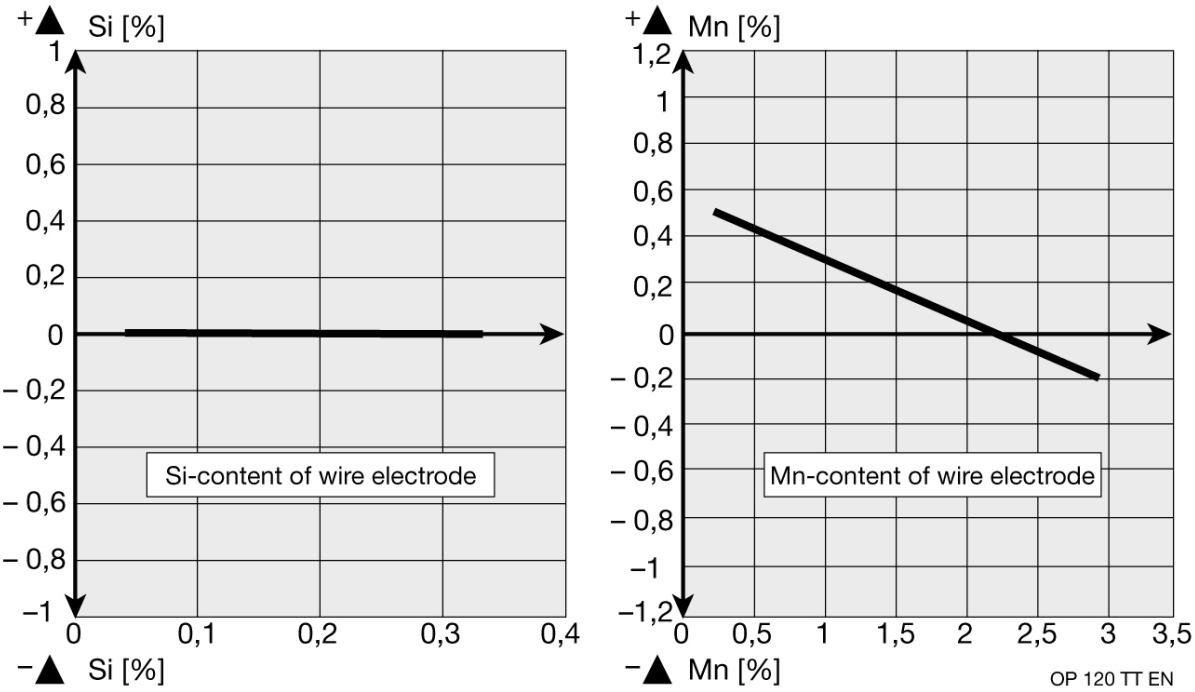
	Approvals	Grade
OE-S2	DB	●
OE-S2	DNV	IIIYM
OE-S2	GL	3YM
OE-S2	LRS	3YM
OE-S2	TÜV	●
OE-S3	DB	●
OE-S3	TÜV	●

Flux Main Components	
CaF2	30 %
CaO + MgO	30 %
Al2O3 + MnO	20 %
SiO2 + TiO2	15 %

Boniszewski Basicity	3.1

METALLURGICAL BEHAVIOUR

Pick-up and burn-out of the alloying elements Si and Mn = f (alloy content of wire electrode)
DVS-Merkblatt 0907 Part 1



Chemical analysis (Typical values in %)

	C	Mn	Si	Cr	Ni	Mo
OE-S2 CrMo1	0.07	1.2	0.3	1	-	0.5
OE-S2 Mo	0.06	1.2	0.4	-	-	0.5
OE-S1	0.05	0.8	0.2	-	-	-
OE-S2	0.06	1.2	0.4	-	-	-
OE-SD3 1Ni ½Mo	0.05	1.6	0.4	-	0.9	0.5
OE-SD2 1NiCrMo	0.06	1.4	0.5	1	0.9	0.6

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-S2 CrMo1	680°Cx2h	≥ 380	570-670	≥ 22
OE-S2 CrMo1	920°C/air+720°C	≥ 310	430-530	≥ 28
OE-S2 Mo	As Welded	≥ 450	600-700	≥ 24
OE-S1	As Welded	≥ 360	440-540	≥ 25
OE-S2	As Welded	≥ 420	500-600	≥ 24
OE-SD3 1Ni ½Mo	620°Cx2h	≥ 580	680-720	≥ 30
OE-SD2 1NiCrMo	As Welded	≥ 760	840-870	≥ 24
OE-SD2 1NiCrMo	660°Cx3h	≥ 590	690-720	≥ 26

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)				
		+20 °C	0 °C	-20 °C	-40 °C	-60 °C
OE-S2 CrMo1	680°Cx2h	≥ 200	≥ 150			
OE-S2 CrMo1	920°C/air+720°C		≥ 200			
OE-S2 Mo	As Welded	≥ 130	≥ 90	≥ 70	≥ 40	
OE-S1	As Welded	≥ 150	≥ 90			
OE-S2	As Welded	≥ 160	≥ 130	≥ 100	≥ 70	≥ 40
OE-SD3 1Ni ½Mo	620°Cx2h				≥ 40	
OE-SD2 1NiCrMo	As Welded				≥ 40	
OE-SD2 1NiCrMo	660°Cx3h				≥ 27	

Typical applications

	Materials
OE-S2 CrMo1	ASME: A199 and A200 Grade T11, A213 Grades T11, T12 EN: 13CrMo4-5, 13CrMoSi5-5
OE-S2 Mo	ASME: X60, X65, ASTM A355 Gr. P1; A182M Gr. F1 EN: 16Mo3, S(P)420-S(P)500; L245-L485
OE-S1	ASME: ASTM A131 Grades A, B, D, DS; A253 all Grades; A529 Grades 42, 50; A570 all Grades; A572 Grades 42, 50; A709 Grades 36, 50 EN: S(P)235-S(P)355; L245-L360
OE-S2	ASME: ASTM A131 Grades A, B, D, DS; A253 all Grades; A529 Grades 42, 50; A570 all Grades; A572 Grades 42, 50; A709 Grades 36, 50 EN: S(P)235-S(P)420
OE-SD3	ASME: A131 Grades E, EH32, EH46; A 572 Grades 42, 50; A633 Grades A, C, D; A285 Grades A, B,C; A537 Class 1; A662 Grades A, B, C; A737 Grades B; A841 EN: S(P)235-S(P)460
OE-SD3 1Ni ½Mo	ASME: X70, X80, N-A-XTRA 55, HY80, QIN EN: S(P)420-S(P)500; L245-L485; 20MnMoNi5-5, 15NiCuMoNb5
OE-SD2 1NiCrMo	ASME: ASTM A302 Grade B, ASTM A336 Grade F30, ASTM A487 Class 1N, 1Q 2N, 2Q, AISI 4130 EN: S(P)460-S(P)555

Redrying
300-350°Cx2-4h

Current Conditions
AC; DC+

Packaging data

Packaging Type	PE
Weight (kg)	25
-	●

OP 120C

OP 120C is an agglomerated fluoride-basic type flux for welding general structural steels, pipe steels and fine-grain steels. On account of its metallurgical behaviour it is used with OE-S1, OE-S2 and OE-S2Mo wires. OP 120C is suitable for submerged-arc single wire, tandem and twin and multi arc, e.g. in the production of large pipes with the two-run technique. Excellent slag detachability even in the root pass. Damp flux should be re-dried at 300-350°C.
Grain size according to EN 760 : 2-20.

Classification		
	EN	760: SA FB 1 67 AC H10
OE-S2	EN	756: S 35 2 FB S2
OE-S2Mo	EN	756: S 38 4 FB S2Mo
OE-S2	AWS	A5.17: F6A2-EM12K
OE-S2Mo	AWS	A5.23: F8A4-F8P4-EA2-A2

	Approvals	Grade
OE-S2Mo	BV	A3YTM
OE-S2Mo	DNV	3YT

CE

Flux Main Components	
CaO + CaF2 + MgO + MnO	50 %
SiO2	20 %
CaF2	15 %

Boniszewski Basicity 2

Chemical analysis (Typical values in %)

	C	Mn	Si	Mo
OE-S2	0.05	1.2	0.4	-
OE-S2Mo	0.06	1.2	0.4	0.4

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation
OE-S2	As Welded	≥ 355	440-560	≥ 24
OE-S2Mo	As Welded	≥ 380	470-600	≥ 20

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)	
		-20 °C	-40 °C
OE-S2	As Welded	50	
OE-S2Mo	As Welded		47

Typical applications

	Materials
OE-S2	ASME: ASTM A131 Grades A, B, D, DS; A253 all Grades; A529 Grades 42, 50; A570 all Grades; A572 Grades 42, 50; A709 Grades 36, 50 EN: S(P)235-S(P)355; L245-L360
OE-S2Mo	ASME: ASTM A355 Gr. P1;A182M Gr. F1 EN: 16Mo3, S(P)355-S(P)460, L245-L450

Redrying
300-350°Cx2-4h

Current Conditions
AC; DC+

Packaging data

Packaging Type	PE
Weight (kg)	25
-	●

OP 121TT

OERLIKON

SAW Fluxes
SAW Basic and Semi-basic Fluxes

OP 121TT is a fully basic agglomerated submerged-arc welding flux that is widely used for the welding of structural and fine grained low alloy steels requiring high integrity welds with low temperature impact and CTOD fracture toughness properties. OP 121TT flux, in combination with a range of Oerlikon submerged-arc wires, in particular with OE-SD3, is established for the welding of offshore structures such as oil platform jackets, piles, decks and modules giving a high level of consistency and mechanical property performance. The flux is widely used for the welding of thick section components in the offshore, nuclear and pressure vessel industries. The flux exhibits a low hydrogen content in the as manufactured condition and gives a high resistance to moisture pick up during exposure under workshop conditions. The flux promotes a very stable arc characteristic during use with excellent slag detachment. The weld is of a uniform even profile with regular fine ripple formation and smooth toe blending. OP 121TT flux is suitable for use with DC+ or AC and is ideal for single wire, twin wire, tandem arc [DC+/AC] and other multi-arc systems using up to 1000A with single wire welding. Grain size according to EN 760: 2-20.

Classification		
	EN	760: SA FB 1 55 AC H5
OE-S1 CrMo2	AWS	A5.23: F8P2-EB3-B3
OE-S2 CrMo1	AWS	A5.23: F7P4-EB2-B2
OE-S2 Mo	AWS	A5.23: F8A4-EA2-A2
OE-S2 Mo	AWS	A5.23: F8P4-EA2-A2
OE-S2 Ni2	AWS	A5.23: F7A10-ENi2-Ni2
OE-S2 Ni2	AWS	A5.23: F7P10-ENi2-Ni2
OE-SD3 Mo	AWS	A5.23: F8P6-EA4-A4
OE-S2	AWS	A5.17: F6P8-EM12K
OE-S2	AWS	A5.17: F7A6-EM12K
OE-SD3	AWS	A5.17: F7A8-EH12K
OE-SD3	AWS	A5.17: F7P8-EH12K
OE-SD3 1Ni ¼Mo	AWS	A5.23: F8A10-EG-G
OE-SD3 1Ni ¼Mo	AWS	A5.23: F8P10-EG-G
OE-SD3 1Ni ½Mo	AWS	A5.23: F9A8-EF3/EG-F3
OE-SD3 1Ni ½Mo	AWS	A5.23: F9P8-EF3/EG-F3
OE-SD3 2NiCrMo	AWS	A5.23: F11A8-EG-G
OE-SD3 2NiCrMo	AWS	A5.23: F11P5-EG-G

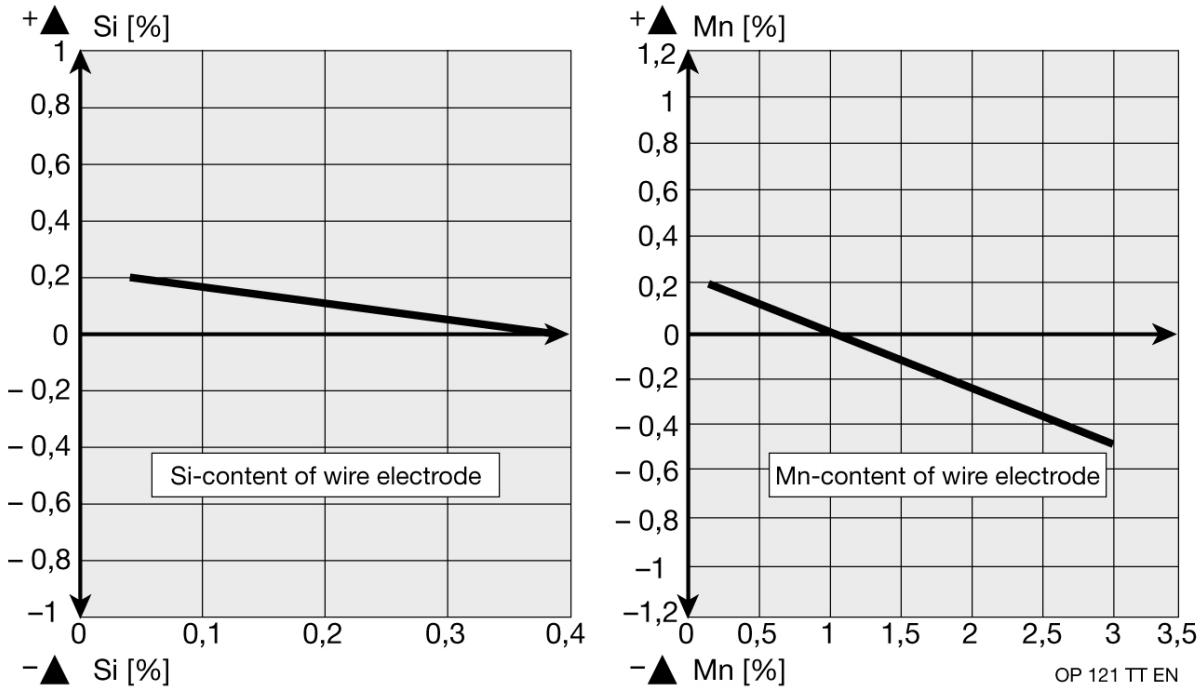
	Approvals	Grade
OE-S2 Mo	ABS	3YM-3YT
FLUXOCORD 31	DB	●
FLUXOCORD 31HD	DB	●
FLUXOCORD 42	DB	●
OE-S2 Mo	DB	●
OE-S2 Ni2	DNV	5YM H5, 3YT H5
OE-S2 Ni2	GL	in Progress
OE-S2 Mo	LRS	3Y40T, 4Y40M H5
FLUXOCORD 31HD	LRS	4Y
FLUXOCORD 41	TÜV	●
OE-S1 CrMo2	TÜV	●
OE-S2 CrMo1	TÜV	●
OE-S2 Mo	TÜV	●
OE-S2 Ni1	TÜV	●
OE-S2 Ni2	TÜV	●
OE-S2 Ni3	TÜV	●
OE-SD3 Mo	TÜV	●
OE-S2	LRS	3M, 3YM
OE-S2	TÜV	●
OE-S3	DB	●
OE-S3	TÜV	●
OE-SD3	ABS	3YM (-40 °C)
OE-SD3	BV	A3YM
OE-SD3	DB	●
OE-SD3	DNV	4Y42M H5
OE-SD3	GL	5Y40M
OE-SD3	LRS	4Y40M
OE-SD3	RMRS	5Y40M HHH
OE-SD3	TÜV	●
OE-SD3 1Ni ¼Mo	ABS	4Y Q460M
OE-SD3 1Ni ¼Mo	TÜV	●
OE-SD3 1Ni ½Mo	ABS	5Y Q550M
OE-SD3 1Ni ½Mo	LRS	3Y50M H5
OE-SD3 1Ni ½Mo	TÜV	●
OE-SD3 2NiCrMo	ABS	5Y Q690M
OE-SD3 2NiCrMo	DB	●
OE-SD3 2NiCrMo	DNV	5Y69M H5
OE-SD3 2NiCrMo	LRS	5Y69M H5
OE-SD3 2NiCrMo	TÜV	●

Flux Main Components	
CaO + MgO	40 %
CaF2	25 %
Al2O3 + MnO	20 %
SiO2 + TiO2	15 %

Boniszewski Basicity	3.1

METALLURGICAL BEHAVIOUR

Pick-up and burn-out of the alloying elements Si and Mn = f (alloy content of wire electrode)
DVS-Merkblatt 0907 Part 1



Chemical analysis (Typical values in %)

	C	Mn	Si	Cr	Ni	Mo
OE-S1 CrMo2	0.08	0.6	0.3	2.2	-	1
OE-S2 CrMo1	0.07	0.9	0.3	1	-	0.5
OE-S2 Mo	0.07	0.9	0.2	-	-	0.5
OE-S2 Ni2	0.07	0.9	0.3	-	2.3	-
OE-S2 Ni3	0.06	0.9	0.2	-	3.3	-
OE-S2	0.07	0.9	0.2	-	-	-
OE-SD3	0.07	1.6	0.3	-	-	-
OE-SD3 1Ni ¼Mo	0.07	1.3	0.3	-	0.9	0.2
OE-SD3 1Ni ½Mo	0.07	1.5	0.3	-	0.95	0.5
OE-SD3 2NiCrMo	0.07	1.4	0.4	0.6	2.2	0.5

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-S1 CrMo2	720°Cx8h	≥ 450	550-650	≥ 22
OE-S1 CrMo2	940°C/air+740°C	≥ 400	520-620	≥ 22
OE-S2 CrMo1	680°Cx2h	≥ 380	530-630	≥ 24
OE-S2 CrMo1	920°C/air+710°C	≥ 310	430-530	≥ 30
OE-S2 Mo	As Welded	≥ 470	550-680	≥ 24
OE-S2 Ni2	As Welded	≥ 450	550-600	≥ 24
OE-S2 Ni2	600°Cx2h	≥ 430	500-600	≥ 26
OE-S2 Ni3	As Welded	≥ 480	560-660	≥ 25
OE-SD3 Mo	As Welded	≥ 550	610-670	≥ 29
OE-SD3 Mo	620°Cx1h	≥ 520	600-660	≥ 27
OE-S2	As Welded	≥ 360	450-550	≥ 28
OE-SD3	As Welded	≥ 450	530-630	≥ 25
OE-SD3	600°Cx2h	≥ 400	490-590	≥ 27
OE-SD3 1Ni ¼Mo	As Welded	≥ 500	560-680	≥ 22
OE-SD3 1Ni ¼Mo	600°Cx2h	≥ 470	550-660	≥ 24
OE-SD3 1Ni ½Mo	As Welded	≥ 550	650-750	≥ 20
OE-SD3 1Ni ½Mo	600°Cx2h	≥ 540	630-730	≥ 22
OE-SD3 2NiCrMo	As Welded	≥ 720	760-900	≥ 18
OE-SD3 2NiCrMo	580°Cx2h	≥ 600	700-850	≥ 19

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)				
		0 °C	-20 °C	-40 °C	-60 °C	-80 °C
OE-S1 CrMo2	720°Cx8h	≥ 100				
OE-S1 CrMo2	940°C/air+740°C	≥ 90				
OE-S2 CrMo1	680°Cx2h	≥ 180				
OE-S2 CrMo1	920°C/air+710°C	≥ 200				
OE-S2 Mo	As Welded	≥ 120	≥ 100	≥ 50		
OE-S2 Ni2	As Welded	≥ 140	≥ 120	≥ 100	≥ 70	≥ 50
OE-S2 Ni2	600°Cx2h	≥ 160	≥ 140	≥ 130	≥ 100	≥ 80
OE-S2 Ni3	As Welded	≥ 160	≥ 140	≥ 130	≥ 100	≥ 80
OE-SD3 Mo	As Welded			≥ 110	≥ 80	
OE-SD3 Mo	620°Cx1h			≥ 130	≥ 60	
OE-S2	As Welded	≥ 160	≥ 100	≥ 50		
OE-SD3	As Welded	≥ 180		≥ 100	≥ 70	
OE-SD3	600°Cx2h	≥ 200		≥ 120	≥ 90	
OE-SD3 1Ni ¼Mo	As Welded			≥ 145	≥ 70	
OE-SD3 1Ni ¼Mo	600°Cx2h			≥ 160	≥ 70	
OE-SD3 1Ni ½Mo	As Welded	≥ 120	≥ 90	≥ 70	≥ 47	
OE-SD3 1Ni ½Mo	600°Cx2h	≥ 140	≥ 120	≥ 90	≥ 70	
OE-SD3 2NiCrMo	As Welded				≥ 69	
OE-SD3 2NiCrMo	580°Cx2h			≥ 47		

Typical applications

	Materials
OE-S2 Ni2	EN: 11MnNi5-3, 15NiMn5-3
OE-S2 CrMo1	ASME: A199 and A200 grade T11, A213 Grades T11, T12 EN: 13CrMo4-5, 13CrMoSi5-5
OE-S2 Mo	ASME: X60, X65, ASTM A355 Gr. P1; A182M Gr. F1 EN: 16Mo3, S(P)355-S(P)460, L245-L450
OE-S2 Ni3	ASME: ASTM A333 Grade 3, ASTM A334 Grade 3; A352LC3; ASTM A203 D, E EN: 12Ni14, S(P)275-S(P)460
OE-S2	ASME: ASTM A131 Grades A, B, D, DS; A253 all Grades; A529 Grades 42, 50; A570 all Grades; A572 Grades 42, 50; A709 Grades 36, 50 EN: S(P)235-S(P)355; L245-L360
OE-SD3	ASME: A516 all Grades EN: S(P)235-S(P)420
OE-SD3 1Ni ¼Mo	ASME: ASTM A131 AH40, DH40, EH40, X65, X70 EN: S(P)275-S(P)460
OE-SD3 1Ni ½Mo	ASME: X70, X80, N-A-XTRA 55, HY80, QIN EN: S(P)420-S(P)500; L245-L485; 20MnMoNi5-5, 15NiCuMoNb5

Redrying
300-350°Cx2-4h

Current Conditions
AC; DC+

Packaging data

Packaging Type	PE	DRY
Weight (kg)	25	25
-	●	●

OP 121TTW

OP 121TTW is a fully basic agglomerated submerged-arc welding flux that is is recommended for applications requiring an extremely low concentration of phosphorus and sulphur in the weld metal, especially for high tensile steels and for joints requiring high toughness at sub-zero temperatures and resistance to ageing. OP 121TTW can also be used for the welding of structural and fine grained low alloy steels requiring high integrity welds with low temperature impact and CTOD fracture toughness properties. The flux is widely used for the welding of thick section components in the offshore, nuclear and pressure vessel industries. The flux exhibits a low hydrogen content in the as manufactured condition and gives a high resistance to moisture pick up during exposure under workshop conditions. The flux promotes a very stable arc characteristic during use with excellent slag detachment. The weld is of a uniform even profile with regular fine ripple formation and smooth toe blending. OP 121TTW flux is suitable for use with DC+ or AC and is ideal for single wire, twin wire, tandem arc [DC+/AC] and other multi-arc systems using up to 1000A with single wire welding. Grain size according to EN 760: 2-20.

Classification		
	EN	760: SA FB 1 55 AC H5
OE-S1 CrMo2	AWS	A5.23: F8P2-EB3-B3
OE-S2 CrMo1	AWS	A5.23: F7P4-EB2-B2
OE-S2 Mo	AWS	A5.23: F8A4-F8P4-EA2-A2
OE-S2 Ni2	AWS	A5.23: F7A10-F7P10-ENi2-Ni2
OE-S2 Ni3	AWS	A5.23: F8A15-F7P15-ENi3-Ni3
OE-S2	AWS	A5.17: F7A6-F6P8-EM12K
OE-SD3	AWS	A5.17: F7A8-F7P8-EH12K
OE-SD3 1Ni ¼Mo	AWS	A5.23: F8A10-F8P10-EG-G
OE-SD3 1Ni ½Mo	AWS	A5.23: F9A8-F9P8-EF3/EG-F3
OE-SD3 2NiCrMo	AWS	A5.23: F11A8-F11P5-EG-G

	Approvals	Grade
OE-S2 Mo	RINA	4Y M
OE-S2 Ni2	RINA	5Y M, 5Y DM
OE-S2 CrMo1	TÜV	●
OE-SD3	TÜV	●
OE-SD3 2NiCrMo	LRS	5Y69M

Flux Main Components	
CaO + MgO	40 %
CaF2	25 %
Al2O3 + MnO	20 %
SiO2 + TiO2	15 %

Boniszewski Basicity 3.1

Chemical analysis (Typical values in %)

	C	Mn	Si	Cr	Ni	Mo
OE-S1 CrMo2	0.08	0.6	0.3	2.2	-	1
OE-S2 CrMo1	0.07	0.9	0.3	1	-	0.5
OE-S2 Mo	0.07	0.9	0.2	-	-	0.5
OE-S2 Ni2	0.07	0.9	0.3	-	2.3	-
OE-S2 Ni3	0.06	0.9	0.2	-	3.3	0.15
OE-S2	0.07	0.9	0.2	-	-	-
OE-SD3	0.07	1.6	0.3	-	-	-
OE-SD3 1Ni ¼Mo	0.07	1.3	0.3	-	0.9	0.2
OE-SD3 1Ni ½Mo	0.07	1.5	0.3	-	0.95	0.5
OE-SD3 2NiCrMo	0.07	1.4	0.4	0.6	2.2	0.5

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation
OE-S1 CrMo2	720°Cx8h	≥ 450	550-650	≥ 22
OE-S1 CrMo2	940°C/air+740°C	≥ 400	520-620	≥ 22
OE-S2 CrMo1	680°Cx2h	≥ 380	530-630	≥ 24
OE-S2 CrMo1	920°C/air+710°C	≥ 310	430-530	≥ 30
OE-S2 Mo	As Welded	≥ 470	550-680	≥ 24
OE-S2 Ni2	As Welded	≥ 450	550-600	≥ 24
OE-S2 Ni2	600°Cx2h	≥430	500-600	≥ 26
OE-S2 Ni3	As Welded	≥ 480	560-660	≥ 25
OE-S2 Ni3	600°C 2 hr	≥ 430	500-610	≥ 26
OE-S2	As Welded	≥ 360	450-550	≥ 25
OE-SD3	As Welded	≥ 450	530-630	≥ 25
OE-SD3 1Ni ¼Mo	As Welded	≥ 500	560-680	≥ 22
OE-SD3 1Ni ¼Mo	600°Cx2h	≥ 470	550-660	≥ 24
OE-SD3 1Ni ½Mo	As Welded	≥ 550	650-750	≥ 20
OE-SD3 1Ni ½Mo	600°Cx2h	≥ 540	630-730	≥ 22
OE-SD3 2NiCrMo	As Welded	≥ 720	760-900	≥ 18
OE-SD3 2NiCrMo	580°Cx2h	≥ 600	700-850	≥ 19

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)				
		-0 °C	-20 °C	-40 °C	-60 °C	-80 °C
OE-S1 CrMo2	720°Cx8h	≥ 100				
OE-S1 CrMo2	940°C/air+740°C	≥ 90				
OE-S2 CrMo1	680°Cx2h	≥ 180				
OE-S2 CrMo1	920°C/air+710°C	≥ 200				
OE-S2 Mo	As Welded	≥ 120	≥ 100	≥ 50		
OE-S2 Ni2	As Welded	≥ 140		≥ 100	≥ 70	≥ 50
OE-S2 Ni2	600°Cx2h		≥ 140	≥ 130	≥ 100	≥ 80
OE-S2 Ni3	As Welded		≥ 140	≥ 130	≥ 100	≥ 80
OE-S2 Ni3	600°C 2 hr		≥ 140	≥ 120	≥ 90	≥ 70
OE-S2	As Welded	≥ 160	≥ 100			
OE-SD3	As Welded		≥ 140	≥ 100	≥ 70	
OE-SD3 1Ni ¼Mo	As Welded			≥ 145	≥ 70	
OE-SD3 1Ni ¼Mo	600°Cx2h			≥ 160	≥ 70	
OE-SD3 1Ni ½Mo	As Welded		≥ 90	≥ 70	≥ 47	
OE-SD3 1Ni ½Mo	600°Cx2h		≥ 120	≥ 90	≥ 70	
OE-SD3 2NiCrMo	As Welded				≥ 69	
OE-SD3 2NiCrMo	580°Cx2h			≥ 47		

Typical applications

	Materials
OE-S2 Ni3	ASME: ASTM A333 Grade 3, ASTM A334 Grade 3; A352LC3; ASTM A203 D,E EN: 12Ni14, S(P)275-S(P)460
OE-S2 CrMo1	ASME: A199 and A200 grade T11, A213 Grades T11, T12 EN: 13CrMo4-5, 13CrMoSi5-5
OE-S2 Ni2	EN: 11MnNi5-3, 15NiMn5-3
OE-S1 CrMo2	ASME: A387 Gr.22, Cl 1 and 2, A 182 Gr.F 22, A 336 Gr.F22 EN: 10CrMo9-10, 12CrMo9-10
OE-S2 Mo	ASME: X 60, X 65, ASTM A355 Gr. P1; A182M Gr. F1 EN: 16Mo3, S(P)355-S(P)460, L245-L450
OE-S2	ASME: ASTM A131 Grades A, B, D, DS; A253 All grades; A529 Grades 42, 50; A570 All grades; A572 Grades 42, 50; A709 Grades 36, 50 EN: S(P)235-S(P)355; L245-L360
OE-SD3	ASME: A516 all grades EN: S(P)235-S(P)420
OE-SD3 1Ni ¼Mo	ASTM A131 AH40, DH40, EH40; API 5L X65, X70 EN: S(P)275-S(P)460; S500; L245-L485
OE-SD3 1Ni ½Mo	ASME: X70, X80, N-A-XTRA 55, HY80, QIN EN: S(P)420-S(P)500; L245-L485; 20MnMoNi5-5, 15NiCuMoNb5
OE-SD3 2NiCrMo	ASME: Q1N, HY80, HY100; USS T1, T1A and T1B; RQT 601, RQT 701 EN: S620-S690; P690; L415-L555

Current Conditions
AC; DC+

Packaging data

Packaging Type	PE	DRYBAG
Weight (kg)	25	25
-	●	●

OP 122 is an agglomerated fluoride-basic type flux for the joint welding of general structural steels, boiler and pipe steels, as well as fine-grain structural steels. OP 122 is suitable for SA twin-wire, tandem and multi-wire welding and for welding from both sides in one pass, for example when producing large pipes. In order to improve the weld metal toughness the use of Mo-alloyed wire electrodes is recommended for this process. OP 122 has a high current-carrying capacity and is therefore also suited for fillet welding with a large throat thickness in steel construction. The slag removal is excellent. OP 122 can be welded on DC (+pole) and AC at up to 1200 A.
Grain size according to EN 760: 2-20.

Classification		
	EN	760: SA FB 1 65 AC H5
OE-S2	AWS	A5.17: F7A5-F6P5-EM12K
OE-SD3	AWS	A5.17: F7A4-F6P4-EH12K
OE-S2Mo	AWS	A5.23: F7A2-EA2-A2

	Approvals	Grade
FLUXOCORD 35 25 2D	ABS	3YT
FLUXOCORD 35 25 3D	ABS	3YTM
FLUXOCORD 35 25 2D	BV	3YTM
FLUXOCORD 35 25 3D	DB	●
FLUXOCORD 35 25 2D	DB	●
FLUXOCORD 35 25 2D	DNV	IIIY40T
FLUXOCORD 35 25 2D	GL	3YT
FLUXOCORD 35 25 3D	GL	3YTM
FLUXOCORD 35 25 2D	LRS	3YT, 3YM
FLUXOCORD 35 25 3D	LRS	3YT, 3YM
FLUXOCORD 35 25 2D	RMRS	3YTM

	Approvals	Grade
OE-S2	ABS	3YTM
OE-S2	DB	●
OE-S2	DNV	IIIYTM
OE-S2	GL	3YTM
OE-S2	LRS	3YT, 3YM
OE-S2	TÜV	●
OE-S3	DB	●
OE-S2Mo	DB	●
OE-S2Mo	GL	3YTM
OE-S2Mo	LRS	3YT, 3YM
OE-S2Mo	TÜV	●

Flux Main Components	
CaO + MgO	30 %
Al2O3 + MnO	25 %
CaF2	20 %
SiO2 + TiO2	20 %

Boniszewski Basicity 1.7

Chemical analysis (Typical values in %)

	C	Mn	Si	Mo
OE-S2	0.07	1.0	0.2	-
OE-SD3	0.07	1.5	0.3	-
OE-S2Mo	0.07	1.0	0.2	0.5

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-S2	As Welded	≥ 400	450 - 550	≥ 24
OE-SD3	As Welded	≥ 400	500 - 600	≥ 24
OE-S2Mo	As Welded	≥ 480	550 - 650	≥ 20

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)			
		20 °C	0 °C	-20 °C	-40 °C
OE-S2	As Welded	≥ 150	≥ 110	≥ 90	
OE-SD3	As Welded	≥ 160	≥ 130	≥ 100	≥ 70
OE-S2Mo	As Welded	≥ 90	≥ 70	≥ 40	

Typical applications

	Materials
OE-S2	ASME: ASTM A131 Grades A, B, D, DS; A253 all Grades; A529 Grades 42, 50; A570 all Grades; A572 Grades 42, 50; A709 Grades 36, 50 EN: S(P)235-S(P)355; L245-L360
OE-SD3	ASME: EN: S(P)235-S(P)355; L245-L360
OE-S2Mo	ASME: API-5L X60, X65, ASTM A355 Gr. P1; A182M Gr. F1 EN: 16Mo3, S(P)355-S(P)460, L245-L450
OE-S2CrMo1	ASME: A199 and A200 Grade T11, A213 Grades T11, T12 EN: 13CrMo4-5, 13CrMoSi5-5

Redrying
300-350°Cx2-4h

Current Conditions
AC; DC+

Packaging data

Packaging Type	PE
Weight (kg)	25
-	●

OP 125W

OP 125 W is an agglomerated special welding flux of the fluoride-basic type, suitable for the welding of creep resistant steels. The metallurgical behaviour is characterised by an extremely low pick-up of silicon, and a neutral behaviour for the pick-up of manganese. OP 125 W is used for twin wire or multi-wire welding with two or more wire electrodes. It has a low bulk density and the flux consumption is correspondingly low. Even in the case of high interpass temperatures, slag removal is good. OP 125 W is suitable for use on either DC or AC up to 800 A.
Grain size according to DIN EN 760: 2-20

Classification		
	EN	760: SA FB 1 55 AC H5
OE-S1CrMo2	AWS	A5.23: F8P0-EB3-B3
OE-S1CrMo5	AWS	A5.23: F8P0-EB6-B6

	Approvals	Grade
FLUXOCORD 31	DB	●
OE-S2CrMo1	DB	●
OE-S2CrMo1	TÜV	●
OE-S1CrMo2	DB	●
OE-S1CrMo2	TÜV	●
OE-S1CrMo5	DB	●
OE-S1CrMo5	TÜV	●

Flux Main Components	
CaO + MgO	40 %
CaF2	25 %
Al2O3 + MnO	20 %
SiO2 + TiO2	15 %

Chemical analysis (Typical values in %)

	C	Mn	Si	Cr	Mo
OE-S2Mo	0.06	0.8	0.2	-	0.5
OE-S2CrMo1	0.06	0.8	0.2	1.0	0.5
OE-S1CrMo2	0.06	0.6	0.2	2.2	1.0
OE-S1CrMo5	0.06	0.6	0.2	5.0	0.6

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-S2Mo	As Welded	≥ 470	550-650	≥ 22
OE-S2CrMo1	710°C	≥ 380	510-610	≥ 22
OE-S2CrMo1	920°C/air+710°C	≥ 310	430-530	≥ 30
OE-S1CrMo2	740°C	≥ 420	520-620	≥ 25
OE-S1CrMo2	940°C/air+740°C	≥ 400	500-600	≥ 25
OE-S1CrMo5	740°C	≥ 450	520-620	≥ 22
OE-S1CrMo5	950°C/air+740°C	≥ 400	500-600	≥ 22

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)		
		+20 °C	0 °C	-20 °C
OE-S2Mo	As Welded	≥ 160	≥ 130	≥ 110
OE-S2CrMo1	710°C	≥ 200	≥ 180	
OE-S2CrMo1	920°C/air+710°C	≥ 200	≥ 200	
OE-S1CrMo2	740°C	≥ 180	≥ 140	
OE-S1CrMo2	940°C/air+740°C	≥ 150	≥ 100	
OE-S1CrMo5	740°C	≥ 150	≥ 120	
OE-S1CrMo5	950°C/air+740°C	≥ 130	≥ 100	

Typical applications

	Materials
OE-S1CrMo2	ASME: A387 Gr.22, Cl 1 and 2, A 182 Gr.F 22, A336 Gr.F22 EN: 10CrMo9-10, 12CrMo9-10
OE-S1CrMo5	ASME: A182 Gr. F5, A199 Gr. T5, A213 Gr.T5, A335 Gr.P5; A336 Cl. F5, A369 Gr. FP5, A387 Gr.5, Cl 1 and 2 EN: 12CrMo19-5, X12CrMo5

Redrying
300-350°Cx2-4h

Packaging data

Packaging Type	PE
Weight (kg)	25
-	●

OP CROMO F537

OERLIKON

SAW Fluxes
SAW Basic Fluxes

OP CROMO F537 is a special agglomerated fluoride-basic type. Specially designed for the welding of creep resistant steels 2,25Cr-1Mo-0,25V and 2,25Cr-1Mo with main focus on maximum toughness values at low temperatures and high purity of the weld metal. Weld metal deposited with OE-CROMO S225 shows no reduction in toughness after "Step Cool" heat treatment and therefore the weld metal is not sensitive to "Temper Embrittlement". The X-factor and J factor are very low. Exceptionally low silicon pick-up and neutral behaviour in terms of manganese are typical of the metallurgical properties of this flux. It can be welded on DC+ and AC at up to 800 A. As the bulk density of this flux is low, so is the rate of consumption. The flux can be welded with the twin-wire process and can also be used for tandem welding with two or more wire electrodes. Controlled X and J factor to satisty step cooling requirement.
All weld metal creep test results have been performed, which allows the calculation of the wall thickness of the component, based on the properties of the base metal for operating temperatures up to 550°C.
To reach optimal toughness values welding should be performed on AC-polarity. OP CROMO F537 can be used in tandem, twin-arc and multi-wire applications.
Damp flux should be re-dried at 300-350°C. Grain size according to EN 760: 2-20.

Classification		
	EN	760: SA FB 1 55 AC H5
OE-CROMO S225	AWS	A5.23: F9P2-EB3R-B3R
OE-CROMO S225V	AWS	A5.23: F9P2-EGR-GR
OE-S1CrMo5	AWS	A5.23: F8P0-EB6-B6

Approvals	Grade
OE-S2CrMo1	TÜV	●
OE-CROMO S225	TÜV	●
OE-S1CrMo5	TÜV	●

CE

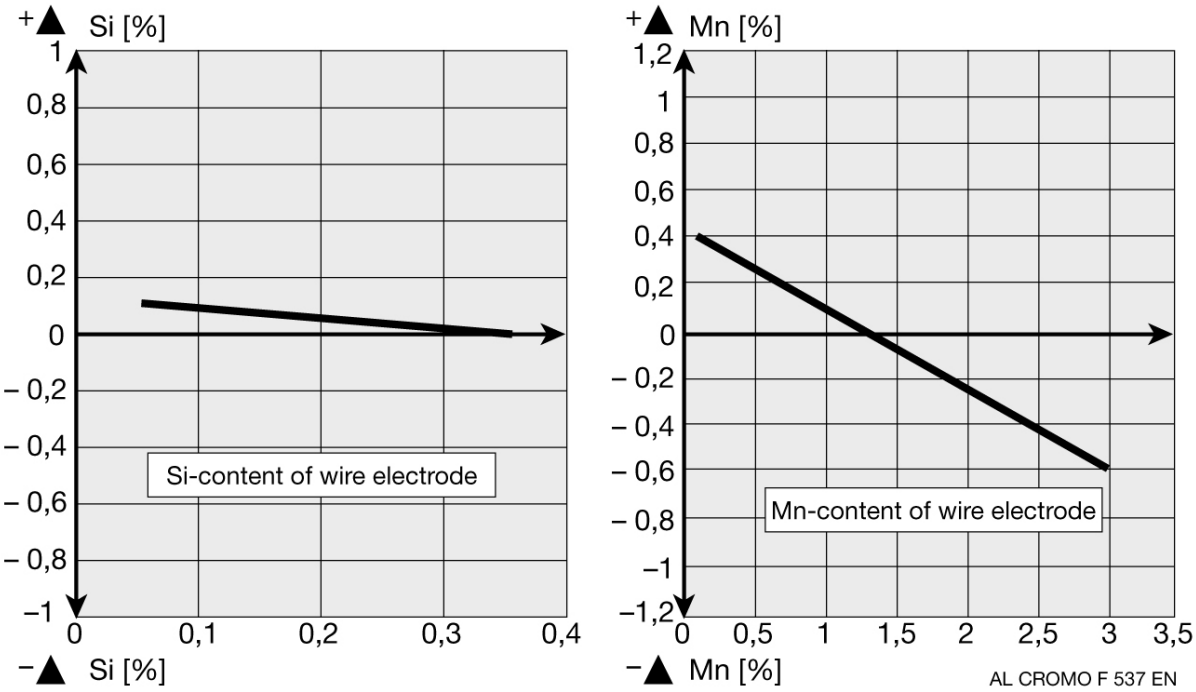
Flux Main Components	
CaO + MgO	40 %
CaF2	25 %
Al2O3 + MnO	20 %
SiO2 + TiO2	15 %

Boniszewski Basicity ~2.6

AIR LIQUIDE WELDING

METALLURGICAL BEHAVIOUR

Pick-up and burn-out of the alloying elements Si and Mn = f (alloy content of wire electrode)
DVS-Merkblatt 0907 Part 1



Chemical analysis (Typical values in %)

	C	Mn	Si	Cr	Mo	Nb	V
OE-CROMO S225	≤ 0.12	≤ 1	≤ 0.25	2.2	1	-	-
OE-CROMO S225V	≤ 0.12	≤ 1	≤ 0.25	2.4	1	0.02	0.25
OE-S1CrMo5	≤ 0.12	≤ 1	≤ 0.5	5	0.5	-	-

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-CROMO S225	690°Cx8h	≥ 540	620 - 750	≥ 18
OE-CROMO S225V	710°Cx8h	≥ 540	620 - 750	≥ 18
OE-S1CrMo5	760°Cx2h	≥ 470	550 - 700	≥ 20

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)		
		0 °C	-20 °C	-40 °C
OE-CROMO S225	690°Cx8h	≥ 100	≥ 100	≥ 50
OE-CROMO S225V	710°Cx8h		≥ 27	
OE-S1CrMo5	760°Cx2h		≥ 54	

OP CROMO F537

Typical applications

	Materials
OE-CROMO S225	ASME: A387 Gr.22, Cl 1 and 2, A182 Gr.F 22, A336 Gr.F22 EN: 10CrMo9-10, 12CrMo9-10
OE-CROMO S225V	ASME: SA541 Gr.22V, SA336 F22V EN: 12CrMoV9-10
OE-S1CrMo5	ASME: A182 Gr. F5, A199 Gr. T5, A213 Gr.T5, A335 Gr.P5;' A336 Cl. F5, A369 Gr. FP5, A387 Gr.5, Cl 1 and 2 EN: 12CrMo19-5, X12CrMo5

Redrying
300-350°Cx2-4h

Current Conditions
AC; DC+

Packaging data

Packaging Type	PE
Weight (kg)	25
-	●

OP 33

OERLIKON

SAW Fluxes
Stainless and Heat resistant steels

OP 33 is used for welding stainless and heat resistant steels. OP 33 is neutral in respect to the carbon content of the weld metal so that low C-steels can be welded with suitable wire electrodes. Although OP 33 is not chromium compensated here is no loss of chromium and it is neutral in respect to silicon and manganese. The welds are smooth and have a fine ripple without undercut at the toes and without slag residues (spinel). OP 33 is an aluminate-fluorite type and forms a very thin slag, therefore a low heat input per unit length of weld is recommended. OP 33 has good slag detachability and is ideal for fillet welding. Damp flux should be re-dried at 300-350°C. Grain size according to EN 760: 2-20.

Classification	
EN	760: SA AF 2 54 DC

	Approvals	Grade
OE-308L	DB	●
OE-308L	TÜV	●
OE-347	DB	●
OE-347	TÜV	●
OE-316L	DB	●
OE-316L	TÜV	●
OE-318	DB	●
OE-318	TÜV	●

	Approvals	Grade
OE-20 16 L	DB	●
OE-20 16 L	RINA	N50 M
OE-20 16 L	TÜV	●
OE-S 22 09	DB	●
OE-S 22 09	RINA	2209 M
OE-S 22 09	TÜV	●
OE-309L	TÜV	●
OE-309LMo	RINA	309Mo M

CE

Boniszewski Basicity	1.8

Chemical analysis (Typical values in %)

	C	Mn	Cr	Ni	Mo	Nb
OE-308L	≤ 0.03	1.5	18	9	-	-
OE-347	≤ 0.07	1.6	18	9	-	0.5
OE-316L	≤ 0.03	1.6	18	10	2.7	-
OE-318	≤ 0.07	1.3	18	10	2.7	0.5
OE-20 16 L	≤ 0.015	7	20	16	3	-
OE-S 22 09	≤ 0.03	1.8	23	9	3	-
OE-309LMo	≤ 0.03	1.8	21	15	3	-

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-308L	As Welded	≥ 350	≥ 500	≥ 35
OE-347	As Welded	≥ 370	≥ 575	≥ 30
OE-316L	As Welded	≥ 350	≥ 525	≥ 30
OE-318	As Welded	≥ 370	≥ 600	≥ 30
OE-20 16 L	As Welded	≥ 390	≥ 570	≥ 35
OE-S 22 09	As Welded	≥ 550	≥ 750	≥ 25
OE-309LMo	As Welded	≥ 420	≥ 600	≥ 25

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)		
		+20 °C	-60 °C	-196 °C
OE-308L	As Welded	≥ 75	60	
OE-347	As Welded	≥ 65		
OE-316L	As Welded	≥ 75	60	
OE-318	As Welded	≥ 65		
OE-20 16 L	As Welded	≥ 70		≥ 30
OE-S 22 09	As Welded		70	
OE-309LMo	As Welded	≥ 80		

Typical applications

	Materials
OE-308L	ASME: AISI 304 - 304L - 302 EN: X5CrNi18-8 (1.4301), X2CrNi18-8 (1.4300)
OE-347	ASME: AISI 347 - 321 EN: X12CrNiTi18-9 (1.4878), X10CrNiTi18-9 (1.4541), X10CrNiNb18-9 (1.4550), X5CrNiNb18-9 (1.4543),
OE-347	ASME: ASTM A336 Grades F321, F347 EN: X10CrNiTi18-9 (1.4541), X10CrNiNb18-9 (1.4550), X5CrNiNb18-9 (1.4543), X12CrNiTi18-9 (1.4870)
OE-316L	ASME: ASTM A351 Grades CF3M, CF3MA EN: X2CrNiMo18-12(1.4435), X2CrNiMo18-10 (1.4404), X5CrNiMo18-10 (1.4401)
OE-318	ASME: AISI 318L EN: X10CrNiMoTi18-12 (1.4573), X10CrNiMoNb18-12 (1.4583), X10CrNiMoTi18-10 (1.4571), X10CrNiNb18-9 (1.4450), X10CrNiMoNb18-10 (1.4580), X12CrNiTi18-9 (1.4870)
OE-20 16 L	ASME: EN: X2CrNiMoN17-13-3 (1.4429), X2CrNiMoN18-14-3 (1.3952); X2CrNiMo18-14-3 (1.4435)
OE-S 22 09	ASME: A182 Grade F51, UNS S31803 - S31500 - S31200 - S32304 EN: X2CrNiMoN22-5 (1.4462)
OE-309LMo	First layer on Carbon-Manganese steels and low alloy steels for 316L overlay.

Redrying
300-350°Cx2-4h

Current Conditions
DC+

Packaging data

Packaging Type	PE
Weight (kg)	25
-	●

OP F500

OERLIKON

SAW Fluxes
Stainless and Heat resistant steels

OP F500 is a special agglomerated flux for welding austenitic stainless steels including stabilised compositions. OP F500 is neutral and it is used for welding both single wire and multiwire. Suitable for welding thin plates at high travel speeds. Excellent slag detachability even at high interpass temperatures.Damp flux should be re-dried at 300-350°C.
Grain size according to EN 760: 2-20.

Classification	
EN	760: S A FB 2 53 AC

	Approvals	Grade
LEXAL S 22 9 3 N	ABS	
LEXAL S 22 9 3 N	BV	UP
LEXAL S 22 9 3 N	DNV	
AS 316L	DNV	316L M
LEXAL S 22 9 3 N	GL	4462
LEXAL S 22 9 3 N	LRS	S 31803
LEXAL S 22 9 3 N	RINA	F 2209 M
AS 309LMo	RINA	F 309LMo

	Approvals	Grade
AS 308L	TÜV	●
AS 309L	TÜV	●
AS 316L	TÜV	●
AS 347	TÜV	●
OE-316L	GL	4404
OE-309L	DNV	309L
OE-309L	GL	4332

Flux Main Components	
CaO + CaF2 + MgO	54 %
Al2O3	37 %
SiO2	7 %

Boniszewski Basicity 2.2

Chemical analysis (Typical values in %)

	C	Mn	Si	Cr	Ni	Mo	Nb	Cu	N
OE-308L	0.02	1.5	0.5	18	9	-	-	≤ 0.35	-
OE-347	0.07	1.5	0.5	18	9	-	1	≤ 0.35	-
OE-316L	0.02	1.5	0.5	18	10	2.5	-	-	-
OE-318	0.07	1.5	0.5	18	10	2.5	-	-	-
OE-S 22 09	0.03	1.5	0.5	22	8.5	3	-	-	0.18
OE-309L	0.02	1.5	0.5	22	13	-	-	-	-
OE-309LMo	0.02	1.5	0.5	20	14	2.5	-	-	-

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-308L	As Welded	≥ 350	≥ 500	≥ 35
OE-347	As Welded	≥ 500	≥ 570	≥ 30
OE-316L	As Welded	≥ 350	≥ 520	≥ 30
OE-318	As Welded	≥ 390	≥ 600	≥ 30
OE-S 22 09	As Welded	≥ 600	≥ 700	≥ 30
OE-309L	As Welded	≥ 400	≥ 550	≥ 30
OE-309LMo	As Welded	≥ 370	≥ 550	≥ 25

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)	
		+20 °C	-60 °C
OE-308L	As Welded	≥ 75	
OE-347	As Welded		≥ 70
OE-316L	As Welded	≥ 75	
OE-318	As Welded		≥ 100
OE-S 22 09	As Welded	≥ 50	
OE-309L	As Welded	≥ 70	≥ 70
OE-309LMo	As Welded	≥ 65	

Typical applications

	Materials
OE-308L	ASME: AISI 304 - 304L - 302 EN: X5CrNi18-8 (1.4301), X2CrNi18-8 (1.4300)
OE-347	ASME: ASTM A336 Grades F321, F347 EN: X10CrNiTi18-9 (1.4541), X12CrNiTi18-9 (1.4870), X10CrNiNb18-9 (1.4550), X5CrNiNb (1.4543)
OE-316L	ASME: ASTM A351 Grades CF3M, CF3MA EN: X2CrNiMo18-10 (1.4404), X2CrNiMo18-12 (1.4435), X5CrNiMo18-10 (1.4401)
OE-318	ASME: AISI 318L EN: X10CrNiMoNb18-10 (1.4580), X10CrNiMoTi18-12 (1. 4573), X10CrNiMoNb18-12 (1.4583)
OE-S 22 09	ASME: A182 Grade F51, UNS S31803 - S31500 - S31200 - S32304 EN: X2CrNiMoN22-5-8 (1.4462)
OE-309LMo	First layer on Carbon-Managanese steels and low alloy steels for 316L overlay

Redrying
300-350°Cx2-4h

Current Conditions
AC; DC+

Packaging data

Packaging Type	PE
Weight (kg)	25
-	●

OP 70Cr Spezial

OERLIKON

SAW Fluxes
Stainless and Heat resistant steels

OP 70Cr Spezial is an agglomerated fluoride-basic type flux for welding austenitic and heat resisting steels. The Carbon and Silicon alloying characteristics are neutral, which means that neither pick-up nor burn-out will occur. OP 70Cr Spezial donates a small amount of manganese and contains chromium compensation to ensure that no burn-out will occur. As OP 70Cr Spezial produces a weld metal with a high resistance to hot cracking and a very low diffusible hydrogen level it is the ideal flux for welding austenitic steels with heavy wall thicknesses. Due to its good slag release OP 70Cr Spezial is particularly suited for narrow gap applications. Weld seams are finely rippled and blend smoothly into the base metal.Welded with DC+. Damp flux should be re-dried at 300-350°C.
Grain size according to EN 760: 2-20.

Classification	
EN	760: SA FB 2 57 H5

Flux Main Components	
CaO + MgO	35 %
CaF2	30 %
Al2O3 + MnO	20 %
SiO2 + TiO2	10 %

Boniszewski Basicity	2.8

Chemical analysis (Typical values in %)

	C	Mn	Si	Cr	Ni	Mo
OE-308L	0.027	1.6	0.3	19.2	10.5	-
OE-316L	0.025	1.8	0.5	18.0	11.7	2.6

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-308L	As Welded	≥ 210	520-670	≥ 30
OE-316L	As Welded	≥ 380	550-600	≥ 27

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)
		+20 °C
OE-308L	As Welded	≥ 60
OE-316L	As Welded	≥ 60

Typical applications

	Materials
OE-308L	ASME: AISI 304 - 304L - 302 EN: X2CrNi18-8 (1.4300), X5CrNi18-8 (1.4301), X2CrNi19-11 (1.4306)
OE-316L	ASME: ASTM A351 grades CF3M, CF3MA EN: X2CrNiMo18-8 (1.4535), X2CrNiMo18-10 (1.4404), X5CrNiMo18-10 (1.4401)

Current Conditions
DC+

Packaging data

Packaging Type	PE
Weight (kg)	25
-	●

OP 76

OERLIKON

SAW Fluxes
Stainless and Heat resistant steels

OP 76 is an agglomerated, fluoride-basic type flux for welding stainless and heat-resistant steels. The flux is also suitable for welding Duplex and fully austenitic steels and nickel alloys. In terms of weld metal carbon content, the behaviour of OP 76 can be described as neutral, so that low carbon steels can be welded if suitable wires are used. In terms of silicon and manganese, the metallurgical behaviour is neutral. The flux is highly basic and therefore features a high resistance to hot-cracking. Thus it is particularly well suited for joint welding large cross-sections. Good slag detachability when used with titanium and niobium free wire electrodes. Damp flux should be re-dried at 300-350°C.
Grain size in accordance with EN 760: 2-20.

Classification	
EN	760: SA FB 2 55 AC H5

	Approvals	Grade
OE-308L	DB	●
OE-308L	TÜV	●
OE-347	DB	●
OE-347	TÜV	●
OE-316L	DB	●
OE-316L	TÜV	●
OE-318	DB	●

	Approvals	Grade
OE-318	TÜV	●
OE-20 16 L	DB	●
OE-20 16 L	TÜV	●
OE-S 22 09	DB	●
OE-S 22 09	TÜV	●
NIFIL 625	TÜV	●

Flux Main Components	
CaO + MgO	40 %
CaF2	25 %
Al2O3 + MnO	20 %
SiO2 + TiO2	15 %

Boniszewski Basicity	2.7

Chemical analysis (Typical values in %)

	C	Mn	Cr	Ni	Mo	Nb	Cu	V	N
OE-308L	0.03	1.2	19	9	-	-	-	-	-
OE-347	0.07	1.5	19	9	-	0.5	-	-	-
OE-316L	0.03	1.6	19	10	3	-	-	-	-
OE-318	0.07	1.3	19	10	3	0.5	-	-	-
OE-20 16 L	0.03	7	20	16	3	0.5	-	-	0.15
OE-S 22 09	0.03	1.8	23	9	3	-	-	-	0.1
OE-S 25 10	0.04	0.5	25	10	4	-	-	-	0.25
NIFIL 600	0.03	-	22	74	-	2.5	-	-	-
NIFIL 625	0.03	0.3	23	60	10	3.5	-	-	-
OE-KV7M	0.13	1.1	9.5	≤ 1	1.2	0.3	0.25	0.25	0.07

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-308L	As Welded	≥ 350	≥ 550	≥ 35
OE-347	As Welded	≥ 370	≥ 575	≥ 30
OE-316L	As Welded	≥ 370	≥ 550	≥ 30
OE-318	As Welded	≥ 370	≥ 600	≥ 30
OE-20 16 L	As Welded	≥ 410	≥ 600	≥ 30
OE-S 22 09	As Welded	≥ 550	≥ 750	≥ 25
OE-S 25 10	As Welded	≥ 550	≥ 650	≥ 20
NIFIL 600	As Welded	≥ 380	≥ 600	≥ 30
NIFIL 625	As Welded	≥ 450	≥ 760	≥ 23
OE-KV7M	760°Cx4h	≥ 550	≥ 680	≥ 22

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)	
		+20 °C	-40 °C
OE-308L	As Welded	≥ 75	
OE-347	As Welded	≥ 65	
OE-316L	As Welded	≥ 75	
OE-318	As Welded	≥ 65	
OE-20 16 L	As Welded	≥ 120	
OE-S 22 09	As Welded		≥ 90
OE-S 25 10	As Welded		≥ 50
NIFIL 600	As Welded	≥ 100	
NIFIL 625	As Welded	≥ 75	
OE-KV7M	760°Cx4h	≥70	

Typical applications

	Materials
OE-308L	ASME: AISI 304 - 304L - 302 EN: X2CrNi18-9 (1.4306), X2CrNi19-11 (1.4306), X5CrNi18-8 (1.4301), 12Ni19 (1.5680)
OE-347	ASME: ASTM A336 Grades F321, F347 EN: X12CrNiTi18-9 (1.4878), X10CrNiTi18-9 (1.4541), X10CrNiNb18-9 (1.4550), X5CrNiNb18-9 (1.4543)
OE-316L	ASME: ASTM A351 Grades CF3M, CF3MA EN: X2CrNiMo18-12 (1.4435), X2CrNiMo18-10 (1.4404), X5CrNiMo18-10 (1.4401)
OE-318	ASME: AISI 318L EN: X10CrNiMoNb18-10 (1.4580), X10CrNiMoTi18-10 (1.4571), X10CrNiMoTi18-12 (1.4573), X10CrNiMoNb18-12 (1.4583)
OE-20 16 L	EN: 10Ni14 (1.5637)
OE-S 22 09	ASME: A182 Grade F51, UNS S31803 - S31500 - S31200 - S32304 EN: X2CrNiMoN22-5-8 (1.4462)
OE-S 25 10	EN: X2CrNiMoN25-7-4 (1.4410)
NIFIL 600	ASME: UNS N06600; UNS N08800; UNS N08810 EN: 2.4816; 1.4876; 1.4958
NIFIL 625	ASME: UNS N06625;UNS N08825, A353-70, A553-70 EN: 2.4816; 1.4876; 1.4958
OE-KV7M	ASME: Grade 91 (ASTM A387), P91 (ASTM A335) EN: X10CrMoVNb9-1

Redrying
300-350°Cx2-4h

Current Conditions
AC; DC+

Packaging data

Packaging Type	PE
Weight (kg)	25
-	●

OP F77

OERLIKON

SAW Fluxes
Stainless and Heat resistant steels

OP F77 is a fused flux, developed to give good weldability on AC current up to 900A on a single electrode. Very well adapted for horizontal welding, but can be used in flat position for butt and fillet welds. Particularly recommended for welding 9% nickel steel in cryogenic (LPG/LNG) applications such as tank fabrication with NIFIL C276 wire. Very low moisture pick-up and good slag detachment. When horizontal welding gives flat wettability and limited weld reinforcement. Good distribution of the flux and good uniformity of the slag in the 2G position. Flux is not hygroscopic; does not absorp moisture.

Classification
EN 760: SF CS 2 65 AC H5

Flux Main Components	
CaO + CaF2 + MgO	55 %
SiO2	28 %
Al2O3 + TiO2 + ZrO2	10 %

Boniszewski Basicity 1.3

Chemical analysis (Typical values in %)

	C	Mn	Si	Cr	Ni	Mo	Fe	W
NIFIL C276	0.020	0.6	0.3	15.5	Rem	16	6	3.5

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J) -196 °C
FREEZAL S276	As Welded	≥ 500	600-720	≥ 35	≥ 70

Materials

ASTM: A553

Redrying
100°Cx1h

Current Conditions
AC; DC+

Packaging data

Packaging Type	PE
Weight (kg)	25
-	●

OP XNi is a basic welding flux designed for being used in combination with nickel base wire electrodes. It features an excellent slag detachability and a high resistance to the formation of hot cracks. OP XNi is suitable for joint welding and cladding of small surfaces with wire electrodes. Damp flux should be re-dried at 300-350°C.
Grain size according to EN 760: 2-20.

Classification
EN 760: SA AB 2 AC H5

Flux Main Components	
Al2O3 + MnO	47 %
CaF2	20 %
CaO + MgO	18 %
SiO2 + TiO2	6 %

Boniszewski Basicity	5

Chemical analysis (Typical values in %)

	C	Mn	Si	Cr	Ni	Mo	Nb	Fe
NIFIL 600	0.02	4	0.35	21.5	70	-	2.5	0.8
NIFIL 625	0.015	2	0.4	21	60	9	3.5	0.5

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation
	As Welded	≥ 350	≥ 600	≥ 42
NIFIL 600	As Welded	≥ 350	≥ 600	≥ 42
NIFIL 625	As Welded	≥ 460	≥ 730	≥ 42

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J) -196 °C
	As Welded	≥ 80
NIFIL 600	As Welded	≥ 95
NIFIL 625	As Welded	≥ 80

Typical applications

	Materials
NIFIL 600	ASME: UNS N06600; UNS N08800; UNS N08810 EN: 2.4816; 1.4876; 1.4958
NIFIL 625	ASME: SA353-70; SA553-70; UNS N06625; UNS N08825 EN: 2.4816; 1.4876; 1.4958; X7Ni9 (1.5663); X8Ni9 (1.5662)
NIFIL C276	SA353-70; SA 553-70; X7Ni9 (1.5663); X8Ni9 (1.5662)

Redrying
300-350°Cx2-4h

Current Conditions
AC; DC+

OP 1250A

OERLIKON

SAW Fluxes
Hardfacing

OP 1250A is an agglomerated welding flux used for hardfacing applications in combination with OE-S2 and OE-S2Mo wire electrodes. Applications include the hardfacing of machine gear parts and rails. The alloying effect of the flux depends, to a large degree, on the welding parameters chosen. For instance, optimum properties are achieved with 600 A, 32 V, 50 cm/min. OP 1250A is suitable for use on both direct current (DC+) and AC. Damp flux should be re-dried at 300-350°C.
Grain size according to EN 760: 2-20.

Classification
EN 760: SA CS 3 97 CCrMo AC

Flux Main Components	
SiO2 + TiO2	40 %
CaO + MgO	30 %
Al2O3 + MnO	20 %
CaF2	10 %

Chemical analysis (Typical values in %)

	C	Mn	Si	Cr	Mo
(~1) OE-S2	0.1	1.3	0.5	0.3	0.1
(~2) OE-S2	0.1	1.4	0.7	0.5	0.2
(~3) OE-S2	0.1	1.5	0.9	0.8	0.3
(~1) OE-S2Mo	0.1	1.4	0.5	0.5	0.3
(~2) OE-S2Mo	0.1	1.4	0.5	0.5	0.5
(~3) OE-S2Mo	0.1	1.5	0.7	0.7	0.6

All-weld metal Mechanical Properties

	Heat Treatment	Hardness
(~1) OE-S2	As Welded	220 HB
(~2) OE-S2	As Welded	225 HB
(~3) OE-S2	As Welded	250 HB
(~1) OE-S2Mo	As Welded	225 HB
(~2) OE-S2Mo	As Welded	230 HB
(~3) OE-S2Mo	As Welded	260 HB

Redrying
300-350°Cx2-4h

Current Conditions
AC; DC+

Packaging data

Packaging Type	PE
Diam(mm) / weight(kg)	25
-	●

OP 1300A

OERLIKON

SAW Fluxes
Hardfacing

OP 1300A is an agglomerated welding flux used for hardfacing in combination with OE-S2 and OE-S2Mo wire electrodes. Applications include the hardfacing of dredger parts, machine gear parts and rails. The alloying effect of the flux depends, to a large degree, on the welding parameters chosen. For instance, optimum properties are achieved with 600A, 32V, 50 cm/min. OP 1300A is suitable for use on both direct current (DC+) and AC.
Damp flux should be re-dried at 300-350°C.
Grain size according to EN 760: 2-20.

Classification
EN 760: SA CS 3 87 CCrMo AC

Flux Main Components	
SiO2 + TiO2	40 %
CaO + MgO	30 %
Al2O3 + MnO	20 %
CaF2	10 %

Chemical analysis (Typical values in %)

	C	Mn	Si	Cr	Mo
(~1) OE-S2	0.1	1.2	0.5	1.1	0.1
(~2) OE-S2	0.1	1.3	0.7	1.4	0.2
(~3) OE-S2	0.1	1.5	0.9	1.8	0.3
(~1) OE-S2Mo	0.1	1.2	0.5	1.3	0.3
(~2) OE-S2Mo	0.1	1.3	0.7	2.0	0.5
(~3) OE-S2Mo	0.1	1.4	0.8	2.1	0.6

All-weld metal Mechanical Properties

	Heat Treatment	Hardness
(~1) OE-S2	As Welded	230 HB
(~2) OE-S2	As Welded	280 HB
(~3) OE-S2	As Welded	290 HB
(~1) OE-S2Mo	As Welded	260 HB
(~2) OE-S2Mo	As Welded	350 HB
(~3) OE-S2Mo	As Welded	360 HB

Redrying
300-350°Cx2-4h

Current Conditions
AC; DC+

Packaging data

Packaging Type	PE
Diam(mm) / weight(kg)	25
-	●

OP 1350A

OERLIKON

SAW Fluxes
Hardfacing

OP 1350A is an agglomerated welding flux used for hardfacing in combination with OE-S2 and OE-S2Mo wires. Applications include the hardfacing of dredger parts and rails. The alloying effect of the flux depends, to a large degree, on the welding parameters chosen. For instance, optimum properties are achieved with 600 A, 32 V, 50 cm/min. OP 1350A is suitable for use on both direct current (DC+) and AC.
Damp flux should be re-dried at 300-350°C.
Grain size according to EN 760: 2-20.

Classification	
EN	760: SA CS 3 99 CCrMo AC

Flux Main Components	
SiO2 + TiO2	40 %
CaO + MgO	30 %
Al2O3 + MnO	20 %
CaF2	10 %

Chemical analysis (Typical values in %)

	C	Mn	Si	Cr	Mo
(~1) OE-S2 Mo	0.1	1.5	0.6	1.3	0.4
(~2) OE-S2 Mo	0.1	1.7	0.8	1.5	0.5
(~3) OE-S2 Mo	0.1	1.9	1.0	2.1	0.6
(~1) OE-S2	0.1	1.5	0.6	1.2	0.2
(~2) OE-S2	0.1	1.7	0.7	1.4	0.2
(~3) OE-S2	0.1	1.9	0.9	1.9	0.3

All-weld metal Mechanical Properties

	Heat Treatment	Hardness
(~1) OE-S2 Mo	As Welded	280 HB
(~2) OE-S2 Mo	As Welded	370 HB
(~3) OE-S2 Mo	As Welded	390 HB
(~1) OE-S2	As Welded	260 HB
(~2) OE-S2	As Welded	320 HB
(~3) OE-S2	As Welded	330 HB

Redrying
300-350°Cx2-4h

Current Conditions
AC; DC+

Packaging data

Packaging Type	PE
Diam(mm) / weight(kg)	25
-	●

OP 1450A

OERLIKON

SAW Fluxes
Hardfacing

OP 1450A is an agglomerated welding flux used for hardfacing in combination with wire electrodes OE-S2 and OE-S2Mo. Applications include the hardfacing of piston rod ends and earth moving equipment. The alloying effect of the flux depends, to a large degree, on the welding parameters chosen. For instance, optimum properties are achieved with 600A, 32 V, 50 cm/min. OP 1450A is suitable for use on both direct current (DC+) and AC.
Damp flux should be re-dried at 300-350°C.
Grain size according to EN 760: 2-20.

Classification
EN 760: SA CS 3 87 CCrMo AC

Flux Main Components	
SiO2 + TiO2	40 %
CaO + MgO	30 %
Al2O3 + MnO	20 %
CaF2	10 %

Chemical analysis (Typical values in %)

	C	Mn	Si	Cr	Mo
(~1) OE-S2	0.14	1.2	0.4	1.9	0.1
(~2) OE-S2	0.18	1.3	0.5	2.8	0.2
(~3) OE-S2	0.19	1.3	0.6	2.8	0.3
(~1) OE-S2Mo	0.17	0.9	0.4	1.9	0.3
(~2) OE-S2Mo	0.19	1.1	0.6	2.6	0.6
(~3) OE-S2Mo	0.2	1.2	0.7	2.9	0.6

All-weld metal Mechanical Properties

	Heat Treatment	Hardness
(~1) OE-S2	As Welded	280 HB
(~2) OE-S2	As Welded	350 HB
(~3) OE-S2	As Welded	370 HB
(~1) OE-S2Mo	As Welded	310 HB
(~2) OE-S2Mo	As Welded	440 HB
(~3) OE-S2Mo	As Welded	450 HB

Redrying
300-350°Cx2-4h

Current Conditions
AC; DC+

Packaging data

Packaging Type	PE
Diam(mm) / weight(kg)	25
-	●

OP 10U

OP 10U is a very fine-grained agglomerated flux for use as the backing medium in the single-sided welding process. For single-sided welding OP 10U is spread as a very thin layer of a few millimetres in thickness in the central groove of a copper backing bar which is pressed against the underside of the weld joint. After welding the slag detaches easily from the underside and the root of the weld exhibits a uniform profile. OP 10U is suitable for use with single, tandem and multi-wire welding processes. The optimised grain size in combination with the special chemical composition of OP 10U ensures that the weld metal blendes smoothly and evenly into the base material and that the weld seam surface is smooth and even as well. Damp flux should be re-dried at 300-350°C
Grain size according to EN 760: 1-12.

Classification	
EN	760: SA CS 1

Flux Main Components	
CaO + MgO	35 %
SiO2 + TiO2	32 %
CaF2	7 %
Al2O3 + MnO	5 %

Redrying
300-350°Cx2-4h

Current Conditions
AC; DC+

Packaging data

Packaging Type	PE
Weight (kg)	25
-	●

AST 100A

OERLIKON

SAW Fluxes
Cladding

AST 100A is an agglomerated submerged-arc welding flux used in combination with ferritic stainless steel SUPRASTRIP 430. The special formula enhances the weld bead profile with excellent and easy slag detachability and compensates the slight chromium burn out during welding. The flux is suitable for the hard facing weld overlay of continuous casting rolls.
Damp flux should be re-dried at 300-350°C.
Grain size according to EN 760: 2-20.

Classification
EN 760: SA CS 2

Flux Main Components	
SiO2	32 %
MgO	28 %
Al2O3	15 %
CaF2	10 %

Boniszewski Basicity	1

Chemical analysis (Typical values in %)

	C	Mn	Si	Cr
(~3) SUPRASTRIP 430	0.05	0.25	0.9	16.05

All-weld metal Mechanical Properties

	Hardness
SUPRASTRIP 430	220HB

Redrying
300-350°Cx2-4h

Current Conditions
DC+

OP 87

OERLIKON

SAW Fluxes
Cladding

OP 87 is an agglomerated welding flux for strip cladding with chromium, chromium-nickel, and chromium-nickel-molybdenum consumables. In combination with wire electrodes it is also suitable for joint welding of stainless and heat resistant steels. The flux may be welded on either DC or AC. Due to the low penetration, DC (-pole) is recommended for strip cladding. OP 87 also shows a good slag detachability with only slight residues on the seam surface when used with strips/wires containing titanium or niobium elements for stabilisation.
Damp flux should be re-dried at 300-350°C.
Grain size according to EN 760: 2-20.

Classification	
EN	760: SA CS 2 99 AC

	Approvals	Grade
SUPRASTRIP 19 12 3 L	TÜV	●
SUPRASTRIP 19 12 3 L	TÜV	●
OE-308L	DB	●
OE-308L	UDT	
OE-347	DB	●

	Approvals	Grade
OE-347	UDT	
OE-316L	DB	●
OE-316L	TÜV	●
OE-318	DB	●
OE-318	TÜV	●

Flux Main Components	
SiO2 + TiO2	35 %
Al2O3 + MnO	25 %
CaO + MgO	20 %
CaF2	10 %

Boniszewski Basicity 1

Chemical analysis (Typical values in %)

	C	Cr	Ni	Mo	Nb
OE-308L	0.03	18	9	-	-
OE-347	0.07	18	9	-	≥ 8xC
OE-316L	0.03	18	10	2.5	-
OE-318	0.07	18	10	2.5	≥ 8xC

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-308L	As Welded	≥ 350	≥ 550	≥ 35
OE-347	As Welded	≥ 350	≥ 575	≥ 30
OE-316L	As Welded	≥ 370	≥ 550	≥ 30
OE-318	As Welded	≥ 370	≥ 600	≥ 30

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)
		20 °C
OE-308L	As Welded	≥ 75
OE-347	As Welded	≥ 65
OE-316L	As Welded	≥ 75
OE-318	As Welded	≥ 65

Typical applications

	Materials
OE-308L	ASME: AISI 304 - 304L - 302 EN: X2CrNi19-11 (1.4306)
OE-347	ASME: ASTM A336 Grades F321, F347 EN: X12CrNiTi18-9 (1.4878), X10CrNiNb18-9 (1.4550), X10CrNiTi18-9 (1.4541), X5CrNiNb18-9 (1.4543)
OE-316L	ASME: ASTM A351 Grades CF3M, CF3MA EN: X2CrNiMo18-12 (1.4435), X2CrNiMo18-10 (1.4404)
OE-318	ASME: AISI 318L EN: X10CrNiMoNb18-10 (1.4580), X10CrNiMoTi18-12 (1.4573), X10CrNiMoTi18-10 (1.4571), X10CrNiMoNb18-12 (1.4583)

Redrying
300-350°Cx2-4h

Current Conditions
AC; DC+

Packaging data

Packaging Type	PE
Weight (kg)	25
-	●

AST 300

OERLIKON

SAW Fluxes
Cladding

AST 300 is used with austenitic stainless strips such as SUPRASTRIP 19 9 L, 24 13 L, 21 13 3 L, 19 12 3 L. The AST 300 flux composition compensates for chromium and nickel loss during welding and enhances the weld bead profile, slag residues are self releasing. AST 300 is used for submerged arc strip cladding of pressure vessels, chemical and petrochemical reactor vessels. Damp flux should be re-dried at 300-350°C.
Grain size according to EN 760: 2-20.

Classification	
EN	760: S A CS 2 Cr

Flux Main Components	
SiO2	29 %
MgO	25 %
Al2O3	16 %
CaF2	10 %

Boniszewski Basicity	1.1

Chemical analysis (Typical values in %)

	C	Mn	Si	Cr	Ni
(~2) SUPRASTRIP 19 9 L	0.028	1.42	0.78	19.6	10.4
(~1) SUPRASTRIP 24 13 L	0.059	1.46	0.65	17.7	10.1

Redrying
300-350°Cx2-4h

Current Conditions
DC+

AST 347

OERLIKON

SAW Fluxes
Cladding

AST 347 is an agglomerated submerged-arc welding flux used with austenitic stabilized stainless steel strips, such as SUPRASTRIP 19 9 LNb. The special formula enhances the weld bead profile with excellent and easy slag detachability. The flux is suitable for weld overlay in petrochemical, chemical and nuclear applications. Damp flux should be re-dried at 300-350°C.
Grain size according to EN 760: 2-20.

Classification	
EN	760: S A AB 2

Flux Main Components	
Al2O3	29 %
SiO2	25 %
MgO	17 %
CaF2	15 %
CaO	5 %

Boniszewski Basicity	0.8

Chemical analysis (Typical values in %)

	C	Mn	Si	Cr	Ni	Nb	Ferrite
(~1) SUPRASTRIP 24 13 LNb	0.05	1.2	0.7	18.5	10.5	0.6	-
(~2) SUPRASTRIP 19 9 LNb	0.04	1.2	0.8	19.5	10.2	0.5	8

Redrying
300-350°Cx2-4h

Current Conditions
DC+

AST 600

OERLIKON

SAW Fluxes
Cladding

AST 600 is a basic agglomerated submerged-arc welding flux used in combination with high nickel alloyed strip, such as SUPRASTRIP 625. The special formula enhances the weld bead profile with excellent and easy slag detachability. The weld bead shows a very high hot cracking resistance. The flux is suitable for weld overlay in petrochemical, chemical and nuclear applications. Damp flux should be re-dried at 300-350°C.
Grain size according to EN 760: 2-20.

Classification	
EN	760: S A AB 2

Flux Main Components	
Al2O3	39 %
CaO	19 %
CaF2	12 %
SiO2	10 %
MgO	7 %
MnO	5 %

Boniszewski Basicity	1.5

Chemical analysis (Typical values in %)

	C	Mn	Si	Cr	Ni	Mo	Nb	Fe
(~1) SUPRASTRIP 625	0.04	1	0.4	19	Rem	8	2.8	12
(~2) SUPRASTRIP 625	0.02	1	0.3	20	Rem	9	3.2	3

Redrying
300-350°Cx2-4h

Current Conditions
DC+

ELECTROSLAG FLUXES

OERLIKON

ELT 300

OERLIKON

Electroslag Cladding Fluxes

ELT 300 is a high basic agglomerated welding flux used in combination with stainless steel strip (welding speed up to 25 cm/min) for the cladding of surfaces according to the electroslag process.
ELT 300 shows a very low moisture pick up.
The special formula enhances a smooth weld seam surface with excellent and easy slag detachability. Due to the very high hot cracking resistance ELT 300 is used in petrochemical and nuclear applications.
Damp flux should be re-dried at 300-350°C.
Grain size according to EN 760: 2-20.

Classification	
EN	760: SA AB 2

Flux Main Components	
CaF2	60 %
Al2O3	20 %
SiO2	8 %

Boniszewski Basicity 3.7

Chemical analysis (Typical values in %)

	C	Mn	Si	Cr	Ni	Ferrite
(~2) SUPRASTRIP 19 9 L	0.02	1.5	0.5	19.4	10.3	9.8

Redrying
Re-dry at 300 - 350°C for 2 hours

Current Conditions
DC+

ELT 300S

OERLIKON

Electroslag Cladding Fluxes

ELT 300S is a high basic agglomerated flux especially designed for high speed (35 cm/min) electroslag strip cladding with stainless steel welding strip.
With pure austenitic or austenitic/ferritic strip, this flux is also suitable with normal welding conditions.
ELT 300S shows an excellent slag removal and good wettability with the base metal. Furthermore,ELT 300S has a very low moisture pick up and a low flux consumption should be noted.
If high speed conditions are not possible, ELT 300S is perfectly suitable for the standard cladding conditions.
Dramp flux should be re-dried at 300-350°C.

Classification	
EN	760: S A FB 2

Flux Main Components	
CaF2	60 %
Al2O3	20 %
SiO2	8 %

Boniszewski Basicity >3

Chemical analysis (Typical values in %)

	C	Mn	Si	Cr	Ni	Ferrite
(~1) SUPRASTRIP 24 13 L	0.02	1.4	0.45	19.5	11	6

Redrying
Re-dry at 300-350°C for 2 hours

ELT 347-1

ELT 347-1 is a high basic agglomerated welding flux used in combination with 347 strip for monolayer cladding.
The special formula enhances a smooth weld seam surface with excellent and easy slag detachability.
Damp flux should be re-dried at 300-350°C.
Grain size according to EN 760: 2-20.

Classification	
EN	760: SA FB 2CrNi

Flux Main Components	
CaF2	65 %
Al2O3	10 %
SiO2	10 %

Chemical analysis (Typical values in %)

	C	Mn	Si	Cr	Ni	Nb	Ferrite
(~1) SUPRASTRIP 19 9 LNb	0.02	1.3	0.5	19	10	0.45	7

Redrying
Re-dry at 300-350°C for 2 hours

Current Conditions
DC+

ELT 316-1

OERLIKON

Electroslag Cladding Fluxes

ELT 316-1 is a high basic agglomerated welding flux used in combination with 316L strip for monolayer cladding.
ELT 316-1 exhibits a very low moisture pick up.
The special formula enhances a smooth weld seam surface with excellent and easy slag detachability.
Damp flux should be re-dried at 300-350°C.
Grain size according to EN 760: 2-20.

Classification	
EN	760: SA FB 2CrNiMo

Flux Main Components	
CaF2	64 %
Al2O3	19 %
SiO2	10 %

Chemical analysis (Typical values in %)

	C	Mn	Si	Cr	Ni	Mo	Ferrite
(~1) SUPRASTRIP 19 12 3 L	0.02	1.2	0.43	18.7	12.5	2.64	8

Redrying
Re-dry at 300-350°C for 2 hours

Current Conditions
DC+

AIR LIQUIDE WELDING

ELT 600

OERLIKON

Electroslag Cladding Fluxes

ELT 600 is a high basic agglomerated welding flux used in combination with high nickel alloyed strip, such as Suprastrip 625, for the cladding of surfaces according to the electroslag process. ELT 600 is used,due to its very high hot cracking resistance, for the electroslag cladding of pressure vessels, chemical and petrochemical reactor vessels. ELT 600 has excellent welding characteristics with the weld bead exhibiting good wetting at the weld toes ELT 600 exhibits a very low moisture pick up. Welding speed up to 25 cm/min.
The special formula enhances a smooth weld seam surface with excellent and easy slag detachability.
Damp flux should be re-dried at 300-350°C.
Grain size according to EN 760: 2-20.

Classification	
EN	760: S A FB 2

Flux Main Components	
CaF2	60 %
Al2O3	20 %
SiO2	8 %

Boniszewski Basicity 3.9

Chemical analysis (Typical values in %)

	C	Mn	Si	Cr	Ni	Mo	Nb	Fe
(~1) SUPRASTRIP 625	0.03	0.2	0.25	19.5	Rem	8	3	10

Redrying
Re-dry at 300-350°C for 2 hours

Current Conditions
DC+

ELT 600S

OERLIKON

Electroslag Cladding Fluxes

ELT 600S is a high basic, high speed welding flux (35 cm/min) used in combination with high nickel alloyed strip, such as Suprastrip 625, for the cladding of surfaces according to the electroslag process. ELT 600S is used,due to its very high hot cracking resistance, for the electroslag cladding of pressure vessels, chemical and petrochemical reactor vessels. ELT 600S has excellent welding characteristics with the weld bead exhibiting good wetting at the weld toes

ELT 600S exhibits a very low moisture pick up.

The special formula enhances a smooth weld seam surface with excellent and easy slag detachability.

Damp flux should be re-dried at 300-350°C.

Grain size according to EN 760: 2-20.

Classification
EN 760: SA FB 2

Flux Main Components	
CaF2	65 %
Al2O3	20 %
SiO2 + TiO2	12 %

Boniszewski Basicity	4

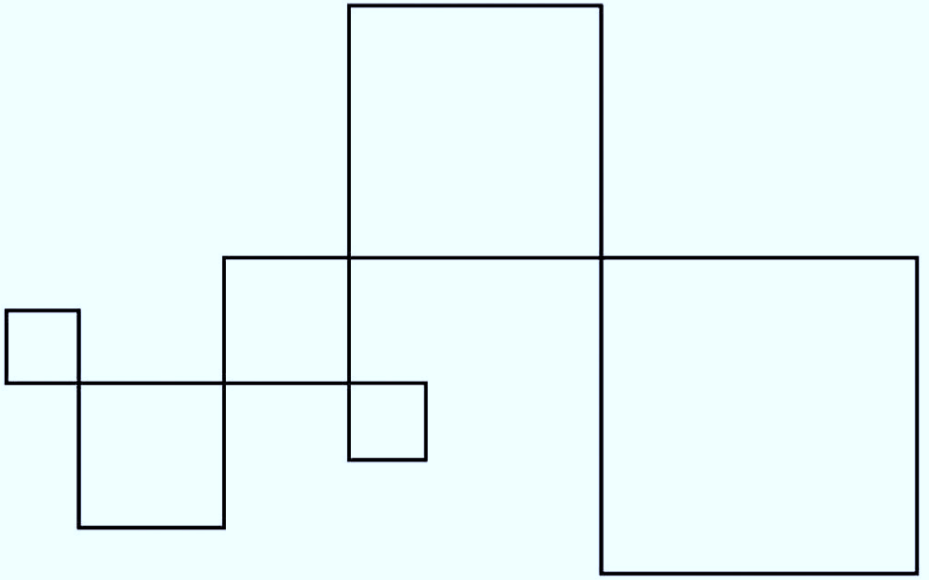
Chemical analysis (Typical values in %)

	C	Mn	Si	Cr	Ni	Mo	Nb	Fe
(~1) SUPRASTRIP 625	0.04	0.19	0.25	18.2	Rem	7.4	2.8	15

Redrying
Re-dry at 300-350°C for 2 hours

Current Conditions
DC+

SAW SOLID WIRES



OERLIKON

SAW Wires / C-Mn and Low-Alloy Steels					
Product Name	AWS / ASME SEC. II Part C	Classification according to AWS / ASME	EN	Classification according to EN	Page
OE-S1	A5.17	EL12	756	S1	602
OE-S2	A5.17	EM12K	756	S2	602
OE-S3	A5.17	EH10K	756	S3	602
OE-S4	A5.17	EH14	756	S4	602
OE-SD3	A5.17	EH12K	756	S3Si	602
OE-S2NiCu	A5.23	EG	756	SNi1Cu	603
OE-S2Ni1	A5.23	ENi1	756	S2Ni1	603
OE-S2Ni2	A5.23	ENi2	756	S2Ni2	603
OE-S2Ni3	A5.23	ENi3	756	S2Ni3	603
OE-S2Mo	A5.23	EA2	756	S2Mo	603
OE-SD3Mo	A5.23	EA4	756	S3Mo	604
OE-S4Mo	A5.23	E6	756	S4Mo	604
OE-SD3 1Ni ¼Mo	A5.23	EG	756	SZ	604
OE-SD3 1Ni ½Mo	A5.23	EG-EF3	14295	S3Ni1Mo	604
OE-SD2 1NiCrMo	A5.23	EG	14295	SZ	604
OE-SD3 2NiCrMo	A5.23	EG	14295	S3Ni2.5CrMo	605
TIBOR 22	A5.23	EG	14295	SZ	605
TIBOR 33	A5.23	EG	14295	SZ	605

SAW Wires / Chromium-Molybdenum Steels					
Product Name	AWS / ASME SEC. II Part C	Classification according to AWS / ASME	EN ISO	Classification according to EN ISO	Page
OE-S2CrMo1	A5.23	EB2	24598-A	S CrMo1	605
OE-S1CrMo2	A5.23	EB3	24598-A	S CrMo 2	605
OE-CROMO S225	A5.23	EB3R	24598-A	S CrMo 2	606
OE-CROMO S225V	A5.23	EGR	24598-A	SZ	606
OE-S1CrMo5	A5.23	EB6	24598-A	S CrMo5	606
OE-KV7M	A5.23	EB9	24598-A	S CrMo91	606

SAW Wires / Stainless and Heat Resistant Steels					
Product Name	AWS / ASME SEC. II Part C	Classification according to AWS / ASME	EN ISO	Classification according to EN ISO	Page
OE-410	A5.9	ER 410	14343-A	S 13	607
OE-430	A5.9	ER 430	14343-A	S 17	607
OE-308L	A5.9	ER 308L	14343-A	S 19 9 L	607
OE-347	A5.9	ER 347	14343-A	S 19 9 Nb	607
OE-316L	A5.9	ER 316L	14343-A	S 19 12 3 L	607
OE-318	A5.9	ER 318	14343-A	S 19 12 3 Nb	608
OE-S 22 09	A5.9	ER 2209	14343-A	S 22 9 3 N L	608
OE-S 25 10	A5.9	EG	14343-A	S 25 9 4 L	608
OE-309L	A5.9	ER 309L	14343-A	S 23 12 L	608
OE-309LMo	A5.9	EG	14343-A	S 23 12 2L	608
OE-22 12 H	A5.9	EG	14343-A	S 22 12 H	609
OE-20 16 L	A5.9	EG	14343-A	S 20 16 3 Mn L	609

SAW Wires / Nickel Alloys					
Product Name	AWS / ASME SEC. II Part C	Classification according to AWS / ASME	EN	Classification according to EN	Page
NIFIL 600	A5.14	ER NiCr3	18274	S Ni 6082	610
NIFIL 625	A5.14	ER NiCrMo-3	18274	S Ni 6625	610
NIFIL C276	A5.14	ER NiCrMo-4	18274	S Ni 6276	610

OE-S1

Classification	
EN	756: S1
AWS	A5.17: EL12

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.1	0.5	0.1	≤ 0.02	≤ 0.02

OE-S2

Classification	
EN	756: S2
AWS	A5.17: EM12K

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.1	1	0.1	≤0.02	≤0.02

OE-S3

Classification	
EN	756: S3
AWS	A5.17: EH10K

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.1	1.45	0.1	≤ 0.020	≤ 0.020

OE-S4

Classification	
EN	756: S4
AWS	A5.17: EH 14

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.1	1.9	0.1	0.01	0.01

OE-SD3

Classification	
EN	756: S3Si
AWS	A5.17: EH 12K

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cu
0.1	1.7	0.3	≤0.015	≤0.015	0.04

OE-S2 NiCu

Classification	
EN	756: SNi1Cu
AWS	A5.23: EG

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Cu
0.1	1	0.25	≤ 0.02	≤ 0.02	<0.3	1.0	0.5

OE-S2 Ni1

Classification	
EN	756: S2Ni1
AWS	A5.23: ENi1

Chemical analysis (Typical values in %)

C	Mn	Si	Ni
0.1	1	0.15	0.9

OE-S2 Ni2

Classification	
EN	756: S2Ni2
AWS	A5.23: ENi2

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni
0.06	1	0.2	≤ 0.015	≤ 0.015	2.3

OE-S2 Ni3

Classification	
EN	756: S2Ni3
AWS	A5.23: ENi3

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni
0.08	1	0.2	≤ 0.015	≤ 0.015	3.2

OE-S2 Mo

Classification	
EN	756: S2Mo
AWS	A5.23: EA2

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Mo
0.1	1	0.2	≤ 0.02	≤ 0.02	0.5

OE-SD3 Mo

Classification	
EN	756: S3Mo
AWS	A5.23: EA4

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Mo	Cu
0.1	1.6	0.1	≤0.015	≤0.015	0.5	0.04

OE-S4 Mo

Classification	
EN	756: S4Mo
AWS	A5.23: EA3

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Mo
0.1	1.9	0.2	≤ 0.020	≤ 0.020	0.5

OE-SD3 1Ni ¼Mo

Classification	
EN	756: SZ
AWS	A5.23: EG

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni	Mo
0.1	1.5	0.25	< 0.015	< 0.015	0.95	0.25

OE-SD3 1Ni ½Mo

Classification	
EN	14295: S3Ni1Mo
AWS	A5.23: EF3/EG

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni	Mo
0.12	1.7	0.2	≤ 0.015	≤ 0.015	0.95	0.5

OE-SD2 1NiCrMo

Classification	
EN	14295: SZ
AWS	A5.23: EG

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo
0.1	1	0.25	1.1	1	0.5

OE-SD3 2NiCrMo

Classification	
EN	14295: S3Ni2,5CrMo
AWS	A5.23: EG

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo
0.12	1.5	0.2	0.6	2.4	0.5

TIBOR 22

Classification	
EN	14295: SZ
AWS	A5.23: EG

Chemical analysis (Typical values in %)

C	Mn	Si	Mo	Ti	B
0.1	1.3	≤ 0.1	0.4	0.05	0.005

TIBOR 33

Classification	
EN	14295: SZ
AWS	A5.23: EG

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Mo	Ti	B
0.09	1.2	0.3	≤ 0.015	≤ 0.015	0.5	0.16	0.013

OE-S2 CrMo1

Classification	
EN	24598-A: S CrMo1
AWS	A5.23: EB2

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Mo
0.12	1	0.2	≤ 0.02	≤ 0.02	1.2	0.5

OE-S1 CrMo2

Classification	
EN	24598-A: S CrMo 2
AWS	A5.23: EB3

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Mo
0.12	0.5	0.2	≤ 0.02	≤ 0.02	2.5	1

OE-CROMO S225

Classification	
EN	24598-A: S CrMo 2
AWS	A5.23: EB3 R

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Mo
0.13	≤ 0.7	≤ 0.2	≤ 0.01	≤ 0.01	2.5	1

OE-CROMO S225V

Classification	
EN	2459-A: SZ
WR	A5.23: EG R

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Mo	Nb	V
≤ 0.13	≤ 1	≤ 0.2	2.5	1	0.02	0.25

OE-S1 CrMo5

Classification	
EN ISO	24598-A: S CrMo5
AWS	A5.23: EB6

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Mo	Nb	V
0.1	0.5	0.3	5.5	0.6	-	-

OE-KV7M

Classification	
EN	12070: SCrMo91
AWS	A5.23: EB9

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo	Nb	V
0.1	0.6	0.15	9	0.7	0.9	0.06	0.22

OE-410

Classification	
EN ISO	14343-A: S 13
AWS	A5.9: ER 410

Chemical analysis (Typical values in %)

C	Mn	Si	Cr
≤ 0.12	≤ 0.4	≤ 0.5	13

OE-430

Classification	
EN ISO	14343-A: S 17
AWS	A5.9: ER 430

Chemical analysis (Typical values in %)

C	Mn	Si	Cr
≤ 0.1	≤ 0.6	≤ 0.5	16

OE-308L

Classification	
EN ISO	14343-A: S 19 9 L
AWS	A5.9: ER308L

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni
0.02	1.5	0.4	≤ 0.02	≤ 0.02	20	10

OE-347

Classification	
EN	14343-A: S 19 9 Nb
AWS	A5.9: ER 347

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Nb
0.05	1.6	0.4	≤ 0.02	≤ 0.02	19.5	9.5	0.7

OE-316L

Classification	
EN	14343-A: S 19 12 3 L
AWS	A5.9: ER 316L

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo
0.02	1.6	0.4	≤ 0.02	≤ 0.02	18	12.5	2.5

OE-318

Classification	
EN	14343-A: S 19 12 3 Nb
AWS	A5.9: ER 318

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo	Nb
0.05	1.3	0.4	19	12	2.7	0.7

OE-S 22 09

Classification	
EN	14343-A: S 22 9 3 N L
AWS	A5.9: ER 2209

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	N
0.025	1.8	0.4	≤ 0.02	≤ 0.02	23	9	3	0.12

OE-S 25 10

Classification	
EN	14343-A: S 25 9 4 L

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	N
0.02	2	0.4	≤ 0.02	≤ 0.02	26	10	4	0.25

OE-309L

Classification	
EN	14343-A: S 23 12 L
AWS	A5.9: ER309L

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni
0.02	1.8	0.4	≤ 0.02	≤ 0.02	24	13.5

OE-309LMo

Classification	
EN	14343-A: S 23 12 2 L
AWS	A5.9: EG

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo
0.02	1.5	0.4	≤ 0.02	≤ 0.02	21	14.5	2.7

OE-22 12 H

Classification	
EN	14343-A: S 22 12 H
AWS	A5.9: EG

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni
0.12	2	1	22	12

OE-20 16 L

Classification	
EN	14343-A: S 20 16 3 Mn L
AWS	A5.9: EG

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	N
0.02	7	0.2	≤ 0.02	≤ 0.02	20	16	3	0.15

NIFIL 600

Classification	
EN ISO	18274: S Ni 6082
AWS	A5.14: ER NiCr3

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Nb
0.02	3.0	0.2	20	>65	2.5

NIFIL 625

Classification	
EN ISO	18274: S Ni 6625
AWS	A5.14: Er NiCrMo-3

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo	Nb	Fe
0.02	0.3	0.3	22	> 60	9	3.5	<1

NIFIL C276

Classification	
EN ISO	18274: S Ni 6276
AWS	5.14: ERNiCrMo-4

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo	Fe	W
<0.02	0.7	0.07	15.5	bal	16	5	4

SAW CORED WIRES

OERLIKON

SAW Cored Wires / C-Mn and low-alloy steels						
Product Name	Flux	AWS / ASME SEC. II Part C	Classification according to AWS / ASME	EN ISO	Classification according to EN ISO	Page
FLUXOCORD 31	OP 121TT	A5.17	F7AP4-EC-G	-	-	614
FLUXOCORD 31 HD	OP 121TT	A5.17	F7AP8-EC1	756	S 42 6 FB T3	615
	OP 139	A5.17	F7AP8-ECG	-	-	
	OP 181	A5.17	F7AP4-ECG	-	-	
FLUXOCORD 35 25	OP 122	-	-	-	-	617
FLUXOCORD 35 25 2D	OP 122	-	-	-	-	618
FLUXOCORD 35 25 3D	OP 122	-	-	-	-	619
FLUXOCORD 41 HD	OP 121TT	A5.23	F9A8-F8P8-EC-F3	756	S 50 6 FB T2Ni1Mo	620
FLUXOCORD 42	OP 121TT	A5.23	F11A8-EC-F5	-	S 69 6 FB TZ	621
FLUXOCORD 43.1	OP 121TT	A5.23	-	-	-	622
FLUXOCORD 48 HD	OP 121TT	A5.23	F8A3-ECG-G	756	S 46 4 FB TZ	623
	OP 139	A5.23	F8A2-ECG-G	756	S 46 3 AB TZ	

636SAW Cored Wires / Hardfacing						
Product Name	Flux	EN	Classification according to EN	DIN	Classification according to DIN	Page
FLUXOCORD 50	OP 122	14700	T Fe1	8555	UP1-GF-BFB1-65-250	624
FLUXOCORD 51	OP 122	14700	T Fe1	8555	UP1-GF-BFB1-65-300	626
FLUXOCORD 52	OP 122	14700	T Fe1	8555	UP1-GF-BFB1-65-400-P	628
FLUXOCORD 54	OP 122	14700	~ T Fe2	8555	UP1-GF-BFB1-65-40-P	630
FLUXOCORD 54-6	OP 122	14700	~ T Fe2	8555	UP5-GF-BFB4-652-40-GP	632

FLUXOCORD 31

OERLIKON

SAW Cored Wires
C-Mn and low-alloy steels

FLUXOCORD 31 is a seamless copper coated basic flux cored wire for submerged arc welding of unalloyed steels and fine grain structural steels in combination with the OERLIKON fluxes OP 121TT (DC+ or AC) and OP 41TT (DC+).

Classification	
OP 121TT	AWS A5.17: F7AP4-EC-G

Chemical analysis (Typical values in %)

	C	Mn	Si
OP 121TT	0.05	1.6	0.2

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
As Welded	≥ 460	520-650	≥ 25
580°Cx2h	≥ 440	520-620	≥ 25

All-weld metal Mechanical Properties - CV

Heat Treatment	Impact Energy (J)	
	-20 °C	-40 °C
As Welded	140	100
580°Cx2h	140	100

Typical applications

	Materials
OP 121TT	ASME: A516 (all Grades) EN: S(P)235 - S(P)420

Current Conditions
AC; DC+

Packaging data

Packaging Type	B450
Diam(mm) / weight(kg)	25
4.0	●

FLUXOCORD 31HD

OERLIKON

SAW Cored Wires
C-Mn and low-alloy steels

FLUXOCORD 31HD is a seamless copper coated basic flux cored wire for submerged arc welding of fine grain structural steels. The deposition rate is increased by ~30% compared to a solid wire of equivalent diameter. Thus, FLUXOCORD 31HD clearly contributes to increasing the productivity.
For heavy wall thickness FLUXOCORD 31HD is used in combination with OP 121TT / TTW. For medium wall thickness the use of OP 132 or OP 192 is recommended. Maximum welding speed, especially with fillet welds, are obtained in combination with OP 181 and OP 191.

Classification		
OP 121TT	EN	756: S 42 6 FB T3
OP 132	AWS	A5.17: F7A8-F7P8-ECG
OP 121TT	AWS	A5.17: F7A8-F7P8-EC1
OP 181	AWS	A5.17: F7A4-F7P4-ECG

	Approvals	Grade
OP 132	GL	
OP 132	TÜV	●
OP 121TT	DB	●
OP 181	DB	●
OP 121TT	LRS	4Y
OP 181	TÜV	●

Chemical analysis (Typical values in %)

	C	Mn	Si
OP 132	0.06	1.7	0.7
OP 121TT	0.06	1.7	0.4
OP 181	0.06	1.9	0.9

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OP 132	As Welded	≥ 420	500-640	≥ 20
OP 121TT	As Welded	≥ 420	500-640	≥ 20
OP 181	As Welded	≥ 420	500-640	≥ 20
OP 181	620°Cx2h	≥ 355	500-640	≥ 20

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)		
		-20 °C	-40 °C	-60 °C
OP 132	As Welded		90	60
OP 121TT	As Welded		100	80
OP 181	As Welded	80	27	
OP 181	620°Cx2h		100	80

Typical applications

	Materials
OP 121TT	EN: S(P)235 - S(P)420 ASME: A516 (all Grades)

Storage	Current Conditions
keep dry and avoid condensation	AC; DC+

Packaging data

Packaging Type	B450
Diam(mm) / weight(kg)	25
2.4	●
3.2	●
4.0	●

FLUXOCORD 35 25

OERLIKON

SAW Cored Wires
C-Mn and low-alloy steels

Micro-alloyed basic tubular cored electrode for SA-welding in combination with OERLIKON fluxes OP 122, Op 122 FB and OP 121 TT. The stringent toughness requirements of a welded joint made from both sides in one pass, are also met at deeper temperatures. Electrode is particularly suited for multi-wire welding. It can be used as 2 D-/3 D- and 4 D- variant in the FMI-process. When welding from both side in one pass, the mechanical properties of the welded joint are influenced both by the admixture resulting form the base metal and the shape of joint used. Optimum toughness properties are obtained when using the double Y- joint.

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S
OP 122	0.05	1.2	0.2	≤ 0.025	≤ 0.020

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OP 122	As Welded	≥ 460	520-620	≥ 24
OP 122	580°Cx1h	≥ 460	520-620	≥24

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)		
		0 °C	-20 °C	-40 °C
OP 122	As Welded	≥ 100	≥ 80	≥ 60
OP 122	580°Cx1h	≥ 80	≥ 60	≥ 47

Typical applications

	Materials
OP 122	EN: S(P)235 - S(P)355, Steels for ship building A,B,D,E,AH32 to EH36, S(P)460

Packaging data

Packaging Type	B450	DRUM
Diam(mm) / weight(kg)	25	250.0
4.0	●	●

FLUXOCORD 35 25 2D

OERLIKON

SAW Cored Wires
C-Mn and low-alloy steels

Using the SA-welding FMI-process (FLUXOCORD-Micro-Injection-Process), a micro-alloyed tubular cored electrode is used in combination with one or several OE S1 solid wire electrodes. SA-2-wires : FLUXOCORD 35 25 2D + 1 x OE-S1

Welding is carried out using OP 122 or OP 121TT fluxes. The weld metal composition obtained in combination with the solid wire electrode OE-S1 corresponds in each case to that of FLUXOCORD 35 25. This refers also to the field of application and the mechanical-technological properties. These wire electrode combinations are particularly suitable for welding from both sides in one pass. It should be noted that with all procedural variants, the micro-alloyed tubular cored electrode should be used on the second welding head. The first electrode should be welded on DC, positive pole, whereas all other electrodes should be connected to AC. For welding from both sides in one pass, OP 122 flux is recommanded. To differentiate these wires, FLUXOCORD 35 25 2D is manufactured without copper coating, whereas the solid wire electrode OE-S1 is copper coated.

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S
OP 122	0.05	1.2	0.2	≤ 0.025	≤ 0.020

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)		
					0 °C	-20 °C	-40 °C
OP 122	As Welded	≥ 460	520-620	≥ 24	≥ 100	≥ 80	≥ 60
OP 122	580°Cx1h	≥ 460	≥ 520		≥ 80	≥ 60	≥ 47

Materials

EN: S(P)235-S(P)355; Steels for ship building A,B,D,E, AH32 to EH36, S(P)460.

Packaging data

Packaging Type	B450	B570
Diam(mm) / weight(kg)	25	80
3.2	●	
4.0	●	●

FLUXOCORD 35 25 3D

OERLIKON

SAW Cored Wires
C-Mn and low-alloy steels

Using the SA-welding FMI-process (FLUXOCORD-Micro-Injection-Process), a micro-alloyed tubular cored electrode is used in combination with one or several OE S1 solid wire electrodes.
SA-3-wires : FLUXOCORD 35 25 3D + 2 x OE-S1
Welding is carried out using OP 122 or OP 121TT fluxes. The weld metal composition obtained in combination with the solid wire electrode OE-S1 corresponds in each case to that of FLUXOCORD 35 25. This refers also to the field of application and the mechanical-technological properties.
These wire electrode combinations are particularly suitable for welding from both sides in one pass. It should be noted that with all procedural variants, the micro-alloyed tubular cored electrode should be used on the second welding head. The first electrode should be welded on DC, positive pole, whereas all other electrodes should be connected to AC.
For welding from both sides in one pass, OP 122 flux is recommanded.
To differentiate these wires, FLUXOCORD 35 25 3D is manufactured without copper coating, whereas the solid wire electrode OE-S1 is copper coated.

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S
OP 121TT	0.05	1.2	0.2	≤ 0.025	≤ 0.020

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)	Impact Energy ISO - V (J)		
					0 °C	-20 °C	-40 °C
OP 121TT	As Welded	≥ 460	520-620	≥ 24	≥ 100	≥ 80	≥ 60
OP 121TT	As Welded 580°Cx1h	≥ 460	520-620	≥ 24	≥ 80	≥ 60	≥ 47

Materials

EN: S(P)235-S(P)355; Steels for ship building A,B,D,E, AH32 to EH36, S(P)460.

Packaging data

Packaging Type	B450	B570
Diam(mm) / weight(kg)	25	80
3.2	●	
4.0	●	●

FLUXOCORD 41HD

OERLIKON

SAW Cored Wires
C-Mn and low-alloy steels

FLUXOCORD 41HD is a seamless copper coated basic flux cored wire for submerged arc welding on higher-strength fine-grain structural steels. The deposition rate is increased by ~30% compared to a solid wire of equivalent diameter. Thus, FLUXOCORD 41HD clearly contributes to increasing the productivity. FLUXOCORD 41HD is used in combination with OP 121TT.

Classification		
OP 121TT	EN	756: S 55 5 FB T2Ni1Mo
OP 121TT	AWS	A5.23: F8P8-EC-F3
OP 121TT	AWS	A5.23: F9A8-EC-F3

	Approvals	Grade
OP 121TT	TÜV	●

Chemical analysis (Typical values in %)

	C	Mn	Si	Ni	Mo
OP 121TT	0.05	1.3	0.2	0.9	0.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
As Welded	≥ 550	620-720	≥ 18
610°Cx8h	≥ 500	550-700	≥ 20

All-weld metal Mechanical Properties - CV

Heat Treatment	Impact Energy (J)		
	-20 °C	-40 °C	-50 °C
As Welded	≥ 80	≥ 60	≥ 47
610°Cx8h	≥ 80	≥ 60	≥ 47

Typical applications

	Materials
OP 121TT	ASME: API-5L: X70; X80; N-A-XTRA 55; HY80; QIN; SA302 Gr.C-D EN: S(P)420; S(P)500; L245-L485; 20MnMoNi5-5; 15NiCuMoNb5

Current Conditions
AC; DC+

Packaging data

Packaging Type	B450
Diam(mm) / weight(kg)	25
2.4	●
3.2	●
4.0	●

FLUXOCORD 42

OERLIKON

SAW Cored Wires
C-Mn and low-alloy steels

FLUXOCORD 42 is a seamless copper coated basic flux cored wire for submerged arc welding on high-strength fine-grain structural steels in combination with OERLIKON OP 121TT W (DC+ or AC). The weld metal composition obtained with FLUXOCORD 42 meets the mechanical property requirements in both the as welded and stress relieved conditions. Before use, the welding flux must be re-dried at 300°C-350°C for two hours or use OP 121TTW in DRYBAG without redying. The mechanical properties depend on the cooling conditions (heat input and interpass temperature) and dilution with base metal (dilution rate and chemical composition of the base metal).

Classification		
OP 121TTW	EN	756: S 69 6 FB TZ
OP 121TTW	AWS	A5.23: F11A8–EC–F5

	Approvals	Grade
OP 121TTW	ABS	5YQ690M
OP 121TTW	DNV	VYM69
OP 121TTW	GL	5Y69M
OP 121TT	ABS	5YQ690M

	Approvals	Grade
OP 121TT	DB	●
OP 121TT	DNV	VYM69
OP 121TT	GL	5Y69M
OP 121TT	LRS	5Y69 H5

Chemical analysis (Typical values in %)

	C	Mn	Si	Cr	Ni	Mo
OP 121TTW	0.05	1.4	0.2	0.6	2.5	0.4

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OP 121TTW	As Welded	≥ 690	750-830	≥ 16
OP 121TTW	580°Cx2h	≥ 690	740-820	≥ 16

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)	
		-20 °C	-60 °C
OP 121TTW	As Welded	80	>69
OP 121TTW	580°Cx2h	50	-

Typical applications

	Materials
OP 121TTW	EN: S620Q-S690Q; S700MC ASME: X80; HY80; QIN; SA 302 Gr.C-D

Current Conditions
AC; DC+

Packaging data

Packaging Type	B450
Diam(mm) / weight(kg)	25
2.4	●
3.2	●
4.0	●

FLUXOCORD 43.1

OERLIKON

SAW Cored Wires
C-Mn and low-alloy steels

FLUXOCORD 43.1 is a seamless copper coated basic flux cored wire for submerged arc welding with the OERLIKON welding fluxes OP 121TT (DC+ or AC) and OP 41TT (DC+) for applications in boiler, apparatus and pipe-line construction when the weldments have to be normalised after welding. The requirements concerning the mechanical and technological properties of the welding joint are fulfilled in the normalised condition as well as in the air hardened condition. The necessary heat treatment depends on the base material. The weld metal deposited by FLUXOCORD 43.1 has not been designed for use in either the as welded nor stress relieved condition.

Chemical analysis (Typical values in %)

	C	Mn	Si	Ni	Mo	V
OP 121TT	0.05	1.4	0.1	1.8	0.35	0.12

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OP 121TT	600°C	≥ 460	570-670	≥ 22
OP 121TT	940°C+600°C	≥ 420	550-650	≥ 22

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)		
		-20 °C	-40 °C	-60 °C
OP 121TT	600°C	100	80	47
OP 121TT	940°C+600°C	100	80	47

Materials

EN: S(P)420; S(P)460; S500

Current Conditions
AC; DC+

Packaging data

Packaging Type	B450
Diam(mm) / weight(kg)	25.0
2.4	●
3.2	●
4.0	●

FLUXOCORD 48HD

OERLIKON

SAW Cored Wires
C-Mn and low-alloy steels

FLUXOCORD 48HD is a seamless copper coated basic flux cored wire for submerged arc welding on weathering steels. The deposition rate is increased by ~30% compared to a solid wire of equivalent diameter. Thus, FLUXOCORD 48HD clearly contributes to increasing the productivity. For thicker sections FLUXOCORD 48HD is used in combination with OP 121TT. For fillet welds and applications requiring a maximum welding speed, optimum results are obtained in combination with OP 132.

Classification		
OP 132	EN	756: S 46 3 AB TZ
OP 121TT	EN	756: S 46 4 FB TZ
OP 132	AWS	A5.23: F8A2-ECG-G
OP 121TT	AWS	A5.23: F8A3-ECG-G

Chemical analysis (Typical values in %)

	C	Mn	Si	Cr	Ni	Cu
OP 132	0.06	1.4	0.6	0.4	0.6	0.5
OP 121TT	0.05	1.3	0.2	0.4	0.7	0.6

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OP 132	As Welded	≥ 460	540 - 620	≥ 20
OP 121TT	As Welded	≥ 460	540 - 620	≥ 20

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)			
		0 °C	-20 °C	-30 °C	-40 °C
OP 132	As Welded	100	80	60	
OP 121TT	As Welded		100	80	60

Typical applications

	Materials
OP 132	EN: S235J0W; S235J2W; S355J0W; S355J2W; S355K2W; CORTEN A-B-C ASME: SA 572-50; A588; A606-4; A262
OP 121TT	EN: S235J0W; S235J2W; S355J0W; S355J2W; S355K2W; CORTEN A-B-C ASME: SA572-50; A588; A606-4; A262

Storage	Current Conditions
Keep dry and avoid condensation	AC; DC+

Packaging data

Packaging Type	B450
Diam(mm) / weight(kg)	25
2.4	●
3.2	●
4.0	●

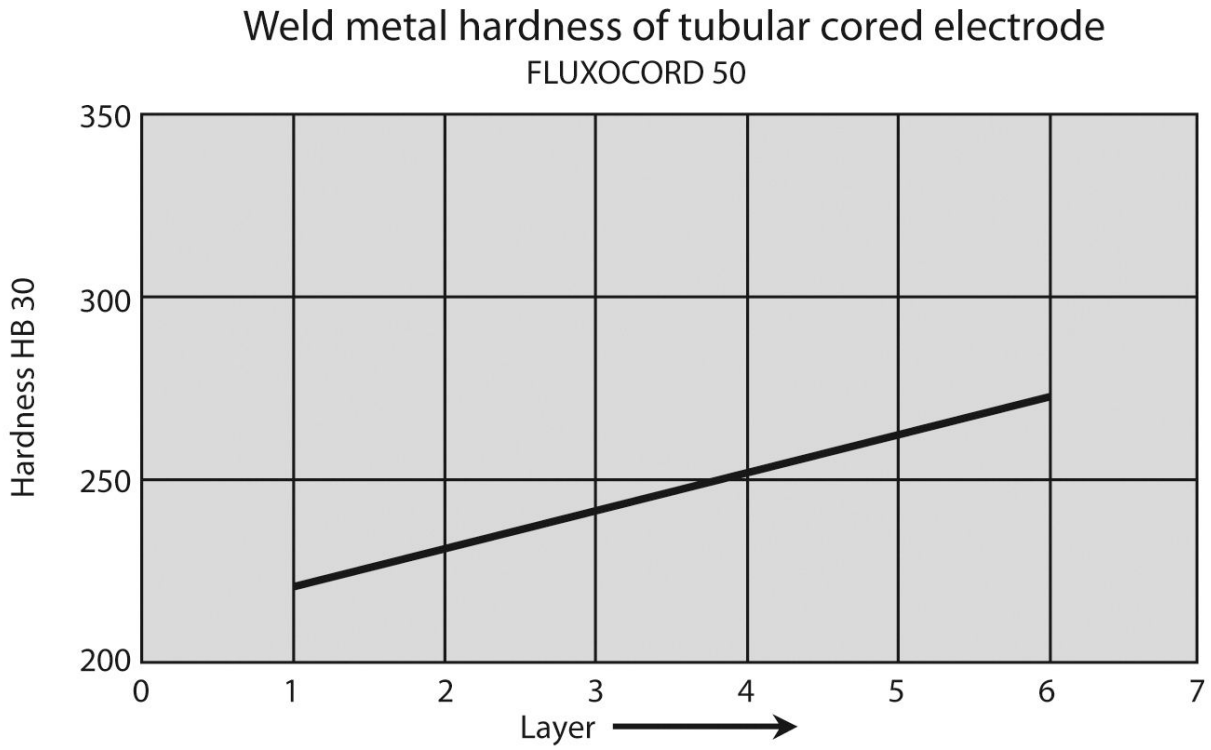
FLUXOCORD 50

OERLIKON

SAW Cored Wires
Hardfacing

FLUXOCORD 50 is a seamless copper coated basic flux cored wire suitable for hardfacings of medium hardness in combination with the flux OP 122. FLUXOCORD 50 is used for hardfacing rollers, caterpillar track rollers, wheel flanges, studs.
The weld metal is tough and crack resistant, therefore a buffer layer is not absolutely necessary. It is suitable for hardfacing components which are subject to heavy impacts. The deposit is machinable by chip forming and flame and inductive hardening are possible.

	Classification	
OP 122	EN	14700: T Fe1
OP 122	DIN	8555: UP1-GF-BFB1-65-250



Chemical analysis (Typical values in %)

	C	Mn	Si	Cr
OP 122	0.14	1.6	0.7	0.6

All-weld metal Mechanical Properties

	Heat Treatment	Hardness
OP 122	As Welded	225-275 HB

Current Conditions
AC; DC+

Packaging data

Packaging Type	B450	DRUM
Diam(mm) / weight(kg)	25.0	250.0
2.4	●	●
3.2	●	●
4.0	●	●

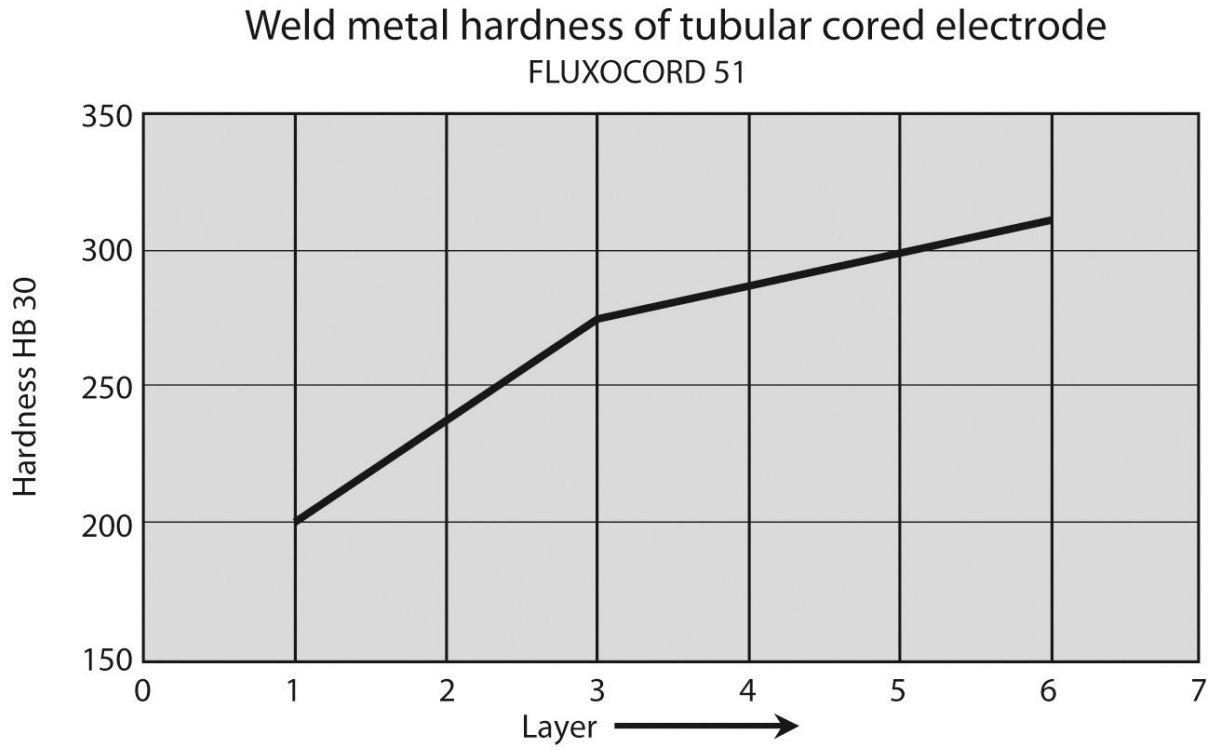
FLUXOCORD 51

OERLIKON

SAW Cored Wires
Hardfacing

FLUXOCORD 51 is a seamless copper coated basic flux cored wire suitable for hardfacing of medium hardness in combination with the flux OP 122. FLUXOCORD 51 is used for hardfacing rollers, caterpillar track rollers, wheel flanges, studs.
The weld metal is tough and crack resistant. Therefore the welding of a buffer layer is not necessary in general. It is suitable for wear-and-tear parts which are subject to heavy impact. The deposit is machinable by chip forming and flame and inductive hardening are possible.

	Classification	
OP 122	EN	14700: T Fe1
OP 122	DIN	8555: UP1-GF-BFB1-65-300



Chemical analysis (Typical values in %)

	C	Mn	Si	Cr
OP 122	0.18	1.7	0.35	1.1

All-weld metal Mechanical Properties

	Heat Treatment	Hardness
OP 122	As Welded	275-325 HB

AIR LIQUIDE WELDING

Current Conditions
AC; DC+

Packaging data

Packaging Type	B450	DRUM
Diam(mm) / weight(kg)	25.0	250.0
2.4	●	●
3.2	●	●
4.0	●	●

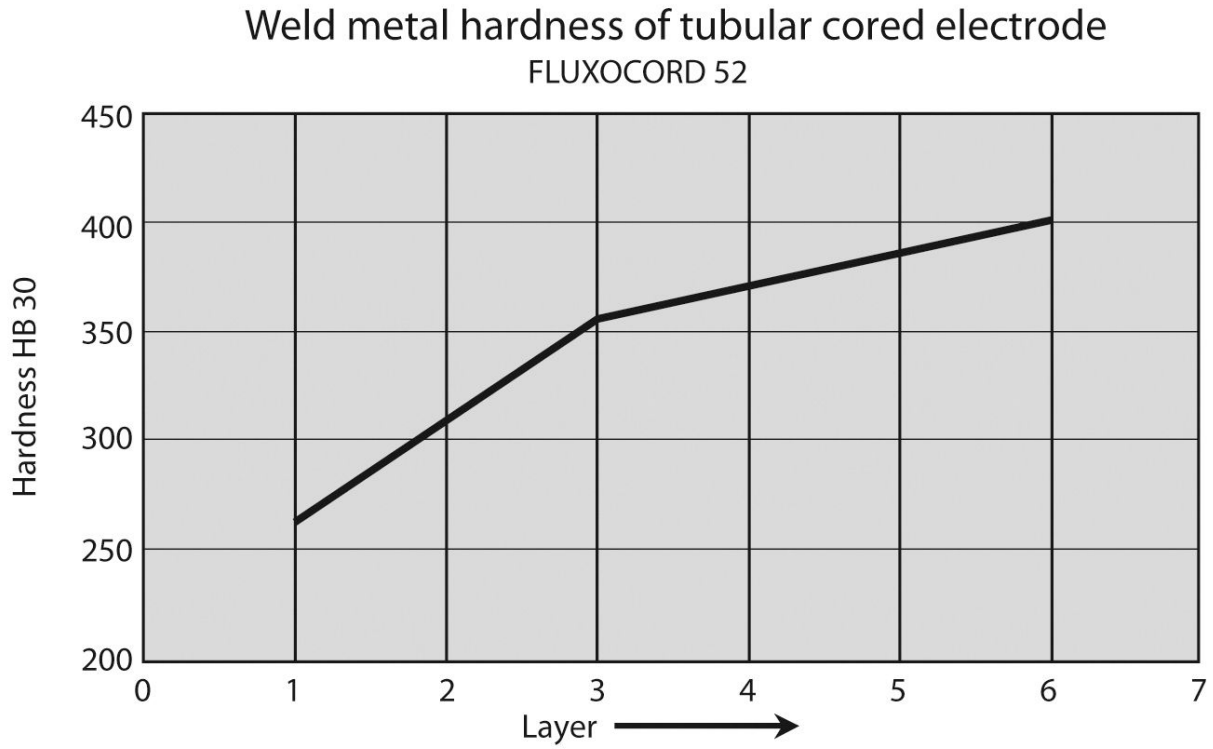
FLUXOCORD 52

OERLIKON

SAW Cored Wires
Hardfacing

FLUXOCORD 52 is a seamless copper coated basic flux cored wire suitable for hardfacings of medium hardness in combination with the flux OP 122.
FLUXOCORD 52 is used for hardfacing rollers, wheel flanges, studs, caterpillar track rollers, excavator parts. The weld metal is resistant to shock and impacts and is machinable by chip forming up to the 3rd layer . The welding of a buffer layer is only necessary with base materials critical to weld. In this case preheating in the range of 200-250°C is recommended. Suitable for flame and inductive hardening.

	Classification	
OP 122	EN	14700: T Fe1
OP 122	DIN	8555: UP1-GF-BFB1-65-400-P



Chemical analysis (Typical values in %)

	C	Mn	Si	Cr
OP 122	0.22	1.8	0.7	1.5

All-weld metal Mechanical Properties

	Heat Treatment	Hardness
OP 122	As Welded	375-450 HB

Current Conditions
AC; DC+

Packaging data

Packaging Type	B450	DRUM
Diam(mm) / weight(kg)	25.0	250.0
2.4	●	●
3.2	●	●
4.0	●	●

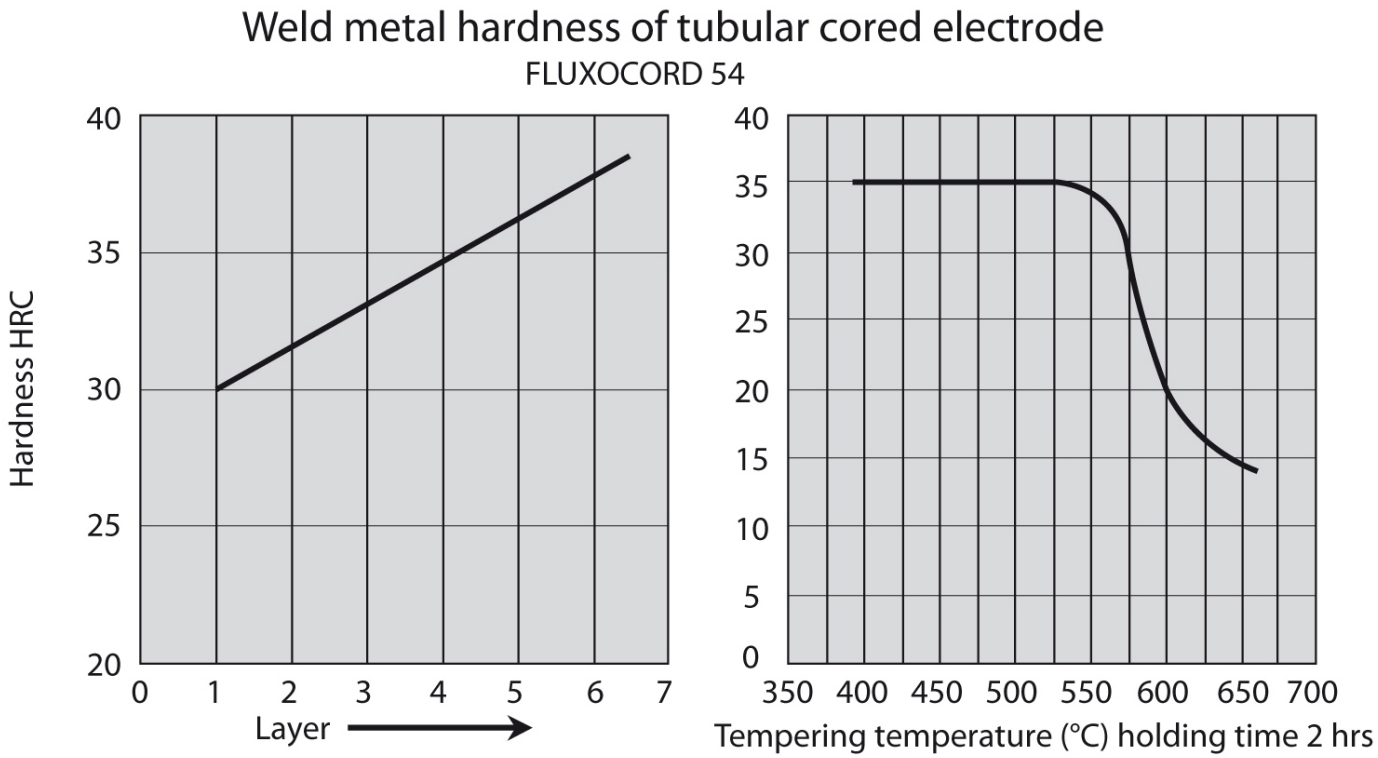
FLUXOCORD 54

OERLIKON

SAW Cored Wires
Hardfacing

FLUXOCORD 54 is a seamless copper coated basic flux cored wire suitable for SAW hardfacing in combination with the flux OP 122. It is used for hardfacing rollers, caterpillar track jackwheels, bearing surfaces, conveyor belt wheels and rolls, etc. Due to its low carbon content, the weld metal is very tough and therefore particularly resistant to shock and impact. The weld metal is machinable using carbide tipped tools. With highly hardenable base metals a buffer layer is required, deposited with FLUXOCORD 31/OP 121TT. Interpass temperatures up to 400°C will not considerably effect deposit hardness.

	Classification	
OP 122	EN	14700: ~T Fe2
OP 122	DIN	8555: UP1-GF-BFB1-65-40-P



Chemical analysis (Typical values in %)

	C	Mn	Si	Cr	Mo
OP 122	0.06	1.1	0.15	4.5	0.5

All-weld metal Mechanical Properties

	Heat Treatment	Hardness
OP 122	As Welded	34-38 HRC

Current Conditions
AC; DC+

Packaging data

Packaging Type	B450	DRUM
Diam(mm) / weight(kg)	25.0	250.0
2.4	●	●
3.2	●	●
4.0	●	●

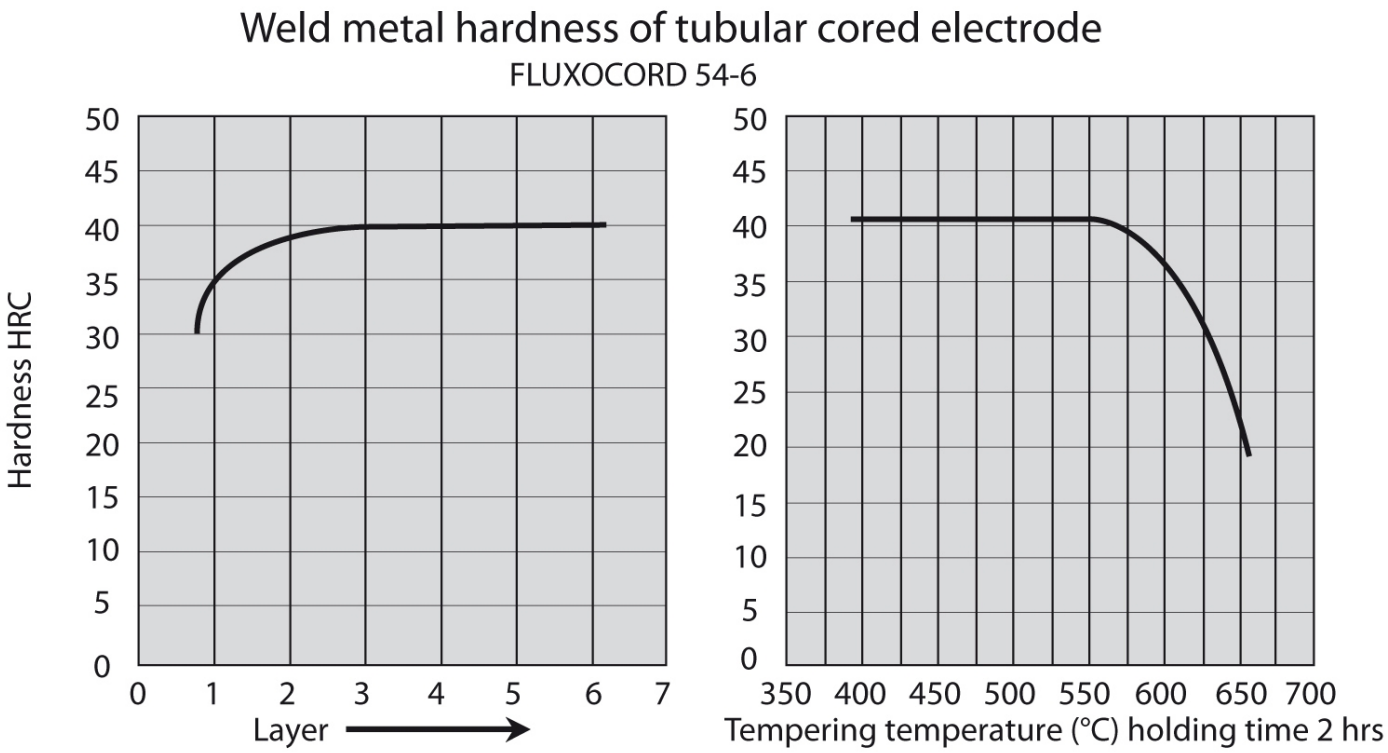
FLUXOCORD 54-6

OERLIKON

SAW Cored Wires
Hardfacing

FLUXOCORD 54-6 is a seamless copper coated basic flux cored wire suitable for hardfacings with high wear-and-tear resistance in combination with the flux OP 122.
Fluxocored 54-6 is used for hardfacing bearing surfaces, conveyor belt rollers and wheels, rolls.
Due to its low carbon content, the weld metal is very tough and therefore particularly resistant to shock and impact. The weld metal is machinable using carbide tipped tools. The welding of a tough buffer layer (with FLUXOCORD 31) is only required with base materials sensitive to welding conditions. Interpass temperatures up to 400°C will not considerably effect hardness.

	Classification	
OP 122	EN	14700: ~T Fe2
OP 122	DIN	8555: UP5-GF-BFB4-652-40-GP



Chemical analysis (Typical values in %)

	C	Mn	Si	Cr	Mo
OP 122	0.08	1.1	0.2	5	0.85

All-weld metal Mechanical Properties

	Heat Treatment	Hardness
OP 122	As Welded	37-42 HRC

Current Conditions
AC; DC+

Packaging data

Packaging Type	B450	DRUM
Diam(mm) / weight(kg)	25.0	250.0
2.4	●	●
3.2	●	●
4.0	●	●

CLADDING STRIPS

OERLIKON

SAW / ES Strips (Cladding)					
Product Name	AWS / ASME SEC. II Part C	Classification according to AWS / ASME	EN ISO / EN	Classification according to EN ISO	Page
SUPRASTRIP 19 9 L	A5.9	EQ308L	14343-A	B 19 9 L	638
SUPRASTRIP 24 13 L	A5.9	EQ309L	14343-A	B 23 12 L	638
SUPRASTRIP 19 9 LNb	A5.9	EQ 347	14343-A	B 19 9 Nb	638
SUPRASTRIP 21 11 LNb	A5.9	~EQ347	14343-A	B 21 11 Nb	638
SUPRASTRIP 24 13 LNb	A5.9	~EQ 309 LNb	14343-A	B Z	638
SUPRASTRIP 19 12 3 L	A5.9	EQ 316L	14343-A	B 19 12 3 L	639
SUPRASTRIP 21 13 3 L	A5.9	~EQ 309LMo	14343-A	B Z	639
SUPRASTRIP 625	A5.14	EQ NiCrMo-3	18274	Ni 6625	639
SUPRASTRIP 825	A5.14	EQ NiFeCr-1	18274	Ni 8065	639

SUPRASTRIP 19 9 L

Classification	
EN ISO	14343-A: B 19 9 L
AWS	A5.9: EQ308L

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni
0.01	1.9	0.4	20	10.5

SUPRASTRIP 24 13 L

Classification	
EN ISO	14343-A: B 23 12 L
AWS	A5.9: EQ309L

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni
0.01	1.8	0.4	23.6	13.3

SUPRASTRIP 19 9 LNb

Classification	
EN ISO	14343-A: B 19 9 Nb
AWS	A5.9: EQ 347

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Nb
0.02	1.8	0.4	19.5	10.5	0.5

SUPRASTRIP 21 11 LNb

Classification	
EN ISO	14343-A: B 21 11 Nb
AWS	A5.9: ~EQ347

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Nb
0.02	1.9	0.2	21	11	0.6

SUPRASTRIP 24 13 LNb

Classification	
EN ISO	14343-A: B Z
AWS	SFA 5.9: ~EQ 309 LNb

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Nb	N
0.02	1.8	0.3	24	12.8	0.7	0.05

SUPRASTRIP 19 12 3 L

Classification	
EN ISO	14343-A: B 19 12 3 L
AWS	A5.9: EQ 316L

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo	N
0.014	1.8	0.35	18.7	12.6	2.7	0.05

SUPRASTRIP 21 13 3 L

Classification	
EN ISO	14343-A: B Z
AWS	A5.9: ~EQ 309LMo

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo
0.01	2	0.3	20.5	14	2.9

SUPRASTRIP 625

Classification	
EN	18274: Ni 6625
AWS	A5.14: EQ NiCrMo-3

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo	Nb	Cu
0.02	0.2	0.1	22	bal	9	3.8	0.4

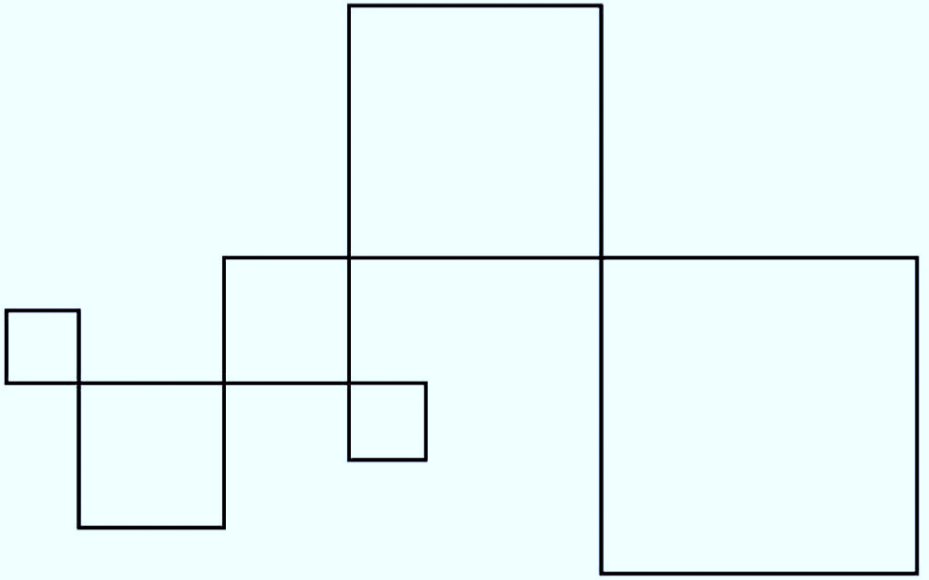
SUPRASTRIP 825

Classification	
EN	18274: Ni 8065
AWS	A5.14: EQ NiFeCr-1

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo	Cu	Fe
0.02	0.8	0.25	20	bal	3	2	30

NOTES FOR THE USER



OERLIKON

Welding of austenitic stainless and heat resisting steels

Except for some restrictions, austenitic stainless and heat resisting steels can be welded employing the same fusion and pressure welding procedures as for welding unalloyed or low-alloy structural steels. Weld processing of these steels will be effected with a view to optaining welded joints that will meet the requirements, as for instance, corrosion-and heat resistance, of the base metals to be welded. Weld consumables to be used, shall be of the same composition or higher alloyed for special applications.

Notice:

- Stabilized steels and weld metal cannot be high-luster polished
- Stabilized steels can be welded using either consumables having the same composition or LC-consumables
- If possible, LC-steels should be welded using LC-consumables
- Nitrogen-alloyed standard austenites are welded using normal consumables, its tensile properties being sufficiently high. Admixture with base metal should be kept low
- A higher thermal expansion coefficient will lead to greater warpage, therefore tack-welding at short spaces
- Low heat conductivity results in heat accumulation or overheating within the weld area, therefore heat input should be limited
- Post-weld treatment of the weld joint is absolutely indispensible in order to obtain a clean metallic surface so that the formation of a faultless passive layer will be possible.

A1 – Welding of standard austenitic steels

- Weld metal of the same composition contains 4 to 12 % (5 to 15 FN) delta ferrite, thus being resistant to hot-cracking
- In case of special requirements, such as welded joints required to be nonmagnetic, highly corrosion resistant or tough at subzero temperatures, a fully austenitic weld metal shall be chosen
- Admixture from the base metal should be below 40 % and if possible, nitrogen pick-up during welding should be kept low, in order not to lower the delta ferrite too much
- No preheating, interpass temperature max. 150 °C
- Are striking only within weld groove
- Delta ferrite is magnetic
- Cr Ni-austenites may also be joined by using Cr Ni Mo-consumables, but with regard to corrosion resistance, weld metal of the same composition should be preferred.

A2 – Welding of fully austenitic steels

The strong tendency of fully austenitic weld metal to hot-cracking should be considered when welding such steels.

Above all, the following items should be observed:

- Absolutely clean weld area, in order to avoid that agents producing hot-cracking, and in particular sulphur, do not enter the weld pool
- To avoid local stress concentrations and great wall thickness by design considerations
- To avoid a large and overheated weld bath in order to keep grain size small and the weld residual stresses of the weld joint low.

This means:

- Limited heat input (max. 10 to 15 kJ/cm)
- Using stringer beads or only slight weaving
- No preheating, interpass temperature max. 130 (150) °C
- Filling-up end crater, if necessary grinding out
- Welding root with sufficient section, in order to avoid longitudinal stress cracking.

F - A – Welding of ferritic-austenitic steels:

• These steels with a two-phase structure of delta-ferrite and austenite are defined as Duplex-steels. They are well-suited for fusion welding.
• Highest admissible operating temperature for welded structures is 250°C. In the temperature range between 250 to 900 °C there will occur a decline in toughness due to the 475 °C embrittlement and the formation of brittle intermetallic phases.
• Weld consumable of the same nitrogen-alloyed composition, the nickel content of which being slightly increased for limiting the delta-ferrite content in the weld metal. Admixture from the less nickel-containing steel should not exceed 40 %. Welding without adding weld metal only possible with subsequent solution annealing and quenching.
• Welding without preheating, interpass temperature max. 250 °C (steels having about 23 % Cr) or max. 150 °C (steels having about 25 % Cr).
• Heat input is chosen a bit higher as in welding austenitic steels. Depending upon welding procedure, thickness of workpiece etc., welding is carried out at 5 to 25 kJ/cm (steels with about 23 % Cr) or at 2 to 15 kJ/cm (steels with about 25 % Cr).
• Possessing high contents of delta-ferrite, steels are susceptible to hydrogen induced cracking. Therefore, hydrogen pick-up during welding shall be kept low (e.g. by redrying covered electrodes, no hydrogen¬bearing shielding gas).

F1 - Welding of semi ferritic chromium steels

• Weld metal of the same composition and the HA-zone exhibit a structure consisting of martensite or structure as tempered, resp., delta-ferrite and finely distributed carbides.
• Preheating and interpass temperature is 200 to 300 °C.
• Annealing at 700 to 800 °C after welding will results in tempering of martensite and enhancing toughness by coagulation of the chromium carbides and restoring resistance to intergranular corrosion (stabilizing).
• Due to the tendency to forming cold-cracks, pick-up of hydrogen during welding should be kept low (redrying covered electrodes, no hydrogen-bearing shielding gases).
• Weld consumables of the same composition if matching the color of the base metal, identical thermal expansion coefficient and nickel-free weld metal are required.
• Dissimilar weld consumables (austenite or nickel-chromium alloy) if a tough weld metal is required and not heat treatment after welding is not possible.

F2 – Welding of fully ferritic chromium steels

• At temperatures of over 950 °C the pure ferritic structure has a tendency to grain coarsening. A coarse grain will result in a loss of toughness and cannot be restored by any heat treatment.
• Therefore, welding should be done with low heat input (low amperage, small electrode diameter, stringer beads or only slight weaving).
• In ferritic steels, the transition temperature from the ductile to the cleavage fractures, determined by the impact test, is situated in the room temperature range. In order to avoid cracking in the heat affected zone (HAZ) and keeping the weld residual stresses low, preheat and interpass temperature of 200 to 300 °C must be chosen.
• Because of the tendency to form cold cracks, the hydrogen pick-up during welding should be kept low, if possible (redrying covered electrodes, no hydrogen bearing shielding gas).
• Multipass welds are preferably made using dissimilal tough weld consumables (austenite or nickel-chromium alloys). If matching the color of the base metal or weld metal poor in nickel is required, cover layer is welded using weld metal of the same composition as base metal.
• Annealing at 700 to 800 °C after welding improves toughness of heat affected zone (HAZ) and the identical weld metal, reduces weld residual stresses and restores resistance to intergranular corrosion (stabilizing).

M – Welding of martensitic chromium steels:

- These steels are air-hardening and possess only restricted weldability. In order to keep hardening of the heat affected zone (HAZ) low, a preheat and interpass temperature of 200 to 300 °C has to be chosen.
- Steels with C>0,2 % are not suitable for welded structures.
- Tempering at 700 to 800 °C immediately after welding, will raise the toughness of the welded joint and reduces weld residual stresses.
- Because of the tendency to produce cold cracking, hydrogen pick-up during welding should be kept low (redrying covered electrodes, no hydrogen bearing shielding gases).
- Weld consumables of the same composition as base metal are preferably used for cover layers, if matching the color of the base metal or nickel-poor weld metal is required.
- Dissimilar austenitic weld consumables according to DIN 8556 are mainly used, and for steels having a higher carbon content, also Cr Ni-consumables according to Din 1763 can be employed.

Soft martensitic stainless chromium-nickel steel:

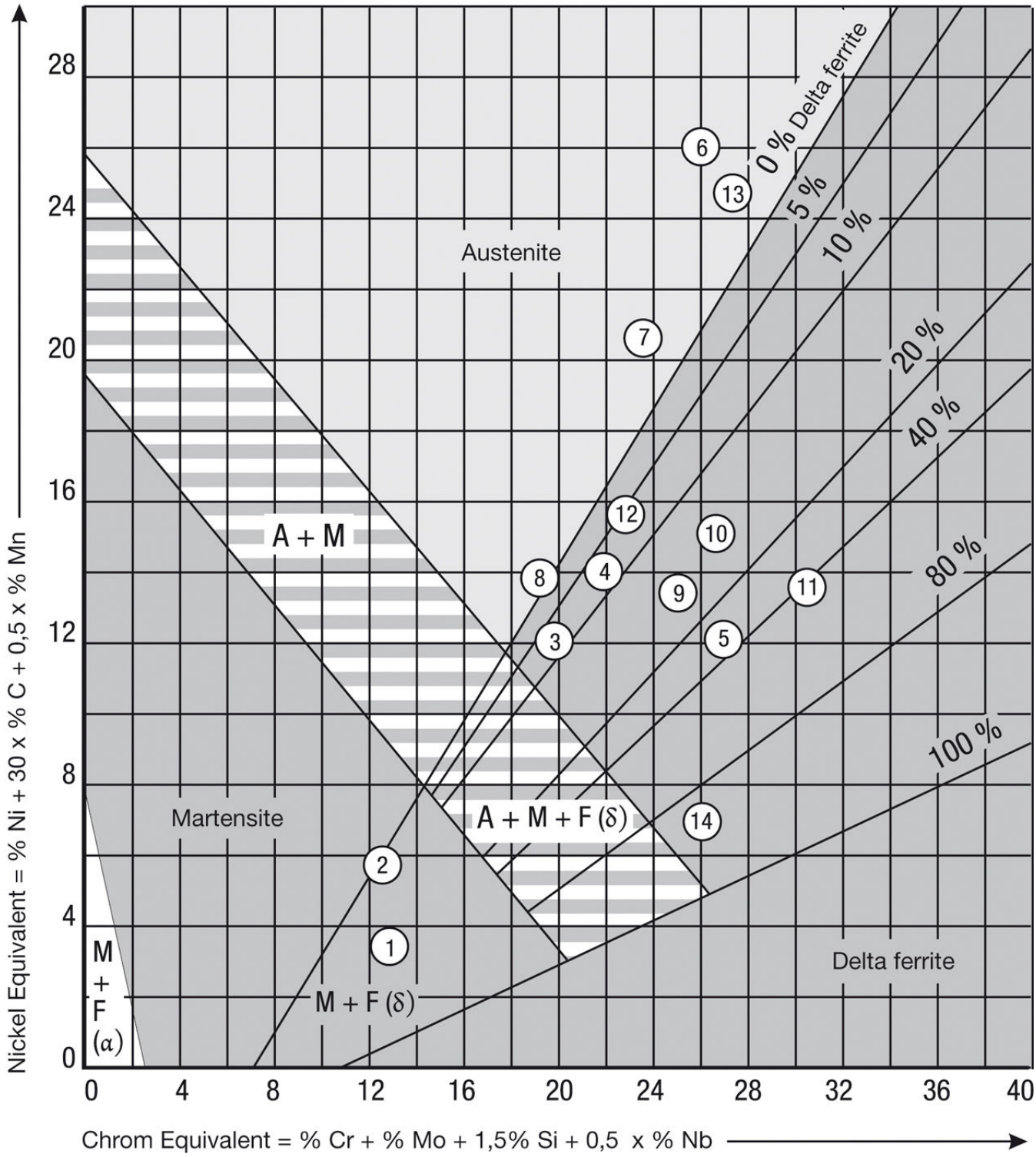
- A carbon content limited to 0,05 % leads to the formation of ductile martensite in the heat affected zone (HAZ) and the weld metal of the same composition.
- Preheating to 100 °C of thick-walled workpieces, interpass temperature should be 100 to 150 °C.
- Because of the tendency to produce cold cracking, hydrogen pick-up during welding should be kept low (redrying covered electrodes, no hydrogen bearing shielding gases).
- Weld consumables of the same composition will produce a weld metal with max. 0,04 % carbon and 5 % delta-ferrite.
- Tempering after welding at 580 to 620 °C for enhanced ductility.

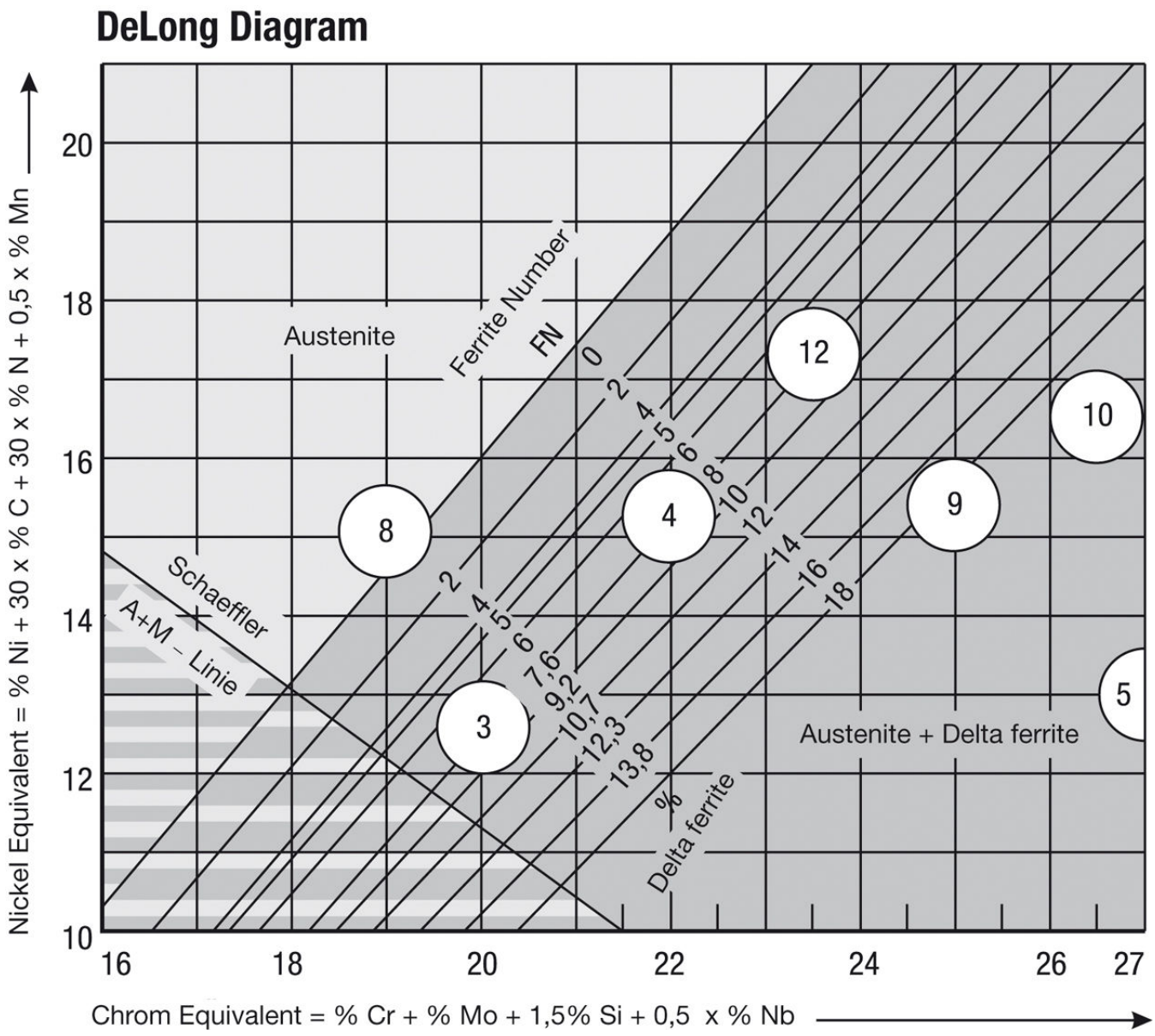
Schaeffler-DeLong-WCR diagrams

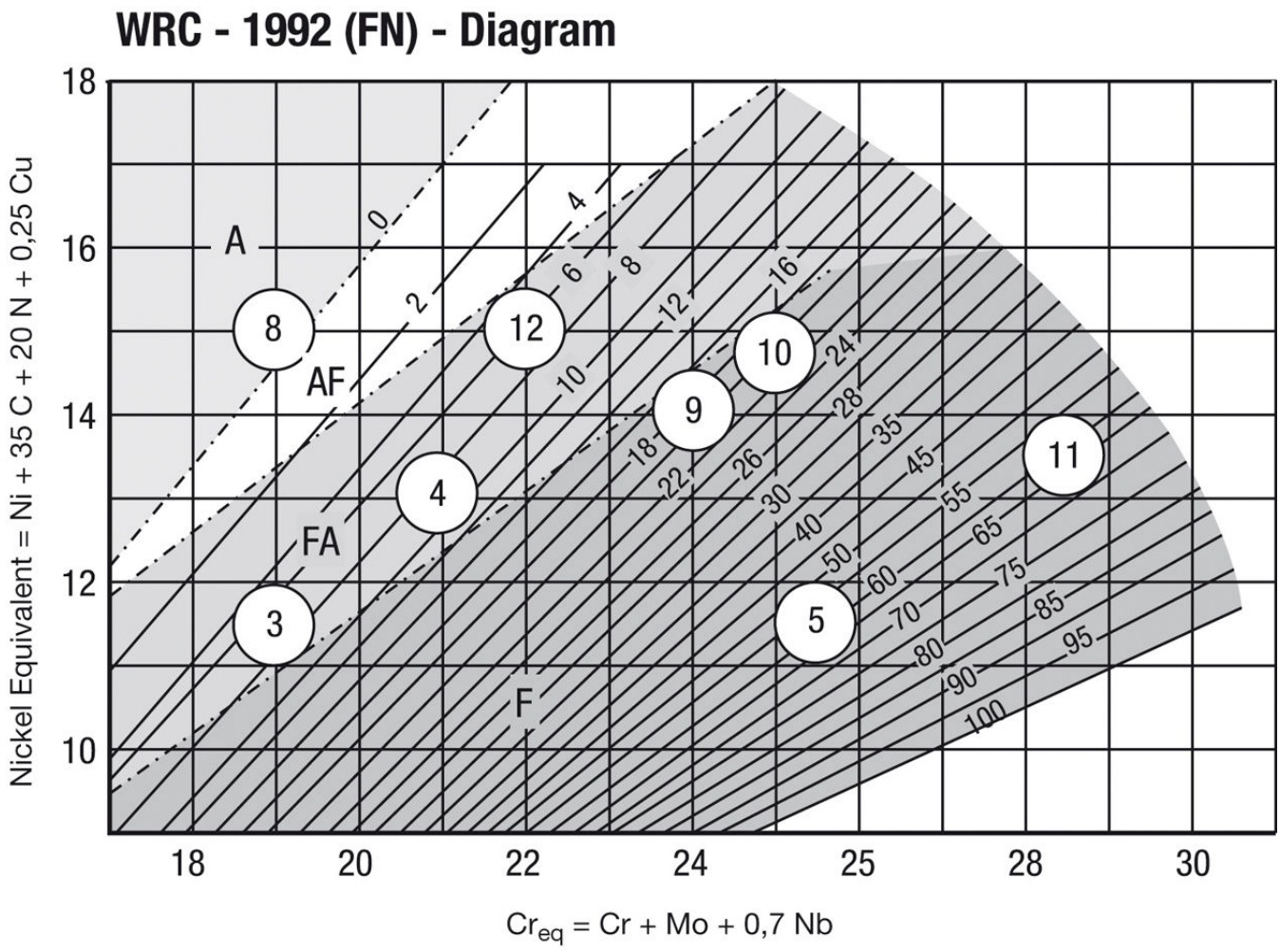
1	**13 1 - 1.4018 - 410 mod.**
	BASINOX 410 S
2	**13 4 - 1.4351 - 410 NiMo**
	BASINOX 410 NiMo S
	INERTROD 410 NiMo
	INERTFIL 410 NiMo
3	**19 9 L - 1.4316 - 308 L**
	SUPRANOX 308 L
	BASINOX 308 L
	INERTROD 308 L Si
	INERTFIL 308 L Si
	FLUXINOX 308 L / FLUXINOX 308 L-PF
	OE-308 L + OP 33 / OP 76
	19 9 Nb - 1.4551 - 347
	SUPRANOX 347
	BASINOX 347
	INERTROD 347 Si
	INERTFIL 347 Si
	FLUXINOX 347 / FLUXINOX 347-PF
	OE-347 + OP 33 / OP 76
4	**19 12 3 L - 1.4430 - 316 L**
	SUPRANOX 316 L
	BASINOX 316 L
	INERTROD 316 L Si
	INERTFIL 316 L Si
	FLUXINOX 316 L / FLUXINOX 316 L-PF
	OE-316 L + OP 33 / OP 76
	19 12 3 Nb - 1.4576 - 318
	SUPRANOX 318
	BASINOX 318
	INERTROD 318 Si
	INERTFIL 318 Si
	FLUXINOX 318 / FLUXINOX 318 PF
	OE-318 + OP 33 / OP 76
5	**22 9 3 N L - (1.4462) - 2209**
	SUPRANOX E 22 9 3 N
	INERTROD 22 9 3
	INERTFIL 22 9 3
	FLUXINOX 22 9 3 L / FLUXINOX 22 9 3 L-PF
	OE-S 22 09 + OP 33 / OP 76
6	**20 25 5 Cu - 1.4519 - 385**
	BASINOX 904 L
	INERTROD 904 L
	INERTFIL 904 L
7	**20 16 3 Mn L - 1.4455**
	BASINOX 20 16 L
	INERTROD 20 16 L
	INERTFIL 20 16 L
	OE-20 16 L + OP 76
8	**18 8 Mn - 1.4370 - ähnlich 307**
	SUPERCHROMAX N
	SUPERCHROMAX R
	INERTROD 307
	INERTFIL 307
	FLUXINOX 307 / FLUXINOX 307-PF
	OE-18 8 6 + OP 33
9	**23 12 L - 1.4332 - 309 L**
	SUPRANOX 309 L
	INERTROD 309 L
	INERTFIL 309 L
	FLUXINOX 309 L / FLUXINOX 309 L-PF
	OE-309 L + OP 33
10	**23 13 2 L - 1.4459 - 309 Mo L**
	SUPRANOX 309 Mo L
	FERINOX
	INERTROD 309 Mo L
	FLUXINOX 309 Mo L / FLUXINOX 309 Mo L-PF
	OE-309 L Mo + OP
11	**29 9 - 1.4337 - ähnlich 312**
	DW 312
	INERTROD 312
	INERTFIL 312
	FLUXINOX 312
12	**22 12 - 1.4829 - ähnlich 309**
	INERTROD 22 12
	INERTFIL 22 12
	FLUXINOX 309 H-PF
	OE-22 12 H + OP 33 / OP 76
13	**25 20 - 1.4842 - ähnlich 310**
	INERTROD 310
	INERTFIL 310
	FLUXINOX 310 / FLUXINOX 310-PF
14	**25 4 - 1.4820**
	FLUXINOX 25.4

Schaeffler Diagram

(Valid till 0,2% C - 4,0% Mn - 1,0% Si - 3,0% Mo - 1,5 Nb)




DeLong Diagram
Austenite
Ferrite Number
FN
0
2
4
5
6
8
10
12
14
16
18
Schaeffler
A+M – Linie
Austenite + Delta ferrite
% Delta ferrite
7,6
9,2
10,7
12,3
13,8
8
4
12
10
9
3
5
20
18
16
14
12
10
16
18
20
22
24
26
27
Nickel Equivalent = % Ni + 30 x % C + 30 x % N + 0,5 x % Mn
Chrom Equivalent = % Cr + % Mo + 1,5% Si + 0,5 x % Nb


WRC - 1992 (FN) - Diagram
Nickel Equivalent = Ni + 35 C + 20 N + 0,25 Cu
18
16
14
12
10
A
AF
FA
F
8
12
10
9
11
4
3
5
0
2
4
6
8
12
16
10
18
22
24
26
28
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
18
20
22
24
25
28
30
Cr_eq = Cr + Mo + 0,7 Nb

Processing Guidelines

As compared to steel, in welding aluminium and its alloys, some specific features of the material have to be taken into account. On grounds of corrosion, the working and storage of aluminium materials must be separated from other materials. Besides this, all tools used in processing aluminium should only be employed for this material.

Since aluminium has a substantially better thermal conductivity as compared to structural steel, penetration depth in welding is reduced and degassing of the weld pool is impeded. As a results, there may occur incomplete fusion or pores in the weld seam. By preheating the workpiece, as well as by accompanying heating during welding of thicker sections, such sources of trouble can be prevented. Moreover, before initiating welding, the aluminium oxide skin should be completely removed from the weld area by milling or brushing with a stainless steel brush.

As fusion-welding procedures, especially the metal-inert-gas welding process (MIG) as well as the tungsten-inert-gas process (TIG) using alternating current, have been applied with great success. With these welding procedures mainly argon or an argon/helium mixture is used as shielding gas. However, it is important to note that argon will produce a more quiet and stable arc than argon/helium mixture. On the other hand, in using argon/helium mixtures there will be a higher arc performance with the same current setting. In MIG–welding, the welding process can be stabilized by using large wire diameters. Moreover, the plastic outfit for the cable and hose assembly, as well as for the wire feed unit, should not be missing in MIG–welding. Since aluminium has a highly reflecting surface, protective clothing in welding is a must in order to protect oneself against burns by ultraviolet radiation during welding.

Name of alloy DIN EN 573 / DIN 1725		Suitable	Material	Use of welding consumables	
Numeric	Chem. Symbole	OERLIKON Welding	Numbers	for TIG welding	for MIG welding
EN AW-1200 EN AW-1050 EN AW-1070 EN AW-1080	EN AW-Al 99,0 EN AW-Al 99,5 EN AW-Al 99,7 2) EN AW-Al 99,8 2)	ALUFIL Al99,5Ti 1) ALUROD Al99,5Ti 1) 4) ALCORD Al	3.0805	suitable	suitable
EN AW-5754 EN AW-5754 EN AW-5251 EN AW-5454 3.3241 3.3541	EN AW-AlMg3 EN AW-AlMg1 EN AW-AlMg2 EN AW-AlMg3Mn G-/GK-AlMg3Si G-/GK-AlMg3	ALUFIL AlMg3 ALUROD AlMg3 4)	3.3536	suitable	suitable
EN AW-5019 EN AW-5754 EN AW-6060 EN AW-6061 EN AW-6082 3.3262 3.3541	EN AW-AlMg5 EN AW-AlMg3 EN AW-AlMgSi EN AW-AlMg1SiCu EN AM-AlSi1MgMn G-/GK-AlMg5Si G-/GK-AlMg5	ALUFIL AlMg5 ALUROD AlMg5	3.3556	suitable	suitable
EN AW-6005 EN AW-6061 EN AW-6082 EN AW-7020	EN AW-AlSiMg EN AW-AlMg1SiCu EN AW-AlSi1MgMn EN AW-AlZn4,5Mg1	ALUFIL AlMg4,5Mn ALUROD AlMg4,5Mn	3.3548	suitable	suitable
EN AW-5083 EN AW-7020	EN AW-AlMg4,5Mn0,7 EN AW-AlZn4,5Mg1	ALUFIL AlMg4,5MnZr 3)	3.3546	suitable	suitable
3.2341	G-/GK-AlSi5Mg	ALUFIL AlSi5 ALUROD AlSi5 4) ALCORD 5Si	3.2245	suitable	suitable
3.2212 3.2332 3.2373 3.5221	G-GK-AlSi11 G-/GK-AlSi10Mg(Cu) G-/GK-AlSi12 G-/GK-AlSi12Cu	ALUFIL AlSi12 ALUROD AlSi12 4) ALCORD 12Si	3.2585	suitable	suitable
Pure aluminum and aluminum alloys with less 2 wt -% alloying elements, Al-Si casting alloys to 7%.	-	ALUFIL AlSi5 ALUROD AlSi5 4) ALCORD 5Si	3.2245	welding possible	welding possible

1) TIG-content results in grain refinement in the weld.
2) If the chemical resistance of the weld is sufficient.
3) The Zr content results in an increased safety in the hot cricks in the weld metal.
4) Suitable for the gas welding.

If it is anodized after welding, the seam is colored gray by Si, so use ALUFIL AlMg5 or ALUROD AlMg5.

Appendix-Notes for the user
Types of cast iron

Cast iron is an iron-carbon cast alloy with carbon contents from 2% up to about 4%, silicon from 0,5% to 3% and phosphorus mostly from 0,1% to 0,6%. Shaping of cast iron parts is by casting the molten metal into moulds, since it cannot be cold-or hot-worked.

In cast iron the carbon content may appear in two forms:
- combined with iron in a form known as cementite Fe3C (white cast iron)
- in the free state as graphite carbon (lamellar or nodular graphite).

The cooling rate, as well as the silicon content, have a strong influence upon the formation of the cast iron structure. If cooling is very fast or with a low silicon content, the structure will consist of ledeburite, pearlite and possibly martensite. According to the colouring of the fracture of a broken piece, it is called “white cast iron” which is hard and brittle and is not suitable for welding.
Slow cooling at a higher silicon content will result in the segregation of carbon as graphite in a ferritic-pearlitic or pearlitic matrix. According to the graphite segregation, it is distinguished between lamellar cast iron (GG = grey cast iron) and nodular cast iron (GGG).

The graphite veins of lamellar grey cast iron act as notches which cause the embrittlement of cast iron. The elongation is generally below 1%. The classification of cast iron is based on the minimum tensile strength of specimens taken from separately cast test pieces with a cast diameter of 30 mm. According to DIN 1691 there are the following cast iron grades: GG-10, GG-15, GG-20, GG-25, GG-30, GG-35 and GG-40.

By adding magnesium or cerium to the cast, graphite is almost completely transformed into a more or less globular form. Cast iron with nodular graphite has a higher tensile strength and improved elongation when compared to lamellar cast iron,. The classification is also according to the minimum tensile strength and improved elongation, as follows: GGG-40, GGG-50, GGG-60, GGG-70 and GGG-80.

In malleable cast iron the carbon appears in combined form as cementite. Depending upon the subsequent heat treatment during which cementite is transformed. There are two types of commercial malleable cast iron:

- decarburised annealed (white) malleable cast iron (GTW). Depending on the annealing time, a more or less thick ferritic "skin" is formed and the core will be of pearlite with tempered carbon (graphite). Grade GTW-S38 is suitable for joining by fusion-welding, since the ferritic "skin" is sufficiently thick. The classification is according to the minimum tensile strength GTW-35, GTW-40, GTW-45, GTW-55, GTW-65 and GTW-S38.

- not decarburised annealed (black) malleable cast iron (GTS). By annealing in a neutral atmosphere cementite will transform to temper carbon in a ferritic matrix. The classification is also according to the minimum tensile strength: GTS-35, GTS-45, GTS-55, GTS-65 and GTS-70.

In this process, formerly known as “cold welding” the cast iron part is welded without pre-heat or only slightly preheated (up to max. 300 °C).

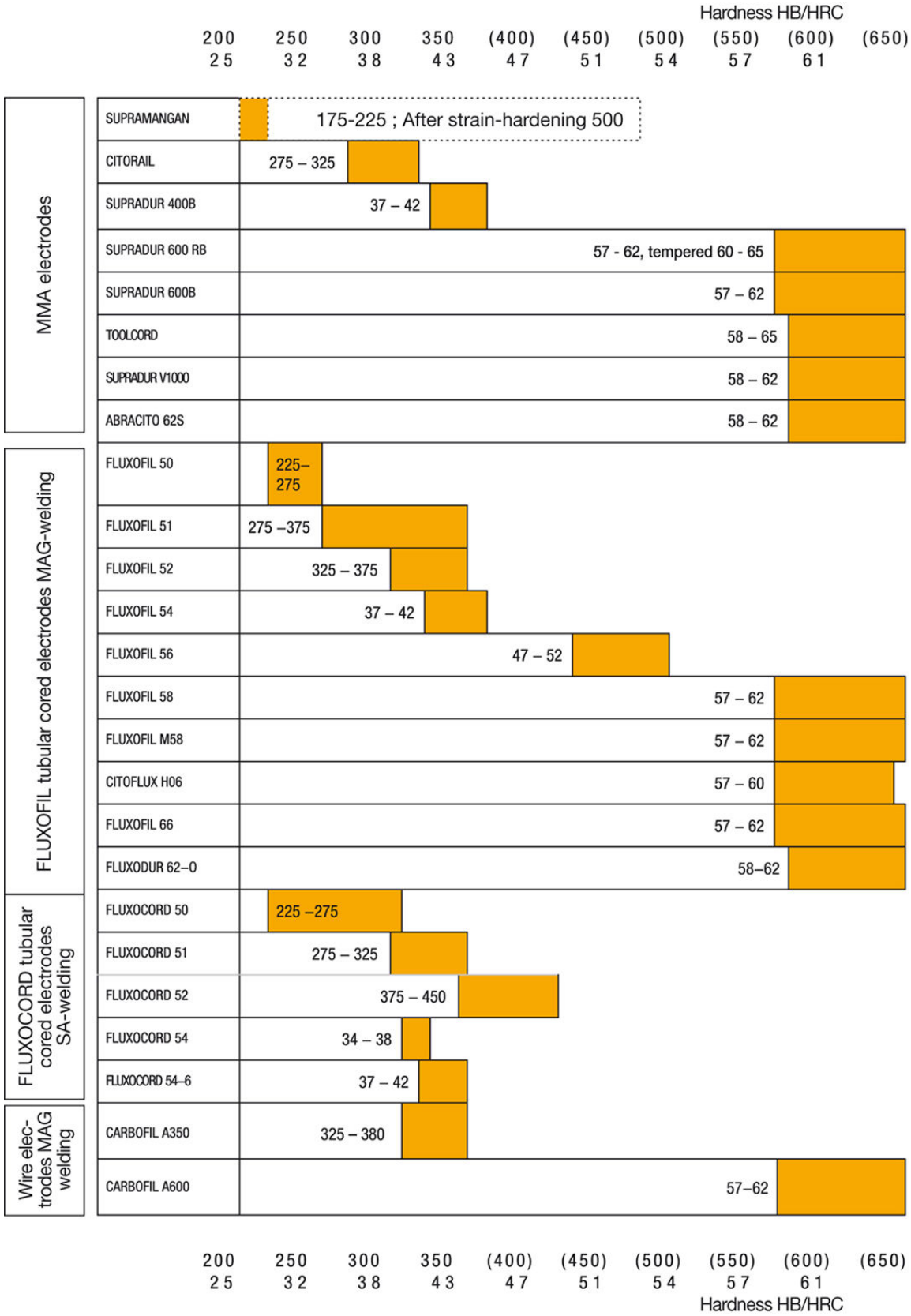
The MMA electrode SUPERFONTE Ni deposits a nickel weld metal. It is of low tensile strength, so that residual stresses are kept to a minimum. Welding should be done with a low heat input using smaller diameter electrodes and depositing only short, narrow weld beads of max. 30mm length. By slightly peening the weld bead while hot, tensile stresses arising from shrinkage of the weld area can be accomodated.

SUPERFONTE Ni is widely used for the joint welding of lamellar cast iron parts, but also for joining them to structural steels or non-ferrous metals. Additionally, an important field of application is the reconditioning of parts made of grey cast iron.

Preparation of the workpiece :

- Removing all contaminants, such as oil, grease, rust, casting skin from the part to be welded.
- Check crack propagation by drilling a small hole at the start and end of any cracks.
- Prepare the weld groove by grinding, plasma torch, powder cutting or arc-gouging. Flame cutting and gouging are not applicable to cast iron.
- Up to 12 mm material thickness, a V-groove is preferred. A double V-groove should be used if the part is accessible from both sides, in order to avoid or minimise distortion.
- Remove casting skin from both sides of the groove, 30mm wide, by grinding.
- Avoiding sharp edges and abrupt transition zones.
- In order to ensure close fitting of the parts to be joined, they should be tack-welded together before preparing grooves.
- In the case of high-load resistant joints, the sides of the groove should be studded and the studs placed in a staggered manner.

The MMA electrode SUPERFONTE NiFe produces a weld deposit containing about 50% nickel and 50% ferrite. Compared to a nickel weld metal, it is characterised by a lower coefficient of thermal expansion (lower shrinkage) as well as higher tensile strength and toughness values. This alloy type is preferably used for welding lamellar cast iron, black-heart malleable castings or joining them to structural steels. The weld metal produced by this electrode is tough and crack-resistant with good tensile properties and can be machined by chip-forming.


Hardness HB/HRC
200 25
250 32
300 38
350 43
(400) 47
(450) 51
(500) 54
(550) 57
(600) 61
(650)
MMA electrodes
SUPRAMANGAN
175-225 ; After strain-hardening 500
CITORAIL
275 – 325
SUPRADUR 400B
37 – 42
SUPRADUR 600 RB
57 - 62, tempered 60 - 65
SUPRADUR 600B
57 – 62
TOOLCORD
58 – 65
SUPRADUR V1000
58 – 62
ABRACITO 62S
58 – 62
FLUXOFIL tubular cored electrodes MAG-welding
FLUXOFIL 50
225–275
FLUXOFIL 51
275 –375
FLUXOFIL 52
325 – 375
FLUXOFIL 54
37 – 42
FLUXOFIL 56
47 – 52
FLUXOFIL 58
57 – 62
FLUXOFIL M58
57 – 62
CITOFLUX H06
57 – 60
FLUXOFIL 66
57 – 62
FLUXODUR 62–0
58–62
FLUXOCORD tubular cored electrodes SA-welding
FLUXOCORD 50
225 –275
FLUXOCORD 51
275 – 325
FLUXOCORD 52
375 – 450
FLUXOCORD 54
34 – 38
FLUXOCORD 54–6
37 – 42
Wire electrodes MAG welding
CARBOFIL A350
325 – 380
CARBOFIL A600
57–62

Standard forms of delivery Electrodes

Boxes (cardboard)

Designation	Short	Approx. Weight (kg)	Boxes per carton	Note
Package	CBOX	4-5	3	Standard
Package	CBOH	2	6	in some cases as an additional supply CBOX

Small Package (plastic)

Designation	Short	Approx. Weight (kg)	Small packs per carton
Small Pack	SMPA	0.5	12

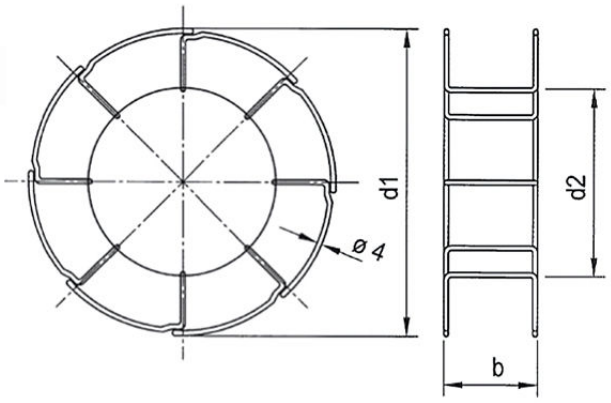
Vacuum package (aluminium, plastic, composite)

Designation	Short	Approx. Weight (kg)	VP packs per carton
VP dry, CITODRY	DRYF	0.3 - 1.0	12 - 20
VP medium	VPMD	1.8 - 2.8	6

Cans (metal)

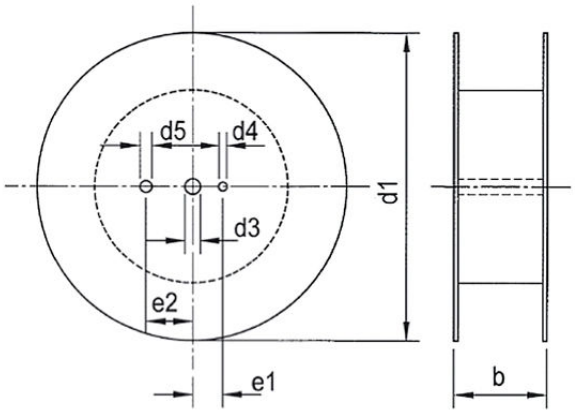
Designation	Short	Approx. Weight (kg)	Cans per carton	Note
Can	MCAN	9	2	FLEXAL Electrode
Can	TUBM	2	6	ALCORD Electrode

Metallic spool (B)



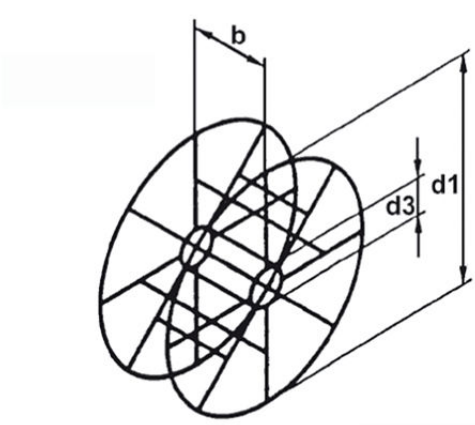
Designation	Spool weight (kg)	Outside diameter d1	Inside diameter d2	External width b (mm)	EN ISO 544
B200	5	200	90	55	-
B300	7-20	300	180	100	B 300

Plastic spool (S)



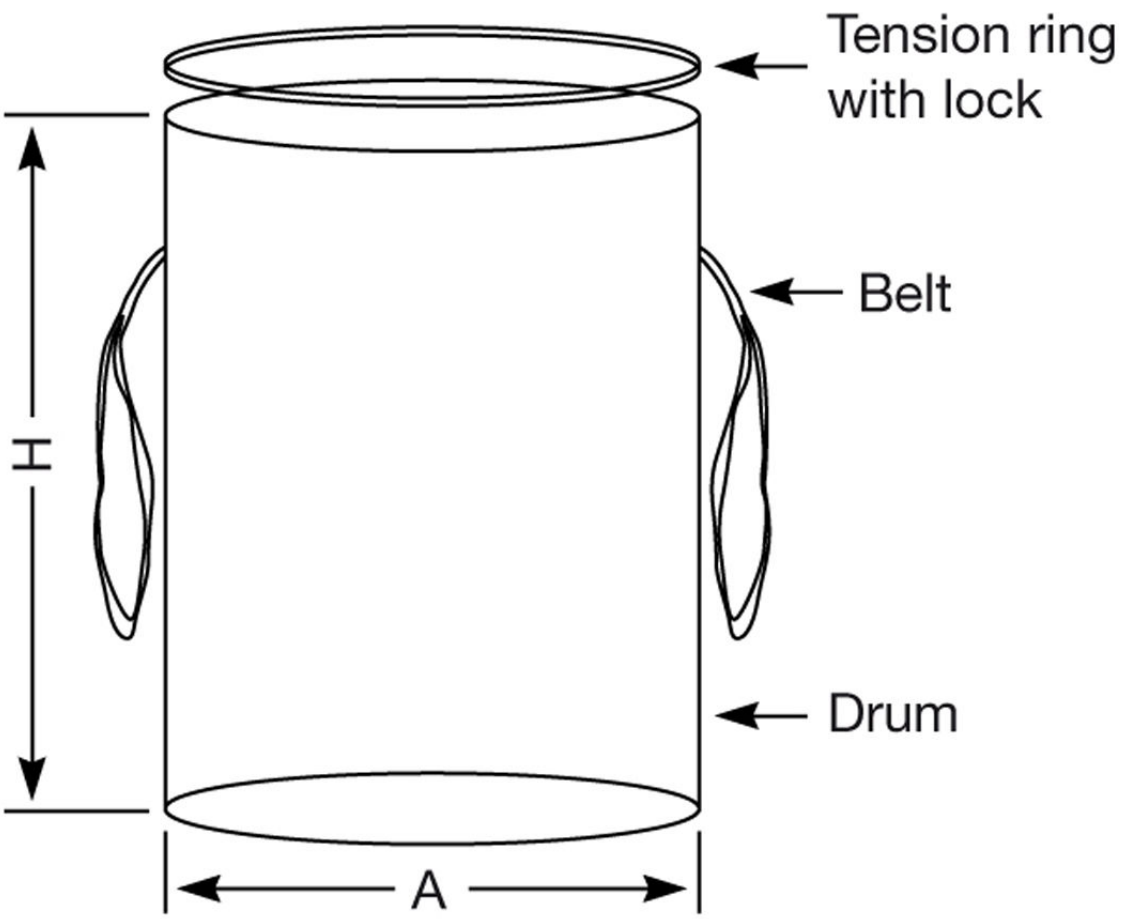
Designation	Spool weight (kg)	Outside diameter d1	External diameter b	Spool hole diameter d3	EN ISO 544
S200	5	200	55	50.5	S 200
S300	7-15	300	100	50.5	S 300
D 760	300	760	310	45	-

Metallic spool with hub



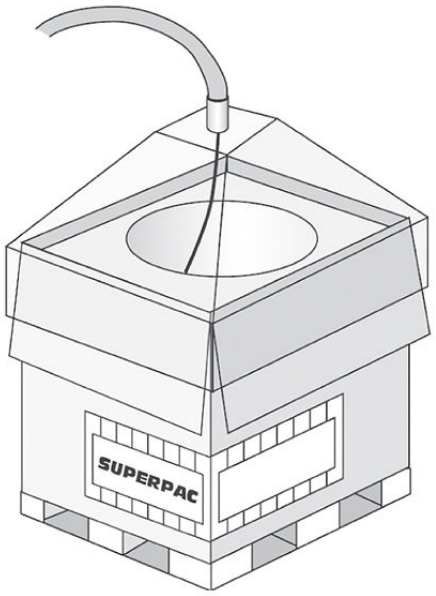
Designation	Spool weight (kg)	Outside diameter d1 (mm)	External width b (mm)	Mandrel hole diameter d3 (mm)	EN ISO 544
BS300	7-15	300	103	51.5	BS300

Drum



Designation	Short designation	Weight (Kg)	Outside diameter A	Drum height H	Compatible with	Remarks
ROUNDPAC	DRUM	300	518	950	Yes	SW
Drum	DRUM	300	570	940	No	SW
LONGPLAYI	DRUM	200	518	790	Yes	FCW
FCW = Flux Cored Wire - SW = Solid Wire						

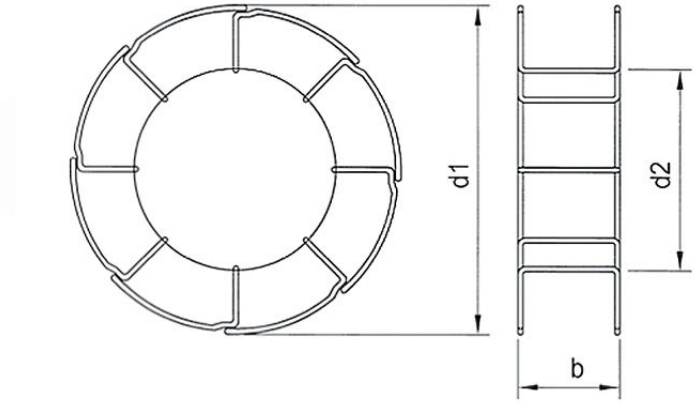
SUPERPAC



Designation	Short	Weight (kg)	Pallet dimensions (mm)	Height (mm)	Overall (mm)
SUPERPAC 150	SUPA	150	560x560	590	890
SUPERPAC 300	SUPA	300	560x560	890	1290
SUPERPAC 450	SUPA	450	725x725	890	1290
SUPERPAC 550*	SUPA	550	725x725	1090	1180

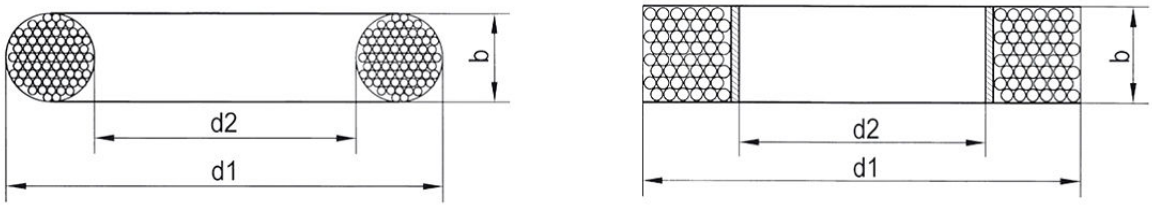
* option as "endless" (24 / 7)- variant by connecting the end of the wire and the beginning of an other wire with two barrels, special hood and accessories needed

Metallic spool & Plastic spool



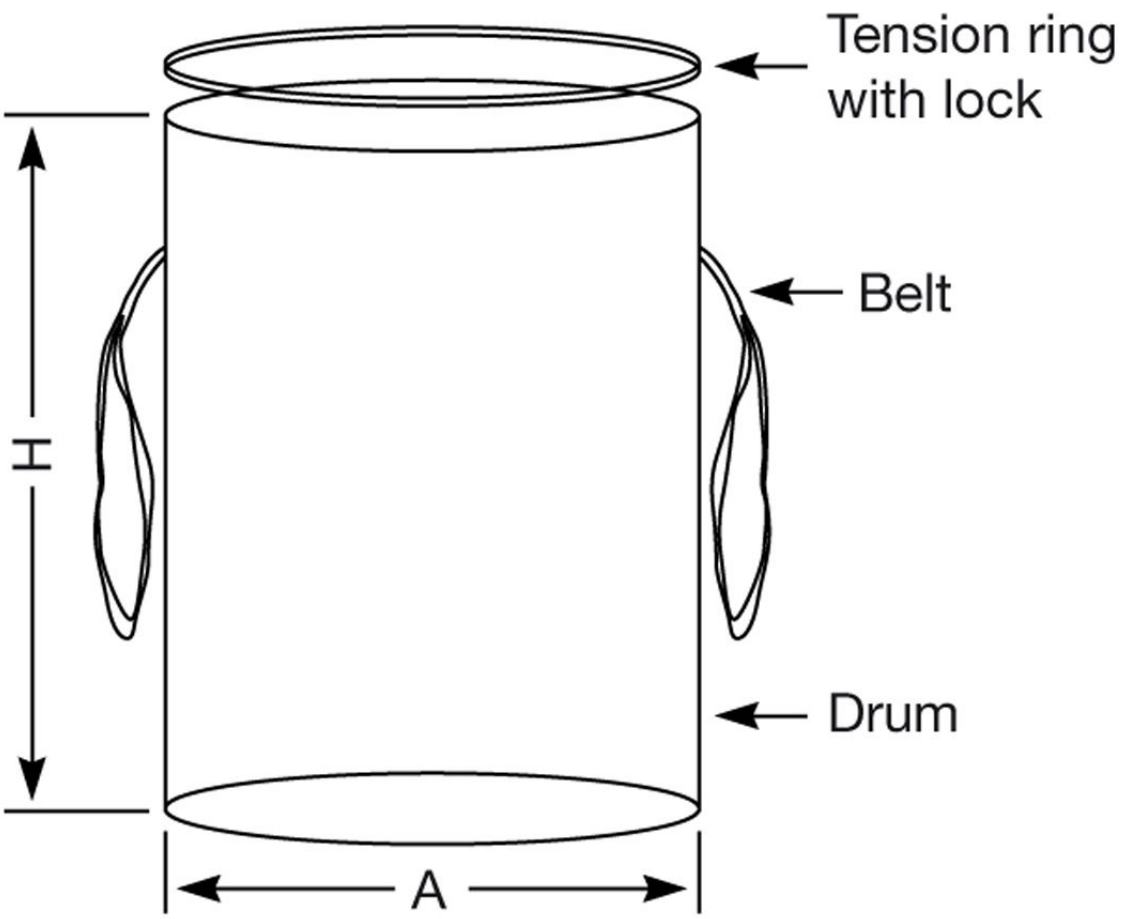
Designation	Designation ISO 544	Spool weight (kg)	Outside diameter d1 (mm)	External diameter b (mm)	Inside diameter d2 (mm)	Spool hole diameter (mm)
B 300	B 300	16	300	100	180	-
K 435	-	20	435	70	308	-
B 450	B 450	25	450	100	308	-
K 415	B 450	25	450	100	308	-
D 500	-	150	500	350	-	40.5
B 570	-	80, 90, 100	760	115	570	-
K 570	-	80, 90, 100	760	115	570	-
S 760	S 760E	300	760	290	-	40,5
D 760	S 760E	300	760	290	-	40,5

Ring



Designation	Designation ISO 544	Spool weight (kg)	Outside diameter d1 (mm)	Width b (mm)	Inside diameter d2 (mm)
A-Ring	-	90, 100	-	90	570
B-Ring	-	25	375	70	280

Drum



Oerlikon designation	Drum weight (kg)	Drum diameter A (mm)	Drum height H (mm)	Core diameter (mm)	Remarks
Drum 250	250	570	770	-	Flux cored wire
Drum 300	300	585	800	315	Solid wire
Drum 380	380	585	1000	315	Solid wire
Other forms of bulk packaging available on request					

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